Project Number(s): PC P21-0300 LD ____________ GP ____________

CITY OF VISTA
CALIFORNIA

PRIORITY DEVELOPMENT PROJECT

STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR

CAMINO LARGO
VISTA, CA

PREPARED FOR:
Kyun Tae Kim
Frank Sohaei, Trustee of the Falor Family Trust
2359 Pio Pico Drive
Carlsbad, CA 92008
(760) 420-1267

December 6, 2021

NOTE: This Priority Development Project SWQMP Template and Instructions are offered as a tool to assist users in complying with RWQCB Order No. R9-2015-0001 (Permit), and is not intended to warrant or guarantee Permit compliance, which is the independent and sole responsibility of the user. This template is subject to revision without notice, at any time.

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ENGINEER OF WORK CERTIFICATION STATEMENT

Preparer's Certification

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

I have read and understand that the City Engineer 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 the City Engineer 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.

SWQMP PREPARED BY:
BRUCE RICE

bHA, Inc

5115 AVIENDA ENCINAS
Carlsbad, CA 92008
(760) 931-8700
BRICE@BHAINCSD.COM
R.C.E. 60676
EXPIRES 12-31-22

60676, Expires 12/31/22
Signature, PE License Number & Expiration Date

Bruce Rice
Print Name

12-6-21
Date

PROJECT OWNER CERTIFICATION STATEMENT

Owners Certification

This PDP SWQMP has been prepared for Camino Largo by BHA, Inc. The PDP SWQMP is intended to comply with the PDP requirements of the City of Vista BMP Design Manual, which is a design manual for compliance with local City and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan. Once the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan, including ensuring on-going operation and maintenance of structural BMPs. A signed copy of this document shall be available on the subject property into perpetuity.

OWNER DETAILS:
Kyun Tae Kim
Frank Sohaei, Trustee of the Falor Family Trust
2359 Pio Pico Drive
Carlsbad, CA 92008
(760) 420-1267

Project Owner's Signature

Kyun Tae Kim ; Frank Sohaei

Print Name

8/23/2021

Date

CITY OF VISTA STAFF REVIEW

Reviewed and Approved:	
City Staff Signature:	Date:

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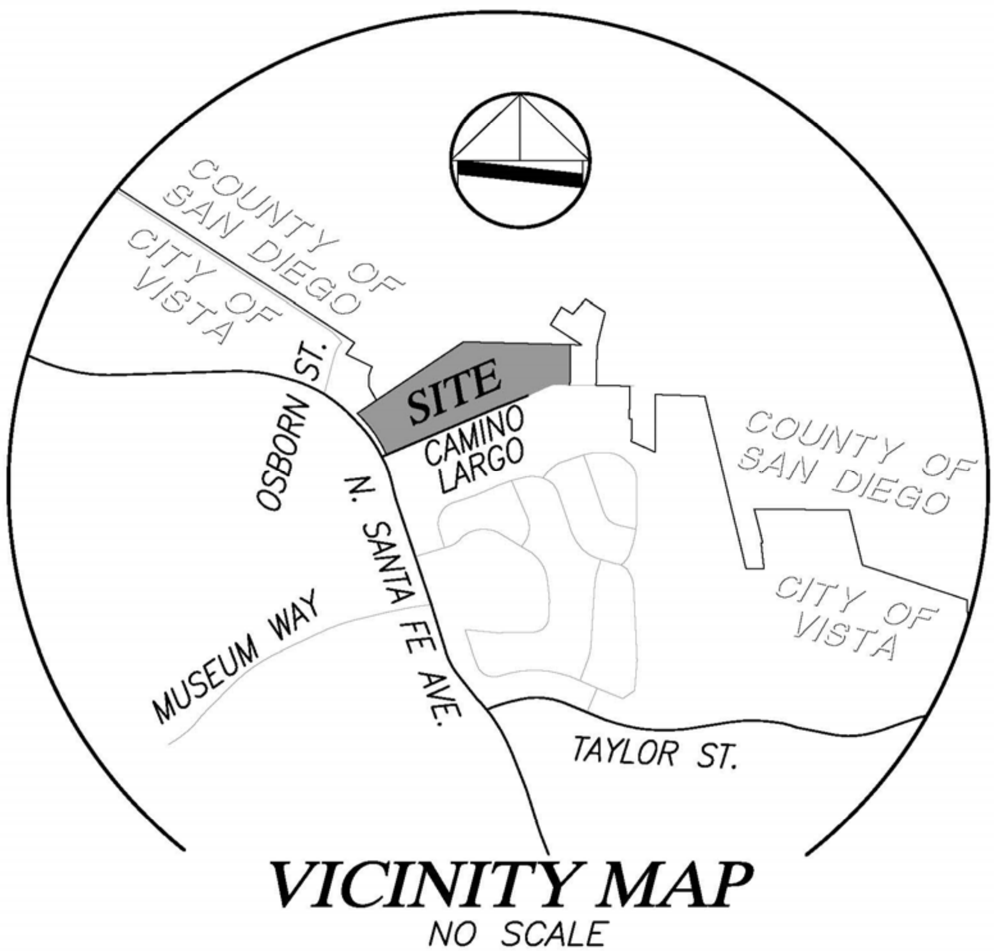
PROJECT VICINITY MAP

Project Name: Camino Largo

Permit Application Number: P21-0300

Insert Project Vicinity Map Below:



FORM 1 – PROJECT CATEGORY DETERMINATION CHECKLIST

This form is used to assess stormwater BMP requirements applicable to the proposed project. The form is available as a stand-alone fillable checklist on the City's website and a completed copy must be included with the final SWQMP submitted to the City. The form is available at:

http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms

Project ID:
P21-0300

CHECKLIST FOR DETERMINATION OF PROJECT CATEGORY

Project Name: Camino Largo

Project Location: North Santa Fe Avenue and Camino Largo

APPLICABILITY OF PERMANENT, POST-CONSTRUCTION STORMWATER BMP REQUIREMENTS AND PROJECT TYPE DETERMINATION

Overview and Instructions

The City of Vista's (City's) Stormwater Management Program is regulated by the San Diego regional municipal stormwater permit (referred to as a Municipal Separate Storm Sewer System Permit). This permit requires that new development and redevelopment projects incorporate permanent stormwater Best Management Practices (BMPs) into the project design. The City of Vista's *BMP Design Manual* (formerly *SUSMP Manual*) discusses BMP requirements applicable to new development and redevelopment projects.

ALL STANDARD AND PRIORITY PROJECTS ARE REQUIRED TO INCORPORATE SITE DESIGN AND SOURCE CONTROL BMPS. Additional treatment control and hydromodification management BMP requirements apply to projects that meet specific criteria or thresholds. This checklist must be completed by the project applicant or proponent, and is used to determine if those additional BMPs are required.

Not all site improvements are considered "development projects" under the MS4 Permit.

Development projects are defined by the MS4 Permit as "construction, rehabilitation, redevelopment, or reconstruction of any public or private projects". Development projects are issued local permits to allow construction activities. To further clarify, this checklist applies only to new development or redevelopment activities and/or projects that have the potential to contact storm water and contribute an anthropogenic source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

A project must be defined consistent with the California Environmental Quality Act (CEQA) definitions of "project."

CEQA requires that the project include "the whole of the action". "Whole of the Action" means the project may not be segmented or phased into small parts either onsite or offsite if the effect is to reduce the quantity of impervious area and fall below thresholds for applicability of storm water requirements. This requirement precludes "piece-mealing," which is the improper (and often artificial) separation of a project into smaller parts to avoid preparing Environmental Impact Report level documentation.

As indicated above, for the purposes of the *BMP Design Manual*, the "project" is the "whole of the action" which has the potential for adding or replacing or resulting in the addition or replacement of, roofs, pavement, or other impervious surfaces, thereby resulting in increased flows and storm water pollutants.

When defining the project, the following questions are considered:

- What are the project activities?
- Do they occur onsite or offsite?
- What are the limits of the project (project boundary)?
- What is the whole of the action associated with the project (i.e. what is the total amount of new or

replaced impervious area considering all of the collective project components through all phases of the project)?

- Are any facilities or agreements to build facilities offsite in conjunction with providing service to the project (street-widening, utilities)?

Responses to the checklist represent an initial assessment of the proposed project conditions and impacts. City staff will confirm this checklist based on assessment of the development application and/or project plans. Results of the checklist will classify a project as one of the following: Priority Development Project, Standard Project, or Non-development Project.

If additional information is needed while completing this checklist, please refer to the City's *BMP Design Manual*. Alternatively, contact City Land Development staff.

This Form is divided into 4 sections:

1. Post-Construction Stormwater Requirement Exemptions
2. Priority Development Project Determination
3. Special Consideration for Redevelopment Projects (50 Percent Rule)
4. Final Project Determination

SECTION 1 – POST CONSTRUCTION STORMWATER REQUIREMENT EXEMPTIONS	City of Vista BMP Design Manual	
This section will determine whether your project is exempt from post-construction BMP requirements and would be classified as a Non-Development Project. See section 1.3 of the City's *BMP Design Manual* for further discussion.	**YES**	**NO**
(a) Replacement of impervious surfaces that are part of a routine maintenance activity, such as (check yes if any apply): (i) Replacing roof material on an existing building (ii) Rebuilding a structure to original design after damage from earthquake, fire or similar disaster (iii) Restoring pavement or other surface materials affected by trenches from utility work (iv) Resurfacing existing roads and parking lots, including slurry, overlay and restriping (v) Routine replacement of damaged pavement, including full depth replacement, if the sole purpose is to repair the damage (vi) Constructing new sidewalk, pedestrian ramps or bike lanes on existing roads (within existing street right-of-way) (vii) Restoring a historic building to its original historic design (viii) Routine replacement of damaged pavement, such as pothole repair **Note**: Work that creates impervious surface outside of the existing impervious footprint is not considered routine maintenance.	☐	☒
(b) Repair or improvements to an existing building or structure that do not alter the size (check yes if any apply): (i) Plumbing, electrical and HVAC work (ii) Interior alterations including major interior remodels and tenant build-out within an existing commercial building (iii) Exterior alterations that do not change the general dimensions and structural framing of the building (does not include building additions or projects where the existing building is demolished)	☐	☒
If you answered **YES** to either category (a) or (b), your project is considered a Non-Development Project, and post construction BMP requirements do not apply. Please proceed to Section 4 and check the **Non-Development Project** box. If you answered **NO** to category (a) and (b), please proceed to Section 2.		

SECTION 2 – PRIORITY DEVELOPMENT PROJECT DETERMINATION	City of Vista BMP Design Manual	
This section determines whether your project is a **Priority Development Project (PDP)** or a **Standard Project.** See section 1.4 of the City's *BMP Design Manual* for further discussion. The following eight (8) types of projects are defined as **PDPs:**	**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.	☒	☐
(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.	☐	☒
(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.	☒	☐

(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 discharge 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; 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 City. For projects adjacent to an ESA, but not discharging to an ESA, the 2,500 sq-ft threshold does not apply as long as the project does not physically disturb the ESA and the ESA is upstream of the project. There are no Areas of Special Biological Significance (ASBS) or State Water Quality Protected Areas in the City's jurisdiction. The ESAs within the City's boundaries which include 303(d)-listed impairments and RARE beneficial use designations are listed below: • Agua Hedionda Creek • Buena Creek • Buena Vista Creek • Loma Alta Creek	☐	☒
(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. This category includes Retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.	☐	☒
(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. This means any activity that moves soils or substantially alters the pre-existing vegetated or man-made cover of any land. This includes, but is not limited to the following: (i) Grading, digging, cutting, scraping, stockpiling, pavement removal, and exterior construction; (ii) Substantial removal of vegetation where soils are disturbed including but not limited to removal by clearing or grubbing; or (iii) Any activity which bares soil or rock or involves streambed alterations or the diversion or piping of any watercourse.	☒	☐
If you answered **YES** to any of the categories above (a-f), your project is considered a PDP. Please proceed to section 3 and check the **Priority Development Project** Box in Section 4. If you answer **NO** to all categories, then your project is considered a Standard Project. Please proceed to Section 4 and check the **Standard Project Box**.		

SECTION 3 – SPECIAL CONSIDERATIONS FOR REDEVELOPMENT PROJECTS (50 PERCENT RULE)	City of Vista BMP Design Manual	
This section determines additional considerations required for **Redevelopment PDPs.** See section 1.7 of the City's *BMP Design Manual* for further discussion.	**YES**	**NO**
Will redevelopment result in the creation or replacement of impervious surface in an amount of more than 50 percent of the surface area of the previously existing development? See clarification on calculation of the ratio of impervious surface below. These requirements for managing storm water on an entire redevelopment project site are commonly referred to as the "50 Percent Rule". For the purpose of calculating the ratio, the surface area of the previously existing development shall be the area of <u>impervious surface</u> within the previously existing development. The following steps shall be followed to estimate the area that requires treatment to satisfy the MS4 Permit requirements: 1. How much total impervious area currently exists on the site? 2. How much existing impervious area will be replaced with new impervious area? 3. How much new impervious area will be created in areas that are pervious in the existing condition? 4. Total created and/or replaced impervious surface = Step 2 + Step 3. 5. **<u>50 Percent Rule Test</u>**: Is step 4 more than 50 Percent of Step 1? If yes, treat all impervious surface on the site (including existing impervious surface not being replaced or added). If no, then treat only Step 4 impervious surface and any area that comingles with created and/or replaced impervious surface area. <u>Note</u>: Step 2 and Step 3 must not overlap, as it is fundamentally not possible for a given area to be both "replaced" and "created" at the same time. Also activities that occur as routine maintenance (see Section 1 of this form) shall not be included in Step 2 and Step 3 calculation. For example, a 10,000 square foot development proposes replacement of 4,000 square feet of impervious area. The treated area is less than 50 percent of the total development area and only the 4,000 square foot area is required to be treated.	☐	☒
If you answered **YES**, then you must implement the PDP requirements for all impervious surfaces across the entire site. Please proceed to Section 4 and check the box under PDP indicating that the Project **Is a Redevelopment Project Subject to the 50 Percent Rule**. If you answered **NO,** then you are only required to treat impervious surfaces that are replaced or created. Please proceed to section 4 and check the box under PDP indicating this is **Not a Redevelopment Project Subject to the 50 Percent Rule**.		

SECTION 4 – FINAL PROJECT DETERMINATION

BASED ON THE INFORMATION PROVIDED IN SECTIONS 1-3, THIS PROJECT IS DETERMINED TO BE A:

☒ **PRIORITY DEVELOPMENT PROJECT.** PRIORITY REQUIREMENTS APPLY AND A STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) MUST BE SUBMITTED AT THE TIME OF APPLICATION.

- ☐ THIS **IS** A REDEVELOPMENT PROJECT SUBJECT TO THE 50 PERCENT RULE.
- ☒ THIS **IS NOT** A REDEVELOPEMNT PROJECT SUBJECT TO THE 50 PERCENT RULE.

☐ **STANDARD PROJECT.** STANDARD REQUIREMENTS APPLY AND APPLICABLE SECTIONS OF A STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) MUST BE SUBMITTED AT THE TIME OF APPLICATION.

☐ **NON DEVELOPMENT PROJECT.**

Applicant Information and Signature Box

Address: Kyun Tae Kim; Frank Sohaei, Trustee of the Falor Family Trust 2359 Pio Pico Drive, Carlsbad, CA 92008	APN(s) 159-240-07
Applicant Name: Kyun Tae Kim; Frank Sohaei	Applicant Title: Owner
Applicant Signature: [signatures]	Date: 8/23/21

City use only

Concur:	Yes	No
By:		
Date:		
Land Dev #:		

Supporting discussion for this checklist, as well as BMP requirements for Priority Development Projects and Standard Projects, is provided in the City of Vista *BMP Design Manual*.

FORM 2 – PROJECT OVERVIEW

Page 1 of 11

Project Name	Camino Largo
Project Address	2123 N. Santa Fe Ave, Vista, CA 92084
Assessor's Parcel Number(s) (APN(s))	159-240-07
Permit Application Number	P21-0300
Watershed *(select one checkbox; use webpage below to determine watershed)* http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms	
San Luis Rey	☒ Lower San Luis Rey – Mission, 903.11
Carlsbad	☐ Loma Alta – Loma Alta, 904.10 ☐ Buena Vista – El Salto, 904.21 ☐ Buena Vista – Vista, 904.22 ☐ Agua Hedionda – Los Monos, 904.31 ☐ Agua Hedionda – Buena, 904.32 ☐ San Marcos – Batiquitos, 904.51
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	9.301 Acres (405,137 Square Feet)
Area to be Disturbed by the Project (Project Area)	8.864 Acres (386,127 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	4.597 Acres (200,222 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	4.267 Acres (185,905 Square Feet)
NOTE: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form 2, Page 2 of 11
DESCRIPTION OF EXISTING SITE CONDITIONS
Current Status of the Site (select all that apply and describe below): ☐ Existing development ☐ Previously graded but not built out ☐ Demolition completed without new construction ☒ Agricultural or other non-impervious use ☒ Vacant, undeveloped/natural Describe: In the existing condition, there is a nursery with greenhouse facilities, including dirt roadways and various storage structures. Less than 5% of the property site is impervious. The remaining existing property is vacant. The site is surrounded by undeveloped lands and single family residential homes.
Existing Land Cover Includes (select all that apply and describe below): ☒ Vegetative Cover 9.301 Acres (405,137 Square Feet) ☐ Non-Vegetated Pervious Areas ___ Acres (___ Square Feet) ☐ Impervious Areas ___ Acres (___ Square Feet) Describe: In the existing condition, less than 5% of the property site is impervious. Site terrain continues to support a modest growth of native grass. Currently there is a nursery on site.
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): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☒ 10 feet < GW Depth < 20 feet ☒ GW Depth > 20 feet According to the *Percolation Data* provided by Vinje & Middleton Engineering, Inc. dated August 16, 2016, ground water was not encountered at depths greater than 20 feet in Boring A. Groundwater was encountered at 13.5 feet in Boring B. See References for full infiltration testing report.

Existing Natural Hydrologic Features (select all that apply and describe in next section):

- ☒ Drainage ditch/Swale/Waterway
- ☐ Seeps
- ☐ Springs
- ☐ Wetlands
- ☐ None

The existing topography of the project site varies between 8% and 50% in slope, and encompasses a ridge line that tops out at elevation 362.0. The lowest relative elevation within the subject property is 294.0. The existing ridge line divides the site into two separate basins that drain towards POC-1 and POC-2. All existing storm water runoff on the west side of the ridge line flows southerly towards POC-1 on the surface, and ultimately flows south across Camino Largo toward a small stream that feeds Guajome Lake. All existing storm water runoff on the north side of the ridge line, POC-2, flows westerly on the surface until discharging southerly over the top of the paved private road, and into a natural swale. A small amount of ponding occurs before the runoff crests over the road.

Additionally, there is a significant amount of offsite run-on from the hillside to the northeast of the project site. This run-on flows to the same discharge point as POC-2. All drainage enters an existing stream bed to the south of Camino Largo, eventually joining at the existing culvert crossing below North Santa Fe Avenue, approximately 100 feet south of the project site.

Form 2, Page 3 of 11

DESCRIPTION OF EXISTING SITE DRAINAGE PATTERNS

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

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

Describe existing site drainage patterns:

The project site is a hillside property dominated by an east-west trending ridge that rises approximately 66 feet above the lowest site terrain along North Santa Fe Avenue. The steepest project slopes descend to the north at 3:1(H:V) gradients. Site terrain continues to support a modest growth of native grass. Currently there is a nursery on the site, including greenhouse facilities, dirt roadways, and various storage structures. Less than 5% of the property site is impervious. The site is surrounded by undeveloped lands and single family residential homes.

The existing drainage area is divided into two (2) basins. Areas draining towards POC-1 sheet flows from the top of the southerly ridge and then westerly along Camino Largo until discharging to the south side of Camino Largo just before North Santa Fe Ave at POC-1. Areas draining towards POC-2 sheet flows westerly off the ridge until discharging southerly over the top of the decomposed granite private road and into a natural swale at POC-2. In Additional offsite areas northeast of the easterly boundary flows to POC-2. All drainage enters an existing stream bed to the south of Camino Largo, eventually joining at an existing culvert crossing below North Santa Fe Avenue approximately 100 feet south of the project site

See Pre-Developed Condition Hydromodification Management Exhibit for pre-developed site drainage patterns.

POC-ID	Drainage Area (ac)	100-Year Peak Flow (cfs)
POC-1	4.95	7.05
POC-2	4.16	6.23
Total	9.11	13.28

Form 2, Page 4 of 11
DESCRIPTION OF PROPOSED SITE DEVELOPMENT
Project Description / Proposed Land Use and/or Activities: The Camino Largo Project proposes the development of a forty six (46) lot residential subdivision with individual level building pads on 9.3 gross acres. The project also proposes the minor widening and improvement of the Camino Largo private drive, which will include paving, sidewalks with curb and gutter. The graded site will include forty six (46) new residential lots with driveways and landscaping areas along five (5) streets north of Camino Largo. Approximately 53% of the property will be impervious. Biofiltration basins are proposed for the two main drainage basins for POC-1 and POC-2. Proposed grading has been minimized as much as possible to maintain existing slope and drainage patterns. The disturbed area is 7.86 acres; the existing site is 0% impervious pre-development and 53% impervious post-development. Two (2) Points of Compliance (POC) have been identified in the southwestern and southeastern corner of the project site, as shown on the DMA Exhibit. POC-1 is the existing culvert underneath North Santa Fe Avenue and POC-2 is the existing swale located south of the existing cul-de-sac on Camino Largo. Drainage patterns reflected on the DMA Exhibit will slightly increase the acreage draining to POC-1 and POC-2. Both POCs include new impervious contributing area and are subject to Hydromodification Plan (HMP) compliance.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): The project also proposes the minor widening and improvement of the Camino Largo private drive, which will include paving, sidewalks with curb and gutter. The graded site will include forty six (46) new residential lots with driveways and landscaping areas along five (5) streets north of Camino Largo. Approximately 53% of the property will be impervious.
List/describe proposed pervious features of the project (e.g., landscape areas): The proposed pervious features of the project will include landscape areas in the parkways of the private streets and around the single family residences and the associated grading of the proposed pads.
Does the project include grading and changes to site topography? ☒ Yes ☐ No Describe: Project grading will occur on approximately 8.86 acres of the project. Proposed grading has been minimized as much as possible and avoids the steep slope areas. This maintains existing slope and drainage patterns to the fullest extent possible. Post-development site flow will mimic pre-developed drainage conditions, and will discharge from the site at below historical flow rates (see Preliminary Hydrology and Hydraulic Report for discussion and calculations). Impervious surfaces have been minimized where feasible. Due to minimized grading, some areas remain undisturbed on the project site.

Form 2, Page 5 of 11

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 also proposes drainage improvements consisting of concrete brow ditches, storm drain pipes, catch basins, and biofiltration basins to maintain the pre-developed runoff characteristics. Proposed grading has been minimized as much as possible and avoids the steep slope areas. This maintains existing slope and drainage patterns to the fullest extent possible.

POC-1
There is one (1) biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1.

POC-2
There is one (1) biofiltration basin which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flows into a natural swale.

Rip rap energy dissipaters are proposed at storm drain outlets to reduce flow velocities. Post-development site flow will mimic existing drainage conditions, and will discharge from the site at below historical flow rates. The Homeowners Association will maintain the private road, storm drain system, and biofiltration basins.

POC-ID	Drainage Area (ac)	Undetained 100-Year Peak Flow (cfs)	Detained 100-Year Peak Flow (cfs)
POC-1	4.85	21.29	6.96
POC-2	5.33	19.17	6.21

Form 2, Page 6 of 11
POTENTIAL POLLUTANT SOURCE AREAS
Identify whether any of the following features, activities, and/or pollutant source areas will be present. Select all Pollutant Source Areas that apply and include them on the DMA Exhibit. Source control BMPs must be identified for each of these areas in Form 3 of this SWQMP: ☒ On-site storm drain inlets ☐ Sump pumps or French drains ☐ Interior or sub-surface parking garages ☒ Need for future indoor & structural pest control ☒ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, or other water features ☐ Food preparation and/or service ☐ Refuse/trash collection areas ☐ Industrial processes ☐ Outdoor storage of equipment, chemicals, or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☐ Fire sprinkler test and relief point ☐ Miscellaneous drain or wash down areas ☒ Plazas, sidewalks, and parking lots Describe: Prohibitive dumping placards and/or signage will be provided at storm drain inlets and catch basins. Pest-resistant or well-adapted plant varieties such as drought tolerant and/or native plants will be planted in landscape areas. Flow reducers or shutoff valves triggered by a pressure drop to control water loss will be used in the event of broken sprinkler heads or lines. Sidewalk area along the streets will drain to the curb and gutter and then downstream into biofiltration areas for treatment.

Form 2, Page 7 of 11
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):
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**
Guajome Lake (903.11)	Eutrophic	
Lower San Luis Rey River (903.11	Benthic Community Effects	
	Chloride	
	Enterococcus	
	Fecal Coliform	
	Phosphorus	
	Selenium	
	Sulfates	
	Total Dissolved Solids	
	Total Nitrogen as N	
	Toxicity	

Identification of Project Site Pollutants*

***Identification of project site pollutants 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**	**Expected from the Project Site**	**Also a Receiving Water Pollutant of Concern**
Sediment	☐	☐	☐
Nutrients	☐	☐	☐
Heavy Metals	☐	☐	☐
Organic Compounds	☐	☐	☐

Trash & Debris	☐	☐	☐
Oxygen Demanding Substances	☐	☐	☐
Oil & Grease	☐	☐	☐
Bacteria & Viruses	☐	☐	☐
Pesticides	☐	☐	☐

Form 2, Page 8 of 11
HYDROMODIFICATION MANAGEMENT REQUIREMENTS
Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual; select one box and describe below)? ☒ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Describe: The biofiltration facilities were modeled using EPA SWMM version 5.1. The SWMM model uses continuous simulation modeling to determine the minimum required hydromodification management volumes for each proposed biofiltration basin. POC-1 There is one (1) biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1. POC-2 There is one (1) biofiltration basin which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flows into a natural swale.

Form 2, Page 9 of 11
CRITICAL COARSE SEDIMENT YIELD AREAS
**This section only required if hydromodification management requirements apply*
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries (select all that apply and describe below)? Additional signed and stamped reports must be provided to document any exemption from coarse sediment yield requirements. ☐ Yes ☒ No, No critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the BMP Design Manual been performed? ☐ 6.2.1 Verification of Geomorphic Landscape Units (GLUs) Onsite ☐6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☐No critical coarse sediment yield areas to be protected based on verification of GLUs onsite ☐Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 2.B of the SWQMP. ☐Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Describe:

Form 2, Page 10 of 11
FLOW CONTROL FOR POST-PROJECT RUNOFF
**This section only required if hydromodification management requirements apply*
List and describe point(s) of compliance for hydromodification management flow control (see Section 6.3.1). Identify each point of compliance for flow control on the Hydromodification Management Exhibit in Attachment 2A. 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 the report. Hydromodification Screening for Camino Largo prepared by Chang Consultants, Date August 6, 2021. Discussion / Additional Information: (optional)

Form 2, Page 11 of 11
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. The site topography contains natural channels and low points where runoff would historically gather before flowing off-site. The proposed on-site grading follows the same general topography, with storm drain features located in those historically low areas to safely convey runoff off the site.
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.

FORM 3 – SOURCE CONTROL BMPS FOR ALL DEVELOPMENT PROJECTS

Page 1 of 4

PROJECT IDENTIFICATION & SOURCE CONTROLS			
Project Name: Camino Largo			
Permit Application Number: P21-0300			
All development projects must implement source control BMPs SC-1 through SC-6, unless justification is provided by qualified design professional See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following, and provide description. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. • "No" means the BMP is applicable to the project but it is not feasible to implement. • "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).			
Source Control Requirement	**Applied?**		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Acknowledge that an illicit discharge is any discharge to the MS4 that is not composed entirely of wash water. Provide educational materials to prevent illicit discharges as a component of the Operation and Maintenance Plan (O&M Plan).			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Prohibitive dumping placards and/or signage will be provided at storm drain inlets and catch basins.			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			

Form 3, Page 2 of 4			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	**Applied?**		
a. On-site storm drain inlets	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Storm drain inlets and catch basins will be labeled with "No Dumping Drains to Waterways". See DMA Exhibit.			
b. Sump pumps or French drains	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
c. Interior or sub-surface parking garages	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
d. Need for future indoor & structural pest control	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Pest-resistant or well-adapted plant varieties such as drought tolerant and/or native plants will be planted in landscape areas. Integrated Pest Management (IPM) educational materials will be distributed to future occupants as a component of the O&M Plan that address physical pest elimination techniques such as relying on natural enemies to consume pests, weeding, pruning, and etc.			
e. Landscape/outdoor pesticide use	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Irrigation systems will be designed for the specific water requirements of each landscape area. Landscaping will be designed to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. Flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines will be used. Water conservation educational materials will also be provided for future occupants.			

Form 3, Page 3 of 4			
Source Control Requirement	**Applied?**		
f. Pools, spas, ponds, decorative fountains, or other water features	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
g. Food preparation and/or service	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
h. Refuse/trash collection areas	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
i. Industrial processes	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
j. Outdoor storage of equipment, chemicals, or materials	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
k. Vehicle and equipment cleaning	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
l. Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
m. Fuel dispensing areas	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			

Form 3, Page 4 of 4			
n. Loading docks	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
o. Fire sprinkler test water and relief point	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
p. Miscellaneous drain or wash down areas	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible:			
q. Plaza, sidewalks, parking lots	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: Sidewalk area along the streets will drain to the curb and gutter and then downstream into biofiltration areas for treatment.			
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

FORM 4 – SITE DESIGN BMPS FOR ALL DEVELOPMENT PROJECTS

PROJECT IDENTIFICATION
Project Name: Camino Largo
Permit Application Number: P21-0300

All development projects must implement site design BMPs SD-1 through SD-8, unless justification is provided by qualified design professional. See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following, and provide description.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual.
- "No" means the BMP is applicable to the project but it is not feasible to implement.
- "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).

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: A proposed storm drain pipe underneath Camino Largo will be constructed to maintain the drainage stream at POC-2. Additionally, flows draining towards POC-1 will discharge at the historical point of discharge.			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: Steep natural areas located to the north of the basins draining towards POC-1 and POC-2 will be preserved where feasible. See DMA Exhibit for location of undisturbed areas. Soil disturbance is minimized where feasible.			
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: Impervious areas have been reduced where feasible.			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: Soil compaction will be minimized in natural landscape areas. Disturbed slope soils will also be amended and aerated.			

Form 4, Page 2 of 2			
SD-5 Impervious Area Dispersion	☐ Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: Landscape will effectively receive and infiltrate, and treat runoff from impervious areas. Roof drains will be directed to landscape areas where feasible prior to discharging to storm water conveyance systems.			
SD-6 Runoff Collection	☐ Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: Landscape will effectively receive and infiltrate, and treat runoff from impervious areas. Roof drains will be directed to landscape areas where feasible prior to discharging to storm water conveyance.			
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: Landscape design and plant palette will be selected that minimizes required resources (irrigation, fertilizers and pesticides). Native plants require less fertilizer and pesticide use because they are already adapted to local rainfall patterns and soils conditions.			
SD-8 Harvest and Use of Precipitation *Note: Worksheet B.3-1, "Harvest and Use Feasibility" must be included in this section of the SWQMP.*	☐Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: See *Worksheet B.3-1, "Harvest and Use Feasibility"*			

FORM 5 – STRUCTURAL POLLUTANT CONTROL AND HYDROMODIFICATION MANAGEMENT BMPS

PROJECT IDENTIFICATION
Project Name: Camino Largo
Permit Application Number: P21-0300
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 local jurisdiction 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 local jurisdiction must confirm the maintenance (see Section 7 of the *BMP Design Manual*). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the *BMP Design Manual* were followed, and the results (type of BMP selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate structures. Note: Each structural pollutant control and hydromodification management BMP must be clearly identified on a site map (Attachment 1a), and described in supporting table (Attachment 1B). A feasibility analysis was then conducted for infiltration and if infiltration is fully or partially feasible for the project's structural BMPs. The negative impacts associated with retention were identified and substantiated through completion of Worksheet C.4-1 (Form I-8). Since infiltration is considered infeasible, biofiltration BMPs were chosen as the type of structural BMP for DMA 1 and DMA 2. The biofiltration facilities were modeled using EPA SWMM version 5.1. The SWMM model uses continuous simulation modeling to determine the minimum required hydromodification management volumes for each proposed biofiltration basin. The types of structural BMPs chosen were also based on downstream receiving waters and treatment goals. Since POC-1 is located upstream from a receiving water that is 303(d) listed for a nutrient pollutant, Nutrient Sensitive Media Design (BF-2) was selected for the Biofiltration Basins 1 and 2 to minimize the potential for export of nutrients from the media.

POC-1
There is one (1) biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1.

POC-2
There is one (1) biofiltration basin which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flow into a natural swale.

DISP-1 and DMIN-1
Project frontage street improvements include North Santa Fe street widening delineated by DISP-1 and DMIN-1. North Santa Fe cross section is in a full superelevation cross section, 4% sloping away from the project frontage in a southeasterly direction. Therefore it is infeasible to provide any stormwater treatment or flow control without the ultimate street improvements being completed. However, the proposed sidewalk along the project frontage will be non-contiguous with the proposed curb and gutter, allowing impervious dispersion to occur effectively disconnecting the concrete sidewalk from directly draining offsite by routing runoff from the sidewalk onto the adjacent landscape areas.

Camino Largo
Project frontage street improvements include Camino Largo street widening delineated on the DMA Exhibit. Camino Largo will be improved to the centerline and another 12 feet to the south of the centerline, except where the crown of Camino Largo has been transition to the south 8 feet between Private Street – Lot F and the spillway to prevent street runoff from overflowing to the south and bypassing the BMP 2. A proposed 8 inch curb and gutter will be used between the previously mentioned crown transition to sufficiently convey street runoff into BMP 2.

FORM 6 – STORMWATER BMP MAINTENANCE MECHANISM

PROJECT IDENTIFICATION
Project Name: Camino Largo
Permit Application Number: P21-0300
Maintenance Requirements
A stormwater structural BMP operations and maintenance plan must be prepared for PDPs. A template plan is available at: http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms Has a stormwater structural BMP operations and maintenance plan been prepared? ☒ Yes, included with Attachment 3A ☐ No bHA, Inc land planning, civil engineering, surveying 5115 Avenida Encinas, Suite L Carlsbad, CA 92008-4387 (760) 931-8700 [INSERT PREPARER'S TITLE/COMPANY]
All projects are required to maintain designed functionality of structural BMPs in perpetuity. Privately-owned projects must record a *Storm Drain Maintenance Agreement* with the County of San Diego Assessor's Office. A template *Storm Drain Maintenance Agreement* is available at: http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms Has a Storm Drain Maintenance Agreement been submitted to the County? ☒ Yes, copy included with Attachment 3B ☐ No ☐ Not Applicable (e.g., city-owned property/project)

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this

ATTACHMENT 1 – POLLUTANT CONTROLS: SUPPORT DOCUMENT AND CHECKLIST

checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 1A	Drainage Management Area (DMA) Exhibit See DMA Exhibit Checklist on next page.	☒ Included
Attachment 1B	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, DMA Type, and BMPs* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1A	☒ Included on DMA Exhibit in Attachment 1A ☐ Included as Attachment 1B
Attachment 1C	Harvest and Use Feasibility Screening Checklist (Worksheet B.3-1) Refer to Appendix B.3-1 of the *BMP Design Manual*.	☒ Included ☐ Not included because the entire project will use Infiltration BMPs
Attachment 1D	Categorization of Infiltration Feasibility Condition (Worksheet C.4-1) Refer to Appendices C and D of the *BMP Design Manual*.	☒ Included ☐ Not included because the entire project will use Harvest and Use BMPs
Attachment 1E	Pollutant Control BMP Design Worksheets and Calculations Refer to Appendices B and E of the *BMP Design Manual* for structural pollutant control BMP design guidelines	☒ Included

ATTACHMENT 1A – DMA EXHIBIT CHECKLIST

For Attachment 1A, provide map(s) for the project site, titled "DMA Exhibit." The checklist below identifies minimum elements that must be included with the DMA Exhibit.

- ☒ Underlying hydrologic soil group
- ☒ Approximate depth to groundwater
- ☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands, etc.)
- ☒ Critical coarse sediment yield areas to be protected
- ☒ Existing topography and impervious areas
- ☒ Existing and proposed site drainage network and storm drain structures
- ☒ Proposed connections to offsite drainage
- ☒ Proposed demolition
- ☒ Proposed grading
- ☒ Proposed impervious features
- ☒ Proposed design features and surface treatments used to minimize imperviousness
- ☒ Drainage management area (DMA) boundaries
- ☒ DMA identification numbers (DMA ID)
- ☒ DMA areas (square footage or acreage)
- ☒ DMA type (Drains to BMP, Self-mitigating, De Minimis, or Self-retaining)
- ☒ Potential pollutant source areas and corresponding required source controls (see Form 2 and Form 3 of SWQMP, *BMP Design Manual* Chapter 4 and Appendix E.1)
- ☒ Proposed Structural BMPs (see Form 5 of SWQMP)

PROJECT CHARACTERISTICS

SOIL TYPE	D
PARCEL AREA	9.301 ACRES
DISTURBED AREA	8.864 ACRES
PROPOSED IMPERVIOUS AREA	4.597 ACRES
PROPOSED PERVIOUS AREA	4.267 ACRES
DEPTH TO GROUNDWATER	> 20 FEET

BASIN	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	PROPOSED STRUCTURAL	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
BASIN 1	DMA 1	ROOF, DRWY, LANDSCAPE	205,008	119,767	85,241	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	6,147
BASIN 2	DMA 2	ROOF, DRWY, LANDSCAPE	137,024	79,102	57,922	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	9,279
	BYPASS 2	NATURAL	73,893	0	73,893	BYPASS	BYPASS	--	--
SM	SM 1	LANDSCAPE	8,747	0	8,747	SM	--	--	--
SM	SM 2	LANDSCAPE	404	0	404	SM	e	--	--
SM	SM 3	LANDSCAPE	865	0	865	SM	--	--	--
SM	SM 4	LANDSCAPE	6,734	0	6,734	SM	--	--	--

IMPERVIOUS DSIPERSION	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	DISPERSION AREA (SF)	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
DISP-1	DISP-1	LANDSCAPE	6,532	1,353	3,842	DISP	1,337	--	--

LEGEND	SYMBOL
DMA NAME / DMA AREA (SF)	DMA 1 / 205,008 SF
POINT OF CONCENTRATION	POC 1
DMA BOUNDARY	
PROJECT BOUDNARY	
FLOW PATH	
PROPOSED BROW DITCH	
ON-SITE STORM DRAIN INLET	
RIP RAP ENERGY DISSIPATER PER D40	
BIOFILTRATION/INFILTRATION BMP	
IMPERVIOUS AREA	

DETAIL: OFFSITE DRAINAGE

SOURCE CONTROL BMPS:

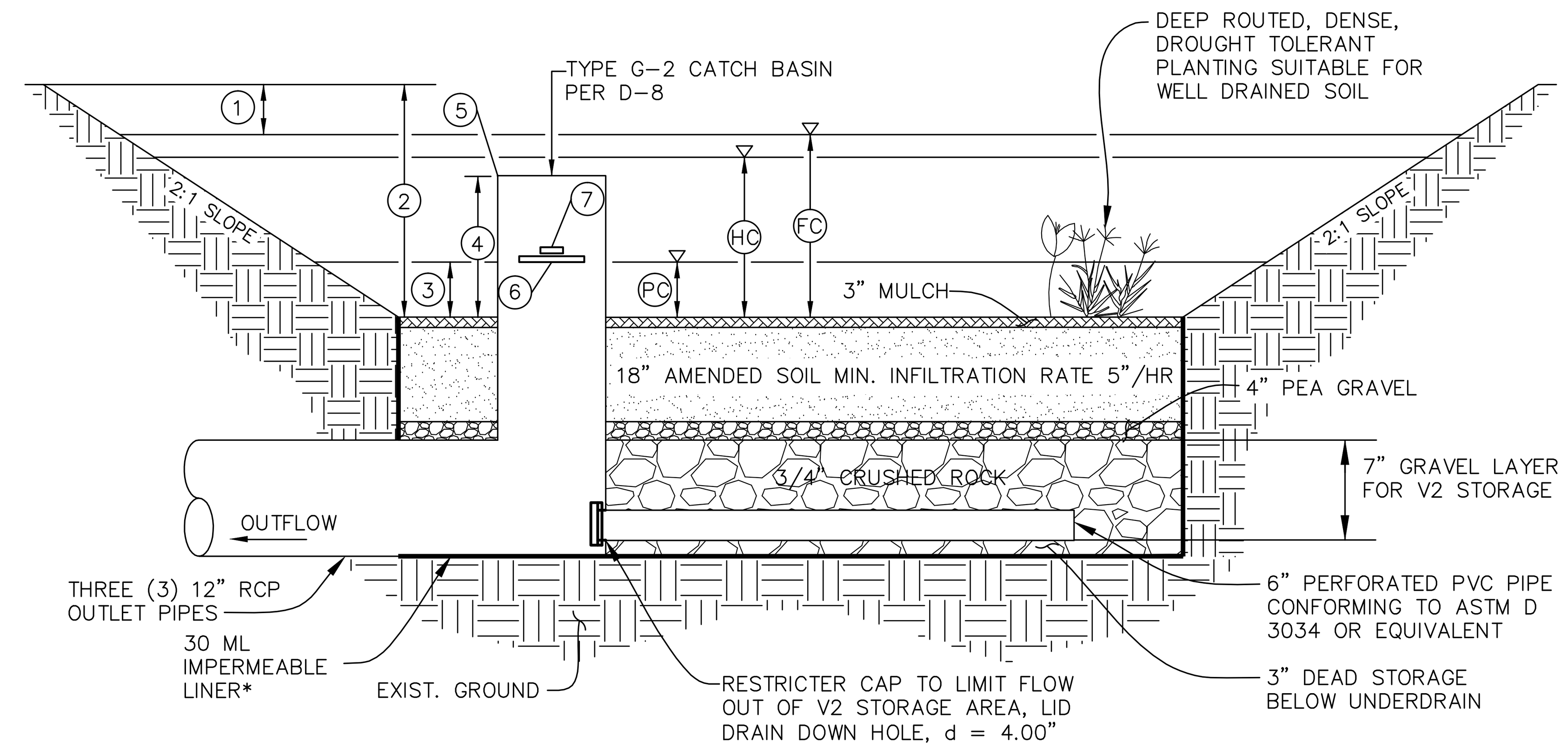
- SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
- SC-2 STORM DRAIN STENCILING AND SIGNAGE
- SC-6 ADDITIONAL BMPS BASED ON POTENTIAL RUNOFF POLLUTANTS:
  - A ON-SITE STORM DRAIN INLETS
  - B NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
  - C LANDSCAPE/OUTDOOR PESTICIDE USE
  - D SIDEWALKS

LID AND SITE DESIGN:

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

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008-4387
(760) 931-8700

DMA EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA



LEGEND

1. FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
2. BASIN HEIGHT H_{MAX} = 30.00"
3. PONDING DEPTH = 6.00"
4. RISER INVERT H_{TOP} = 18.00"
5. *EMERGENCY WEIR INVERT = 18.00"
6. *LOWER SLOT INVERT = 6.00" 1 – 5" HIGH X 34" LONG OPENING
7. *UPPER SLOT INVERT = 7.00" 1 – 4" HIGH X 10" LONG OPENING

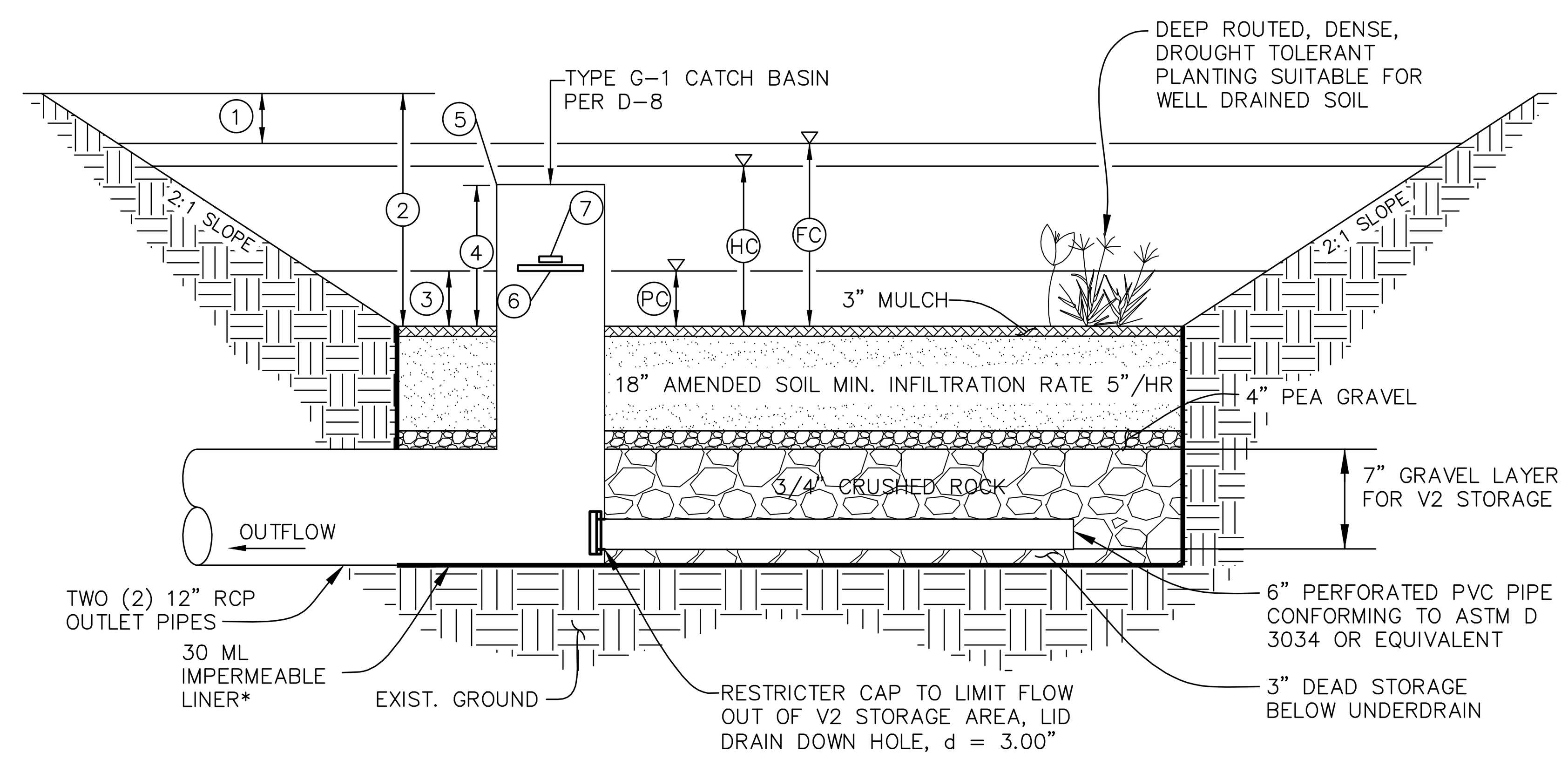
(PC) POLLUTANT CONTROL WSEL = 6.00"
(HC) HYDROMODIFICATION CONTROL WSEL = 13.92"
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 1

NOT TO SCALE

*30 MIL LINER NOTE: 30-MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN-WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN-WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



LEGEND

1. FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
2. BASIN HEIGHT H_{MAX} = 30.00"
3. PONDING DEPTH = 6.00"
4. RISER INVERT H_{TOP} = 18.00"
5. *EMERGENCY WEIR INVERT = 18.00"
6. *LOWER SLOT INVERT = 6.00" 1 – 3" HIGH X 32" LONG OPENING
7. *UPPER SLOT INVERT = 7.00" 1 – 2" HIGH X 6" LONG OPENING

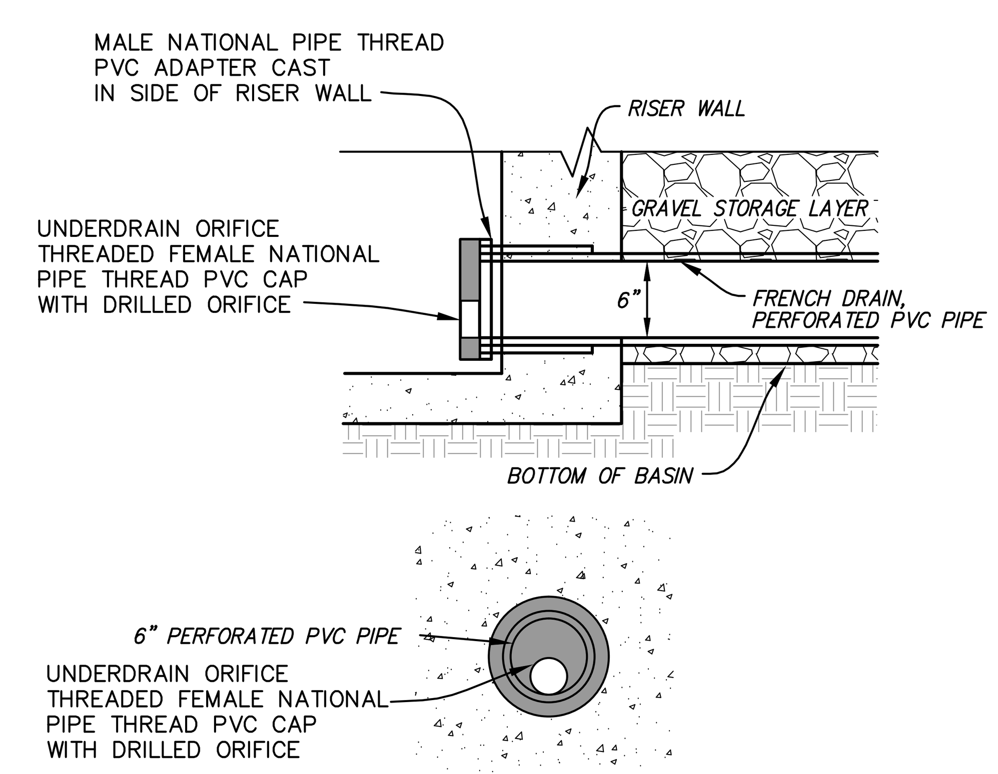
(PC) POLLUTANT CONTROL WSEL = 6.00"
(HC) HYDROMODIFICATION CONTROL WSEL = 6"
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 2

NOT TO SCALE

*30 MIL LINER NOTE: 30-MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN-WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN-WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



RESTRICTOR CAP DETAIL BMP 1 & 2

NOT TO SCALE

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008-4387
(760) 931-8700

DMA EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

SHEET 2 OF 2

ATTACHMENT 1C – HARVEST AND USE FEASIBILITY SCREENING CHECKLIST (WORKSHEET B.3-1)

Worksheet B.3-1. Harvest and Use Feasibility Screening

Harvest and Use Feasibility Screening		Worsksheet B.3-1
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☐ Toilet and urinal flushing ☒ Landscape irrigation ☐ Other:______________		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. Modified ETWU = 2.7 x [[(0.2 x180,518)/0.9] x 0.015] = 1,625 cf Total Previous Area = 180,518 sf		
3. Calculate the DCV using worksheet B-2.1. DCV = 7,329+4,899=12,228 cf		
3a. Is the 36-hour demand greater than or equal to the DCV? Yes ⇩ / (No) ⇨	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV? Yes ⇩ / (No) ⇨	3c. Is the 36-hour demand less than 0.25DCV? (Yes) ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

ATTACHMENT 1D– CATEGORIZATION OF INFILTRATION FEASIBILITY

JOB # 16-190-S
Test Site Location:
Camino Largo,
Vista

Storm Water BMP
Percolation Data

08/16/16

Infiltration BMP Type	Infiltration Basin
Test Method	Shallow Percolation Testing (Option 2)
Factor of Safety	FS=3
Drill Date	08/10/16
Test Date	08/11/16
Equipment Type	B-31 Mobile Drill Using Solid Stem Auger
Test Bore Diameter	8" inch
Observation Bore Diameter	6" inch
Groundwater Conditions	Groundwater Encountered @ 13' 5" In Deep B
Weather Conditions	Dry, Sunny, 88° to 90° F

Test No.	Depth (*ft*)	Percolation Rate (*mpi*)	Infiltration Rate (in/hr)	
1	4'	20.00	0.16	**BAISN A**
1a	4'	10.00	0.31	
2	4'	15.00	0.23	**BASIN G**
2a	4'	12.00	0.29	
3	4'	30.00	0.104	**BASIN B**
3a	4'	34.00	0.101	

BAISN A	Average = 15.00 mpi	Average = 0.24 in/hr
BASIN G	Average = 13.50 mpi	Average = 0.26 in/hr
BASIN B	Average = 32.00 mpi	Average = 0.103 in/hr

Infiltration Rates Vary Slightly Due to Actual Depth of Hole In Inches

Depth (ft)	Observation Boring A	08/8/2016
No Groundwater Encountered		
Clean Depth = 20' 1"		

Depth (ft)	Observation Boring B	08/10/2016
0 - 3'	Tan Loamy Sand	
3 - 19'	Brown Sandy Clay	
	End @ 19'	

note: See Geotechnical Report For USCS Soil Classifications

Ralph M. Vinje GE # 863
8-17-16

Vinje & Middleton
Engineering, Inc.

2450 Auto Park Way
Escondido, CA 92029-1229
(760) 743-1214

16-192-S

BASINS A,B & G RESULTS PAGE

Categorization of Infiltration Feasibility Condition			Form I-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?**			
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: TEST DATA WAS COLLECTED FROM SIX 8" INCH DIAMETER BORINGS DRILLED TO 4' FEET AND ONE 6" INCH BORING DRILLED TO 19' FEET WITHIN 50' FEET OF THE RESIDENTIAL STORM WATER DETENTION BASIN AREAS. SEE ATTACHED INFILTRATION RATE RESULTS AND TEST LOCATIONS. MAXIMUM INFILTRATION RATES OF = 0.31 INCHES/HOUR AND MINIMUM INFILTRATION RATE = 0.10 INCHES/HOUR WERE RECORDED. AVERAGED TESTED INFILTRATION RATES = 0.24 IN/HR IN BASIN A, 0.103 IN/HR IN BASIN B & 0.26 IN/HR IN BASIN G. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: UNKNOW HAZARD POTENTIAL BASED ON COLLECTED FIELD DATA HAVING AVERAGE INFILTRATION RATES EQUAL TO OR LESS THAN 0.31 INCHES/HOUR. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Form I-5			
Criteria	Screening Question	Yes	No
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: UNKNOW HAZARD POTENTIAL BASED ON COLLECTED FIELD DATA HAVING AVERAGE INFILTRATION RATES EQUAL TO OR LESS THAN 0.31 INCHES/HOUR. 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 seasonally or ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: UNKNOW HAZARD POTENTIAL BASED ON COLLECTED FIELD DATA HAVING AVERAGE INFILTRATION RATES EQUAL TO OR LESS THAN 0.31 INCHES/HOUR. 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	FULL INFILTRATION? **NO**	

Form I-5			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria **Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
Provide basis: TEST DATA WAS COLLECTED FROM SIX 8" INCH DIAMETER BORINGS DRILLED TO 4' FEET AND ONE 6" INCH BORING DRILLED TO 19' FEET WITHIN 50' FEET OF THE RESIDENTIAL STORM WATER DETENTION BASIN AREAS. SEE ATTACHED INFILTRATION RATE RESULTS AND TEST LOCATIONS. MAXIMUM INFILTRATION RATES OF = 0.31 INCHES/HOUR AND MINIMUM INFILTRATION RATE = 0.10 INCHES/HOUR WERE RECORDED. AVERAGED TESTED INFILTRATION RATES = 0.24 IN/HR IN BASIN A, 0.103 IN/HR IN BASIN B & 0.26 IN/HR IN BASIN G. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
Provide basis: EXISTING OR PROPOSED EARTHEN SLOPES IN EXCESS OF 3' FEET WILL NOT BE DOWN SLOPE OF THE PROPOSED RESIDENTIAL STORM WATER BASINS. ALL OTHER FACTORS MAY BE MITIGATED. INFILTRATION BASINS WILL BE IN CLOSE PROXIMITY TO THE EXISTING UNDERGROUND UTILITIES. THESE UTILITIES MUST BE PROTECTED FROM DAMAGE POTENTIALLY CAUSED BY THE PROPOSED 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.			

Form I-5			
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: STABALIZED GROUNDWATER CONDIDTIONS WERE OBSERVED AT 13.42' FEET BELOW EXISTING GRADE IN BORING B. PROPOSED BASIN DEPTH IS 4' FEET BELOW EXISTING GRADE. IT APPEARS THAT A MINIMUM OF 10' SEPARATION TO GROUNDWATER IS NOT FEASIBLE AT BASIN B. ADDITIONALY IT SHOULD BE NOTED THAT THIS IS THE DRY SEASON IN SEVERE DROUGHT CONDITIONS. GROUNDWATER WAS NOT OBSERVED NEAR BASINS A & G, AND WILL MEET A MINIMUM 10' SEPARATION FROM BASIN BOTTOM TO STABALIZED GROUNDWATER ELEVATION. 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 VIOLATIONS ARE EXPECTED TO REMAIN UNCHANGED AND NON EXISTING. 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 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	NO INFILTRATION	

Template Date: March 29, 2016 Preparation Date: 08/17/16

PDP SWQMP - Attachments

Form I-5 Certification

The Geotechnical Engineer certifies they completed Form I-5 except Criteria 4 & 8 (see Appendix C.4.3).

0000Professional Geotechnical Engineer's Printed Name:

RALPH MALCOLM VINJE

Professional Geotechnical Engineer's Signed Name:

Date: 8-17-16

REGISTERED PROFESSIONAL ENGINEER
RALPH MALCOLM VINJE
No. 863
Exp. 12-31-17
GEOTECHNICAL
STATE OF CALIFORNIA

The Project Design Engineer certifies they completed Criteria 4 & 8 (see Appendix C.4.4).

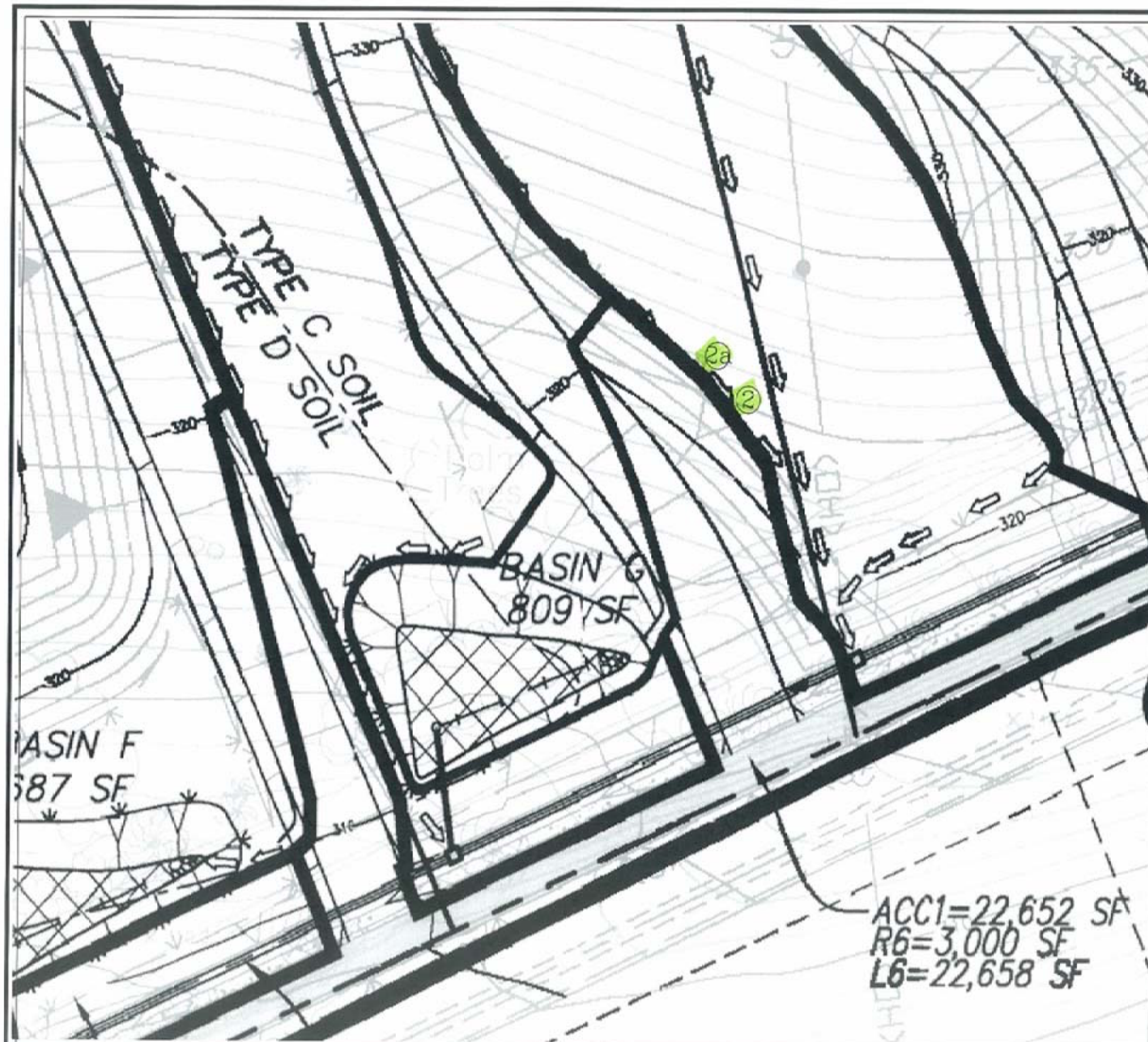
Professional Project Design Engineer's Printed Name:

____

Professional Project Design Engineer's Signed Name:

____

Date: ________________________________



VINJE & MIDDLETON ENGINEERING, INC.
2450 Auto Park Way
Escondido, CA 92029-1229
760-743-1214

Ralph M. Vinje GE 863

LOT INFORMATION

DATE: 8/16/2016
JOB No. 16-192-S
APN 159-240-07
ACRES 9.20

Owners Address	Site Location
Kim & Falor Family Trusts	2123 North Santa Fe,
c/o: Mackenzie Morgan	Vista, CA 92084-2503
5115 Avenida Encinas, Suite L	
Carlsbad, CA 92008-4387	
760-931-8700 ext. 228	
mmorgan@bhaincsd.com	

LEGEND

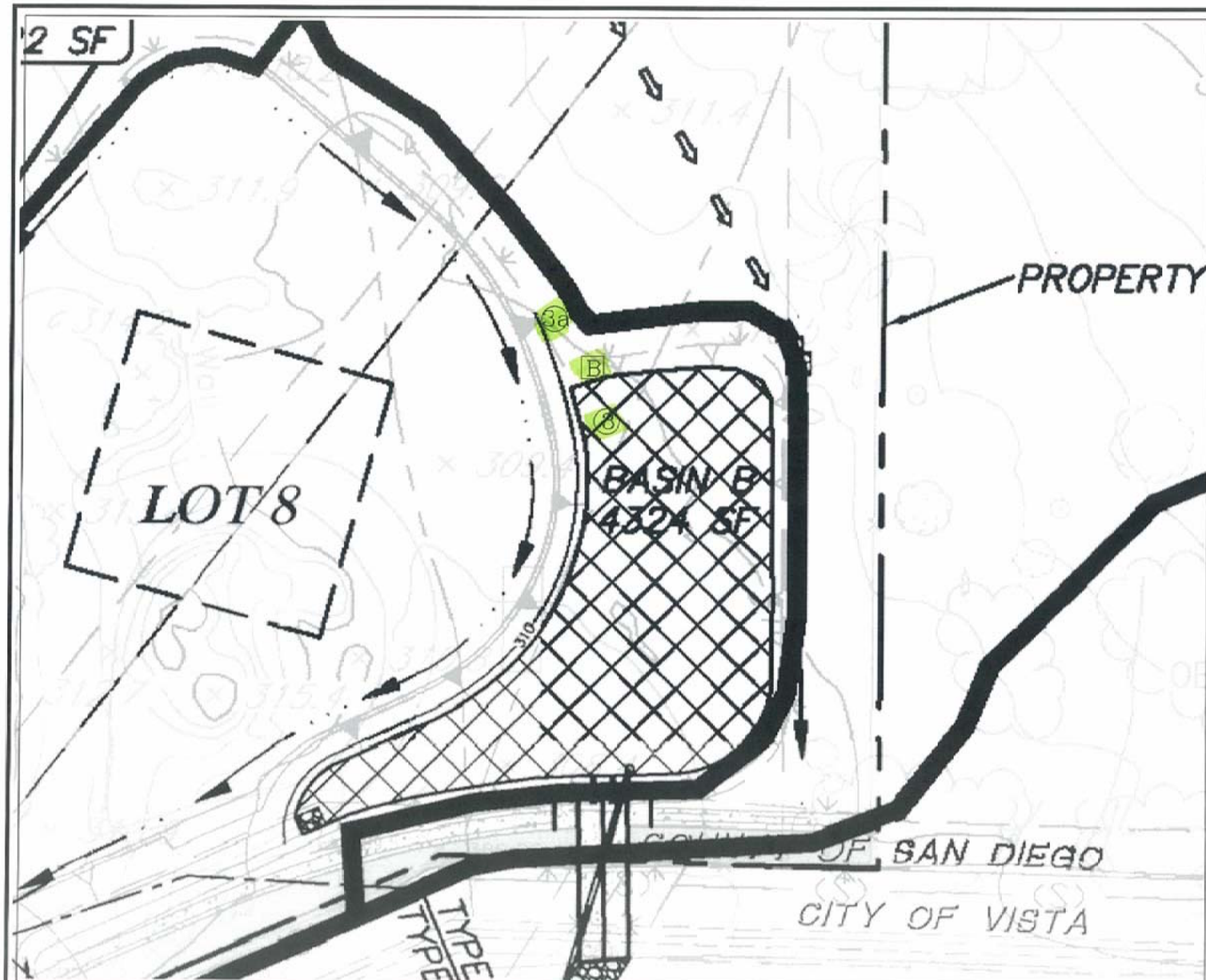
① Perc Test Location
Ⓐ Groundwater Boring
30 Contour Line w/ 1' Interval

BASIN G

SCALE: 1" = 20'

FIGURE 1

Infiltration Test Boring Location Map



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Kim & Falor Family Trusts c/o: Mackenzie Morgan 5115 Avenida Encinas, Suite L Carlsbad, CA 92008-4387 760-931-8700 ext. 228 mmorgan@bhaincsd.com	2123 North Santa Fe, Vista, CA 92084-2503

LEGEND

1 — Perc Test Location
A — Groundwater Boring
30 — Contour Line w/ 1' Interval

BASIN B

SCALE: 1" = 20'

N

FIGURE 1

Infiltration Test Boring Location Map

ATTACHMENT 1E– POLLUTANT CONTROL BMP DESIGN WORKSHEETS AND CALCULATIONS

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

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	1	2									unitless
	2	85th Percentile 24-hr Storm Depth	0.66	0.66									inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	119,767	79,102									sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)	85,241	57,922									sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	205,008	137,024	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.65	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.65	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	7,329	4,899	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.65	0.65	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	7,329	4,899	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.65	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	133,255	89,066	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	7,329	4,899	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

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

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Basic Analysis	1	Drainage Basin ID or Name	1	2	-	-	-	-	-	-	-	-	unitless
	2	85th Percentile Rainfall Depth	0.66	0.66	-	-	-	-	-	-	-	-	inches
	3	Predominant NRCS Soil Type Within BMP Location	D	D									unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted	Restricted									unitless
	5	Nature of Restriction	Groundwater	Groundwater									unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No	No									yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	Yes	Yes									yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer	No	No									in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	0.000	-	-	-	-	-	-	-	-	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	1.5%	-	-	-	-	-	-	-	-	percentage
	12	Fraction of DCV Requiring Retention	0.01	0.01	-	-	-	-	-	-	-	-	ratio
	13	Required Retention Volume	73	49	-	-	-	-	-	-	-	-	cubic-feet

No Warning Messages

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

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
BMP Inputs	1	Drainage Basin ID or Name	1	2	-	-	-	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	0.000	-	-	-	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	7,191	5,010	-	-	-	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated	Vegetated									unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined	Lined									unitless
	6	Does BMP Have an Underdrain?	Underdrain	Underdrain									unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard	Standard									unitless
	8	Provided Surface Area	6,132	8,300									sq-ft
	9	Provided Surface Ponding Depth	6	6									inches
	10	Provided Soil Media Thickness	18	18									inches
	11	Provided Gravel Thickness (Total Thickness)	7	7									inches
	12	Underdrain Offset	3	3									inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	3.00	3.00									inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.15	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	120	120	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.17	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	1,229	1,493	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	5,962	3,517	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.3512	0.3512	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	2.47	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	2.47	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	14.85	10.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	11.20	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	2	3	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	5	6	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	26.05	22.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	8,943	5,276	0	0	0	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	8,943	5,276	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	4,471	2,638	0	0	0	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	4,471	2,638	0	0	0	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	-	-	-	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	**Deficit of Effectively Treated Stormwater**	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	cubic-feet

No Warning Messages

ATTACHMENT 2 – HYDROMODIFICATION MANAGEMENT CONTROLS: SUPPORT DOCUMENTATION & CHECKLIST

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

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 2A	Hydromodification Management Exhibit	☒ Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2B	Management of Critical Coarse Sediment Yield Areas See Section 6.2 of the *BMP Design Manual*.	☒ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map Analyses, as applicable, for Critical Coarse Sediment Yield Area Determination, per *BMP Design Manual:* ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2C	Geomorphic Assessment of Receiving Channels See Section 6.3.4 of the *BMP Design Manual*.	☐ Not performed ☒ Included ☐ Submitted as separate stand-alone document
Attachment 2D	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary See Chapter 6 and Appendix G of the *BMP Design Manual*	☒ Included ☐ Submitted as separate stand-alone document
Attachment 2E	Vector Control Plan	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

ATTACHMENT 2A – HYDROMODIFICATION MANAGEMENT EXHIBIT

For Attachment 2A, provide map(s) for the project site, titled "Hydromodification Management Exhibit." The checklist below identifies minimum elements that must be included with the exhibit.

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

PROJECT CHARACTERISTICS	
SOIL TYPE	D
PARCEL AREA	9.301 ACRES
DISTURBED AREA	8.864 ACRES
PROPOSED IMPERVIOUS AREA	4.597 ACRES
PROPOSED PERVIOUS AREA	4.267 ACRES
DEPTH TO GROUNDWATER	> 20 FEET

BASIN	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	PROPOSED STRUCTURAL	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
BASIN 1	DMA 1	ROOF, DRWY, LANDSCAPE	205,008	119,767	85,241	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	6,147
BASIN 2	DMA 2	ROOF, DRWY, LANDSCAPE	137,024	79,102	57,922	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	9,279
	BYPASS 2	NATURAL	73,893	0	73,893	BYPASS	BYPASS	--	--
SM	SM 1	LANDSCAPE	8,747	0	8,747	SM	--	--	--
SM	SM 2	LANDSCAPE	404	0	404	SM	e	--	--
SM	SM 3	LANDSCAPE	865	0	865	SM	--	--	--
SM	SM 4	LANDSCAPE	6,734	0	6,734	SM	--	--	--

IMPERVIOUS DSIPERSION	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	DISPERSION AREA (SF)	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
DISP-1	DISP-1	LANDSCAPE	6,532	1,353	3,842	DISP	1,337	--	--

LEGEND	SYMBOL
DMA NAME / DMA AREA (SF)	DMA 1 / 205,008 SF
POINT OF CONCENTRATION	POC 1
DMA BOUNDARY	
PROJECT BOUDNARY	
FLOW PATH	
PROPOSED BROW DITCH	
ON-SITE STORM DRAIN INLET	
RIP RAP ENERGY DISSIPATER PER D40	
BIOFILTRATION/INFILTRATION BMP	
IMPERVIOUS AREA	

DETAIL: OFFSITE DRAINAGE

SOURCE CONTROL BMPS:

- SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
- SC-2 STORM DRAIN STENCILING AND SIGNAGE
- SC-6 ADDITIONAL BMPS BASED ON POTENTIAL RUNOFF POLLUTANTS:
  - A ON-SITE STORM DRAIN INLETS
  - B NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
  - C LANDSCAPE/OUTDOOR PESTICIDE USE
  - D SIDEWALKS

LID AND SITE DESIGN:

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

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HMP EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

K:\Civil 3D\1154\DWG\SWMP\HMP_TSM.dwg, 12/8/2021 9:13:54 AM

HYDROMODIFICATION CALCULATIONS

ENVIRONMENTAL PROTECTION AGENCY (EPA) STORM WATER MANAGEMENT MODEL 5.1 (SWMM) CONTINUOUS SIMULATION MODELS WERE PREPARED FOR THE PRE AND POST-DEVELOPED CONDITIONS AT THE SITE IN ORDER TO DETERMINE IF THE PROPOSED DETENTION FACILITY HAS SUFFICIENT VOLUME TO MEET CURRENT HYDROMODIFICATION MANAGEMENT PLAN (HMP) REQUIREMENTS FROM THE SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD (SDRWQCB), AS ESTABLISHED AT THE HMP DOCUMENT DATED MARCH 2011, PREPARED BY BROWN AND CALDWELL. THE CONTINUOUS SIMULATION MODEL USES 58 YEARS OF RAINFALL DATA RECORDED BY THE OCEANSIDE RAIN GAUGE (RAINFALL DATA EXISTS FROM 8/28/1951 THROUGH 5/23/2008.

LOW FLOW THRESHOLD

A LOW FLOW THRESHOLD FOR 0.5Q2 VALUE WAS USED TO DETERMINE THE DIAMETER OF THE LOW FLOW ORIFICE.

SWMM DEVELOPMENT

STORMWATER RUNOFF FROM THE PROPOSED PROJECT SITE IS ROUTED TO TWO (2) POINTS OF COMPLIANCE. POC-1 IS LOCATED NEAR THE SOUTHWEST CORNER OF THE PROJECT SITE. POC-1 COLLECTS RUNOFF FROM ONE ONE BASIN. POC-2 LOCATED NEAR THE SOUTHEAST CORNER OF THE PROJECT SITE. POC-2 COLLECTS RUNOFF FROM ONE ONSITE BASIN AND ONE OFFSITE BASIN. THE INPUT DATA REQUIRED TO DEVELOP SWMM ANALYSES INCLUDE RAINFALL, WATERSHED CHARACTERISTICS, AND BMP CONFIGURATIONS. THE OCEANSIDE GAUGE FROM THE PROJECT CLEAN WATER WEBSITE WAS USE FOR THIS STUDY, SINCE IT IS THE MOST REPRESENTATIVE OF THE SITE PRECIPITATION DUE TO ELEVATION AND PROXIMITY TO THE PROJECT SITE. EVAPORATION FOR THE SITE WAS MODELED USING AVERAGE MONTHLY VALUES FROM THE COUNTY HOURLY DATASET. THE SITE WAS MODELED WITH TYPE D HYDROLOGIC SOILS, SOILS ARE MOSTLY ASSUMED TO BE UNCOMPACTED IN EXISTING CONDITIONS. IN DEVELOPED CONDITIONS, SOILS WITHIN THE DEVELOPED PORTION OF THE SITE ARE ASSUMED TO BE COMPACTED, WHILE SOILS IN UNDEVELOPED AREAS ARE ASSUMED TO REMAIN UNCOMPACTED. BASED ON THE HMP REVIEW AND AND ANALYSIS PREPARED FOR THE CITY OF VISTA, OTHER SWMM INPUTS FOR THE SUBAREAS ARE DISCUSSED IN THE APPENDICES OF THE SWMM STUDY, WHERE THE SELECTION OF PARAMETERS IS EXPLAINED IN DETAIL.

HMP MODELING

PRE-DEVELOPED AND POST-DEVELOPED CONDITIONS

THE PRE-DEVELOPED SITE WAS MODELED AS ENTIRELY PERVIOUS, AS REQUIRED BY RWQCB ORDER NO. R9-2013-0001. STORM WATER RUNOFF FROM THE IMPERVIOUS ROOF AND ROAD AREAS WILL INTERCEPTED BY CATCH BASINS IN THE STREET, AND CONVEYED VIA A STORM DRAIN SYSTEM TO BIOFILTRATION BASINS. TWO (2) BIOFILTRATION BASINS WITH NO INFILTRATION ARE LOCATED WITHIN THE PROJECT SITE AND ARE RESPONSIBLE FOR HANDLING WATER QUALITY REQUIREMENTS FOR POC-1 AND POC-2.

BIOFILTRATION BASINS 1 AND 2 (BMPS 1 AND 2) ARE 6 INCHES DEEP WITH AN INTERNAL OUTLET STRUCTURE (SEE DIMENSIONS IN TABLE 2). FLOWS WILL THEN DISCHARGE FROM THE BASIN VIA THE OUTLET STRUCTURE OR INFILTRATE THROUGH THE BASE OF THE FACILITIES TO THE RECEIVING AMENDED SOIL AND LOW FLOW ORIFICE. THE RISER STRUCTURE WILL ACT AS A SPILLWAY SUCH THAT PEAK FLOWS CAN BE SAFELY DISCHARGED TO THE RECEIVING STORM DRAIN SYSTEM. BENEATH THE BASIN'S 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 A 7-INCH RESERVOIR LAYER OF GRAVEL. AN UNDERDRAIN PIPE WITH LOW FLOW ORIFICE OUTLET WILL BE PROVIDED WITHIN THE GRAVEL LAYER TO CARRY AWAY FILTERED RUNOFF TO THE RECEIVING STORM DRAIN SYSTEM. THE BASINS WILL ALSO INCLUDE A 3-INCH SATURATED STORAGE LAYER OF GRAVEL BELOW THE UNDERDRAIN PIPE. A RISER STRUCTURE WILL BE CONSTRUCTED WITHIN THE BMPS WITH A LOW FLOW ORIFICE OUTLET AND AN EMERGENCY OVERFLOW, SUCH THAT PEAK FLOWS CAN BE SAFELY DISCHARGED TO THE RECEIVING STORM DRAIN SYSTEM (SEE DIMENSIONS IN TABLE 2 AND 3).

THE BIOFILTRATION BASIN WILL ALSO FULFILL WATER QUALITY REQUIREMENTS. THEREFORE, THE BASIN WILL BE DUAL PURPOSE TO ACHIEVE THE FLOW-DURATION REQUIREMENTS SET FORTH IN THE COUNTY HMP, AS WELL AS ADDRESS THE STORM WATER QUALITY REQUIREMENTS SET FORTH IN THE MS4 PERMIT AS REGIONAL POST-CONSTRUCTION TREATMENT BMPS FOR THE DEVELOPED AREA. FULL BIOFILTRATION OF THE DCV IS ACHIEVABLE BASED ON THE BASIN FOOTPRINT AND STORAGE PROVIDED ABOVE THE UNDERDRAIN - NAMELY THE SURFACE PONDING, MEDIA AND AGGREGATE STORAGE.

HYDROMODIFICATION & TREATMENT CONTROL BMPS

DEVELOPED CONDITIONS

STORMWATER RUNOFF FROM THE PROPOSED PROJECT SITE IS ROUTED TO TWO (2) POINTS OF COMPLIANCE, POC-1 LOCATED NEAR THE SOUTHWEST CORNER OF THE PROJECT SITE. POC-2 LOCATED NEAR THE SOUTHEAST CORNER OF THE PROJECT SITE. POC-2 COLLECTS RUNOFF FROM ONE ONSITE BASIN AND ONE OFFSITE BASIN.

PRIOR TO DISCHARGING FROM THE PROJECT SITE, DEVELOPED ON-SITE RUNOFF FROM DMA-1 AND DMA 2 IS DRAINED TO ONSITE RECEIVING BIOFILTRATION BASIN FACILITIES FOR POLLUTANT CONTROL, HYDROMODIFICATION AND FLOW DETENTION.

TABLE 1 - SUMMARY OF DMAS:

POC	DMA	TRIBUTARY AREA (AC)	IMPERVIOUS PERCENTAGE (%)
1	DMA 1	4.706	58.42%
	BMP1	0.141	0.00%
2	DMA 2	3.146	57.73%
	BMP 2	0.213	0.00%
	BYPASS 2	1.696	0.00%
OFFSITE	SM 1	0.201	0.00%
	SM 2	0.009	0.00%
	SM 3	0.020	0.00%
	SM 4	0.155	0.00%
	DISP-1	0.155	60.05%
	DMIN-1	0.124	100.00%

BMP MODELING FOR WATER QUALITY PURPOSES

MODELING OF BIOFILTRATION BASINS

TWO (2) BIOFILTRATION BASIN FACILITIES ARE PROPOSED FOR POLLUTANT CONTROL, HYDROMODIFICATION AND FLOW DETENTION. TABLE 2 ILLUSTRATES THE DIMENSIONS REQUIRED FOR HMP COMPLIANCE FOR THE BIOFILTRTION BASINS, BMP 1 AND BMP 2. TABLES 3 ILLUSTRATES THE ORIFICE DIMENSIONS REQUIRED FOR BIOFILTRATION BASIN.

TABLE 2 - SUMMARY OF DIMENSIONS FOR BIOFILTRATION BASINS BMPs:

Biofiltration BMP	Tributary Area (Ac)	Dimensions				
		BMP Area(1) (ft^2)	Underdrain Orifice, D(2) (in)	Total Gravel Depth(3)	Riser Invert Elev,	Min. Total Surface
BMP 1	4.706	6,147	4.00	7	18	12
BMP 2	3.121	9,279	3.00	7	18	12

Notes: (1): Area of amended soil = area of gravel = area of BMP.

(2): Diameter of the orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold (50%Q2).

(3): Total depth of gravel including 3" of saturated storage located below

(4): Depth from bottom of pond to invert of emergency overflow weir.

TABLE 3 - SUMMARY OF ORIFICE DIMENSION FOR BMPS:

Biofiltration BMP	Lower Slot Dimensions			Upper Slot Dimensions			Emergency Weir	
	Outlet Type(1)	Invert Elev, HL(2) (in)	(#) - Width x Height (in) (3)	Outlet Type(1)	Invert Elev, HL(2) (in)	(#) - Width x Height (in)	Riser Invert Elev,	Weir Perimeter Length(5)
BMP 1	Slot	6	(2) - 34 x 5	Slot	7	(1) - 10 x 4	18	11.83
BMP 2	Slot	6	(2) - 32 x 3	Slot	7	(1) - 6 x 2	18	11.83

Notes: (1): Shape of orifice opening in riser structure.

(2): Depth from bottom of pond to invert of lower slot or weir.

(3): Number of slots and slot dimensions: For example for BMP 1: Two 29-inch wide by 3-inch high slots at 6-inches above bottom of basin and one 10-inch wide by 3-inch high slot at 7-inches above bottom of basin.

(4): Depth from bottom of pont to invert of emergency overflow weir.

(5): Overflow length, the internal perimeter of the riser.

FLOW DURATION CURVE COMPARISION

FLOW DURATION CURVES (FDC) WERE COMPARED AT THE PROJECT'S POCS BY EXPORTING THE HOURLY RUNOFF TIME SERIES RESULTS FROM SWMM TO A SPREADSHEET. THE FLOW DURATION CURVES (FDC) FOR POC-1 AND POC-2 WERE COMPARED BETWEEN 10% OF THE EXISTING CONDITION Q2 UP TO THE EXISTING CONDITION Q10. THE Q2 AND Q10 WERE DETERMINED WITH A PARTIAL DURATION STATISTICAL ANALYSIS OF THE RUNOFF TIME SERIES IN AN EXCEL SPREADSHEET USING THE WEIBULL PLOTTING POSITION METHOD.

THE RANGE FROM 10% OF Q2 UP TO Q10 WAS DIVIDED INTO 100 EQUAL TIME INTERVALS; THE NUMBER OF HOURS THAT EACH FLOW RATE WAS EXCEEDED WAS COUNTED FROM THE HOURLY SERIES. ADDITIONALLY, THE INTERMEDIATE PEAKS WITH A RETURN PERIOD "I" WERE OBTAINED (Qi WITH i-3 TO 9). FOR THE PURPOSE OF THE PLOT, THE VALUES ARE PRESENTED AS PERCENTAGE OF TIME EXCEEDED FOR EACH FLOW RATE. FDC COMPARISON FOR POC-1 ARE ILLUSTRATED IN FIGURE 1 AND FIGURE 2 IN BOTH NORMAL AND LOGARITHMIC SCALE IN THE HMP STUDY.

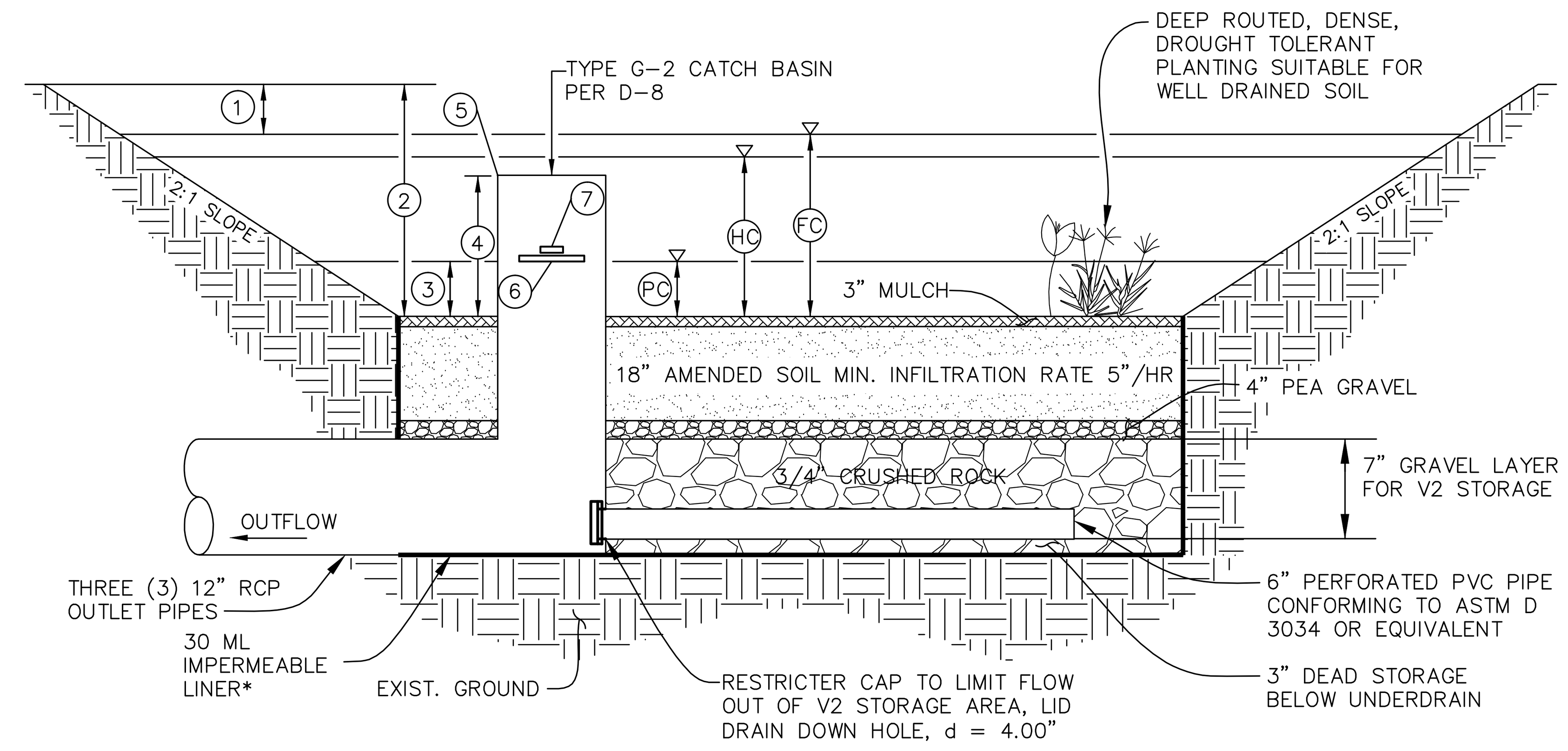
AS CAN BE SEEN IN TABLES 4 AND 5, THE FDC FOR THE PROPOSED CONDITION WITH THE HMP FACILITIES ARE WITHIN 110% OF THE CURVE FOR THE EXISTING CONDITION IN BOTH PEAK FLOW AND DURATION. THE ADDITIONAL RUNOFF VOLUME GENERATED FROM DEVELOPING THE SITE WILL BE RELEASED TO THE STORM DRAIN SYSTEM AT A FLOW RATE BELOW THE 50% Q2 LOWER THRESHOLD. ADDITIONALLY, THE PROJECT WILL NOT INCREASE PEAK FLOW RATES BETWEEN THE Q2 AND THE Q10, AS SHOWN IN THE FDC PLOTS AND ALSO IN THE PEAK FLOW TABLES.

TABLE 4 - Q2 TO Q10 COMPARISON TABLE - POC-1

Return Period (years)	Pre-Dev. Peak Flows (cfs)	Post-Dev. Peak Flows (cfs)	Reduction (cfs)
LF = 0.1xQ2	1.318	0.987	0.331
2-year	2.635	1.973	0.662
3-year	2.847	2.317	0.530
4-year	3.262	2.696	0.566
5-year	3.346	2.914	0.432
6-year	3.446	3.051	0.395
7-year	3.648	3.132	0.517
8-year	3.737	3.160	0.577
9-year	3.985	3.169	0.817
10-year	4.249	3.216	1.033

TABLE 5 - Q2 TO Q10 COMPARISON TABLE - POC-2

Return Period (years)	Pre-Dev. Peak Flows (cfs)	Post-Dev. Peak Flows (cfs)	Reduction (cfs)
LF = 0.1xQ2	1.112	0.474	0.638
2-year	2.224	0.948	1.276
3-year	2.398	1.032	1.366
4-year	2.744	1.166	1.578
5-year	2.825	1.208	1.617
6-year	2.896	1.247	1.648
7-year	3.063	1.315	1.748
8-year	3.138	1.349	1.789
9-year	3.369	1.427	1.942
10-year	3.603	1.513	2.090



LEGEND

1. FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
2. BASIN HEIGHT H_{MAX} = 30.00"
3. PONDING DEPTH = 6.00"
4. RISER INVERT H_{TOP} = 18.00"
5. *EMERGENCY WEIR INVERT = 18.00"
6. *LOWER SLOT INVERT = 6.00"
   1 – 5" HIGH X 34" LONG OPENING
7. *UPPER SLOT INVERT = 7.00"
   1 – 4" HIGH X 10" LONG OPENING

(PC) POLLUTANT CONTROL WSEL = 6.00"

(HC) HYDROMODIFICATION CONTROL WSEL = 13.92"

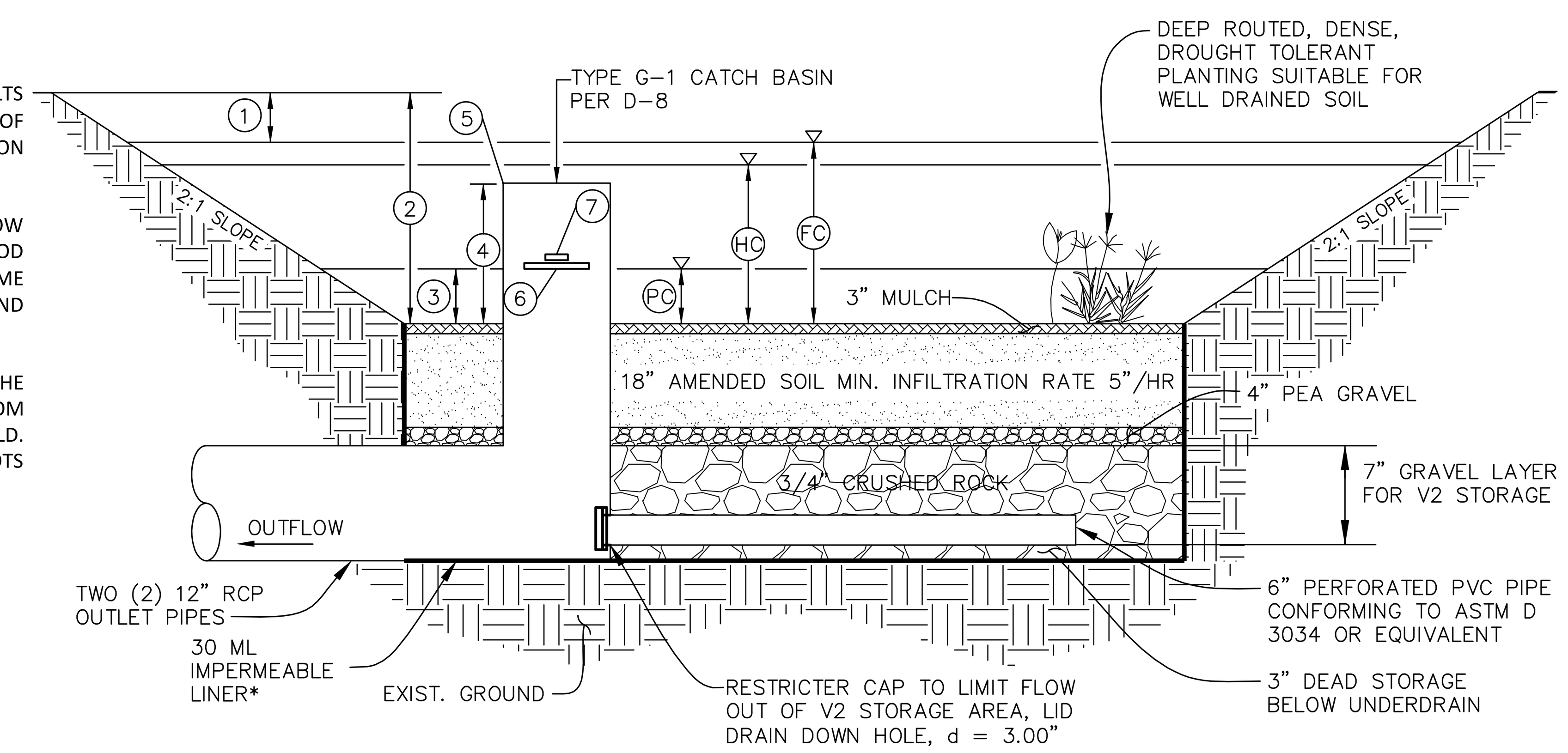
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 1

NOT TO SCALE

*30 MIL LINER NOTE: 30–MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN–WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN–WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



LEGEND

1. FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
2. BASIN HEIGHT H_{MAX} = 30.00"
3. PONDING DEPTH = 6.00"
4. RISER INVERT H_{TOP} = 18.00"
5. *EMERGENCY WEIR INVERT = 18.00"
6. *LOWER SLOT INVERT = 6.00"
   2 – 3" HIGH X 16" LONG OPENINGS
7. *UPPER SLOT INVERT = 7.00"
   1 – 2" HIGH X 6" LONG OPENING

(PC) POLLUTANT CONTROL WSEL = 6.00"

(HC) HYDROMODIFICATION CONTROL WSEL = 7.32"

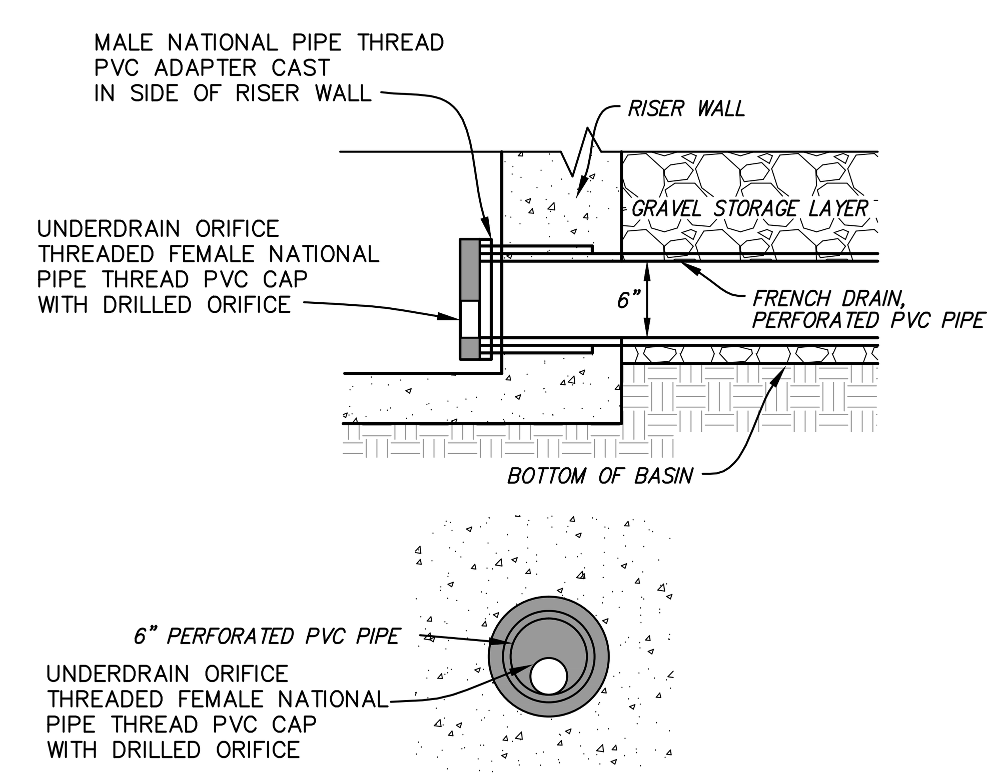
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 2

NOT TO SCALE

*30 MIL LINER NOTE: 30–MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN–WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN–WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



RESTRICTOR CAP DETAIL BMP 1 & 2

NOT TO SCALE

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HMP EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

SUMMARY OF PRE-DEVELOPED CONDITION DRAINAGE AREAS	
DISCHARGE LOCATION (POC)	PRE-DEVELOPMENT AREA (AC)
POC-1	5.07
POC-2	4.14
TOTAL	9.21

DETAIL: OFFSITE DRAINAGE

LEGEND

- BASIN BOUNDARY
- PROPERTY LINE
- FLOW LINE
- SOIL TYPE BOUNDARY

40' 20' 0' 40' 80' 120'
SCALE: 1" = 40'

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PRE-DEVELOPED HMP EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

SHEET 1 OF 1

ATTACHMENT 2B– MANAGEMENT OF CRITICAL COARSE SEDIMENT YIELD AREAS


Critical Coarse Sediment Yield Area Exhibit
Camino Largo 8
Legend
Camino Largo
Choice Nursery
N Santa Fe Av & Rancho Guajome Adobe
Yes
Camino Largo
1000 ft
N
Google earth
©2016 Google

ATTACHMENT 2C– GEOMORPHIC ASSESSMENT

HYDROMODIFICATION SCREENING
FOR
CAMINO LARGO

September 14, 2021

Will sign and stamp upon approval

Wayne W. Chang, MS, PE 46548

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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FOR REVIEW ONLY

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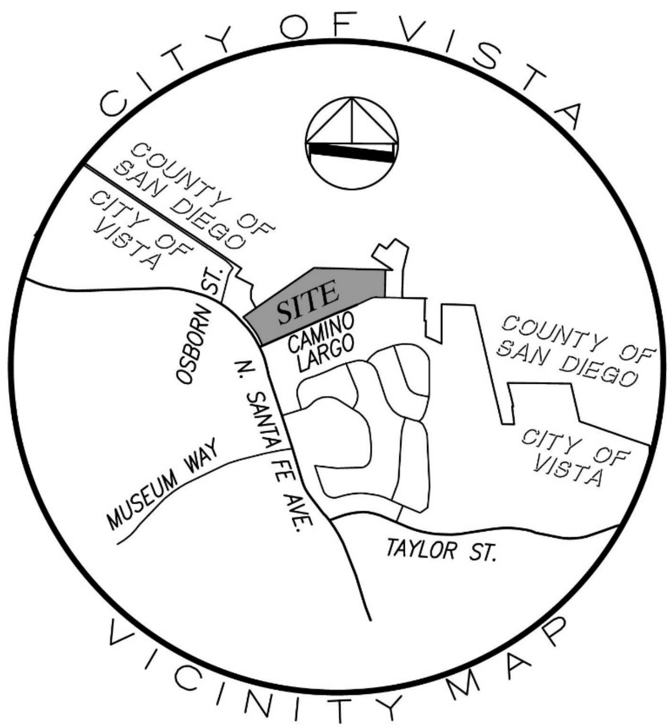
INTRODUCTION

The city of Vista's June 2016, *BMP Design Manual,* outlines low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility,* developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's Critical Flow Calculator spreadsheet to establish the appropriate erosion susceptibility threshold of low, medium, or high.



This report provides a hydromodification screening analysis for the Camino Largo single-family residential project being designed by BHA, Inc. The 9.3-acre site currently supports a nursery and is located northeast of the intersection of North Santa Fe Avenue and Camino Largo in the city of Vista (see the Vicinity Map). The nursery will be redeveloped with 46 homes and private streets.

Under pre-project conditions, storm runoff within the project footprint generally sheet flows in a southerly direction towards Camino Largo, which is an unpaved private street. The runoff continues a short distance (100+ feet) south and enters an unnamed natural drainage course that flows in a westerly direction along the south side of Camino Largo (see the Study Area Exhibit in the map pocket). The unnamed natural drainage course crosses North Santa Fe Avenue in an arch culvert then continues northwest over 2.3 miles to a confluence with the San Luis Rey River.

Under post-project conditions, the project runoff will be treated by one of two biofiltration basins. Runoff from the easterly half of the project will enter a biofiltration basin at the southeast corner of the site. A proposed storm drain will convey the treated runoff out of the biofiltration basin and discharge towards the unnamed natural drainage course. Runoff from the westerly half of the project will enter a biofiltration basin at the southwest corner of the site. A proposed storm drain will convey the treated runoff out of the biofiltration basin and to the North Santa Fe Avenue culvert. The post-project runoff from both halves of the project will ultimately be conveyed away from the site by the unnamed natural drainage course similar to existing conditions.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for the project's two points of compliance (POC), which are the first locations where the project's runoff discharges to natural conveyances. The first POC, labeled POC A, is at the outlet of the proposed storm drain from the southeast biofiltration basin. The second POC, labeled POC B, is at the outlet of the North Santa Fe Avenue culvert.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the first point where one of these is reached:

- at least one reach downstream of the first grade control point
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.).

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area can be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis

The downstream domain of analysis location for each point of compliance (POC) was determined by assessing and comparing the four bullet items above. A POC represents the point below which a channel is natural and subject to hydromodification impacts. As discussed in the Introduction, storm runoff from the project will be treated by one of two biofiltration basins and then conveyed below the project by hardened, non-erodible storm drain pipes to natural conveyances. The two outlets into the natural conveyances are labeled POC A and POC B, respectively. A downstream domain of analysis location was selected below each POC as follows.

Per the first bullet item, the first permanent grade controls below POC A and POC B were identified during a site visit. The storm runoff from POC A flows a short distance to the unnamed natural drainage course and then continues west in the unnamed natural drainage course. The runoff reaches the North Santa Fe Avenue culvert approximately 1,000 feet downstream of POC A. The culvert is a non-erodible facility that provides a grade control for the upstream channel bed. i.e., it will prevent erosion of the upstream channel bed. This is the first permanent grade control below POC A.

The storm runoff from POC B discharges directly into the unnamed natural drainage course from the North Santa Fe Avenue culvert outlet. The runoff continues west in the unnamed natural drainage course a distance of 516 feet before reaching a road crossing with a culvert (see Figure 6). This culvert is the first permanent grade control reached below POC B.

The second bullet item criteria are based on reaching a lentic (standing or still water such as ponds, pools, marshes, lakes, lagoons, etc.) or tidal waterbody. The nearest such waterbody below POC A and POC B is the Upper Pond within Guajome Regional Park. The unnamed natural drainage course flows into the Upper Pond over 1.1 miles downstream of North Santa Fe Avenue. This lentic waterbody is further downstream from POC A and POC B than their first permanent grade controls, so the second bullet item will not govern over the first bullet item in establishing the downstream domain of analysis location for either POC.

The third bullet item is met when the natural watercourse below a POC confluences with a stream with an equal order or larger tributary area. The runoff from POC A flows 90 feet within a natural swale before confluencing with the unnamed natural drainage course. Topographic mapping indicates that the unnamed natural drainage course's watershed area at the confluence is much larger than the natural swale's watershed area. Therefore, the third bullet item criteria for POC A is met where the natural swale below POC A confluences with the unnamed natural drainage course. The confluence is closer to POC A than its downstream permanent grade control, so the third bullet item governs over the first in establishing the downstream domain of analysis location for POC A.

POC B is within the unnamed natural drainage course. Google Earth and a site visit reveal that the unnamed natural drainage course does not confluence with a larger stream between POC B and its first permanent grade control located 516 feet below POC B. Therefore, the third bullet item will not govern over the first in establishing the downstream domain of analysis location for POC B.

The fourth bullet item is met when the natural stream below a POC accumulates 50 or 100 percent drainage area for natural or urban drainage systems, respectively. Both streams below each POC are natural systems, so 50 percent applies. The Study Area Exhibit shows that the stream below POC A accumulates minor area (0.35 acres) between POC A and the confluence with the unnamed natural drainage course. The accumulated area is much less than 50 percent of the area tributary to POC A (3.29 acres). Therefore, fourth bullet item will not govern over the third in establishing the downstream domain of analysis location for POC A.

The Study Area Exhibit indicates that the unnamed natural drainage course below POC B accumulates minor area between POC B and its downstream permanent grade control. The accumulated area is much less than 50 percent of the area tributary to POC B. Therefore, the fourth bullet item will not govern over the first in establishing the downstream domain of analysis location for POC A.

Based on the above information, the downstream domain of analysis location is established by separate criteria for POC A and POC B. For POC A, the location is based on the third bullet item. The natural swale below POC A confluences with the much larger unnamed natural drainage course 90 feet downstream of POC A. This location is closer to POC A than the locations determined by the other bullet item criteria.

For POC B, the downstream domain of analysis location is based on the first bullet item. A permanent grade control occurs where the unnamed natural drainage course enters a roadway culvert below POC B. This is the first downstream domain of analysis point reached from the four bullet criteria. Per the first bullet item, the downstream domain of analysis location should be set one reach (656 feet) below the grade control. Therefore, the downstream domain of analysis location for POC B is 650 feet below the grade control.

<u>*Upstream Domain of Analysis*</u>
The hardened, non-erodible drainage facilities leading to the POC A outlet into the uppermost end of the receiving natural swale. Since the natural swale does not extend upstream of POC A, the upstream domain of analysis location for POC A is at POC A.

The North Santa Fe Avenue culvert extends upstream of POC B. In addition, the project's topographic mapping shows a rock outcropping in the unnamed natural drainage course immediately upstream of the culvert. These culvert and rocks are hard points that check headward migration in the unnamed natural drainage course. Therefore, the upstream domain of analysis location for POC B is at POC B.

Study Reaches within Domain of Analysis
After the upstream and downstream domain of analysis locations are established for POC A and POC B, the study reaches associated with each POC are identified (see the Study Area Exhibit in the map pocket). For POC A, the entire domain of analysis extends from the upstream domain of analysis location at POC A to the downstream domain of analysis location at the confluence of the natural swale below POC A with the unnamed natural drainage course. This reach extends over 90 feet and is labeled Reach 1.

For POC B, the entire domain of analysis extends from the upstream domain of analysis location at POC B to the downstream domain of analysis location 656 feet below the permanent grade control created by a roadway culvert. The domain of analysis was analyzed as two study reaches, Reach 2 and Reach 3. Reach 2 extends 516 feet from the upstream domain of analysis location at POC B to the first permanent grade control below POC B. Reach 2 extends from the first permanent grade control to a point 656 feet below the grade control. All three study reaches are within the 656 foot (200 meters) maximum reach length recommended by SCCWRP.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed areas, valley slopes, and valley widths. NED data is similar to USGS quadrangle mapping.

The Reach 1 watershed area is based on BHA, Inc's. proposed condition hydrology, which determined that 3.29 acres is tributary to POC A (see Appendix A for their Post-Development Hydrology exhibit). The Study Area Exhibit shows that an additional 0.35 acres is tributary to the natural swale below POC A, so the total Reach 1 watershed area covers 3.64 acres (0.0057 square miles).

The watershed areas associated with Reach 2 and 3 were delineated from the USGS' StreamStats program, which is based on their Digital Elevation Model and a digital representation of the stream network. The StreamStats results are included in Appendix A. The watershed delineations are consistent with current USGS quadrangle mapping. Streamstats shows that the watershed areas tributary to Reach 2 and 3 are 676.46 and 739.62 acres (1.0570 and 1.1557 square miles), respectively.

The mean annual precipitation was obtained from the rain gage closest to the site. This is the Western Regional Climate Center's Vista 2NNE gage (see Appendix A). The average annual rainfall measured at the Vista 2NNE gage for the period of record is 13.09 inches.

The valley slope and valley width for Reach 1, 2, and 3 were obtained from 1-foot contour interval topographic mapping prepared for the project supplemented with SANGIS' 2014 2-foot contour interval topographic mapping. NED data was not used because it is not very accurate for these parameters. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within a study reach by the length of the flow line. The valley width is the valley bottom width dictated by breaks in the hillslope. The valley slope and valley width within Reach 1, 2, and 3 along with their watershed areas are included in Table 1.

Reach	Tributary Watershed Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	0.0057	0.0722	2.44
2	1.0570	0.0099	9.14
3	1.1557	0.0136	9.14

Table 1. Summary of Watershed Area, Valley Slope, and Valley Width

The above described values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., d_{50} < 16 mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 10. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Based on the photographs and site investigation, the bed material and resistance is generally within the transitional/intermediate bed category. There was no evidence of a threshold bed condition. However, some bed areas contained smaller grain sizes typically found in a labile bed.

In addition to the material size and compaction, there are several factors that establish the erodibility of a channel such as the flow rate (i.e., size of the tributary area), grade controls, channel slope, vegetative cover, channel planform, etc. The Introduction of the SCCWRP *Hydromodification Screening Tools: Field Manual* identifies several of these factors. When multiple factors influence erodibility, it is appropriate to perform the more detailed SCCWRP analysis, which is to analyze a channel according to SCCWRP's transitional/intermediate bed procedure. This requires the most rigorous steps and will generate the appropriate results given the range of factors that define erodibility. The transitional/intermediate bed procedure takes into account that bed material may fall within the labile category (the bed material size is used in SCCWRP's Form 3 Figure 4), but other factors may trend towards a less erodible condition. Dr. Eric Stein from SCCWRP, who co-authored the *Hydromodification Screening Tools: Field Manual* in the *Final Hydromodification Management Plan* (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. Consequently, this procedure was used to produce more accurate results.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The channel bed along each of the three study reaches is within Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential due to a surface veneer such as vegetation. The soil was probed and penetration was relatively difficult through the underlying layer. The dense, mature vegetative growth along the channel of Reach 1, 2, and 3 serve to armor the channel bed and resist vertical erosion.

Checklist 2 determines grade control characteristics of the channel bed. This is established by the spacing of the grade controls along the channel. Category B on Checklist 2 is based on a spacing of $2/S_v$ or $4/S_v$, where S_v is the channel slope. The S_v value of Reach 1, 2, and 3 are included in Form 1 results in Appendix A and summarized in Table 2. Table 2 also summarizes the $2/S_v$ or $4/S_v$ of each reach along with the length. Reach 1 and Reach 2 are both shorter than their $2/S_v$ values, so are in Category A on Checklist 2. On the other hand, Reach 3 is between its $2/S_v$ and $4/S_v$, so is in Category B.

Reach	S_v, ft/ft	$2/S_v$, feet	$4/S_v$, feet	Length, feet	Category
1	0.0722	91	182	90	A
2	0.0099	664	1,328	516	A
3	0.0136	484	967	656	B

Table 2. Checklist 2 Summary

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the screening index (INDEX) value determined in the initial desktop analysis (see Appendix A). The Form 1 results in Appendix A determined an INDEX of 0.0147 and 0.0196 for Reach 1 and Reach 2, respectively. SCCWRP specifies use of a US SAH-97 half-phi template gravelometer to determine d_{50} in a natural channel. This gravelometer allows a minimum d_{50} measurement of 2 millimeters. The Screening Index Threshold diagram shows that the probability of incising or braiding is less than 50 percent for a d_{50} of 2 millimeters if the INDEX value is 0.022 or less. Since the Reach 1 and Reach 2 Screening Index values are both less than the 50 percent INDEX value, Reach 1 and Reach 2 are both within Category A.

For Reach 3, d_{50} had to be determined to assess the Screening Index Threshold. d_{50} can be derived from a pebble count in which a minimum of 100 particles are obtained along transects at the site. SCCRWP states that if fines less than ½-inch thick are at a sample point, it is appropriate to sample the coarser buried substrate. The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The pebble count results for Reach 3 are included in Appendix B. The results show a d_{50} of 8 millimeters. Plotting the d_{50} and screening index value on the Mobility Index Threshold diagram shows Reach 3 has a less than 50 percent probability of incising or braiding, which falls within Category A.

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Mobility Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$

Table 3 summarizes the Checklist 1, 2, and 3 values for each reach as well as their vertical rating. The results show the vertical rating for all three study reaches is less than 4.5, so these reaches have a low threshold for vertical susceptibility.

Reach	Checklist 1 (armoring)	Checklist 2 (grade control)	Checklist 3 (screening index)	Vertical Rating
1	6	3	3	3.6
2	6	3	3	3.6
3	6	6	3	4.2

Table 3. Overall Vertical Rating

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 11) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within either of the three reaches during a field investigation. As seen in the figures and topographic mapping, the channel banks are mostly gentle and heavily vegetated confirming that mass wasting and extensive fluvial erosion has not occurred.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks in Reach 1, 2, and 3 were moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe. The banks were densely vegetated and/or relatively level and stable as seen in the figures. In addition, the banks showed little evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the topographic mapping and site investigation, the average bank angles in all three reaches are 2:1 (26.6 degrees) or flatter. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26.6 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For Reach 1, 2, and 3 the vertical rating is low, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculations in the spreadsheet in Appendix A show that VWI for Reach 1, 2, and 3 are 1.40, 0.72, and 0.70, respectively, which are all less than 2.

From the above steps, the lateral susceptibility rating is low for Reach 1, 2, and 3 (colored circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for the Camino Largo single-family residential project being designed by BHA, Inc. Storm runoff from the project will be collected by proposed on-site drainage systems, treated by one of two on-site BMPs, and conveyed off-site by storm drain pipes. A channel assessment was performed for the natural streams below each POC based on office analyses and field work. The results indicate a low threshold for vertical and lateral susceptibilities for Reach 1, 2, and 3.

The HMP requires that these results be compared with the critical stress calculator results outlined in the County of San Diego HMP. The critical stress results are included in Appendix B for the study reach using the spreadsheet provided by the County. The channel dimensions were estimated from topographic mapping and Google Earth. Based on these values, the critical stress results returned a low threshold consistent with the SCCWRP channel screening results. Therefore, the SCCWRP analyses and critical stress calculator demonstrate that a low overall threshold is applicable to the project (i.e., $0.5Q_2$).

Figure 1. Looking Downstream towards Reach 1 from Upper End near Future POC A

Figure 2. North Santa Fe Avenue Culvert Outlet at POC B

Figure 3. Looking Downstream towards Reach 2 from Upper End at POC B

Figure 4. Dense Vegetation within Middle of Reach 2

Figure 5. Looking Upstream towards Reach 2 from Lower End

Figure 6. Roadway Culvert Crossing between Reach 2 and 3 (Permanent Grade Control)

Figure 7. Looking Downstream towards Reach 3 from Upper End

Figure 8. Looking South towards Middle of Reach 3


Figure 9. Looking Upstream towards Reach 3 from Lower End

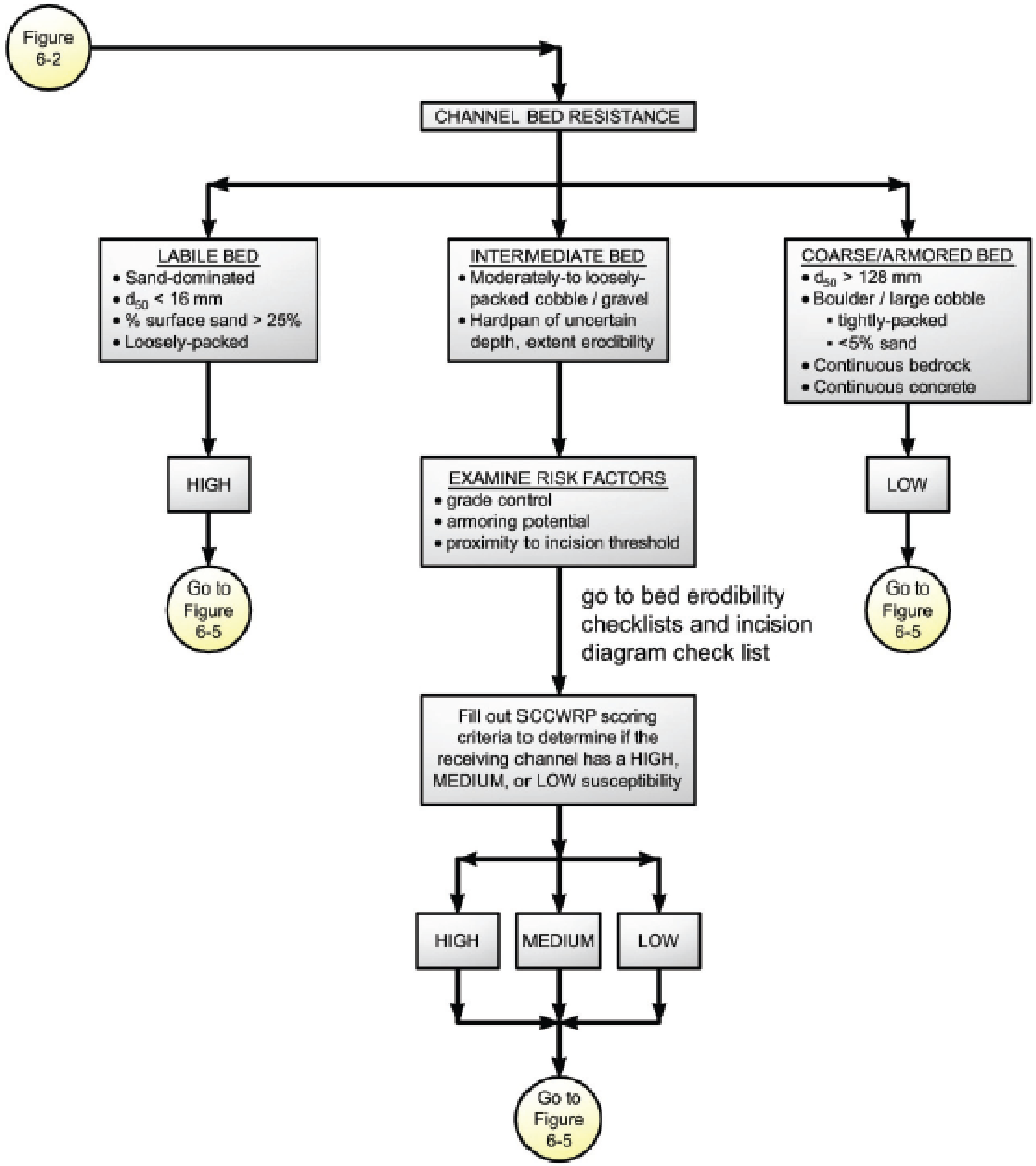


Figure 6-4. SCCWRP Vertical Susceptibility

Figure 10. SCCWRP Vertical Channel Susceptibility Matrix

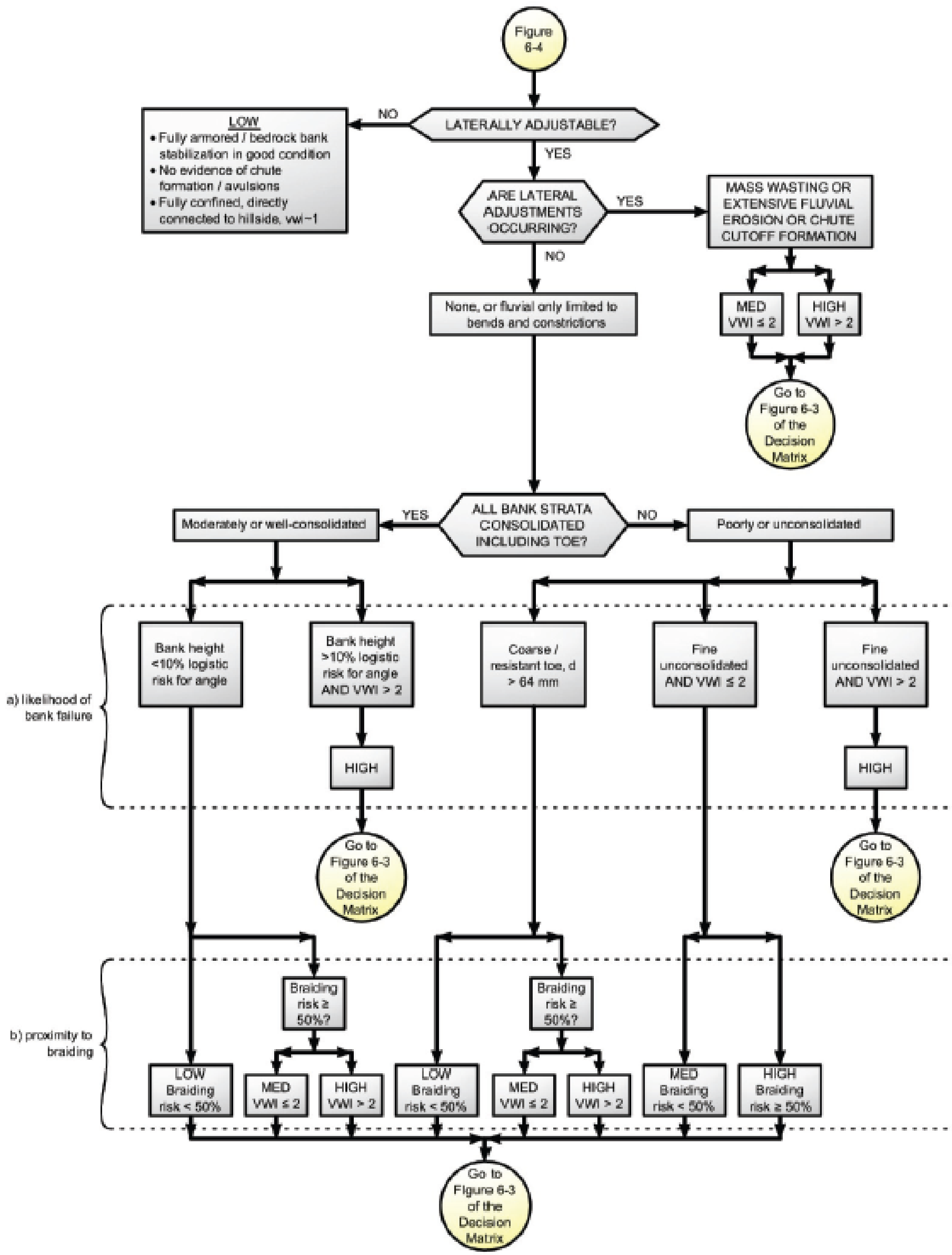


Figure 6-5. Lateral Channel Susceptibility

Figure 11. SCCWRP Lateral Channel Susceptibility Matrix

APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 33.23399 Longitude: -117.24926

Description (river name, crossing streets, etc.): Northeast of intersection of Camino Largo and N. Santa Fe Avenue - Unnamed Natural Drainage Course.

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	See attached Form 1 table on next page for calculated values for each reach.
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	

Form 1 Tabl e 2. Simplif ied peak flo w, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

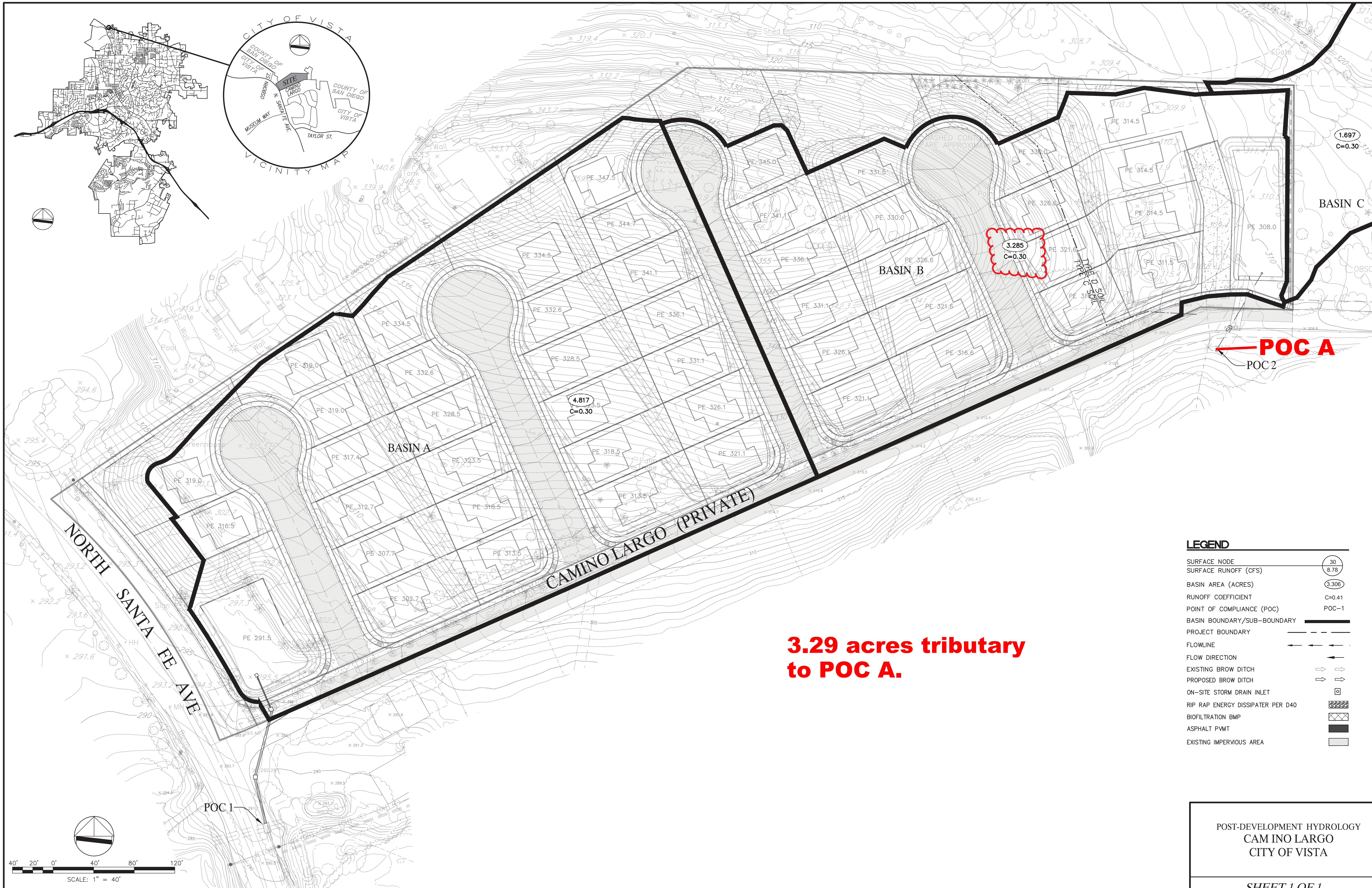
Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	See attached Form 1 table on next page for calculated values for each reach.
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	

(Sheet 1 of 1)

SCCWRP FORM 1 ANALYSES

Reach	Area A, sq. mi.	Mean Annual Precip. P, inches	Valley Slope Sv, m/m	Valley Width Wv, m	10-Year Flow Q10cfs, cfs	10-Year Flow Q10, cms
1	0.0057	13.09	0.0722	2.44	1.5	0.04
2	1.0570	13.09	0.0099	9.14	138.4	3.92
3	1.1557	13.09	0.0136	9.14	149.5	4.23

Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
1	0.015	1.74	1.40
2	0.020	12.71	0.72
3	0.028	13.15	0.70

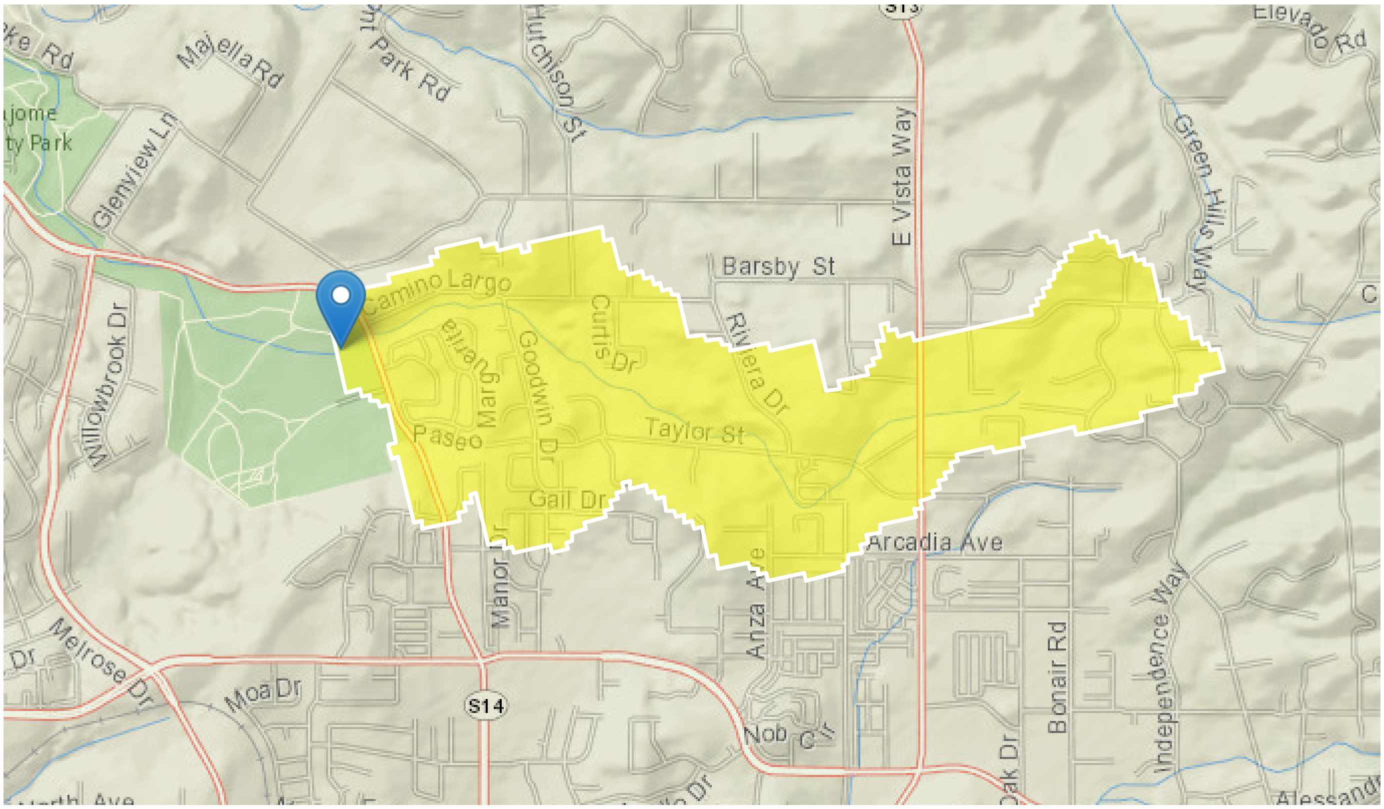


K:\Civil 3D\1154\DATA TRANSFER\TO\Wayne Chang\PRELIM-PROP HYDRO_SWQMP_TSM - Standard\HYDRO\PRELIM-PROP HYDRO_SWQMP_TSM.dwg, 8/4/2021 8:15:49 AM

Area Tributary to Reach 2

StreamStats Report

Region ID: CA
Workspace ID: CA20210804003918730000
Clicked Point (Latitude, Longitude): 33.23230, -117.25114
Time: 2021-08-03 17:39:35 -0700



Basin Characteristics

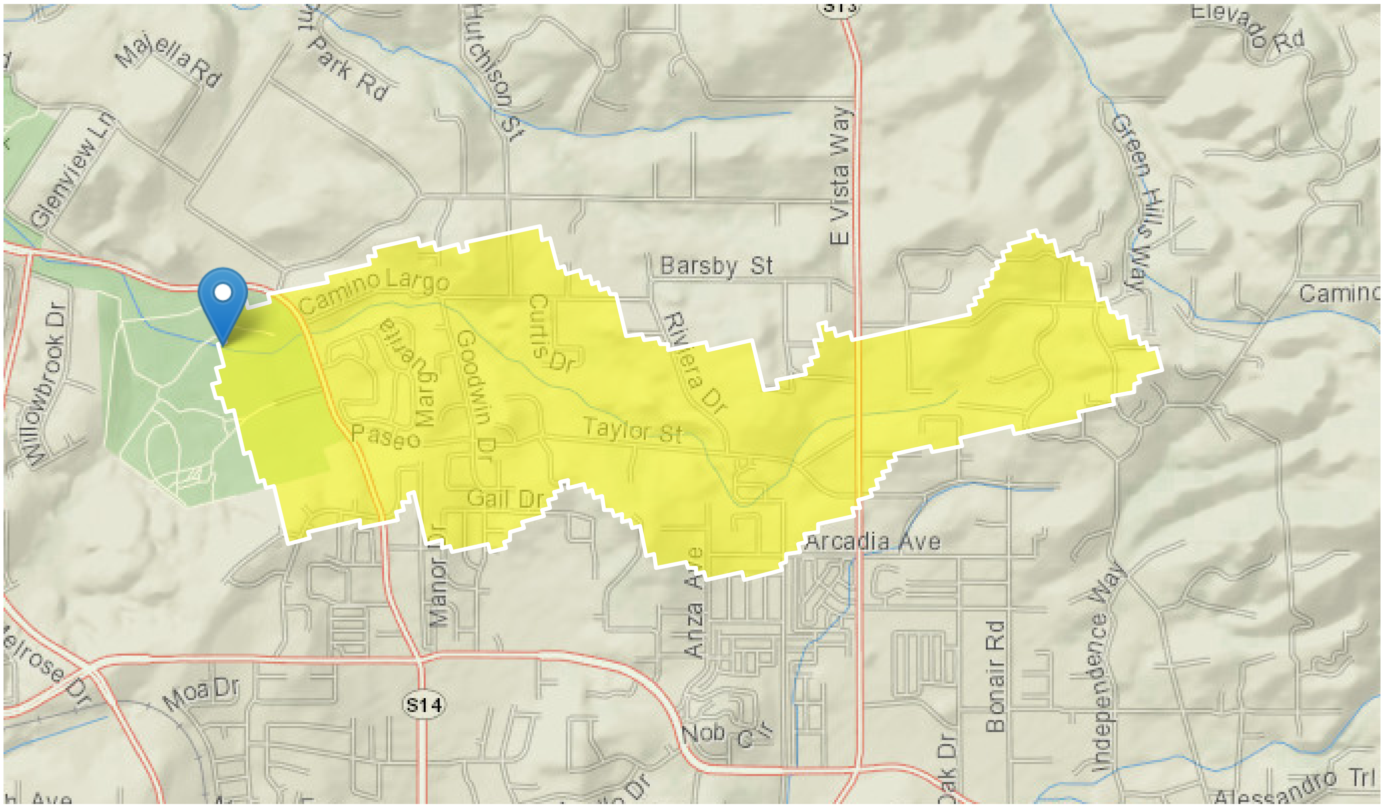
Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.0570	square miles

General Disclaimers

Area Tributary to Reach 3

StreamStats Report

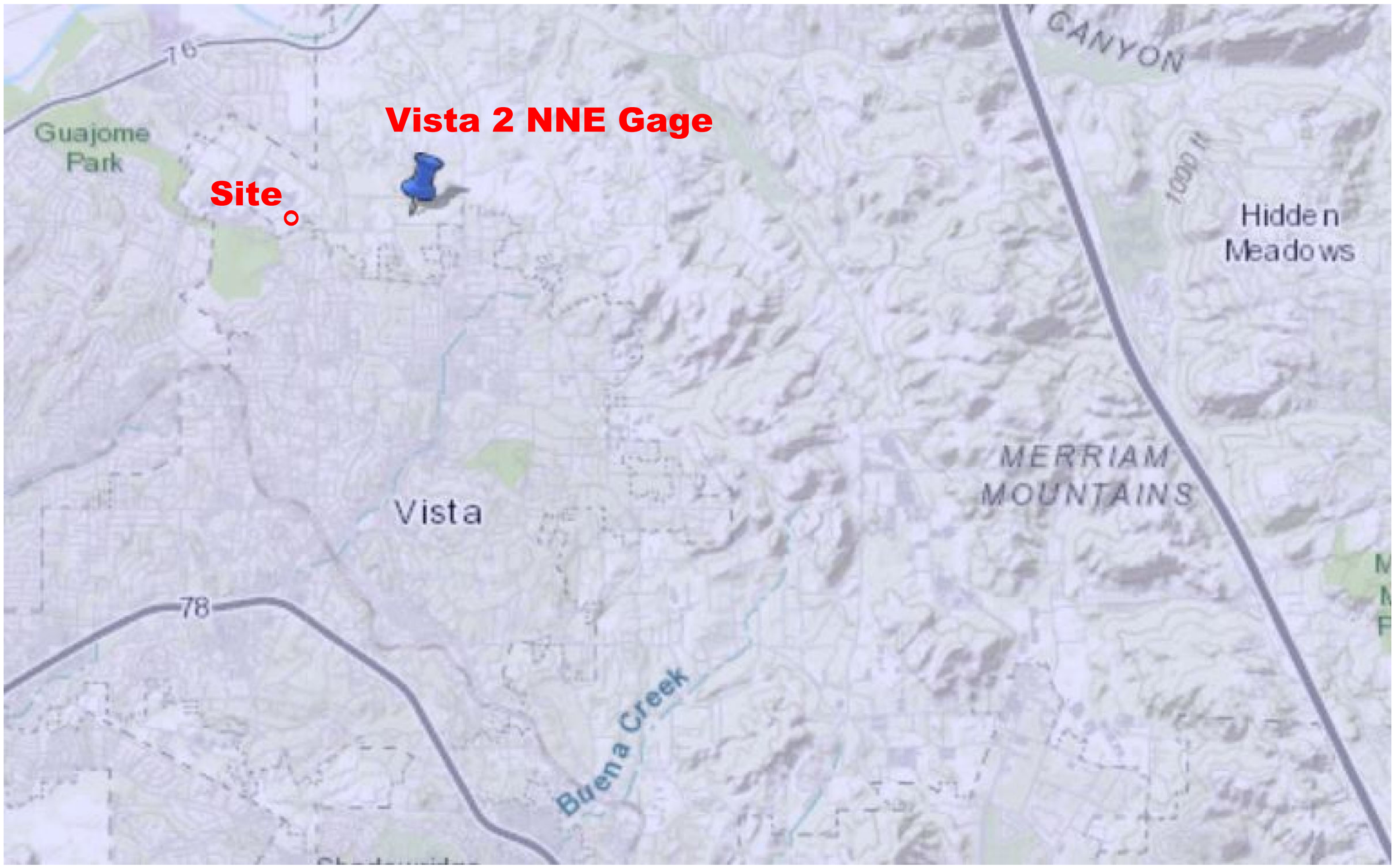
Region ID: CA
Workspace ID: CA20210804003221740000
Clicked Point (Latitude, Longitude): 33.23239, -117.25345
Time: 2021-08-03 17:32:38 -0700



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.1557	square miles

General Disclaimers



Rain Gage Location

VISTA 2 NNE, CALIFORNIA (049378)

Period of Record Monthly Climate Summary

Period of Record : 08/01/1957 to 05/12/2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	67.4	67.8	68.2	70.8	72.9	76.3	81.3	83.0	82.2	77.9	72.3	67.4	74.0
Average Min. Temperature (F)	44.0	45.0	46.3	48.5	53.5	56.6	60.3	61.6	60.0	55.0	48.3	44.0	51.9
Average Total Precipitation (in.)	2.76	2.55	2.24	1.05	0.22	0.11	0.06	0.07	0.25	0.54	1.40	1.83	13.09
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 86.6% Min. Temp.: 87% Precipitation: 87.6% Snowfall: 87.7% Snow Depth: 87.3%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

APPENDIX B

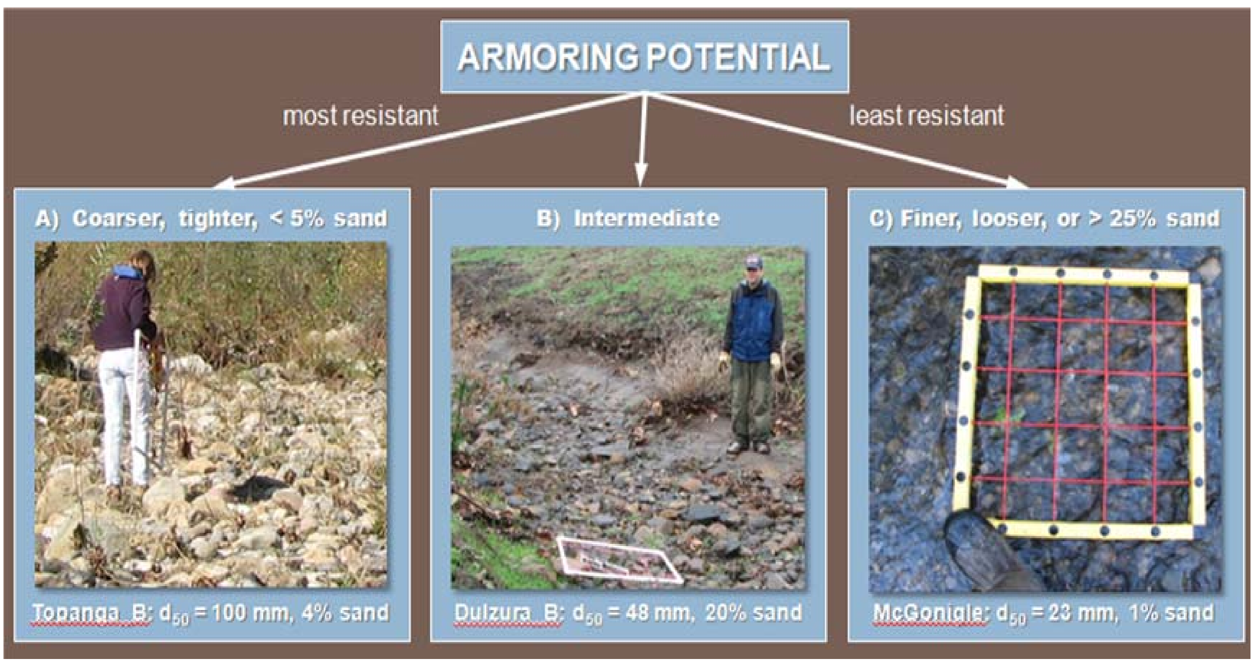
SCCWRP FIELD SCREENING DATA

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☒	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used i**n conjunction with Form 3 Checklist 1.**

(Sheet 2 of 4)

REACH 1, 2, AND 3 RESULTS

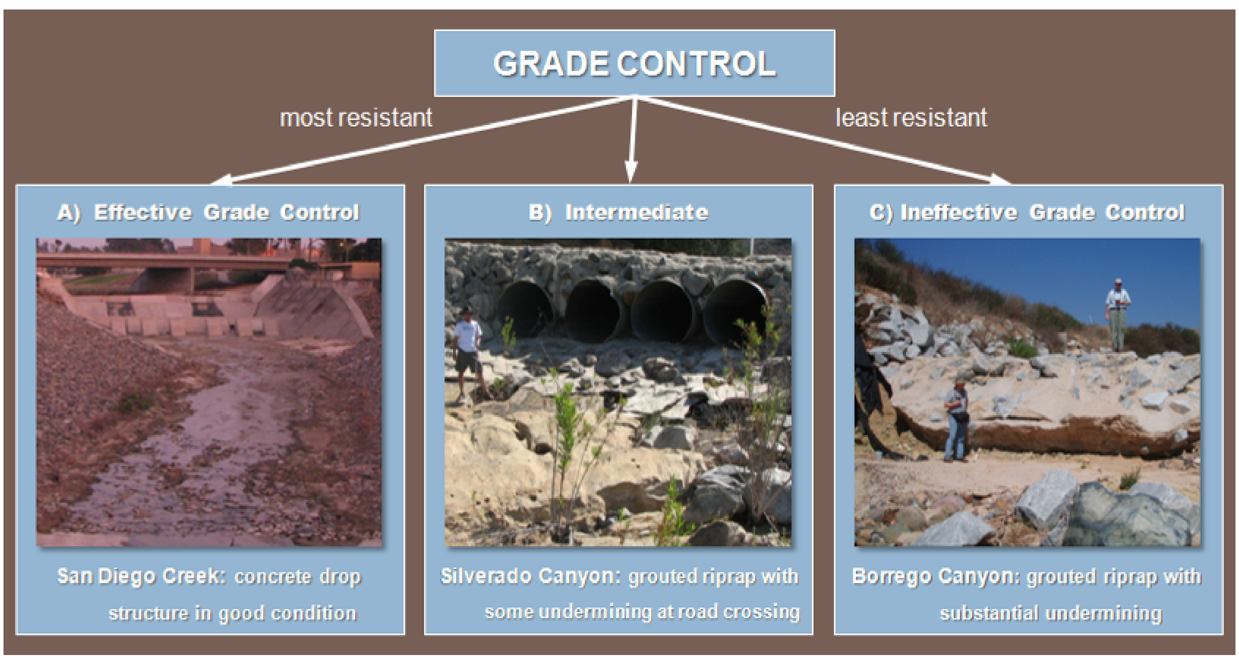
Form 3 Checklist 2: Grade Control

x A Grade control is present with spacing <50 m or 2/S_v m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

x B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

□ C Grade control absent, spaced >100 m or >4/S_v m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

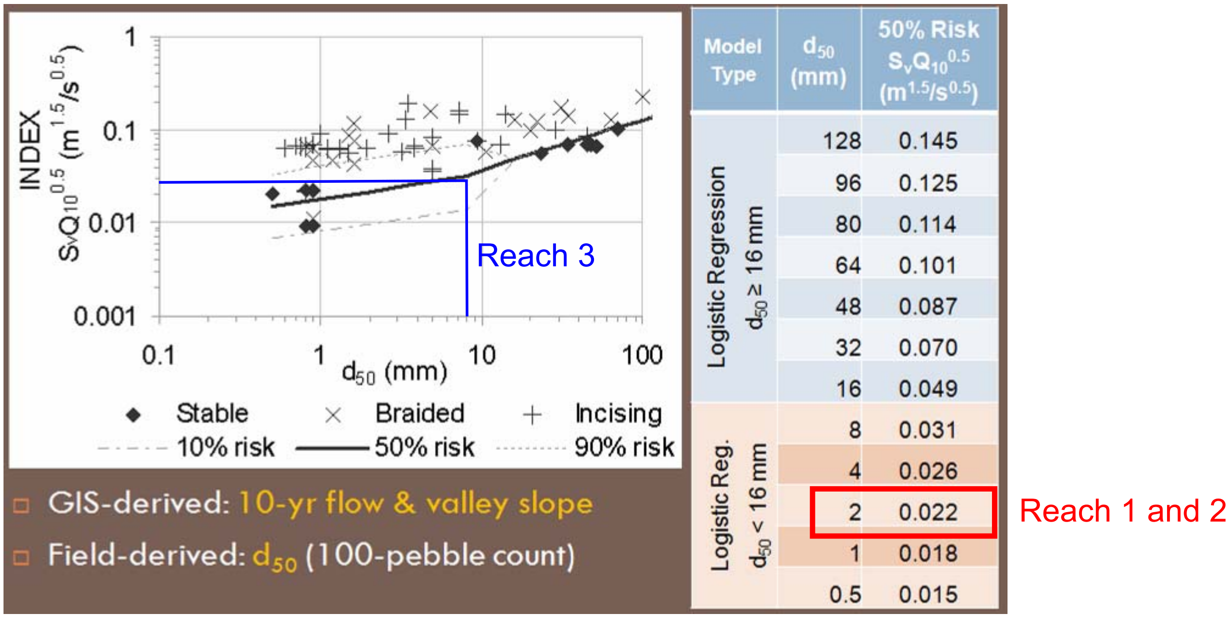
(Sheet 3 of 4)

REACH 1 AND 2 RESULTS

REACH 3 RESULTS

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	**$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *From Form 1*	**$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *50% risk of incising/braiding from table in Form 3 Figure 3 above*	**Screening Index Score (A, B, C)**

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

REACH 1 AND 2 RESULTS

REACH 3 RESULTS

PEBBLE COUNT

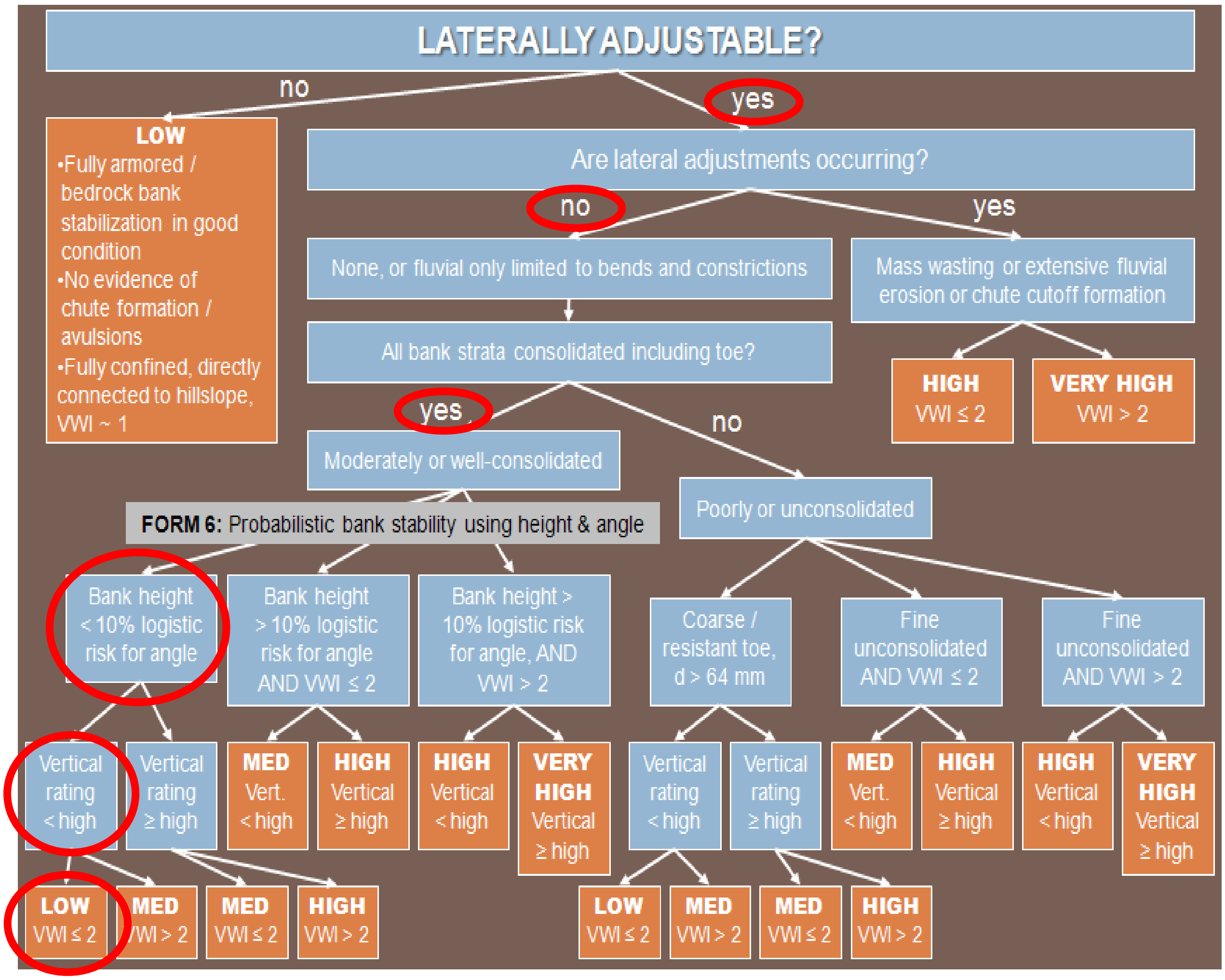
#	Reach 3 Diameter, mm
1	2
2	2
3	2
4	2
5	2
6	2
7	2
8	2
9	2.8
10	2.8
11	2.8
12	2.8
13	2.8
14	2.8
15	2.8
16	2.8
17	2.8
18	2.8
19	2.8
20	2.8
21	4
22	4
23	4
24	4
25	4
26	4
27	4
28	4
29	4
30	4
31	4
32	4
33	4
34	4
35	4
36	4
37	4
38	4
39	4
40	4
41	5.6
42	5.6
43	5.6

#	Reach 3 Diameter, mm
44	5.6
45	5.6
46	5.6
47	5.6
48	5.6
49	8
50	8
51	8
52	8
53	8
54	8
55	8
56	8
57	8
58	8
59	8
60	8
61	8
62	8
63	8
64	8
65	8
66	8
67	8
68	8
69	8
70	8
71	8
72	8
73	8
74	8
75	8
76	8
77	11
78	11
79	11
80	11
81	11
82	11
83	11
84	11
85	11
86	11
87	11
88	11

#	Reach 3 Diameter, mm
89	11
90	11
91	11
92	11
93	11
94	16
95	16
96	16
97	16
98	16
99	16
100	16

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



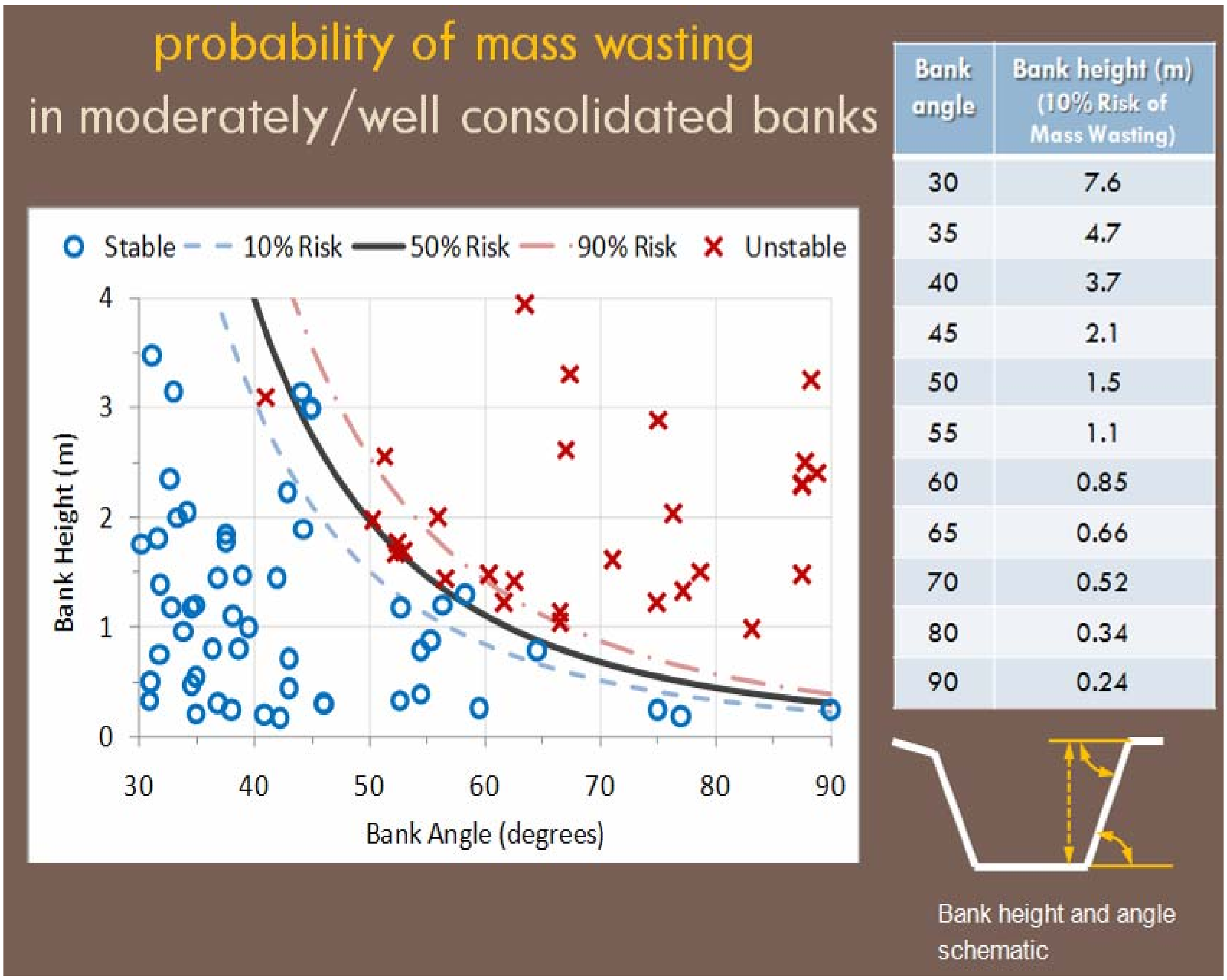
(Sheet 1 of 1)

REACH 1, 2, AND 3 RESULTS

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	26.6 degrees (2:1)	---	---	<10%
Right Bank	26.6 degrees (2:1)	---	---	<10%



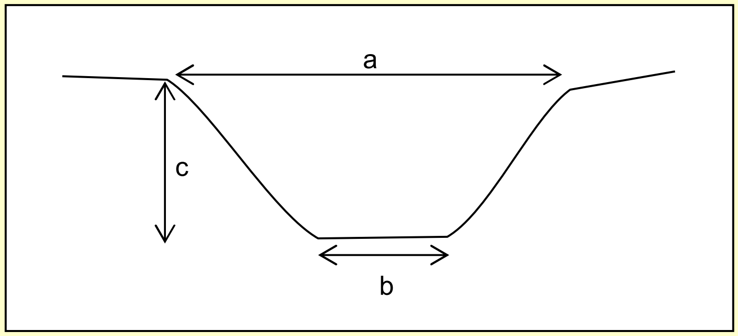
Bank angle	Bank height (m) (10% Risk of Mass Wasting)
30	7.6
35	4.7
40	3.7
45	2.1
50	1.5
55	1.1
60	0.85
65	0.66
70	0.52
80	0.34
90	0.24

Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

Critical Flow Calculator

Reach 1

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	40.0
b) Channel width at bed (ft)	8.0
c) Bank height at top of bank (ft)	1.0
Channel gradient (ft/ft)	0.0722
Receiving channel roughness	Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.09	Receiving water watershed area at PoC (sq mi)	0.0057
Project watershed annual precipitation (inches)	13.09	Project watershed area draining to PoC (sq mi)	0.0057

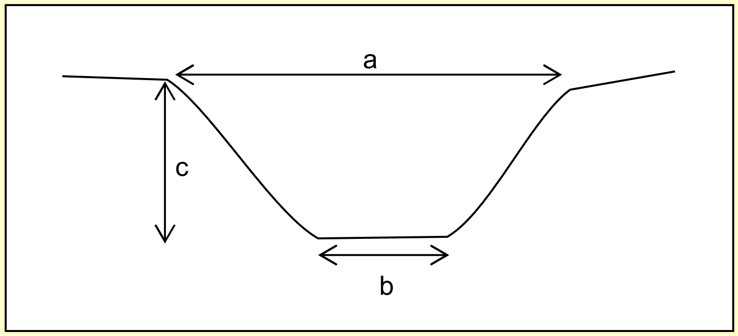
Outputs - Flow control range

Receiving water Q2	0.2	**Point of Compliance low flow rate (cfs)**	**0.1**
Project site Q2	0.2	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Critical Flow Calculator

Reach 2

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	38.0
b) Channel width at bed (ft)	30.0
c) Bank height at top of bank (ft)	2.0
Channel gradient (ft/ft)	0.0099
Receiving channel roughness	Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.09	Receiving water watershed area at PoC (sq mi)	1.0570
Project watershed annual precipitation (inches)	13.09	Project watershed area draining to PoC (sq mi)	1.0570

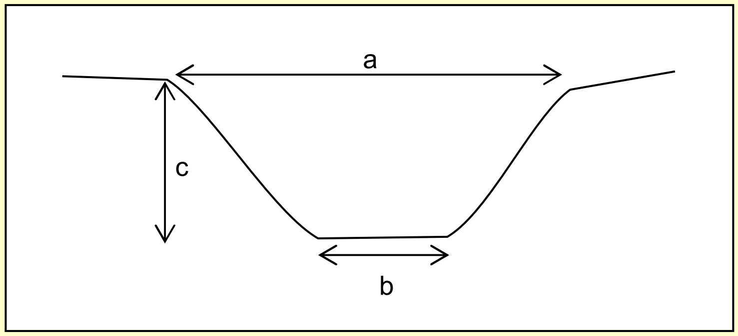
Outputs - Flow control range

Receiving water Q2	9.4	**Point of Compliance low flow rate (cfs)**	**4.7**
Project site Q2	9.4	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Critical Flow Calculator

Reach 3

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	38.0
b) Channel width at bed (ft)	30.0
c) Bank height at top of bank (ft)	2.0
Channel gradient (ft/ft)	0.0136
Receiving channel roughness	Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

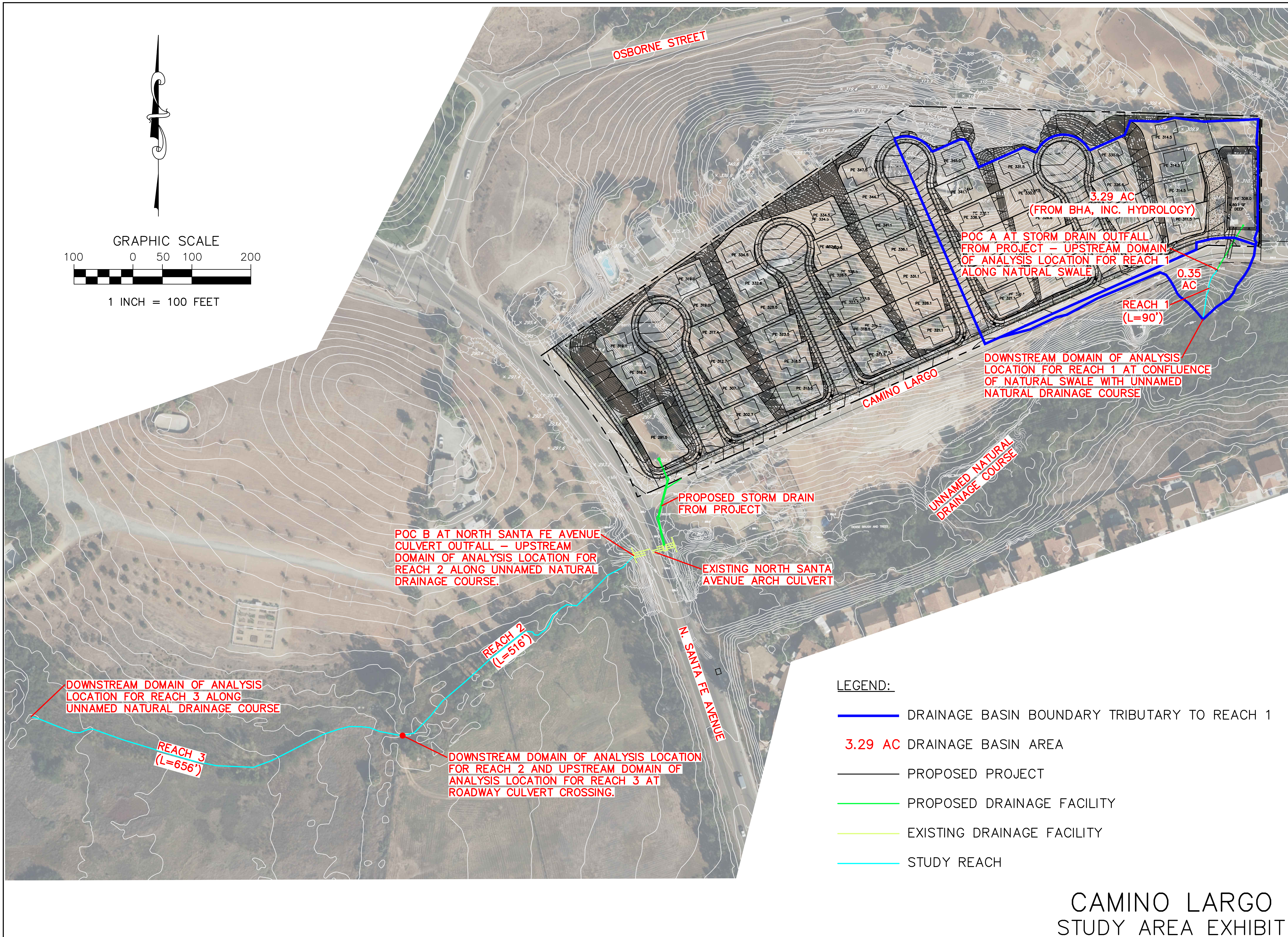
Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.09	Receiving water watershed area at PoC (sq mi)	1.1557
Project watershed annual precipitation (inches)	13.09	Project watershed area draining to PoC (sq mi)	1.1557

Outputs - Flow control range

Receiving water Q2	10.0	**Point of Compliance low flow rate (cfs)**	**5.0**
Project site Q2	10.0	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**



GRAPHIC SCALE
100 0 50 100 200
1 INCH = 100 FEET
OSBORNE STREET
CAMINO LARGO
N. SANTA FE AVENUE
UNNAMED NATURAL DRAINAGE COURSE
3.29 AC (FROM BHA, INC. HYDROLOGY)
POC A AT STORM DRAIN OUTFALL FROM PROJECT – UPSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 1 ALONG NATURAL SWALE
0.35 AC
REACH 1 (L=90')
DOWNSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 1 AT CONFLUENCE OF NATURAL SWALE WITH UNNAMED NATURAL DRAINAGE COURSE
PROPOSED STORM DRAIN FROM PROJECT
POC B AT NORTH SANTA FE AVENUE CULVERT OUTFALL – UPSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 2 ALONG UNNAMED NATURAL DRAINAGE COURSE.
EXISTING NORTH SANTA AVENUE ARCH CULVERT
REACH 2 (L=516')
DOWNSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 3 ALONG UNNAMED NATURAL DRAINAGE COURSE
REACH 3 (L=656')
DOWNSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 2 AND UPSTREAM DOMAIN OF ANALYSIS LOCATION FOR REACH 3 AT ROADWAY CULVERT CROSSING.
LEGEND:
DRAINAGE BASIN BOUNDARY TRIBUTARY TO REACH 1
3.29 AC DRAINAGE BASIN AREA
PROPOSED PROJECT
PROPOSED DRAINAGE FACILITY
EXISTING DRAINAGE FACILITY
STUDY REACH
CAMINO LARGO
STUDY AREA EXHIBIT

ATTACHMENT 2D– FLOW CONTROL FACILITY DESIGN

HYDROMODIFICATION MANAGEMENT PLAN (HMP)
SWMM Modeling for Hydromodification Compliance of:

CAMINO LARGO

2123 N. Santa Fe Ave
Vista, CA 92084
APN: 159-240-07

Prepared For:

Kyun Tae Kim
Frank Sohaei, Trustee of the Falor Family Trust
2359 Pio Pico Drive
Carlsbad, CA 92008
(760) 420-1267

December 6, 2021

Prepared By:

12-6-21

Bruce Rice, R.C.E. 60676 Expires 12/31/22 Date

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(760) 931-8700

W.O. 944-1154-401

HYDROMODIFICATION MANAGEMENT PLAN (HMP)

SWMM Modeling for Hydromodification Compliance of:
Camino Largo Project, City of Vista, CA

INTRODUCTION

This document summarizes the approach used to model the proposed Camino Largo project site in the City of Vista using the Environmental Protection Agency (EPA) Storm Water Management Model 5.1 (SWMM). SWMM simulations were prepared for the pre and post-development conditions at the site in order to determine if the proposed LID biofiltration facilities have sufficient volume to meet the current Hydromodification Management Plan (HMP) requirements from the San Diego Regional Water Quality Control Board (SDRWQCB), as established in the Model BMP Design Manual San Diego Region (BMPDM) for the County of San Diego Copermittees, which includes the City of Vista.

SWMM MODEL DEVELOPMENT

The Camino Largo Project proposes the development of a forty six (46) lot residential subdivision, with individual level building pads, driveways and landscaping areas on 8.86 gross acres. The project also proposes the minor widening and improvement of the Camino Largo private drive, which will include paving, sidewalks with curb and gutter. Approximately 53% of the property will be impervious. Biofiltration basins are proposed for the two main drainage basins for POC-1 and POC-2. Proposed grading has been minimized as much as possible to maintain existing slope and drainage patterns.

POC-1
There is one (1) biofiltration basin proposed, which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1.

POC-2
There is one (1) proposed biofiltration basin, which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flows into a natural swale.

Two (2) SWMM simulations were prepared for each POC in the study: the first for pre-development and the second for the post-developed conditions.

The development drainage patterns reflected on the DMA Exhibit will remain approximately the same acreage draining to the southwest corner (POC-1), while acreage is increased in the post-development condition in the southeast corner (POC-2). Both POCs include impervious contributing area and require SWMM continuous simulation analysis to prove compliance with HMP requirements.

TABLE 1 – CONTRIBUTING AREA – PRE-DEVELOPMENT VS. POST-DEVELOPMENT

POC ID	Pre-Dev Area (Ac)	Post-Dev Area (Ac)	Difference
POC 1	4.952	4.847	-0.104
POC 2	4.153	5.055	0.902

The SWMM 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 simulations, 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 simulations include rainfall, watershed characteristics, and BMP configuration. The Oceanside 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.

Per the California Irrigation Management Information System "Reference Evaporation Zones" (CIMIS ETo Zone Map), the project site is located within the Zone 4 Evapotranspiration Area. Thus evapotranspiration values for the site were modeled using Zone 4 monthly values from Table G.1-1 from the City of Vista BMP Design Manual.

The on-site soil classification is Type C and Type D from USDA Web Soil Survey. Type D soils will be used in POC-1 and POC-2 because it is the main soils type in each DMA (see References).

Onsite soil areas have been assumed to be non-compacted in the existing condition to represent the current condition of the site and fully compacted in the post development conditions. Other SWMM inputs for subareas are discussed in the appendices to this document, where the selection of the parameters is explained in detail.

HMP MODELING

POC-1

DMA 1 will drain into a biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1. Once flows are routed via the proposed BMP, the flow is then conveyed via storm drain to the aforementioned POC. Tables 2.1 and 2.2 summarize data for the POC-1 DMAs.

TABLE 2.1 – SUMMARY OF EXISTING CONDITIONS FOR POC-1

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip
DMA 1	4.952	0.00%
TOTAL	4.952	-

TABLE 2.2 – SUMMARY OF DEVELOPED CONDITIONS FOR POC-1

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip
DMA 1	4.706	58.42%
BMP 1	0.141	0.00%
TOTAL	4.847	-

(1) BMP Areas are separate from the overall DMA to ensure areas are not double counted.

POC-2

There is one (1) proposed biofiltration basin, which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flows into a natural swale.

Once flows are routed via the proposed BMPs, flows are then conveyed via storm drain to the aforementioned POC. Tables 2.3 and 2.4 summarize data for the POC-2 DMAs.

TABLE 2.3 – SUMMARY OF EXISTING CONDITIONS FOR POC-2

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip
DMA 2	3.121	0.00%
BYPASS 1	1.031	0.00%
TOTAL	4.153	-

TABLE 2.4 – SUMMARY OF DEVELOPED CONDITIONS FOR POC-2

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip
DMA 2	3.146	57.73%
BMP 2	0.213	0.00%
BYPASS 2	1.696	0.00%
TOTAL	5.055	-

(1) BMP Areas are separate from the overall DMA to ensure areas are not double counted.

Biofiltration basins in 1 and 2 are responsible for handling hydromodification requirements for POC-1 and POC-2. Basins 1 and Basin 2 will have a ponding depth of 6 inches. BMPs are comprised of an 18-inch layer of amended soil (a highly sandy, organic rich compost with an infiltration capacity of at least 5 in/hr), and a 7-inch reservoir layer of gravel for additional detention, and to accommodate the French drain system. Below the reservoir layer, the basins will include 3 inches of saturated storage. Flows will discharge from the basin via a low-flow orifice outlet within the gravel layer to the receiving storm drain system. A riser structure will be constructed within the BMP with multiple low-flow orifices and an emergency overflow, such that peak flows can be safely discharged to the storm drain system (see dimensions in Table 3 and 4).

General Considerations

The biofiltration basins (BMP 1 and BMP 2) were modeled using the biofiltration LID module within SWMM. The biofiltration module can model the underground gravel storage layer, underdrain with orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the lowest surface discharge opening in the basin riser structure. Ponding above the invert of the lowest surface discharge opening in the basin riser structure is modeled as a detention basin: elevation vs. area, and elevation vs. discharge tables, are needed by SWMM for Modified Puls routing purposes. Detailed outlet structure location and elevations should be shown on the construction plans based on the recommendations of this study.

BMP MODELING FOR HMP PURPOSES

Modeling of dual purpose Water Quality/HMP IMP

HMP-BMP biofiltration basins are proposed for hydromodification conformance and flood control for the project site. Tables 3 and 4 illustrate the dimensions required for HMP compliance according to the SWMM model that was undertaken for the project. Flood control is discussed within the Drainage Report prepared by BHA for this project.

TABLE 3 – SUMMARY OF DUAL PURPOSE BMP: Biofiltration with Surface Ponding

Biofiltration BMP	Tributary Area (Ac)	Dimensions				
		BMP Area(1) (ft^2)	Underdrain Orifice, D(2) (in)	Total Gravel Depth(3)	Riser Invert Elev,	Min. Total Surface
BMP 1	4.706	6,147	4.00	7	18	12
BMP 2	3.121	9,279	3.00	7	18	12

Notes: (1): Area of amended soil = area of gravel = area of BMP.

(2): Diameter of the orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold (50%Q2).

(3): Total depth of gravel including 3" of saturated storage located below

(4): Depth from bottom of pond to invert of emergency overflow weir.

TABLE 4 – SUMMARY HMP RISER SURFACE DISCHARGE STRUCTURES

Biofiltration BMP	Lower Slot Dimensions			Upper Slot Dimensions			Emergency Weir	
	Outlet Type(1)	Invert Elev, HL(2) (in)	(#) - Width x Height (in) (3)	Outlet Type(1)	Invert Elev, HL(2) (in)	(#) - Width x Height (in) (3)	Riser Invert Elev,	Weir Perimeter Length(5)
BMP 1	Slot	6	(1) - 34 x 5	Slot	7	(1) - 10 x 4	18	11.83
BMP 2	Slot	6	(1) - 32 x 3	Slot	7	(1) - 6 x 2	18	11.83

Notes: (1): Shape of orifice opening in riser structure.

(2): Depth from bottom of pond to invert of lower slot or weir.

(3): Number of slots and slot dimensions: For example for BMP 1: Two 29-inch wide by 3-inch high slots at 6-inches above bottom of basin and one 10-inch wide by 3-inch high slot at 7-inches above bottom of basin.

(4): Depth from bottom of pont to invert of emergency overflow weir.

(5): Overflow length, the internal perimeter of the riser.

FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at POC-1 and POC-2 by exporting the hourly runoff time series results from SWMM to a spreadsheet. At both POCs, the FDC was compared between 10% of the existing condition Q_2 up to the existing condition Q_{10}. The Q_2 and Q_{10} were determined using a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Weibull plotting position method.

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 (Qi with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate. FDC comparison at POC-1 and POC-2 is illustrated in Figure 1 and Figure 2, respectively, in both normal and logarithmic scale.

As can be seen in Figure 1 and Figure 2, the FDCs for the proposed condition with the HMP facilities is within 110% of the curve for the existing condition in both peak and duration. 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. Additionally, the project will also not increase peak flow rates between the pre-development Q_2 and the Q_{10}, as shown in the graphic and also in the peak flow tables listed 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 = 0.15 for pervious areas and n = 0.012 for impervious areas (as consistent with the BMP Design Manual). 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 study prepared by Tory R. Walker Engineering (Reference [6]) a value of n = 0.08 has been selected (see Table 1 of Reference [6] included in Attachment 7). The existing condition site includes paved driveways and impervious accessory buildings. Existing impervious areas are assumed to be pervious areas consisting of the bare soil underlying the impervious surfaces. Therefore the existing condition site is primarily a mix of bare dirt and shrubs. Based on these existing site observations, the N value was conservatively selected as 0.08, which is consistent per the reference cited. The BMP Design Manual default value of n = 0.10 was used for the developed portions of the project, as the developed site is assumed to include dense landscaping.

DRAWDOWN TIME

To ensure compliance with the 24 hour and 96 hour drawdown requirements (per Section 6.3.7 of the BMP Design Manual); drawdown calculations are provided in Attachment 10 of this report.

SUMMARY

This study has demonstrated that the proposed biofiltration basins provided for the Camino Largo Project site are sufficient to meet current HMP criteria if the cross-section areas and volumes recommended within this document, and the respective orifice and outlet structures are incorporated as specified within the proposed project site.

KEY ASSUMPTIONS

1. No infiltration test were performed. Infiltration for the site is considered low and within the range of Type D soils.

2. The biofiltration basins will be lined with an impermeable liner (no infiltration).

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
5. Basin Outlet Structure Details
6. SWMM Input Data in Input Format (Existing and Proposed Models)
7. SWMM Screens and Explanation of Significant Variables
8. Geotechnical Documentation
9. Summary files from the SWMM Model
10. Drawdown calculations

REFERENCES

[1] – "*City of Vista BMP Design Manual*", June 2016, City of Vista.

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

[3] – Order R9-2013-001, California Regional Water Quality Control Board San Diego Region (SDRWQCB).

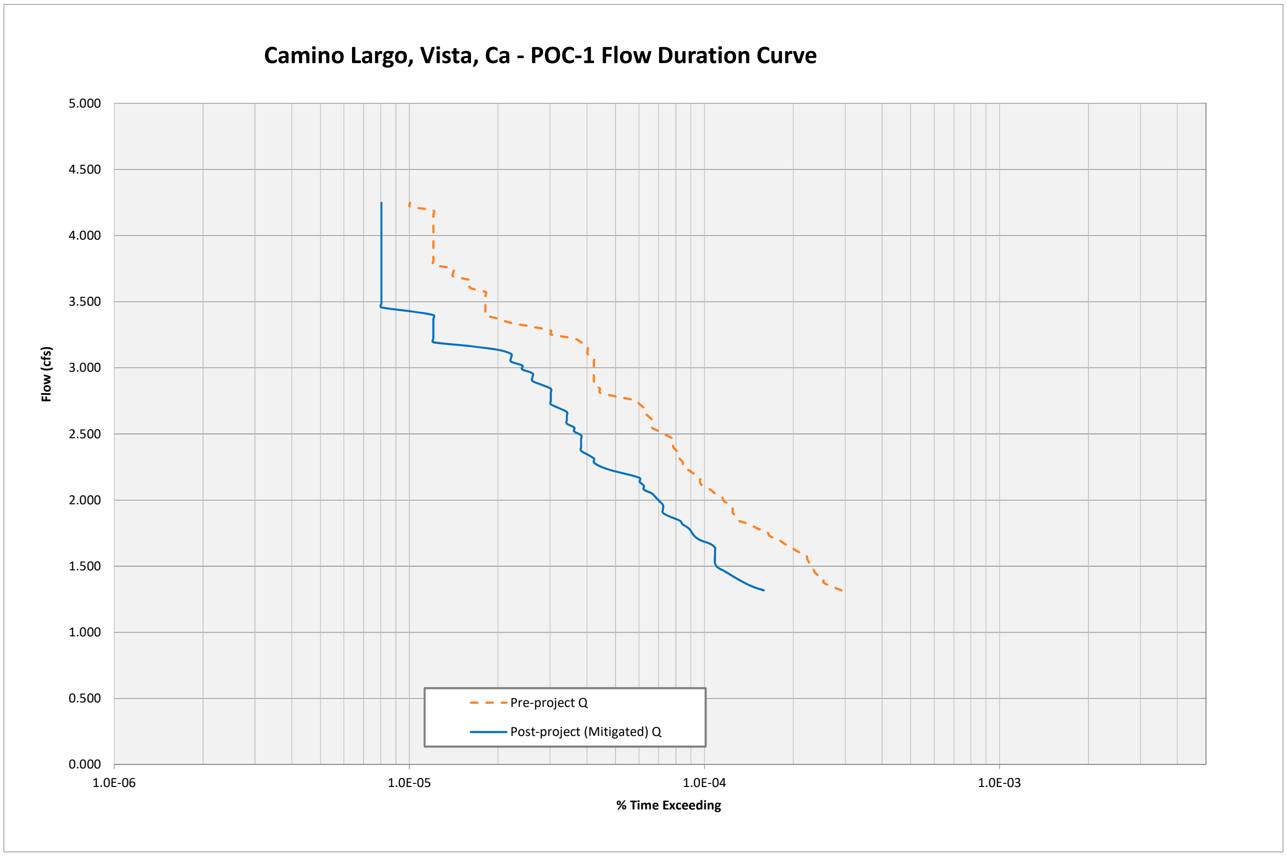
[4] – "*Review and Analysis of San Diego County Hydromodification Management Plan (HMP): Assumptions, Criteria, Methods, & Modeling Tools – Prepared for the Cities of San Marcos, Oceanside & Vista*", May 2012, Tory R. Walker Engineering.

[5] – "*San Diego County Hydraulic Design Manual*", September 2014, County of San Diego Department of Public Works Flood Control Section.

[6] – "*Improving Accuracy in Continuous Hydrologic Modeling: Guidance for Selecting Pervious Overland Flow Manning's n Value in the San Diego Region*", Tory R. Walker Engineering, 2016.

[7] – *"Priority Development Project (PDP) Storm Water Quality Management Plan (SWQMP) for 1017 Sycamore Avenue*", March 18, 2020, BHA, Inc.

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



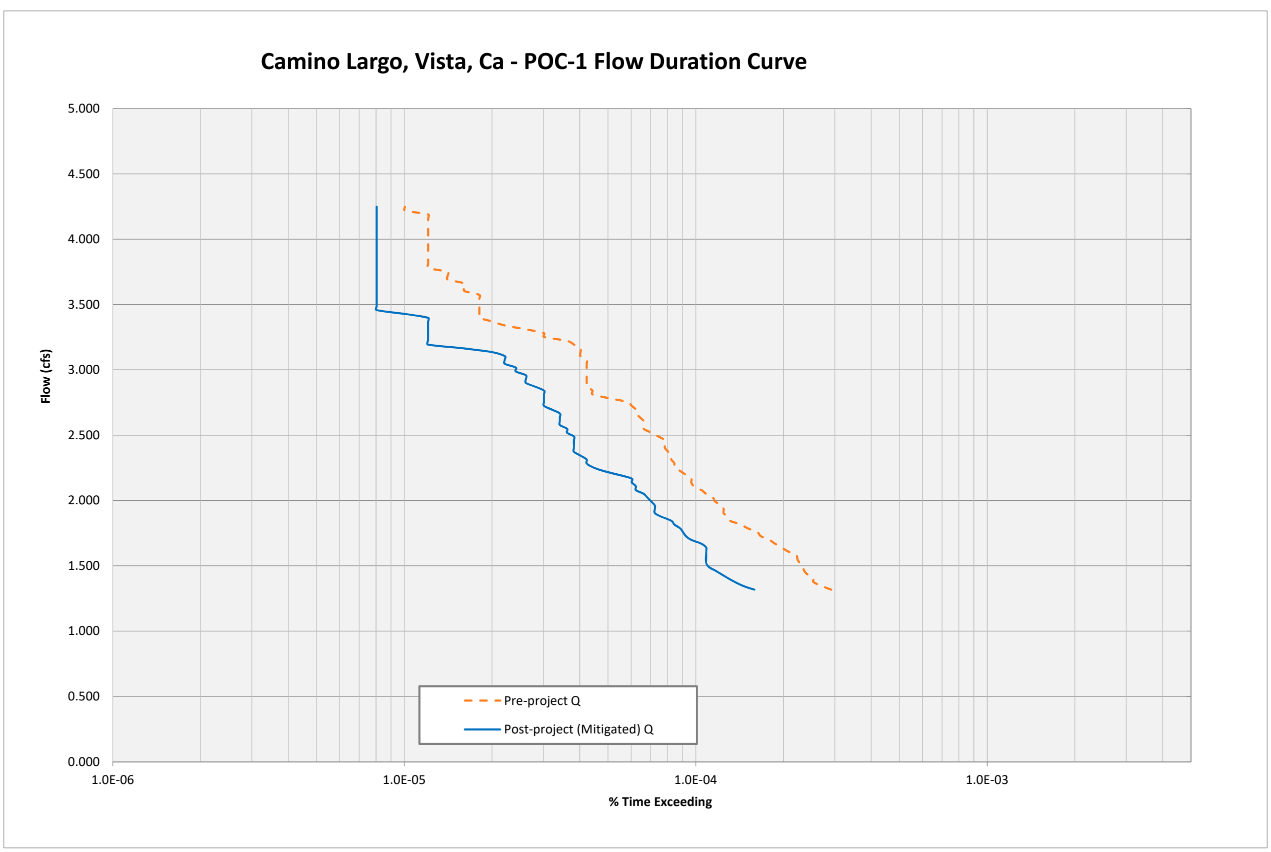
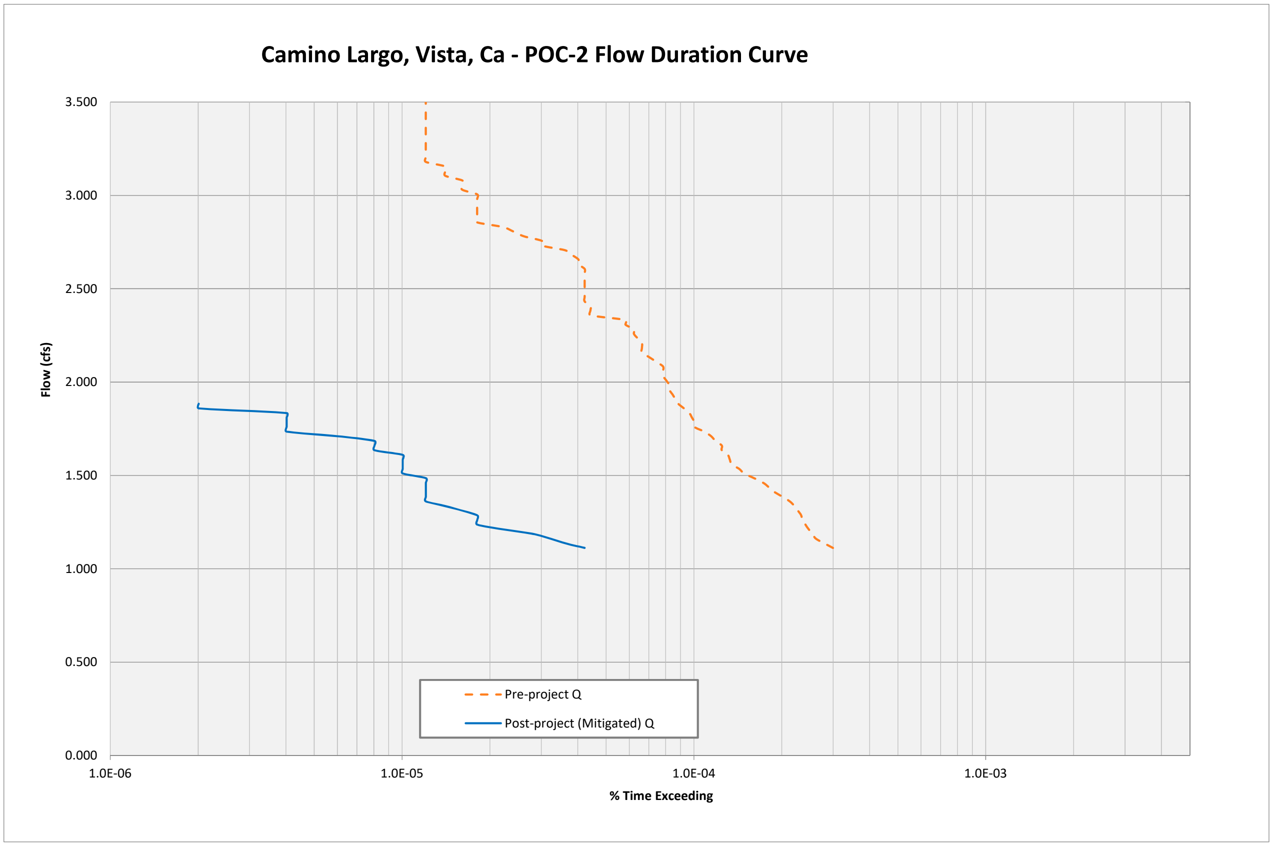
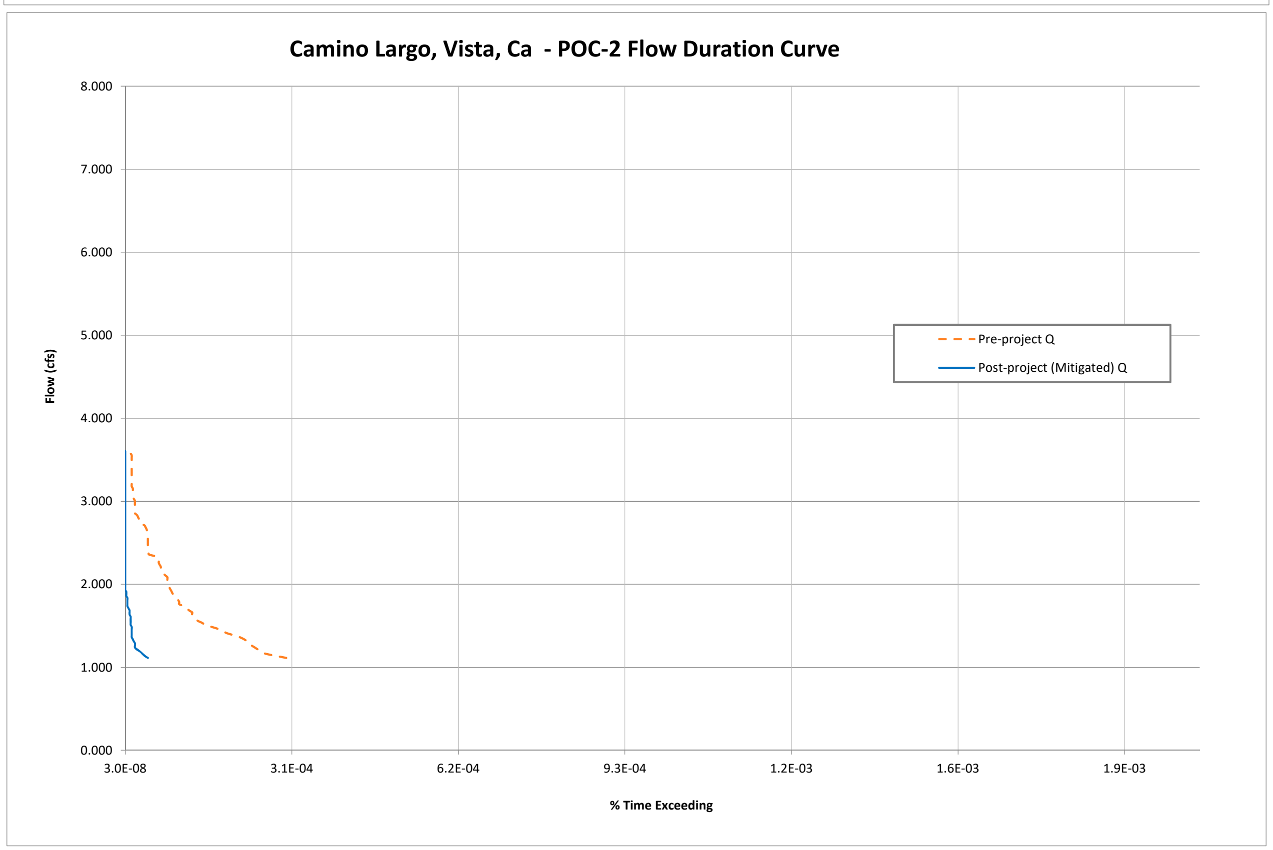


Figure 2a and 2b. POC-2 Flow Duration Curve Comparison (logarithmic and normal "x" scale)





ATTACHMENT 1

Q_2 to Q_{10} Comparison Tables

Peak Flow Frequency Summary – POC-1

Q_2 to Q_{10} Comparison Table - POC-1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
LF = $0.1xQ_2$	1.318	0.987	0.331
2-year	2.635	1.973	0.662
3-year	2.847	2.317	0.530
4-year	3.262	2.696	0.566
5-year	3.346	2.914	0.432
6-year	3.446	3.051	0.395
7-year	3.648	3.132	0.517
8-year	3.737	3.160	0.577
9-year	3.985	3.169	0.817
10-year	4.249	3.216	1.033

Peak Flow Frequency Summary – POC-2

Q_2 to Q_{10} Comparison Table - POC-2

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
LF = $0.1xQ_2$	1.112	0.474	0.638
2-year	2.224	0.948	1.276
3-year	2.398	1.032	1.366
4-year	2.744	1.166	1.578
5-year	2.825	1.208	1.617
6-year	2.896	1.247	1.648
7-year	3.063	1.315	1.748
8-year	3.138	1.349	1.789
9-year	3.369	1.427	1.942
10-year	3.603	1.513	2.090

ATTACHMENT 2

FDC Plots (log and natural “x” scale) and Flow Duration Table

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 $0.1Q_2 – Q_{10}$ is divided into 100 sub intervals, the post development divided by pre-development durations is never larger than 110% (the permit allows up to 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 County of San Diego 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 BHA, not only the range of analysis is clearly depicted (50% 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). BHA performed the analysis using the Weibull Plotting positon Method 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.

Flow Duration Curve Data for Camino Largo POC-1, Vista, CA

Low Flow Threshold:	50%	
0.1xQ2 (Pre):	1.318	cfs
Q10 (Pre):	4.249	cfs
# of Ordinates:	100	
Incremental Q (Pre):	0.02931	cfs
Total Hourly Data:	497370	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	1.318	145	2.92E-04	79	1.59E-04	54%	Pass
1	1.347	134	2.69E-04	72	1.45E-04	54%	Pass
2	1.376	126	2.53E-04	68	1.37E-04	54%	Pass
3	1.405	126	2.53E-04	64	1.29E-04	51%	Pass
4	1.435	120	2.41E-04	61	1.23E-04	51%	Pass
5	1.464	117	2.35E-04	58	1.17E-04	50%	Pass
6	1.493	116	2.33E-04	55	1.11E-04	47%	Pass
7	1.523	113	2.27E-04	54	1.09E-04	48%	Pass
8	1.552	111	2.23E-04	54	1.09E-04	49%	Pass
9	1.581	110	2.21E-04	54	1.09E-04	49%	Pass
10	1.611	103	2.07E-04	54	1.09E-04	52%	Pass
11	1.640	98	1.97E-04	54	1.09E-04	55%	Pass
12	1.669	93	1.87E-04	52	1.05E-04	56%	Pass
13	1.699	89	1.79E-04	48	9.65E-05	54%	Pass
14	1.728	83	1.67E-04	46	9.25E-05	55%	Pass
15	1.757	81	1.63E-04	45	9.05E-05	56%	Pass
16	1.786	75	1.51E-04	44	8.85E-05	59%	Pass
17	1.816	71	1.43E-04	42	8.44E-05	59%	Pass
18	1.845	65	1.31E-04	41	8.24E-05	63%	Pass
19	1.874	64	1.29E-04	38	7.64E-05	59%	Pass
20	1.904	62	1.25E-04	36	7.24E-05	58%	Pass
21	1.933	62	1.25E-04	36	7.24E-05	58%	Pass
22	1.962	61	1.23E-04	36	7.24E-05	59%	Pass
23	1.992	58	1.17E-04	35	7.04E-05	60%	Pass
24	2.021	57	1.15E-04	34	6.84E-05	60%	Pass
25	2.050	54	1.09E-04	33	6.63E-05	61%	Pass
26	2.080	52	1.05E-04	31	6.23E-05	60%	Pass
27	2.109	49	9.85E-05	31	6.23E-05	63%	Pass

28	2.138	48	9.65E-05	30	6.03E-05	63%	Pass
29	2.168	48	9.65E-05	30	6.03E-05	63%	Pass
30	2.197	46	9.25E-05	27	5.43E-05	59%	Pass
31	2.226	44	8.85E-05	24	4.83E-05	55%	Pass
32	2.255	42	8.44E-05	22	4.42E-05	52%	Pass
33	2.285	42	8.44E-05	21	4.22E-05	50%	Pass
34	2.314	41	8.24E-05	21	4.22E-05	51%	Pass
35	2.343	41	8.24E-05	20	4.02E-05	49%	Pass
36	2.373	40	8.04E-05	19	3.82E-05	48%	Pass
37	2.402	39	7.84E-05	19	3.82E-05	49%	Pass
38	2.431	39	7.84E-05	19	3.82E-05	49%	Pass
39	2.461	39	7.84E-05	19	3.82E-05	49%	Pass
40	2.490	37	7.44E-05	19	3.82E-05	51%	Pass
41	2.519	35	7.04E-05	18	3.62E-05	51%	Pass
42	2.549	33	6.63E-05	18	3.62E-05	55%	Pass
43	2.578	33	6.63E-05	17	3.42E-05	52%	Pass
44	2.607	33	6.63E-05	17	3.42E-05	52%	Pass
45	2.637	32	6.43E-05	17	3.42E-05	53%	Pass
46	2.666	31	6.23E-05	17	3.42E-05	55%	Pass
47	2.695	31	6.23E-05	16	3.22E-05	52%	Pass
48	2.724	30	6.03E-05	15	3.02E-05	50%	Pass
49	2.754	29	5.83E-05	15	3.02E-05	52%	Pass
50	2.783	25	5.03E-05	15	3.02E-05	60%	Pass
51	2.812	22	4.42E-05	15	3.02E-05	68%	Pass
52	2.842	22	4.42E-05	15	3.02E-05	68%	Pass
53	2.871	21	4.22E-05	14	2.81E-05	67%	Pass
54	2.900	21	4.22E-05	13	2.61E-05	62%	Pass
55	2.930	21	4.22E-05	13	2.61E-05	62%	Pass
56	2.959	21	4.22E-05	13	2.61E-05	62%	Pass
57	2.988	21	4.22E-05	12	2.41E-05	57%	Pass
58	3.018	21	4.22E-05	12	2.41E-05	57%	Pass
59	3.047	21	4.22E-05	11	2.21E-05	52%	Pass
60	3.076	21	4.22E-05	11	2.21E-05	52%	Pass
61	3.106	20	4.02E-05	11	2.21E-05	55%	Pass
62	3.135	20	4.02E-05	10	2.01E-05	50%	Pass
63	3.164	20	4.02E-05	8	1.61E-05	40%	Pass
64	3.193	19	3.82E-05	6	1.21E-05	32%	Pass
65	3.223	18	3.62E-05	6	1.21E-05	33%	Pass
66	3.252	15	3.02E-05	6	1.21E-05	40%	Pass
67	3.281	15	3.02E-05	6	1.21E-05	40%	Pass
68	3.311	13	2.61E-05	6	1.21E-05	46%	Pass
69	3.340	11	2.21E-05	6	1.21E-05	55%	Pass
70	3.369	10	2.01E-05	6	1.21E-05	60%	Pass

71	3.399	9	1.81E-05	6	1.21E-05	67%	Pass
72	3.428	9	1.81E-05	5	1.01E-05	56%	Pass
73	3.457	9	1.81E-05	4	8.04E-06	44%	Pass
74	3.487	9	1.81E-05	4	8.04E-06	44%	Pass
75	3.516	9	1.81E-05	4	8.04E-06	44%	Pass
76	3.545	9	1.81E-05	4	8.04E-06	44%	Pass
77	3.575	9	1.81E-05	4	8.04E-06	44%	Pass
78	3.604	8	1.61E-05	4	8.04E-06	50%	Pass
79	3.633	8	1.61E-05	4	8.04E-06	50%	Pass
80	3.662	8	1.61E-05	4	8.04E-06	50%	Pass
81	3.692	7	1.41E-05	4	8.04E-06	57%	Pass
82	3.721	7	1.41E-05	4	8.04E-06	57%	Pass
83	3.750	7	1.41E-05	4	8.04E-06	57%	Pass
84	3.780	6	1.21E-05	4	8.04E-06	67%	Pass
85	3.809	6	1.21E-05	4	8.04E-06	67%	Pass
86	3.838	6	1.21E-05	4	8.04E-06	67%	Pass
87	3.868	6	1.21E-05	4	8.04E-06	67%	Pass
88	3.897	6	1.21E-05	4	8.04E-06	67%	Pass
89	3.926	6	1.21E-05	4	8.04E-06	67%	Pass
90	3.956	6	1.21E-05	4	8.04E-06	67%	Pass
91	3.985	6	1.21E-05	4	8.04E-06	67%	Pass
92	4.014	6	1.21E-05	4	8.04E-06	67%	Pass
93	4.044	6	1.21E-05	4	8.04E-06	67%	Pass
94	4.073	6	1.21E-05	4	8.04E-06	67%	Pass
95	4.102	6	1.21E-05	4	8.04E-06	67%	Pass
96	4.131	6	1.21E-05	4	8.04E-06	67%	Pass
97	4.161	6	1.21E-05	4	8.04E-06	67%	Pass
98	4.190	6	1.21E-05	4	8.04E-06	67%	Pass
99	4.219	5	1.01E-05	4	8.04E-06	80%	Pass
100	4.249	5	1.01E-05	4	8.04E-06	80%	Pass

Peak flows calculated with the Weibull Plotting Position

Return Period (years)	Pre-Dev. Peak Flows (cfs)	Post-Dev. Peak Flows (cfs)	Reduction (cfs)
LF = 0.1xQ2	1.318	0.987	0.331
2-year	2.635	1.973	0.662
3-year	2.847	2.317	0.530
4-year	3.262	2.696	0.566
5-year	3.346	2.914	0.432
6-year	3.446	3.051	0.395
7-year	3.648	3.132	0.517
8-year	3.737	3.160	0.577
9-year	3.985	3.169	0.817
10-year	4.249	3.216	1.033

Flow Duration Curve Data for Camino Largo POC-2, Vista, CA

Low Flow Threshold:	50%	
0.1xQ2 (Pre):	1.112	cfs
Q10 (Pre):	3.603	cfs
# of Ordinates:	100	
Incremental Q (Pre):	0.02491	cfs
Total Hourly Data:	497370	hours

The proposed BMP: PASSED

Interval	Pre-project Flow (cfs)	Pre-project Hours	Pre-project % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
0	1.112	149	3.00E-04	21	4.22E-05	14%	Pass
1	1.137	139	2.79E-04	18	3.62E-05	13%	Pass
2	1.162	130	2.61E-04	16	3.22E-05	12%	Pass
3	1.187	127	2.55E-04	14	2.81E-05	11%	Pass
4	1.212	123	2.47E-04	11	2.21E-05	9%	Pass
5	1.237	120	2.41E-04	9	1.81E-05	8%	Pass
6	1.261	117	2.35E-04	9	1.81E-05	8%	Pass
7	1.286	116	2.33E-04	9	1.81E-05	8%	Pass
8	1.311	113	2.27E-04	8	1.61E-05	7%	Pass
9	1.336	110	2.21E-04	7	1.41E-05	6%	Pass
10	1.361	106	2.13E-04	6	1.21E-05	6%	Pass
11	1.386	100	2.01E-04	6	1.21E-05	6%	Pass
12	1.411	94	1.89E-04	6	1.21E-05	6%	Pass
13	1.436	90	1.81E-04	6	1.21E-05	7%	Pass
14	1.461	86	1.73E-04	6	1.21E-05	7%	Pass
15	1.486	80	1.61E-04	6	1.21E-05	8%	Pass
16	1.511	74	1.49E-04	5	1.01E-05	7%	Pass
17	1.535	71	1.43E-04	5	1.01E-05	7%	Pass
18	1.560	67	1.35E-04	5	1.01E-05	7%	Pass
19	1.585	66	1.33E-04	5	1.01E-05	8%	Pass
20	1.610	65	1.31E-04	5	1.01E-05	8%	Pass
21	1.635	62	1.25E-04	4	8.04E-06	6%	Pass
22	1.660	62	1.25E-04	4	8.04E-06	6%	Pass
23	1.685	59	1.19E-04	4	8.04E-06	7%	Pass
24	1.710	57	1.15E-04	3	6.03E-06	5%	Pass
25	1.735	54	1.09E-04	2	4.02E-06	4%	Pass
26	1.760	50	1.01E-04	2	4.02E-06	4%	Pass
27	1.785	50	1.01E-04	2	4.02E-06	4%	Pass

28	1.809	49	9.85E-05	2	4.02E-06	4%	Pass
29	1.834	48	9.65E-05	2	4.02E-06	4%	Pass
30	1.859	46	9.25E-05	1	2.01E-06	2%	Pass
31	1.884	44	8.85E-05	1	2.01E-06	2%	Pass
32	1.909	43	8.65E-05	1	2.01E-06	2%	Pass
33	1.934	42	8.44E-05	0	0.00E+00	0%	Pass
34	1.959	41	8.24E-05	0	0.00E+00	0%	Pass
35	1.984	41	8.24E-05	0	0.00E+00	0%	Pass
36	2.009	40	8.04E-05	0	0.00E+00	0%	Pass
37	2.034	39	7.84E-05	0	0.00E+00	0%	Pass
38	2.059	39	7.84E-05	0	0.00E+00	0%	Pass
39	2.083	39	7.84E-05	0	0.00E+00	0%	Pass
40	2.108	37	7.44E-05	0	0.00E+00	0%	Pass
41	2.133	35	7.04E-05	0	0.00E+00	0%	Pass
42	2.158	33	6.63E-05	0	0.00E+00	0%	Pass
43	2.183	33	6.63E-05	0	0.00E+00	0%	Pass
44	2.208	33	6.63E-05	0	0.00E+00	0%	Pass
45	2.233	32	6.43E-05	0	0.00E+00	0%	Pass
46	2.258	31	6.23E-05	0	0.00E+00	0%	Pass
47	2.283	31	6.23E-05	0	0.00E+00	0%	Pass
48	2.308	29	5.83E-05	0	0.00E+00	0%	Pass
49	2.333	29	5.83E-05	0	0.00E+00	0%	Pass
50	2.357	22	4.42E-05	0	0.00E+00	0%	Pass
51	2.382	22	4.42E-05	0	0.00E+00	0%	Pass
52	2.407	22	4.42E-05	0	0.00E+00	0%	Pass
53	2.432	21	4.22E-05	0	0.00E+00	0%	Pass
54	2.457	21	4.22E-05	0	0.00E+00	0%	Pass
55	2.482	21	4.22E-05	0	0.00E+00	0%	Pass
56	2.507	21	4.22E-05	0	0.00E+00	0%	Pass
57	2.532	21	4.22E-05	0	0.00E+00	0%	Pass
58	2.557	21	4.22E-05	0	0.00E+00	0%	Pass
59	2.582	21	4.22E-05	0	0.00E+00	0%	Pass
60	2.607	21	4.22E-05	0	0.00E+00	0%	Pass
61	2.631	20	4.02E-05	0	0.00E+00	0%	Pass
62	2.656	20	4.02E-05	0	0.00E+00	0%	Pass
63	2.681	19	3.82E-05	0	0.00E+00	0%	Pass
64	2.706	18	3.62E-05	0	0.00E+00	0%	Pass
65	2.731	15	3.02E-05	0	0.00E+00	0%	Pass
66	2.756	15	3.02E-05	0	0.00E+00	0%	Pass
67	2.781	13	2.61E-05	0	0.00E+00	0%	Pass
68	2.806	12	2.41E-05	0	0.00E+00	0%	Pass
69	2.831	11	2.21E-05	0	0.00E+00	0%	Pass
70	2.856	9	1.81E-05	0	0.00E+00	0%	Pass

71	2.881	9	1.81E-05	0	0.00E+00	0%	Pass
72	2.905	9	1.81E-05	0	0.00E+00	0%	Pass
73	2.930	9	1.81E-05	0	0.00E+00	0%	Pass
74	2.955	9	1.81E-05	0	0.00E+00	0%	Pass
75	2.980	9	1.81E-05	0	0.00E+00	0%	Pass
76	3.005	9	1.81E-05	0	0.00E+00	0%	Pass
77	3.030	8	1.61E-05	0	0.00E+00	0%	Pass
78	3.055	8	1.61E-05	0	0.00E+00	0%	Pass
79	3.080	8	1.61E-05	0	0.00E+00	0%	Pass
80	3.105	7	1.41E-05	0	0.00E+00	0%	Pass
81	3.130	7	1.41E-05	0	0.00E+00	0%	Pass
82	3.155	7	1.41E-05	0	0.00E+00	0%	Pass
83	3.179	6	1.21E-05	0	0.00E+00	0%	Pass
84	3.204	6	1.21E-05	0	0.00E+00	0%	Pass
85	3.229	6	1.21E-05	0	0.00E+00	0%	Pass
86	3.254	6	1.21E-05	0	0.00E+00	0%	Pass
87	3.279	6	1.21E-05	0	0.00E+00	0%	Pass
88	3.304	6	1.21E-05	0	0.00E+00	0%	Pass
89	3.329	6	1.21E-05	0	0.00E+00	0%	Pass
90	3.354	6	1.21E-05	0	0.00E+00	0%	Pass
91	3.379	6	1.21E-05	0	0.00E+00	0%	Pass
92	3.404	6	1.21E-05	0	0.00E+00	0%	Pass
93	3.429	6	1.21E-05	0	0.00E+00	0%	Pass
94	3.453	6	1.21E-05	0	0.00E+00	0%	Pass
95	3.478	6	1.21E-05	0	0.00E+00	0%	Pass
96	3.503	6	1.21E-05	0	0.00E+00	0%	Pass
97	3.528	6	1.21E-05	0	0.00E+00	0%	Pass
98	3.553	6	1.21E-05	0	0.00E+00	0%	Pass
99	3.578	5	1.01E-05	0	0.00E+00	0%	Pass
100	3.603	5	1.01E-05	0	0.00E+00	0%	Pass

Peak flows calculated with the Weibull Plotting Position

Return Period (years)	Pre-Dev. Peak Flows (cfs)	Post-Dev. Peak Flows (cfs)	Reduction (cfs)
LF = 0.1xQ2	1.112	0.474	0.638
2-year	2.224	0.948	1.276
3-year	2.398	1.032	1.366
4-year	2.744	1.166	1.578
5-year	2.825	1.208	1.617
6-year	2.896	1.247	1.648
7-year	3.063	1.315	1.748
8-year	3.138	1.349	1.789
9-year	3.369	1.427	1.942
10-year	3.603	1.513	2.090

ATTACHMENT 3

List of the "n" largest Peaks: Pre-Development and Post-Development Conditions

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

- Basic Probabilistic Equation: $R = \frac{1}{P}$

  where,

  R = Return period in years; and

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

- Weibull Equation: $P = \frac{i}{n+1}$

  where,

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

  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 form 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).

Pre-Project Flow Frequency for POC-1 – Long-term Simulation

Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC-1
Statistics - Node POC-1 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	4/14/2003	8	5.563	0.28	58
2	1/4/1978	3	5.189	0.55	29
3	10/1/1983	3	4.985	0.83	19.33
4	1/15/1979	4	4.679	1.11	14.5
5	1/4/1995	7	4.509	1.39	11.6
6	9/23/1986	1	4.195	1.66	9.67
7	2/25/2003	6	3.763	1.94	8.29
8	2/3/1958	31	3.67	2.22	7.25
9	2/24/1969	45	3.6	2.49	6.44
10	10/27/2004	8	3.376	2.77	5.8
11	1/13/1993	10	3.358	3.05	5.27
12	10/29/2000	2	3.339	3.32	4.83
13	2/18/2005	19	3.325	3.6	4.46
14	2/20/1980	13	3.284	3.88	4.14
15	3/17/1982	17	3.241	4.16	3.87
16	1/16/1952	8	3.226	4.43	3.63
17	2/28/1978	16	3.199	4.71	3.41
18	4/1/1958	9	3.184	4.99	3.22
19	3/2/1980	14	2.87	5.26	3.05
20	2/10/1978	4	2.802	5.54	2.9
21	12/29/1991	13	2.793	5.82	2.76
22	11/22/1965	25	2.79	6.09	2.64
23	2/27/1983	4	2.779	6.37	2.52
24	1/29/1983	4	2.777	6.65	2.42
25	2/3/1998	7	2.776	6.93	2.32
26	12/19/1970	20	2.725	7.2	2.23
27	1/27/2008	21	2.698	7.48	2.15
28	2/22/1998	34	2.646	7.76	2.07
29	2/16/1980	3	2.635	8.03	2
30	10/20/2004	6	2.527	8.31	1.93
31	11/15/1952	2	2.526	8.59	1.87
32	2/16/1998	31	2.495	8.86	1.81
33	11/11/1985	5	2.495	9.14	1.76
34	2/18/1993	1	2.474	9.42	1.71
35	12/1/1961	19	2.473	9.7	1.66
36	2/3/1994	12	2.384	9.97	1.61

37	1/15/1993	76	2.349	10.25	1.57
38	1/16/1978	9	2.31	10.53	1.53
39	3/11/1995	23	2.249	10.8	1.49
40	1/5/2008	45	2.244	11.08	1.45
41	2/14/1986	7	2.225	11.36	1.41
42	1/28/1980	26	2.217	11.63	1.38
43	2/14/1998	9	2.193	11.91	1.35
44	3/17/1963	3	2.177	12.19	1.32
45	3/15/1986	22	2.136	12.47	1.29
46	2/12/1992	15	2.103	12.74	1.26
47	2/22/2008	8	2.066	13.02	1.23
48	1/16/1972	3	2.058	13.3	1.21
49	2/27/1991	41	2.049	13.57	1.18
50	3/19/1981	2	2.036	13.85	1.16
51	4/27/1960	4	2.027	14.13	1.14
52	12/22/1982	1	1.999	14.4	1.12
53	2/8/1993	10	1.977	14.68	1.09
54	2/11/2003	27	1.937	14.96	1.07
55	2/6/1969	9	1.878	15.24	1.05
56	8/17/1977	2	1.873	15.51	1.04
57	1/11/2005	9	1.842	15.79	1.02
58	4/28/2005	1	1.832	16.07	1

Pre-project

10-year Q:	4.249	cfs
5-year Q:	3.346	cfs
2-year Q:	2.635	cfs

Lower Flow Threshold: 50%

$0.1xQ_2$ (Pre): 1.318 cfs

Pre-Project Flow Frequency for POC-2 – Long-term Simulation

Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC 2
Statistics - Node POC-2 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	4/14/2003	8	4.668	0.27	58
2	1/4/1978	3	4.361	0.55	29
3	10/1/1983	3	4.183	0.82	19.33
4	1/15/1979	4	3.925	1.1	14.5
5	1/4/1995	6	3.782	1.37	11.6
6	9/23/1986	1	3.566	1.64	9.67
7	2/25/2003	6	3.16	1.92	8.29
8	2/3/1958	31	3.081	2.19	7.25
9	2/24/1969	45	3.022	2.47	6.44
10	10/27/2004	7	2.838	2.74	5.8
11	1/13/1993	10	2.834	3.01	5.27
12	10/29/2000	2	2.82	3.29	4.83
13	2/18/2005	19	2.794	3.56	4.46
14	2/20/1980	13	2.757	3.84	4.14
15	3/17/1982	17	2.731	4.11	3.87
16	1/16/1952	8	2.71	4.38	3.63
17	2/28/1978	16	2.688	4.66	3.41
18	4/1/1958	9	2.68	4.93	3.22
19	3/2/1980	14	2.421	5.21	3.05
20	2/10/1978	4	2.352	5.48	2.9
21	12/29/1991	13	2.347	5.75	2.76
22	11/22/1965	25	2.346	6.03	2.64
23	2/27/1983	4	2.344	6.3	2.52
24	1/29/1983	4	2.343	6.58	2.42
25	2/3/1998	7	2.333	6.85	2.32
26	12/19/1970	20	2.298	7.12	2.23
27	1/27/2008	21	2.289	7.4	2.15
28	2/16/1980	3	2.236	7.67	2.07
29	2/22/1998	34	2.224	7.95	2
30	11/15/1952	2	2.15	8.22	1.93
31	10/20/2004	6	2.148	8.49	1.87
32	11/11/1985	5	2.133	8.77	1.81
33	2/18/1993	1	2.126	9.04	1.76
34	2/16/1998	31	2.097	9.32	1.71
35	12/1/1961	20	2.088	9.59	1.66
36	2/3/1994	12	2.031	9.86	1.61

37	1/15/1993	76	2.002	10.14	1.57
38	1/16/1978	9	1.939	10.41	1.53
39	3/11/1995	23	1.92	10.68	1.49
40	1/5/2008	45	1.894	10.96	1.45
41	2/14/1986	7	1.875	11.23	1.41
42	1/28/1980	26	1.86	11.51	1.38
43	3/17/1963	3	1.848	11.78	1.35
44	2/14/1998	9	1.845	12.05	1.32
45	3/15/1986	22	1.809	12.33	1.29
46	2/12/1992	15	1.795	12.6	1.26
47	2/27/1991	41	1.753	12.88	1.23
48	2/22/2008	8	1.737	13.15	1.21
49	12/22/1982	1	1.732	13.42	1.18
50	1/16/1972	3	1.731	13.7	1.16
51	3/19/1981	2	1.727	13.97	1.14
52	4/27/1960	4	1.704	14.25	1.12
53	2/8/1993	10	1.677	14.52	1.09
54	2/11/2003	27	1.632	14.79	1.07
55	4/28/2005	1	1.622	15.07	1.05
56	2/6/1969	9	1.616	15.34	1.04
57	8/17/1977	2	1.574	15.62	1.02
58	1/11/2005	9	1.548	15.89	1

Pre-project

10-year Q:	3.603	cfs
5-year Q:	2.825	cfs
2-year Q:	2.224	cfs

Lower Flow Threshold: 50%

$0.1xQ_2$ (Pre): 1.112 cfs

Post-Project (Mitigated) Flow Frequency for POC-1 – Long-term Simulation

Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC-1
Statistics - Node POC-1 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	4/14/2003	38	5.217	0.11	58
2	9/29/1983	50	4.79	0.22	29
3	1/3/1995	45	4.515	0.34	19.33
4	1/14/1979	33	4.504	0.45	14.5
5	1/3/1978	74	3.443	0.56	11.6
6	2/25/2003	68	3.169	0.67	9.67
7	9/23/1986	35	3.168	0.78	8.29
8	10/27/2004	34	3.138	0.9	7.25
9	2/23/1969	55	3.117	1.01	6.44
10	2/27/1978	142	3.021	1.12	5.8
11	2/3/1958	38	2.967	1.23	5.27
12	2/13/1980	190	2.881	1.35	4.83
13	1/16/1952	53	2.857	1.46	4.46
14	2/5/1978	209	2.721	1.57	4.14
15	3/2/1980	22	2.672	1.68	3.87
16	2/18/2005	33	2.558	1.79	3.63
17	3/17/1982	45	2.502	1.91	3.41
18	1/16/1978	14	2.354	2.02	3.22
19	1/27/1980	67	2.337	2.13	3.05
20	11/22/1965	29	2.277	2.24	2.9
21	8/16/1977	30	2.226	2.35	2.76
22	2/20/2008	54	2.21	2.47	2.64
23	2/3/1998	40	2.203	2.58	2.52
24	1/16/1972	15	2.193	2.69	2.42
25	10/29/2000	28	2.183	2.8	2.32
26	12/16/1970	75	2.114	2.91	2.23
27	12/29/1991	15	2.032	3.03	2.15
28	1/12/1993	151	2.005	3.14	2.07
29	2/22/1998	69	1.973	3.25	2
30	3/31/1958	107	1.88	3.36	1.93
31	2/14/1986	14	1.877	3.48	1.87
32	1/5/1979	33	1.849	3.59	1.81
33	1/14/1978	19	1.848	3.7	1.76
34	3/7/1968	18	1.811	3.81	1.71
35	1/20/1962	59	1.792	3.92	1.66
36	4/27/1960	11	1.775	4.04	1.61

37	2/16/1998	43	1.716	4.15	1.57
38	1/7/2005	119	1.702	4.26	1.53
39	11/11/1985	29	1.693	4.37	1.49
40	12/28/2004	53	1.692	4.48	1.45
41	11/17/1986	18	1.686	4.6	1.41
42	11/14/1952	45	1.676	4.71	1.38
43	3/24/1994	25	1.651	4.82	1.35
44	3/16/1963	24	1.649	4.93	1.32
45	2/26/1983	165	1.478	5.04	1.29
46	3/11/1995	27	1.46	5.16	1.26
47	12/24/1988	9	1.451	5.27	1.23
48	2/26/2004	13	1.426	5.38	1.21
49	2/1/1960	11	1.412	5.49	1.18
50	12/3/1966	93	1.408	5.61	1.16
51	12/18/1967	44	1.39	5.72	1.14
52	1/12/1960	10	1.387	5.83	1.12
53	1/3/2005	55	1.38	5.94	1.09
54	1/28/1983	15	1.35	6.05	1.07
55	9/17/1963	44	1.342	6.17	1.05
56	1/13/1957	12	1.332	6.28	1.04
57	1/5/2008	54	1.28	6.39	1.02
58	11/21/1996	18	1.243	6.5	1

Post-project (Mitigated)

10-year Q:	3.216	cfs
5-year Q:	2.914	cfs
2-year Q:	1.973	cfs
Lower Flow Threshold:	50%	
$0.1xQ_2$ (Pre):	0.987	cfs

Post-Project (Mitigated) Flow Frequency for POC-2 – Long-term Simulation

Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC 2

Statistics - Node POC-1 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	4/14/2003	5	1.912	0.3	58
2	1/4/1978	3	1.852	0.61	29
3	10/1/1983	2	1.714	0.91	19.33
4	1/15/1979	4	1.693	1.22	14.5
5	1/4/1995	6	1.618	1.52	11.6
6	9/23/1986	1	1.491	1.83	9.67
7	2/25/2003	4	1.359	2.13	8.29
8	2/3/1958	30	1.322	2.44	7.25
9	2/24/1969	44	1.299	2.74	6.44
10	1/13/1993	9	1.224	3.05	5.8
11	10/27/2004	7	1.219	3.35	5.27
12	2/18/2005	3	1.201	3.66	4.83
13	2/20/1980	12	1.188	3.96	4.46
14	10/29/2000	2	1.166	4.27	4.14
15	1/16/1952	7	1.166	4.57	3.87
16	2/28/1978	14	1.162	4.88	3.63
17	4/1/1958	6	1.154	5.18	3.41
18	3/17/1982	17	1.123	5.49	3.22
19	3/2/1980	14	1.037	5.79	3.05
20	2/10/1978	4	1.023	6.1	2.9
21	2/27/1983	1	1.017	6.4	2.76
22	1/29/1983	4	1.015	6.71	2.64
23	11/22/1965	20	1.013	7.01	2.52
24	2/3/1998	4	1.008	7.32	2.42
25	1/27/2008	20	1	7.62	2.32
26	2/16/1980	3	0.98	7.93	2.23
27	12/29/1991	10	0.964	8.23	2.15
28	2/22/1998	28	0.963	8.54	2.07
29	12/19/1970	1	0.948	8.84	2
30	2/16/1998	26	0.91	9.15	1.93
31	2/18/1993	1	0.906	9.45	1.87
32	11/15/1952	1	0.901	9.76	1.81
33	11/11/1985	3	0.901	10.06	1.76
34	10/20/2004	6	0.898	10.37	1.71
35	1/18/1993	6	0.885	10.67	1.66
36	12/2/1961	14	0.863	10.98	1.61

37	1/28/1980	27	0.862	11.28	1.57
38	3/11/1995	22	0.852	11.59	1.53
39	2/3/1994	12	0.851	11.89	1.49
40	3/15/1986	23	0.848	12.2	1.45
41	1/16/1978	5	0.847	12.5	1.41
42	1/5/2008	43	0.83	12.8	1.38
43	2/14/1986	7	0.818	13.11	1.35
44	2/14/1998	4	0.803	13.41	1.32
45	2/12/1992	14	0.797	13.72	1.29
46	2/27/1991	41	0.781	14.02	1.26
47	3/17/1963	3	0.771	14.33	1.23
48	2/22/2008	7	0.765	14.63	1.21
49	1/16/1972	2	0.765	14.94	1.18
50	12/22/1982	1	0.749	15.24	1.16
51	2/8/1993	10	0.743	15.55	1.14
52	2/6/1969	7	0.731	15.85	1.12
53	4/28/2005	1	0.727	16.16	1.09
54	3/19/1981	1	0.72	16.46	1.07
55	4/27/1960	2	0.7	16.77	1.05
56	12/31/2004	2	0.69	17.07	1.04
57	1/11/2005	7	0.682	17.38	1.02
58	3/1/1983	65	0.676	17.68	1

Post-project (Mitigated)

10-year Q:	1.513	cfs
5-year Q:	1.208	cfs
2-year Q:	0.948	cfs

Lower Flow Threshold: 50%

$0.1xQ_2$ (Pre): 0.474 cfs

ATTACHMENT 4

Elevation vs. Area Curves and Elevation vs. Discharge Curves to be used in SWMM

Elevation vs. Area

The elevation vs. area curves in the model are calculated in Excel and imported into the model. The summary of elevation vs. area for each BMP has been provided on the following pages.

The LID surface storage depth beneath the lowest surface discharge structure is accounted for in the LID module as illustrated in Attachment 7.

Elevation vs. Discharge

The total elevation vs. discharge curve is imported from an Excel spreadsheet that calculates the elevation vs. discharge of the outlet system. Elevation vs. discharge relationships are provided in the surface discharge of the biofiltration basin as this is where a Modified Puls routing procedure will be applied in the continuous simulation model.

The low-flow orifice size has been selected to maximum its size while still restricting flows to conform with the required 50% of the Q_2 event flow as mandated in the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. While BHA acknowledges that this orifice is small, to increase the size of these outlets would impact the basin's ability to restrict flows beneath the HMP thresholds, thus preventing the BMP from conforming with HMP requirements.

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

Discharge Equations

The following equations are based on the *San Diego County Hydraulic Design Manual* (September 2014):

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

- Slot:

  As an orifice: $Q_S = B_S * h_S * c_g * \sqrt{2g(H - \frac{h_S}{2})}$ (2.a)

  As a weir: $Q_S = C_W * B_S * H^{3/2}$ (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.

- Vertical Orifices:

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

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

  $\frac{Q_O^2}{g} = \frac{A_{cr}^3}{T_{cr}}; H = y_{cr} + \frac{A_{cr}}{2*T_{cr}}; T_{cr} = 2\sqrt{y_{cr}(D - y_{cr})}; A_{cr} = \frac{D^2}{8}[a_{cr} - \sin(a_{cr})];$
  $y_{cr} = \frac{D}{2}[1 - \sin(0.5 * a_{cr})]$ (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 of 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)

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

Stage-Area for Basin 1

Elevation vs. Area Tables

Depth (ft)	Area (ft^2)	Volume (ft^3)
0.000	6147	0
0.083	6173	514
0.167	6199	1033
0.250	6225	1556
0.333	6250	2083
0.417	6276	2615
0.500	6302	3151
0.583	6328	3691
0.667	6354	4236
0.750	6380	4785
0.833	6405	5338
0.917	6431	5895
1.000	6457	6457
1.083	6483	7023
1.167	6509	7593
1.250	6535	8168
1.333	6560	8747
1.417	6586	9330
1.500	6612	9918
1.583	6638	10510
1.667	6664	11106
1.750	6690	11707
1.833	6715	12311
1.917	6741	12921
2.000	6767	13534

SUB SURFACE STORAGE BASIN 1

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.50	6147	1844	Amended Soil Base (0.2 voids)
-2.08	6147	1434	Gravel Base (0.4 voids)
Gravel & Amended Soil	TOTAL =	3278	(ft^3)
Surface Total	TOTAL =	4236	(ft^3)
BMP	**TOTAL =**	**7514**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Outlet Structure for Discharge of Basin 1

Elevation vs. Discharge Table

Outlet Structure for Discharge of BMP 1
Discharge vs. Elevation Table

Lower orifice		Lower Slot		Emergency Weir	
No. of orif:	0	No. of slots:	1	Invert:	1.250 ft
Dia:	3 in	Invert:	0.000 ft	B:	20.000 ft
Invert:	0.000 ft	B (width):	2.833 ft	V-Notch Angle	0
Area:	0.049 sf	Area:	1.181 sf		
Cg-low:	0.62	h_{slot} (height):	0.417 ft		
		Cg-low:	0.62		
Middle orifice		Upper slot			
No. of orif:	0	No. of slots:	1		
Dia:	4 in	Invert:	0.583 ft		
Invert:	0.417 ft	B (width):	0.833 ft		
Area:	0.000 sf	Area:	0.275 sf		
Cg-low:	0.62	h_{slot} (height):	0.330 ft		
		Cg-low:	0.62		

***Note: h = head above the invert of the lowest surface discharge opening.**

Basin Elev. (ft)	H (ft)	USE h* (ft)	$Q_{orifice-low}$ (cfs)	$Q_{orifice-upper}$ (cfs)	$Q_{slot-low}$ (cfs)	$Q_{slot-upper}$ (cfs)	Q_{emerg} (cfs)	Q_{tot} (cfs)
308.900	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000
308.983	0.583	0.083	0.000	0.000	1.193	0.000	0.000	1.193
309.067	0.667	0.167	0.000	0.000	1.687	0.278	0.000	1.965
309.150	0.750	0.250	0.000	0.000	2.066	0.393	0.000	2.459
309.233	0.833	0.333	0.000	0.000	2.077	0.481	0.000	2.558
309.317	0.917	0.417	0.000	0.000	2.681	0.556	0.000	3.237
309.400	1.000	0.500	0.000	0.000	3.172	0.686	0.000	3.859
309.483	1.083	0.583	0.000	0.000	3.597	0.792	0.000	4.389
309.567	1.167	0.667	0.000	0.000	3.977	0.885	0.000	4.862
309.650	1.250	0.750	0.000	0.000	4.323	0.969	0.000	5.292
309.733	1.333	0.833	0.000	0.000	4.644	1.047	0.000	5.690
309.817	1.417	0.917	0.000	0.000	4.944	1.119	0.000	6.062
309.900	1.500	1.000	0.000	0.000	5.226	1.186	0.000	6.413
309.983	1.583	1.083	0.000	0.000	5.494	1.250	0.000	6.745
310.067	1.667	1.167	0.000	0.000	5.750	1.311	0.000	7.061
310.150	1.750	1.250	0.000	0.000	5.995	1.369	0.000	7.364
310.233	1.833	1.333	0.000	0.000	6.230	1.425	1.491	9.147
310.317	1.917	1.417	0.000	0.000	6.457	1.479	4.219	12.154
310.400	2.000	1.500	0.000	0.000	6.676	1.531	7.750	15.956
310.483	2.083	1.583	0.000	0.000	6.888	1.581	11.932	20.400
310.567	2.167	1.667	0.000	0.000	7.093	1.630	16.675	25.398
310.650	2.250	1.750	0.000	0.000	7.293	1.677	21.920	30.890

Camino Largo
BMP 1

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	6	in
Bioretention Soil Layer	S	18	in
Gravel Layer	G	7	in
TOTAL		2.58	ft
		31	in
Orifice Coefficient	Cg	0.6	--
Low Flow Orifice Diameter	D	4.00	in
Drain exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.653	ft^3/s
Ponding Depth Surface Area	A_{PD}	6225	ft^2
	A_S, A_G	6147	ft^2
Bioretention Surface Area	A_S, A_G	0.141	ac
Porosity of Bioretention Soil	η	0.40	--
Flow Rate (per unit area)	q	11.477	in/hr
Effective Ponding Depth	PD_{eff}	6.04	in
Flow Coefficient	C	0.8596	--
Ponding Depth @ $V_{WQ, required}$	$PD_{orificeFL}$	6	in
Cutoff Flow	Q_{cutoff}	0.65321	cfs

Stage-Area for Basin 2

Elevation vs. Area Tables

Depth (ft)	Area (ft^2)	Volume (ft^3)
0.000	9279	0
0.083	9318	783
0.167	9358	1586
0.250	9397	2408
0.333	9436	3250
0.417	9475	4112
0.500	9515	4993
0.583	9554	5894
0.667	9593	6814
0.750	9632	7754
0.833	9672	8714
0.917	9711	9693
1.000	9750	10692
1.083	9789	11711
1.167	9829	12749
1.250	9868	13807
1.333	9907	14884
1.417	9946	15981
1.500	9986	17098
1.583	10025	18234
1.667	10064	19390
1.750	10103	20566
1.833	10143	21761
1.917	10182	22976
2.000	10221	24210

SUB SURFACE STORAGE BASIN 2

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.50	9279	2784	Amended Soil Base (0.2 voids)
-2.50	9279	3712	Gravel Base (0.4 voids)
Gravel & Amended Soil	TOTAL =	6495	(ft^3)
Surface Total	TOTAL =	6814	(ft^3)
BMP	**TOTAL =**	**13309**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (biofiltration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Effective Depth:	6.08 in

Outlet Structure for Discharge of Basin 2

Elevation vs. Discharge Table

Outlet Structure for Discharge of BMP 2
Discharge vs. Elevation Table

Lower orifice		Lower Slot		Emergency Weir	
No. of orif:	0	No. of slots:	1	Invert:	1.000 ft
Dia:	3 in	Invert:	0.000 ft	B:	11.830 ft
Invert:	0.000 ft	B (width):	2.670 ft	V-Notch Angle	0
Area:	0.049 sf	Area:	0.668 sf		
Cg-low:	0.62	h_{slot} (height):	0.250 ft		
		Cg-low:	0.62		
Middle orifice		Upper slot			
No. of orif:	0	No. of slots:	1		
Dia:	4 in	Invert:	0.583 ft		
Invert:	0.417 ft	B (width):	0.500 ft		
Area:	0.000 sf	Area:	0.083 sf		
Cg-low:	0.62	h_{slot} (height):	0.167 ft		
		Cg-low:	0.62		

***Note: h = head above the invert of the lowest surface discharge opening.**

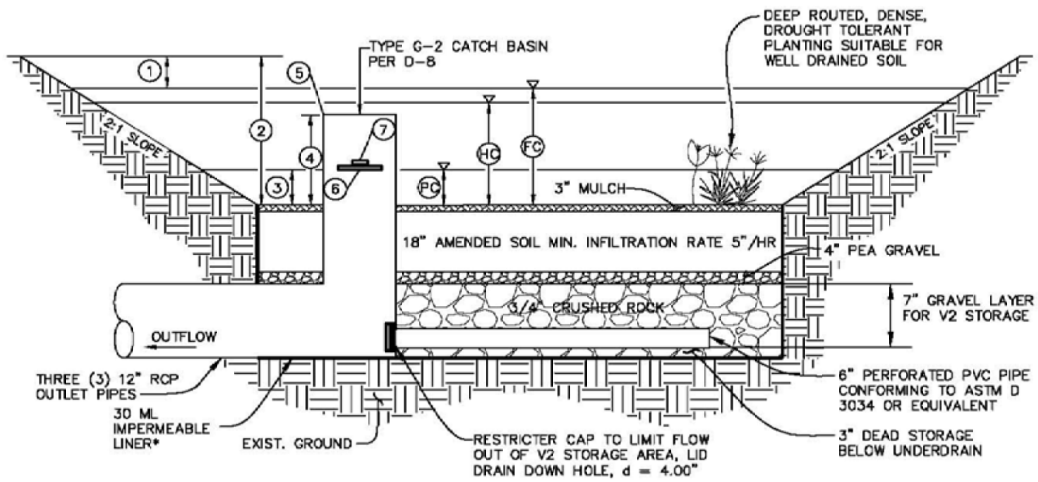
Basin Elev. (ft)	H (ft)	USE h* (ft)	$Q_{orifice-low}$ (cfs)	$Q_{orifice-upper}$ (cfs)	$Q_{slot-low}$ (cfs)	$Q_{slot-upper}$ (cfs)	Q_{emerg} (cfs)	Q_{tot} (cfs)
308.900	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000
308.983	0.583	0.083	0.000	0.000	0.674	0.000	0.000	0.674
309.067	0.667	0.167	0.000	0.000	0.954	0.084	0.000	1.038
309.150	0.750	0.250	0.000	0.000	1.168	0.119	0.000	1.287
309.233	0.833	0.333	0.000	0.000	1.516	0.204	0.000	1.720
309.317	0.917	0.417	0.000	0.000	1.794	0.207	0.000	2.001
309.400	1.000	0.500	0.000	0.000	2.034	0.239	0.000	2.273
309.483	1.083	0.583	0.000	0.000	2.248	0.268	0.000	2.516
309.567	1.167	0.667	0.000	0.000	2.444	0.293	0.000	2.737
309.650	1.250	0.750	0.000	0.000	2.626	0.317	0.000	2.942
309.733	1.333	0.833	0.000	0.000	2.795	0.339	0.000	3.134
309.817	1.417	0.917	0.000	0.000	2.955	0.359	0.000	3.314
309.900	1.500	1.000	0.000	0.000	3.107	0.378	0.000	3.485
309.983	1.583	1.083	0.000	0.000	3.251	0.397	0.882	4.530
310.067	1.667	1.167	0.000	0.000	3.390	0.415	2.495	6.300
310.150	1.750	1.250	0.000	0.000	3.523	0.432	4.584	8.538
310.233	1.833	1.333	0.000	0.000	3.651	0.448	7.058	11.156
310.317	1.917	1.417	0.000	0.000	3.775	0.464	9.863	14.102
310.400	2.000	1.500	0.000	0.000	3.894	0.479	12.966	17.339
310.483	2.083	1.583	0.000	0.000	4.011	0.494	16.339	20.843
310.567	2.167	1.667	0.000	0.000	4.124	0.508	19.962	24.594
310.650	2.250	1.750	0.000	0.000	4.234	0.522	23.820	28.575

Camino Largo
BMP 2

PARAMETER	ABBREV.	Bio-Retention Cell LID BMP	
Ponding Depth	PD	6	in
Bioretention Soil Layer	S	18	in
Gravel Layer	G	7	in
TOTAL		2.5833333	ft
		31	in
Orifice Coefficient	Cg	0.6	--
Low Flow Orifice Diameter	D	3.00	in
Drain exponent	n	0.5	--
Flow Rate (volumetric)	Q	0.371	ft^3/s
Ponding Depth Surface Area	A_{PD}	9515	ft^2
	A_S, A_G	9279	ft^2
Bioretention Surface Area	A_S, A_G	0.213	ac
Porosity of Bioretention Soil	η	0.40	--
Flow Rate (per unit area)	q	4.313	in/hr
Effective Ponding Depth	PD_{eff}	6.08	in
Flow Coefficient	C	0.3203	--
Ponding Depth @ $V_{WQ, required}$	$PD_{orificeFL}$	6	in
Cutoff Flow	Q_{cutoff}	0.37058	cfs

ATTACHMENT 5

Basin Outlet Details



BIOFILTRATION BASIN DETAIL, BMP 1

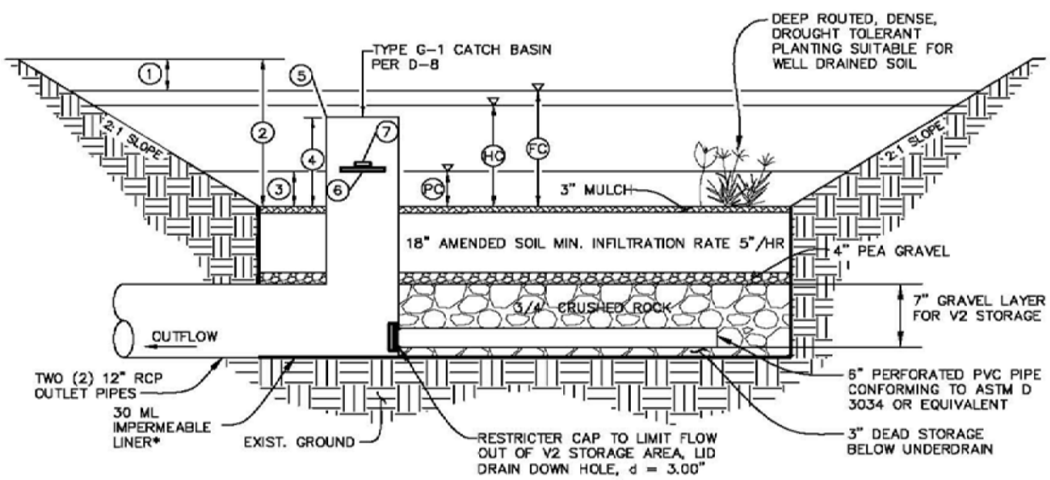
NOT TO SCALE

*30 MIL LINER NOTE: 30-MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN-WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN-WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.

LEGEND

- (1) FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
- (2) BASIN HEIGHT H_{MAX} = 30.00"
- (3) PONDING DEPTH = 6.00"
- (4) RISER INVERT H_{TOP} = 18.00"
- (5) *EMERGENCY WEIR INVERT = 18.00"
- (6) *LOWER SLOT INVERT = 6.00"
  1 - 5" HIGH X 34" LONG OPENING
- (7) *UPPER SLOT INVERT = 7.00"
  1 - 4" HIGH X 10" LONG OPENING
- (PC) POLLUTANT CONTROL WSEL = 6.00"
- (HC) HYDROMODIFICATION CONTROL WSEL = 13.92"
- (FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE



BIOFILTRATION BASIN DETAIL, BMP 2

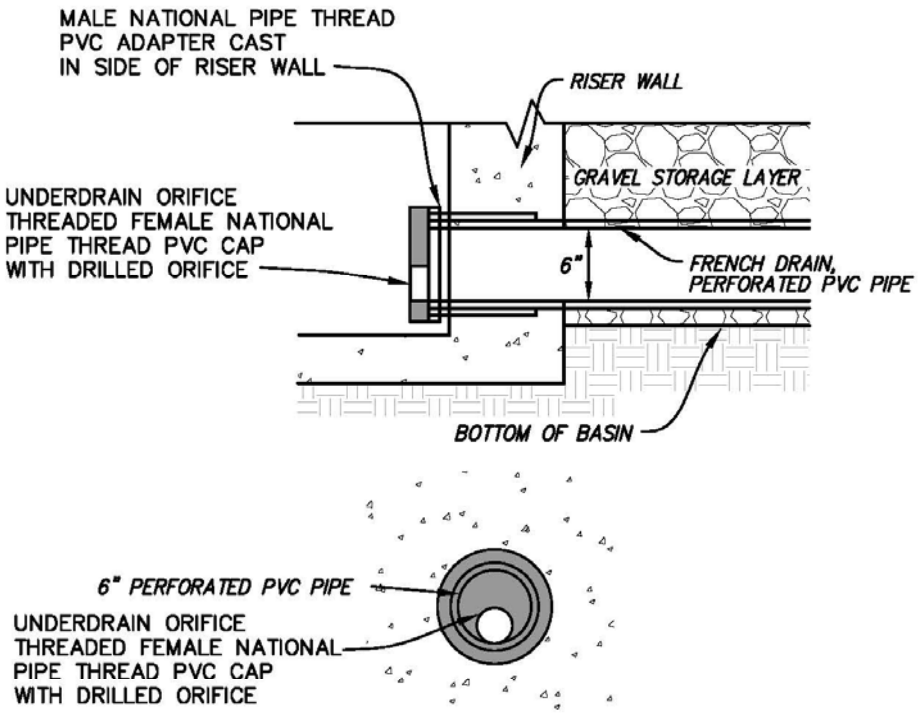
NOT TO SCALE

*30 MIL LINER NOTE: 30-MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN-WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN-WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP://WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.

LEGEND

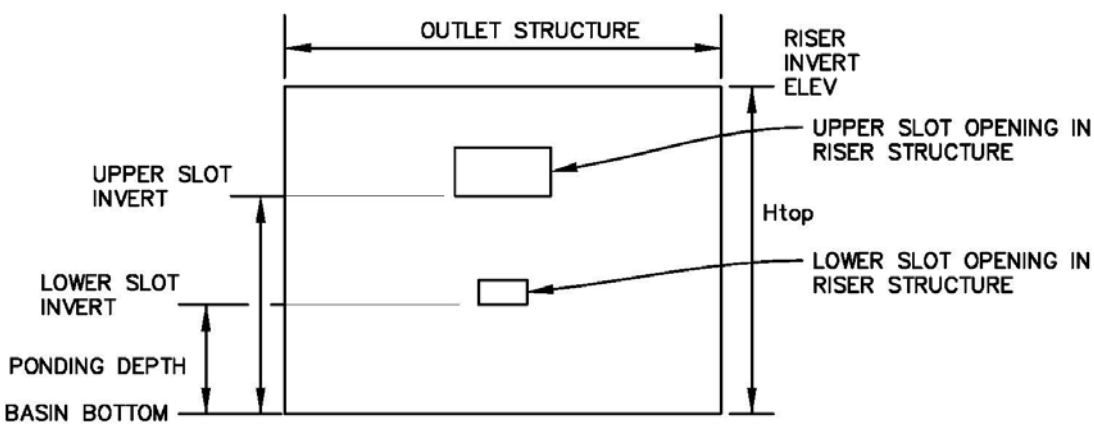
- (1) FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
- (2) BASIN HEIGHT H_{MAX} = 30.00"
- (3) PONDING DEPTH = 6.00"
- (4) RISER INVERT H_{TOP} = 18.00"
- (5) *EMERGENCY WEIR INVERT = 18.00"
- (6) *LOWER SLOT INVERT = 6.00"
  1 – 3" HIGH X 32" LONG OPENING
- (7) *UPPER SLOT INVERT = 7.00"
  1 – 2" HIGH X 6" LONG OPENING
- (PC) POLLUTANT CONTROL WSEL = 6.00"
- (HC) HYDROMODIFICATION CONTROL WSEL = 6"
- (FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE



RESTRICTOR CAP DETAIL BMP 1 & 2

NOT TO SCALE



OUTLET STRUCTURE DETAIL BMP 1 & 2

NOT TO SCALE

ATTACHMENT 6

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

POC-1

PRE-DEVELOPED RUNOFF CONDITION INPUT FILE

```
[TITLE]
;;Project Title/Notes
Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC-1

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

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
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

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

```
[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.03   0.05   0.08   0.11   0.13   0.15   0.15   0.13   0.11   0.08   0.04   0.02
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1            OCEANSIDE        POC-1            4.952    0        890      7.10     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1            0.012      0.10       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-1            9          0.025      0.30

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE        FILE "K:\Library\Stormwater\SWMM\RAIN GAGES\Oceanside Rain Data.dat"

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

```
[TAGS]

[MAP]
DIMENSIONS 191.920 4920.830 1021.827 5718.627
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            757.069            4959.747

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1            706.040            5124.523

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        757.548            5779.526
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POC-1

POST-DEVELOPED RUNOFF CONDITION INPUT FILE

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[TITLE]
;;Project Title/Notes
Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC-1

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

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
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

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

```
[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.03   0.05   0.08   0.11   0.13   0.15   0.15   0.13   0.11   0.08   0.04   0.02
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1            OCEANSIDE        BMP-1            4.706    58.42    993      8.30     0
BMP-1            OCEANSIDE        DIV-1            0.141    0        30       0        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1            0.012      0.10       0.05       0.10       25         OUTLET
BMP-1            0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-1            9          0.01875    0.3
BMP-1            9          0.025      0.3

[LID_CONTROLS]
;;Name           Type/Layer Parameters
;;-------------- ---------- ----------
BMP-1            BC
BMP-1            SURFACE    6.04       0.0        0          0          5
BMP-1            SOIL       18         0.4        0.2        0.1        5          5          1.5
BMP-1            STORAGE    7          0.67       0          0
BMP-1            DRAIN      0.8596     0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSat    FromImp    ToPerv     RptFile
DrainTo
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ----------------------
-- ----------------
BMP-1            BMP-1            1       6141.96    0          0          100        0
```

```
[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[DIVIDERS]
;;Name           Elevation  Diverted Link    Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
DIV-1            0          BYPASS-1         CUTOFF     0.65321    0          0          0          0

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat
IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------          ---
----- --------
STOR-1           0        1.50       0          TABULAR    STORAGE-1B                   0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
BYPASS-1         DIV-1            STOR-1           10         0.01       0          0          0          0
DUM_1            DIV-1            POC-1            10         0.01       0          0          0          0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- --------
STOR-1-ORIFICE   STOR-1           POC-1            0          TABULAR/DEPTH   STOR-1BORIFICE              NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
BYPASS-1         DUMMY        0                0          0          0          1
DUM_1            DUMMY        0                0          0          0          1

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
STOR-1BORIFICE   Rating     0.000      0.000
STOR-1BORIFICE              0.083      1.193
STOR-1BORIFICE              0.167      1.965
STOR-1BORIFICE              0.250      2.459
STOR-1BORIFICE              0.333      2.558
STOR-1BORIFICE              0.417      3.237
STOR-1BORIFICE              0.500      3.859
STOR-1BORIFICE              0.583      4.389
```

```
STOR-1BORIFICE             0.667      4.862
STOR-1BORIFICE             0.750      5.292
STOR-1BORIFICE             0.833      5.690
STOR-1BORIFICE             0.917      6.062
STOR-1BORIFICE             1.000      6.413
STOR-1BORIFICE             1.083      6.745
STOR-1BORIFICE             1.167      7.061
STOR-1BORIFICE             1.250      7.364
STOR-1BORIFICE             1.333      9.147
STOR-1BORIFICE             1.417      12.154
STOR-1BORIFICE             1.500      15.956
STOR-1BORIFICE             1.583      20.400
STOR-1BORIFICE             1.667      25.398
STOR-1BORIFICE             1.750      30.890
;
STORAGE-1B       Storage    0.00       6302
STORAGE-1B                  0.08       6328
STORAGE-1B                  0.17       6354
STORAGE-1B                  0.25       6380
STORAGE-1B                  0.33       6405
STORAGE-1B                  0.42       6431
STORAGE-1B                  0.50       6457
STORAGE-1B                  0.58       6483
STORAGE-1B                  0.67       6509
STORAGE-1B                  0.75       6535
STORAGE-1B                  0.83       6560
STORAGE-1B                  0.92       6586
STORAGE-1B                  1.00       6612
STORAGE-1B                  1.08       6638
STORAGE-1B                  1.17       6664
STORAGE-1B                  1.25       6690
STORAGE-1B                  1.33       6715
STORAGE-1B                  1.42       6741
STORAGE-1B                  1.50       6767

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE        FILE "K:\Library\Stormwater\SWMM\RAIN GAGES\Oceanside Rain Data.dat"

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
```

```
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 191.920 4920.830 1021.827 5718.627
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            717.654            5272.826
DIV-1            413.901            5274.612
STOR-1           416.581            5123.629

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1            159.285            5271.932
BMP-1            277.213            5270.145

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        546.123            5415.768
```

POC-2

PRE-DEVELOPED RUNOFF CONDITION INPUT FILE

```
[TITLE]
;;Project Title/Notes
Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC 2

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

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
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

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
```

```
MIN_SURFAREA         0
MAX_TRIALS           0
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.03   0.05   0.08   0.11   0.13   0.15   0.15   0.13   0.11   0.08   0.04   0.02
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1            OCEANSIDE        POC-1            3.121    0        507      10.10    0
BYPASS2          OCEANSIDE        POC-1            1.031    0        785      11.2     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1            0.012      0.10       0.05       0.1        25         OUTLET
BYPASS2          0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-1            9          0.025      0.30
BYPASS2          9          0.025      0.30

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
```

```
OCEANSIDE        FILE "K:\Library\Stormwater\SWMM\RAIN GAGES\Oceanside Rain Data.dat"

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

[TAGS]

[MAP]
DIMENSIONS 191.920 4920.830 1021.827 5718.627
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            757.069            4959.747

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1            706.040            5124.523
BYPASS2          804.759            5127.873

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        757.548            5779.526
```

POC-2

POST-DEVELOPED RUNOFF CONDITION INPUT FILE

```
[TITLE]
;;Project Title/Notes
Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC 2

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

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
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

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
```

```
MIN_SURFAREA         0
MAX_TRIALS           0
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.03   0.05   0.08   0.11   0.13   0.15   0.15   0.13   0.11   0.08   0.04   0.02
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-2            OCEANSIDE        BMP-2            3.146    57.73    818      4.50     0
BMP-2            OCEANSIDE        DIV-2            0.213    0        20       0        0
BYPASS2          OCEANSIDE        POC-1            1.699    0        785      11.20    0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-2            0.012      0.10       0.05       0.10       25         OUTLET
BMP-2            0.012      0.10       0.05       0.10       25         OUTLET
BYPASS2          0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-2            9          0.01875    0.3
BMP-2            9          0.025      0.3
BYPASS2          9          0.025      0.3

[LID_CONTROLS]
;;Name           Type/Layer Parameters
;;-------------- ---------- ----------
BMP-2            BC
BMP-2            SURFACE    6.08       0.0        0.1        0          5
```

```
BMP-2            SOIL       18         0.4        0.2        0.1        5          5          1.5
BMP-2            STORAGE    7          0.67       0          0
BMP-2            DRAIN      0.3203     0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSat    FromImp    ToPerv     RptFile
DrainTo
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ----------------------
-- ----------------
BMP-2            BMP-2            1       8319.96    0          0          100        0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[DIVIDERS]
;;Name           Elevation  Diverted Link    Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
DIV-2            0          BYPASS-2         CUTOFF     0.37058    0          0          0          0

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat
IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------          ---
----- --------
STOR-2           0        1.50       0          TABULAR    STORAGE-1B                   0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
BYPASS-2         DIV-2            STOR-2           10         0.01       0          0          0          0
DUM_2            DIV-2            POC-1            10         0.01       0          0          0          0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- --------
STOR-2-ORIFICE   STOR-2           POC-1            0          TABULAR/DEPTH   STOR-1BORIFICE              NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
BYPASS-2         DUMMY        0                0          0          0          1
DUM_2            DUMMY        0                0          0          0          1
```

```
[CURVES]
;;Name           Type       X-Value    Y-Value   
;;-------------- ---------- ---------- ----------
STOR-1BORIFICE   Rating     0.000      0.000     
STOR-1BORIFICE              0.083      0.674     
STOR-1BORIFICE              0.167      1.038     
STOR-1BORIFICE              0.250      1.287     
STOR-1BORIFICE              0.333      1.720     
STOR-1BORIFICE              0.417      2.001     
STOR-1BORIFICE              0.500      2.273     
STOR-1BORIFICE              0.583      2.516     
STOR-1BORIFICE              0.667      2.737     
STOR-1BORIFICE              0.750      2.942     
STOR-1BORIFICE              0.833      3.134     
STOR-1BORIFICE              0.917      3.314     
STOR-1BORIFICE              1.000      3.485     
STOR-1BORIFICE              1.083      4.530     
STOR-1BORIFICE              1.167      6.300     
STOR-1BORIFICE              1.250      8.538     
STOR-1BORIFICE              1.333      11.156    
STOR-1BORIFICE              1.417      14.102    
STOR-1BORIFICE              1.500      17.339    
STOR-1BORIFICE              1.583      20.843    
STOR-1BORIFICE              1.667      24.594    
STOR-1BORIFICE              1.750      28.575    
;
STORAGE-1B       Storage    0.00       9515      
STORAGE-1B                  0.08       9554      
STORAGE-1B                  0.17       9593      
STORAGE-1B                  0.25       9632      
STORAGE-1B                  0.33       9672      
STORAGE-1B                  0.42       9711      
STORAGE-1B                  0.50       9750      
STORAGE-1B                  0.58       9789      
STORAGE-1B                  0.67       9829      
STORAGE-1B                  0.75       9868      
STORAGE-1B                  0.83       9907      
STORAGE-1B                  0.92       9946      
STORAGE-1B                  1.00       9986      
STORAGE-1B                  1.08       10025     
STORAGE-1B                  1.17       10064     
STORAGE-1B                  1.25       10103     
STORAGE-1B                  1.33       10143     
STORAGE-1B                  1.42       10182     
STORAGE-1B                  1.50       10221     
```

```
[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE        FILE "K:\Library\Stormwater\SWMM\RAIN GAGES\Oceanside Rain Data.dat"

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

[TAGS]

[MAP]
DIMENSIONS 191.920 4920.830 1021.827 5718.627
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            717.654            5272.826
DIV-2            413.901            5272.826
STOR-2           419.262            5124.523

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-2            159.285            5271.932
BMP-2            278.999            5270.145
BYPASS2          722.121            5432.742

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        546.123            5415.768
```

ATTACHMENT 7

SWMM Screens and Explanation of Significant Variables

EPA SWMM Figures and Explanations

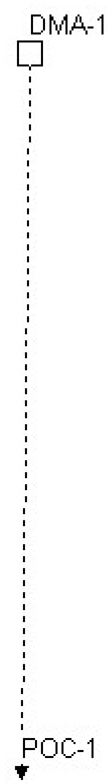
Per the attached, the reader can see the screens associated with the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, storage units, weirs and orifices as a discharge, and outfalls (point of compliance), are also shown.

Variables for modeling are associated with typical recommended values by the EPA-SWMM model and the Model BMP Design Manual San Diego Region.

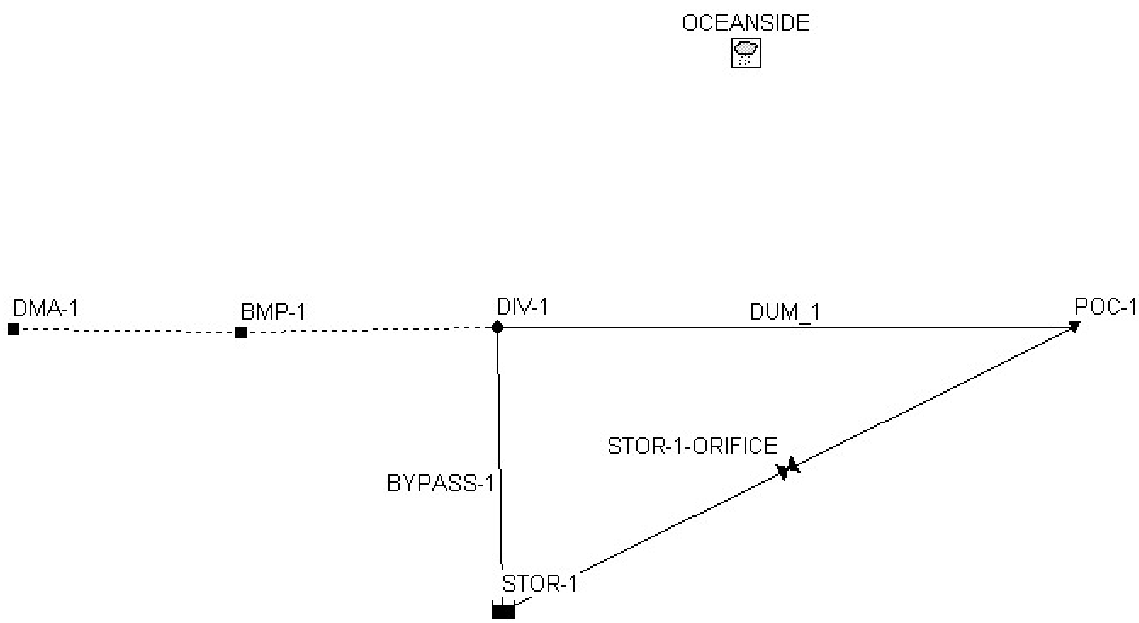
Soil characteristics of the existing soils were determined from the site specific NRCS Web Soil Survey.

Some values incorporated within the SWMM model have been determined from the professional experience of BHA 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.

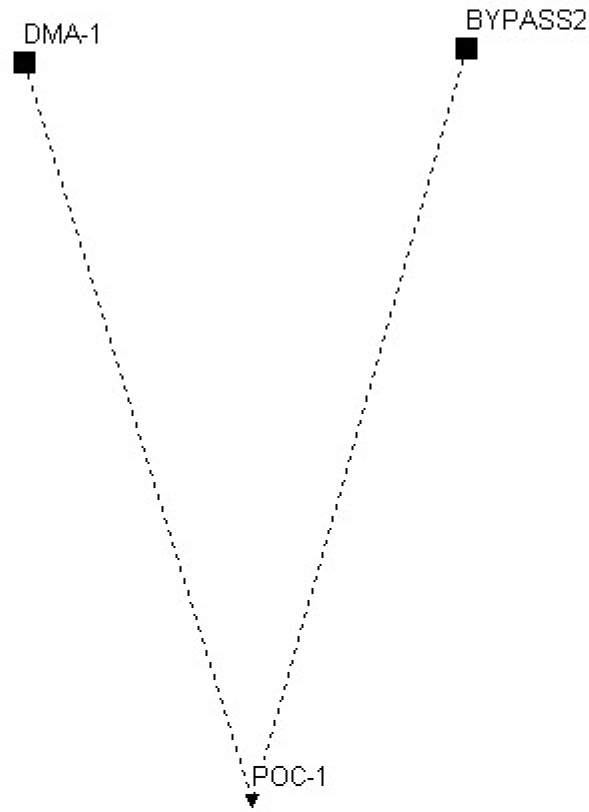
PRE-DEVELOPED CONDITION (POC-1)



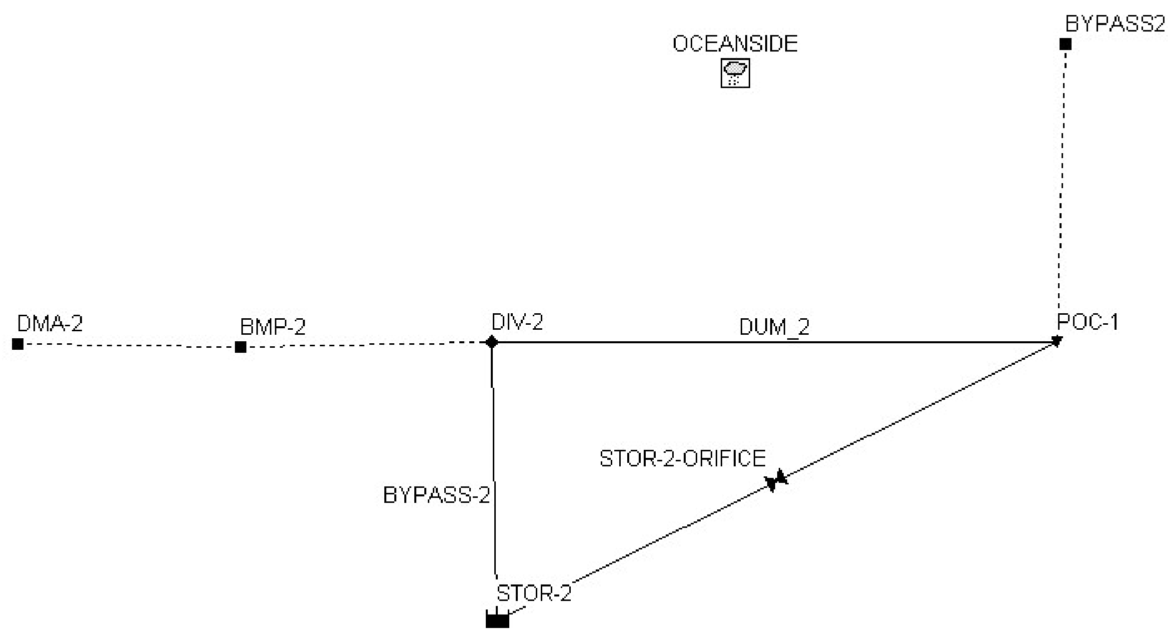
POST-DEVELOPED CONDITION (POC-1)



<u>PRE-DEVELOPED CONDITION (POC-2)</u>



POST-DEVELOPED CONDITION (POC-2)



Explanation of Selected Variables

- Sub Catchment Areas: Please refer to the attached diagram that indicates the DMA and biofiltration BMP sub-areas modeled within the project site at both the pre and post-developed conditions draining to the project's POCs.

  Parameters for the pre-developed model include soils Type C and D as determined from the NRCS Web Soils Survey and ArcGIS BMP Sizing Calculator (see Attachment 8). For the purpose of this report, the entire project site will be modeled with Type D soils. Suction head, conductivity and initial deficit correspond to average values expected for this soil type, according to the BMP Design Manual (BMPDM).

- 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 that the precious routing in a system where the time of concentration is much smaller than 1 hour.

- Sub Catchment BMP: The subcatchment BMP is assigned the area of biofiltration, which is equal to the area of amended soil. At least five (5) decimal places were given regarding the area of the biofiltration to insure that the area used by the program for the LID subroutine corresponds exactly with the actual biofiltration area.

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 lowest surface outlet within the biofiltration basin. This is the volume that can only discharge from the facility via the LID portion of the basin.

  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:

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

Equation (1) allows the determination of SD 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.

  BHA considers such a value to be slightly high; however, in order to comply with the BMPDM, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix G of the BMPDM. Such porosity is equal to the porosity of the gravel per the same manual.

- Porosity: The ratio of the void volume divided by the soil volume is directly related to porosity. Note, by definition, Porosity = Void Ratio ÷ (1 + Void Ratio). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected (also per Appendix G of the BMPDM), which results in a void ratio of 0.4/(1+0.4) = 0.67 for the gravel detention layer.

- Conductivity: Due to the preliminary nature of this study, infiltration may not be a viable addition to the LID design. Even when soil types C and D are present, which generally have low infiltration rates, the possibility that a very low infiltration rate could be determined at design level must be considered. The range of potential infiltration rates to be studied when a site-specific geotechnical investigation has not been completed is shown in Table G.1-5 of the BMP Design Manual. Based on the infiltration rates shown, a conservative low infiltration rate of 0 inches per hour was selected for soil Type D. Therefore, as the BMPs are designed without infiltration, the conductivity value was set to 0 to represent zero infiltration.

- Clogging factor: A clogging factor was not used (0 indicates that there is not 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.

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

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

where,

q is the peak flow in in/hr;

n is 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:

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

where,

Q is the peak flow in cfs;

D is the underdrain orifice diameter in inches;

c_g is the typical discharge coefficient for orifices (0.60-0.65 for thin walls and 0.75-0.80 for thick walls);

g is the gravitational constant (32.2 ft/s^2); and

H and H_D are defined above are also used in inches in Equation (3).

It is clear that:

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

The flow coefficient used in the SWMM Model characterizes the rate of discharge to the outlet as a function of the height of water stored in the biofiltration cell. The flow coefficient, as presented in the BMPDM, can be determined by the following equation:

$$C = c_g \left(\frac{605}{A_{lid}}\right) \left(\frac{\pi D^2}{8}\right) \sqrt{\frac{g}{6}} \quad (5)$$

where,

c_g is the orifice discharge coefficient (0.60-0.65 for thin walls and 0.75-0.80 for thick walls);

A_{lid} is the cumulative footprint area (ft2) of all LID controls;

D is the underdrain orifice diameter in inches; and

g is the gravitational constant (32.2 ft/s^2);

- Cut-Off Flow: The cut-off flow represents the maximum flow rate leaving the “low flow” outlet. The low-flow restrictor is typically more restrictive (i.e. smaller flow rate) than the percolation rate through the engineered soil; therefore, the orifice equation is used to calculate the cutoff flow when H is maximum.

ATTACHMENT 8

Geotechnical Documentation

(See Attachment 5 in SWQMP)

ATTACHMENT 9

Summary Files from the SWMM Model

PRE-DEVELOPED RUNOFF CONDITION (POC-1) OUTPUT FILE

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC-1


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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 08/28/1951 05:00:00
Ending Date .............. 05/23/2008 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 ......       278.595       675.110
Evaporation Loss .........         6.647        16.107
Infiltration Loss ........       213.620       517.658
Surface Runoff ...........        62.281       150.923
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -1.419
```

```
*************************         Volume       Volume
Flow Routing Continuity        acre-feet     10^6 gal
*************************      ---------    ---------
Dry Weather Inflow .......         0.000        0.000
Wet Weather Inflow .......        62.281       20.295
Groundwater Inflow .......         0.000        0.000
RDII Inflow ..............         0.000        0.000
External Inflow ..........         0.000        0.000
External Outflow .........        62.281       20.295
Flooding Loss ............         0.000        0.000
Evaporation Loss .........         0.000        0.000
Exfiltration Loss ........         0.000        0.000
Initial Stored Volume ....         0.000        0.000
Final Stored Volume ......         0.000        0.000
Continuity Error (%) .....         0.000
```

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

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1	675.11	0.00	16.11	517.66	150.92	20.29	5.56	0.224

```
Analysis begun on:  Sat Aug 14 14:13:46 2021
Analysis ended on:  Sat Aug 14 14:14:22 2021
Total elapsed time: 00:00:36
```

POST-DEVELOPED RUNOFF CONDITION (POC-1) OUTPUT FILE

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC-1

WARNING 04: minimum elevation drop used for Conduit BYPASS-1
WARNING 04: minimum elevation drop used for Conduit DUM_1

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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 08/28/1951 05:00:00
Ending Date .............. 05/23/2008 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


**************************        Volume         Depth
```

```
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Initial LID Storage ......         0.021         0.052
Total Precipitation ......       272.688       675.110
Evaporation Loss .........        30.080        74.470
Infiltration Loss ........        77.561       192.022
Surface Runoff ...........        13.864        34.325
LID Drainage .............       154.588       382.722
Final Storage ............         0.040         0.100
Continuity Error (%) .....        -1.255


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       168.453        54.893
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       168.461        54.895
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.005


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


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

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1	675.11	0.00	53.04	197.78	433.01	55.33	5.55	0.641
BMP-1	675.11	14452.06	789.58	0.00	14336.36	54.89	5.72	0.948

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
BMP-1	BMP-1	15127.17	789.61	0.00	1179.99	13156.89	1.80	2.61	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
POC-1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
DIV-1	DIVIDER	0.00	0.00	0.00	0 00:00	0.00
STOR-1	STORAGE	0.00	0.66	0.66	18857 12:17	0.61

****
Node Inflow Summary
****

Maximum Maximum   Lateral   Total   Flow

Node	Type	Lateral Inflow CFS	Total Inflow CFS	Time of Max Occurrence days hr:min	Inflow Volume 10^6 gal	Inflow Volume 10^6 gal	Balance Error Percent
POC-1	OUTFALL	0.00	5.47	18857 12:17	0	54.9	0.000
DIV-1	DIVIDER	5.72	5.72	18857 12:01	54.9	54.9	0.000
STOR-1	STORAGE	0.00	5.07	18857 12:01	0	4.17	-0.060

****

Node Flooding Summary

****

No nodes were flooded.

****

Storage Volume Summary

****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
STOR-1	0.001	0	0	0	4.226	43	18857 12:16	4.82

****

Outfall Loading Summary

****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC-1	2.11	0.19	5.47	54.891
System	2.11	0.19	5.47	54.891

****

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-1	DUMMY	5.07	18857 12:01			
DUM_1	DUMMY	0.65	141 06:38			
STOR-1-ORIFICE	DUMMY	4.82	18857 12:17			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Dec 03 13:51:33 2021
Analysis ended on: Fri Dec 03 13:52:29 2021
Total elapsed time: 00:00:56

PRE-DEVELOPED RUNOFF CONDITION (POC-2) OUTPUT FILE

```
  [TITLE]
;;Project Title/Notes
Camino Largo, Vista, CA, Pre-Developed Runoff Condition, POC 2

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

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
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

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

[EVAPORATION]
;;Data Source    Parameters
```

```
;;-------------- ----------------
MONTHLY          0.03   0.05   0.08   0.11   0.13   0.15   0.15   0.13   0.11   0.08   0.04   0.02
DRY_ONLY         NO

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

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1            OCEANSIDE        POC-1            3.121    0        507      10.10    0
BYPASS2          OCEANSIDE        POC-1            1.031    0        785      11.2     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1            0.012      0.10       0.05       0.1        25         OUTLET
BYPASS2          0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
DMA-1            9          0.025      0.30
BYPASS2          9          0.025      0.30

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
OCEANSIDE        FILE "K:\Library\Stormwater\SWMM\RAIN GAGES\Oceanside Rain Data.dat"

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

```
[TAGS]

[MAP]
DIMENSIONS 191.920 4920.830 1021.827 5718.627
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            757.069            4959.747

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1            706.040            5124.523
BYPASS2          804.759            5127.873

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OCEANSIDE        757.548            5779.526
```

POST-DEVELOPED RUNOFF CONDITION (POC-2) OUTPUT FILE

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Camino Largo, Vista, CA Post-Developed Mitigated Runoff Condition - POC 2

WARNING 04: minimum elevation drop used for Conduit BYPASS-2
WARNING 04: minimum elevation drop used for Conduit DUM_2

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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 08/28/1951 05:00:00
Ending Date .............. 05/23/2008 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
```

```
**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Initial LID Storage ......         0.029         0.068
Total Precipitation ......       284.559       675.110
Evaporation Loss .........        26.243        62.262
Infiltration Loss ........       160.973       381.906
Surface Runoff ...........        22.730        53.926
LID Drainage .............         3.397         8.058
Final Storage ............        74.291       176.254
Continuity Error (%) .....        -1.070


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        26.126         8.514
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        26.126         8.514
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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


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

Percent Not Converging   :   0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-2	675.11	0.00	52.68	201.79	429.22	36.67	3.71	0.636
BMP-2	675.11	6339.49	606.44	2033.37	191.36	1.11	0.10	0.027
BYPASS2	675.11	0.00	11.78	508.39	160.54	7.41	1.91	0.238

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
BMP-2	BMP-2	675.11	461.60	0.00	0.00	213.41	1.80	1.89	0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
POC-1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
DIV-2	DIVIDER	0.00	0.00	0.00	0 00:00	0.00
STOR-2	STORAGE	0.00	0.00	0.00	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
POC-1	OUTFALL	1.91	1.91	18857 12:01	7.41	8.51	0.000
DIV-2	DIVIDER	0.10	0.10	10002 09:31	1.11	1.11	0.000
STOR-2	STORAGE	0.00	0.00	0 00:00	0	0	0.000 gal

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
STOR-2	0.000	0	0	0	0.000	0	0 00:00	0.00

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC-1	0.66	0.10	1.91	8.513
System	0.66	0.10	1.91	8.513

****
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	0.00	0 00:00			
DUM_2	DUMMY	0.10	10002 09:31			
STOR-2-ORIFICE	DUMMY	0.00	0 00:00			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Dec 03 17:24:45 2021
Analysis ended on: Fri Dec 03 17:25:39 2021
Total elapsed time: 00:00:54

ATTACHMENT 10

Drawdown Calculations

Drawdown Calculations

Note: Drawdown calculations are from invert of lowest surface discharge opening in riser structure to the surface bottom of the basin. Therefore, discharge occurs only through the underdrain orifice.

Drawdown Calculations for BMP 1

ORIFICE FLOW

Surface Ponding Depth:	PD	6	in
Ponding Depth Surface Area:	A_{PD}	6147	ft^2
Surface Ponding Volume:	V_{PD}	2408	ft^3
Low Flow Orifice Diameter:	D	4.00	in
Flow Rate (volumetric):	Q	0.371	ft^3/s
Drawdown Time:		1.81	hrs

INFILTRATION CONTROLS✓

Surface Ponding Depth:	PD	6	in
Ponding Depth Surface Area:	A_{PD}	6147	ft^2
Surface Ponding Volume:	V_{PD}	2408	ft^3
INFILTRATION RATE	I	5.00	in/hr
Flow Rate (volumetric):	Q	0.711	ft^3/s
Drawdown Time:		**0.94**	**hrs**

Drawdown Calculations for BMP 2

ORIFICE FLOW

Surface Ponding Depth:	PD	6	in
Ponding Depth Surface Area:	A_{PD}	9279	ft^2
Surface Ponding Volume:	V_{PD}	2408	ft^3
Low Flow Orifice Diameter:	D	3.00	in
Flow Rate (volumetric):	Q	0.371	ft^3/s
Drawdown Time:		1.81	hrs

INFILTRATION CONTROLS✓

Surface Ponding Depth:	PD	6	in
Ponding Depth Surface Area:	A_{PD}	9279	ft^2
Surface Ponding Volume:	V_{PD}	2408	ft^3
INFILTRATION RATE	I	5.00	in/hr
Flow Rate (volumetric):	Q	1.074	ft^3/s
Drawdown Time:		**0.62**	**hrs**

ATTACHMENT 3 - BMP MAINTENANCE INFORMATION

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 3A	Structural BMP Operations and Maintenance Plan	☒ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3B	Draft Maintenance Agreement	☒ Included ☐ Not Applicable

ATTACHMENT 3A – MAINTENANCE PLAN REQUIREMENTS

For Attachment 3A, provide a BMP operation and maintenance plan (O&M Plan). The checklist below identifies minimum elements to be included with the O&M Plan. An O&M Plan template is available at:

http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms

☒ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the *BMP Design Manual* and enhanced to reflect actual proposed components of the structural BMP(s)

☒ Use of O&M Plan template, or plan of equivalent content

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

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

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

Normal Expected Maintenance

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

Non-Standard Maintenance or BMP Failure

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

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

Other Special Considerations

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

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

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

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/

California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook

County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html

San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet BF-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

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

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

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

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

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

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

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

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

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

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

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5			
Threshold/Indicator	Maintenance Recommendation	Date	Description of Maintenance Conducted
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

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

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

ATTACHMENT 3B – MAINTENANCE AGREEMENT

All projects are required to maintain designed functionality of structural BMPs in perpetuity. Privately-owned projects must record a *Storm Drain Maintenance Agreement* with the County of San Diego Assessor's Office. A template *Storm Drain Maintenance Agreement* is available at:

I. Purpose and Scope

This section was prepared based on the Chapter 7 of the City of Vista BMP Design Manual. The goal is to insure that the Project proponent accepts responsibility for all facilities maintenance, repair, and replacement from the time they are constructed until the ownership and maintenance responsibilities is formally transferred to the new owner. Facilities shall be maintained in perpetuity and comply with the City's self-inspection, reporting, and verification requirements.

II. Inspection, Maintenance Log and Self-Verification Forms

Fill the forms in the Structural BMP Maintenance Plan (Attachment 3a) for each BMP using the maintenance schedule and the inspection-maintenance checklists. These forms shall be signed by the responsible party and retained for at least (5) years. Use the DMA Exhibit for the location of BMPs. (Make duplicate copies of these forms and fill out those, not the original ones.)

III. Updates, Revisions and Errata

This maintenance plan is a living document and based on the changes made by maintenance personnel, such as replacement of mechanical equipment, addition maintenance procedure shall be added and maintenance plan shall be kept up to date.

Please add the revisions and updates to the maintenance plan to this section if any, these revisions maybe transmitted to the City at any time. However, at a minimum, updates to the maintenance plan must accompany the annual inspection report.

IV. Introduction

The Camino Largo Project proposes the development of a forty six (46) lot residential subdivision, with individual level building pads on 8.86 gross acres. The project also proposes the minor widening and improvement of the Camino Largo private drive, which will include paving, sidewalks with curb and gutter.

The graded site will include forty six (46) new residential lots with driveways and landscaping areas along five (5) streets north of Camino Largo. Approximately 53% of the property will be impervious. Biofiltration basins are proposed for the two main drainage basins for POC-1 and POC-2. Proposed grading has been minimized as much as possible to maintain existing slope and drainage patterns.

V. Responsibility for Maintenance

A. General

Kyun Tae Kim and Frank Sohaei, Trustee of the Falor Family Trust will enter into a Stormwater Facilities Maintenance Agreement (SWFMA) with the City of Vista to maintain designated facilities herein this section for the Camino Largo Project.

The SWFMA will serve as the mechanism to ensure that proper inspection and maintenance is done in an efficient and timely manner.

<u>Responsible Party</u>

Kyun Tae Kim
Frank Sohaei, Trustee of the Falor Family Trust
2359 Pio Pico Drive
Carlsbad, CA 92008

POC-1
There is one (1) biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1.

POC-2
(760) 420-1267

Kyun Tae Kim and Frank Sohaei, Trustee of the Falor Family will have the direct responsibility for maintenance of Stormwater controls. Funding for the maintenance activities shall be provided by Camino Largo Project or other mechanism to the satisfaction of the City.
Whenever the property is sold and whenever designated individual change, immediately the updated contact information must be provided to the City of Vista.

The Camino Largo Project falls within the "Second Category" of the City of Vista (City) Maintenance Mechanism because the use of biofiltration basins are Best Management Practices (BMPs). The developer would provide the City with security to substantiate the maintenance agreement, which would remain in place for 5 years. The amount of the security would equal the estimated cost of 2 years of maintenance activities. The security can be a cash deposit, letter of credit, or other form acceptable to the City. If a stormwater utility or other permanent mechanism is put into place, it could assume either a primary or backup maintenance role.

B. Staff Training Program

Staff training and education program shall be carried out twice a year, once prior to the rainy season (October 1st) and once during the early dry season (April 30th).
The inspection and maintenance training program consists of the operation and function of the biofiltration basins. Please refer to the Structural BMP Maintenance Plan (Attachment 3a) for fact sheets and checklists. It is the responsibility of 1017 Sycamore Avenue to convey the maintenance and inspection information to the employees. Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

C. Records

Kyun Tae Kim and Frank Sohaei, Trustee of the Falor Family Trust shall retain education, inspection, and maintenance forms and documents for at least five (5) years.

D. Safety

Keep safety considerations at the forefront of inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc.) without proper training or equipment. A confined space should never be entered without at least one additional person present.
If a toxic or flammable substance is discovered, leave the immediate area and contact the local Sheriff at 911. Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to the local Sheriff's Office immediately for response by the Hazardous Materials Unit. The emergency contact number is 911.

VI. Summary of Drainage Areas and Stormwater Facilities

A. Drainage Areas

POC-1
DMA 1 will drain into a biofiltration basin which will outlet into an existing storm drain along-side North Santa Fe Avenue south of Camino Largo and discharge from the site at POC-1.

POC-2

DMA 2 will drain into a biofiltration basin, which outlets via a storm drain into a natural swale at POC-2. Additional offsite areas along the easterly boundary and towards the northeast is diverted around the development via drainage channels and rip rap, to discharge as historically over Camino Largo and sheet flow into a natural swale.

B. Treatment and Flow-Control Facilities

The BMP biofiltration basins in DMA 1 and DMA 2 are responsible for handling hydromodification requirements for POC-1 and POC-2. Basins 1 and Basin 2 will have a ponding depth of 6 inches. BMPs are comprised of an 18-inch layer of amended soil (a highly sandy, organic rich compost with an infiltration capacity of at least 5 in/hr), and a 7-inch reservoir layer of gravel for additional detention, and to accommodate the French drain system. Below the reservoir layer, the basins will include 3 inches of saturated storage. Flows will discharge from the basin via a low-flow orifice outlet within the gravel layer to the receiving storm drain system. A riser structure will be constructed within the BMP with multiple low-flow orifices and an emergency overflow, such that peak flows can be safely discharged to the storm drain system.

VII. Facility Documentation

Please see Structural BMP Maintenance Plan (Attachment 3a) regarding BMPs details and maintenance fact sheets.

VIII. Maintenance Schedule and Checklist

Fill out the Checklists in the Structural BMP Maintenance Plan (Attachment 3a) for each BMP. The required maintenance activities are at the end of the section. At the discretion of the project proponent, a qualified stormwater company may be hired to perform the required inspection and maintenance and provide necessary reports.

EXHIBIT: STORM WATER BMP SHEET

PROJECT CHARACTERISTICS	
SOIL TYPE	D
PARCEL AREA	9.301 ACRES
DISTURBED AREA	8.864 ACRES
PROPOSED IMPERVIOUS AREA	4.597 ACRES
PROPOSED PERVIOUS AREA	4.267 ACRES
DEPTH TO GROUNDWATER	> 20 FEET

BASIN	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	PROPOSED STRUCTURAL	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
BASIN 1	DMA 1	ROOF, DRWY, LANDSCAPE	205,008	119,767	85,241	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	6,147
BASIN 2	DMA 2	ROOF, DRWY, LANDSCAPE	137,024	79,102	57,922	DRAINS TO BMP	DRAINS TO BMP 1	BMP 1	9,279
	BYPASS 2	NATURAL	73,893	0	73,893	BYPASS	BYPASS	--	--
SM	SM 1	LANDSCAPE	8,747	0	8,747	SM	--	--	--
SM	SM 2	LANDSCAPE	404	0	404	SM	e	--	--
SM	SM 3	LANDSCAPE	865	0	865	SM	--	--	--
SM	SM 4	LANDSCAPE	6,734	0	6,734	SM	--	--	--

IMPERVIOUS DSIPERSION	DMA ID	DMA SURFACE TYPE	DMA AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	DMA TYPE	DISPERSION AREA (SF)	STRUCTURAL BMP ID	BIOFILTRATION BASIN FOOTPRINT
DISP-1	DISP-1	LANDSCAPE	6,532	1,353	3,842	DISP	1,337	--	--

LEGEND	SYMBOL
DMA NAME / DMA AREA (SF)	DMA 1 / 205,008 SF
POINT OF CONCENTRATION	POC 1
DMA BOUNDARY	
PROJECT BOUDNARY	
FLOW PATH	
PROPOSED BROW DITCH	
ON-SITE STORM DRAIN INLET	
RIP RAP ENERGY DISSIPATER PER D40	
BIOFILTRATION/INFILTRATION BMP	
IMPERVIOUS AREA	

DETAIL: OFFSITE DRAINAGE

SOURCE CONTROL BMPS:

- SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
- SC-2 STORM DRAIN STENCILING AND SIGNAGE
- SC-6 ADDITIONAL BMPS BASED ON POTENTIAL RUNOFF POLLUTANTS:
  - A ON-SITE STORM DRAIN INLETS
  - B NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL
  - C LANDSCAPE/OUTDOOR PESTICIDE USE
  - D SIDEWALKS

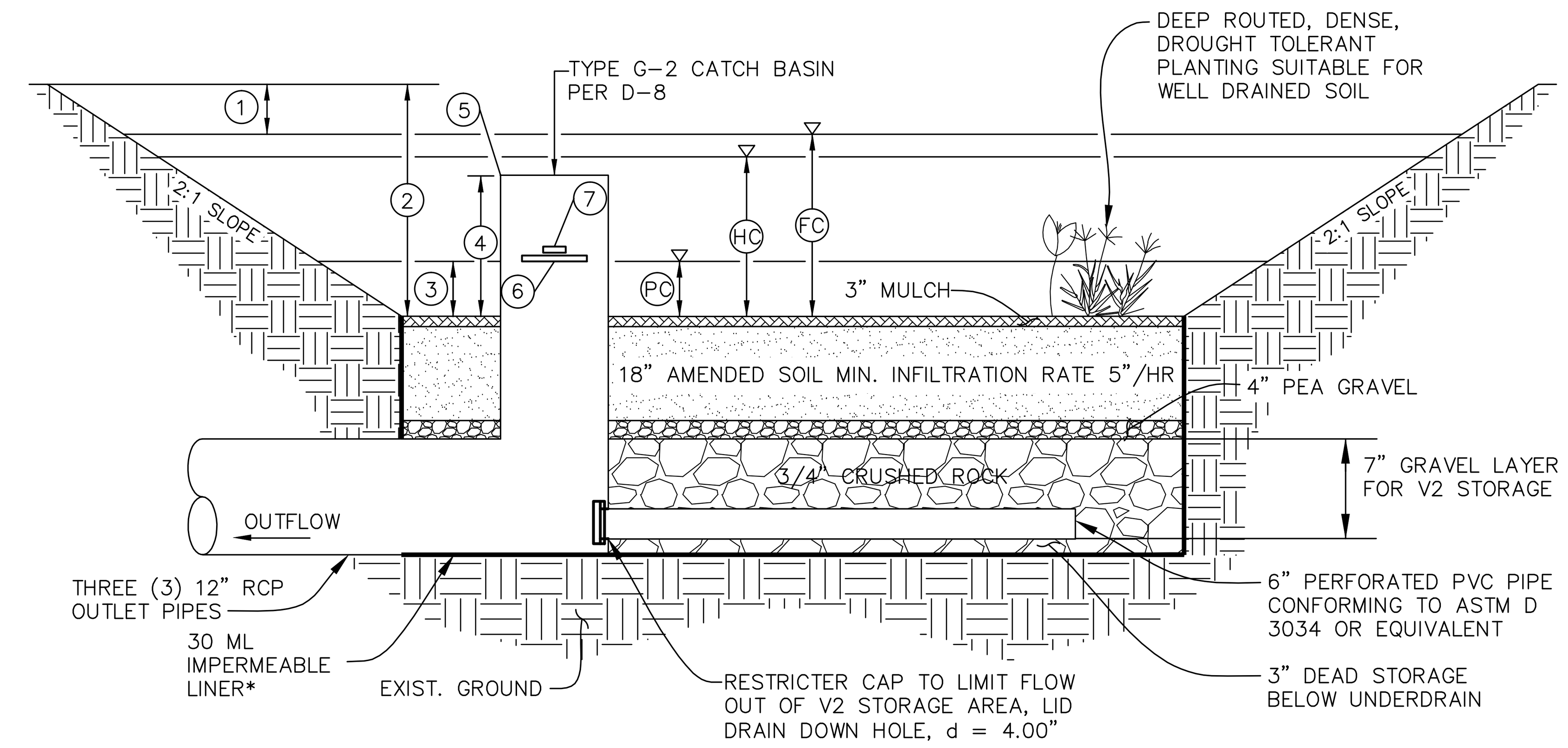
LID AND SITE DESIGN:

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

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008-4387
(760) 931-8700

BMP EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

MAINTENANCE INDICATORS AND ACTIONS FOR BIOFILTRATION BMPS	
TYPICAL MAINTENANCE INDICATORS	TYPICAL MAINTENANCE ACTIONS
ACCUMULATION OF SEDIMENT (OVER 2 INCHES DEEP OR COVERS VEGETATION), LITTER, OR DEBRIS	REMOVE AND PROPERLY DISPOSE OF ACCUMULATED MATERIALS WITHOUT DAMAGE TO THE VEGETATION. CONFIRM THAT SOIL IS NOT CLOGGING AND THAT THE AREA DRAINS AFTER STORM EVENT. TILL OR REPLACE SOIL AS NECESSARY.
POOR VEGETATION ESTABLISHMENT	ENSURE VEGETATION IS HEALTHY AND DENSE ENOUGH TO PROVIDE FILTERING AND TO PROTECT SOILS FROM EROSION. REPLENISH MULCH AS NECESSARY (IF LESS THAN 3 INCHES DEEP), REMOVE FALLEN LEAVES AND DEBRIS, PRUNE LARGE SHRUBS OR TREES, AND MOW TURF AREAS.
OVERGROWN VEGETATION-WOODY VEGETATION NOT PART OF DESIGN IS PRESENT AND GRASS EXCESSIVELY TALL (GREATER THAN 10 INCHES)	MOW OR TRIM AS APPROPRIATE, BUT NOT LESS THAN THE DESIGN HEIGHT OF THE VEGETATION (TYPICALLY 4-6 INCHES FOR GRASS). CONFIRM THAT IRRIGATION IS ADEQUATE AND NOT EXCESSIVE AND THAT SPRAYS DO NOT DIRECTLY ENTER OVERFLOW GRATES. REPLACE DEAD PLANTS AND REMOVE NOXIOUS AND INVASIVE WEEDS.
EROSION DUE TO CONCENTRATED IRRIGATION FLOW	REPAIR/RE-SEED ERODED AREAS AND ADJUST THE IRRIGATION.
EROSION DUE TO CONCENTRATED STORMWATER RUNOFF FLOW	REPAIR/RE-SEED ERODED AREAS AND MAKE APPROPRIATE CORRECTIVE MEASURES SUCH AS ADDING EROSION CONTROL BLANKETS, ADDING STONE AT ENTRY POINTS, OR RE-GRADING WHERE NECESSARY. REMOVE OBSTRUCTIONS AND SEDIMENT ACCUMULATIONS SO WATER DISPERSES.
STANDING WATER (BMP NOT DRAINING). IF MOSQUITO LARVAE ARE PRESENT AND PERSISTENT, CONTACT THE SAN DIEGO VECTOR CONTROL PROGRAM AT (858) 694-2888. MOSQUITO LARVICIDES SHOULD BE APPLIED ONLY WHEN ABSOLUTELY NECESSARY AND THEN ONLY BY A LICENSED INDIVIDUAL CONTRACTOR.	WHERE THERE IS AN UNDERDRAIN, SUCH AS IN PLANTER BOXES AND MANUFACTURED BIOFILTERS, CHECK THE UNDERDRAIN PIPING TO MAKE SURE IT IS INTACT AND UNOBSTRUCTED. ABATE ANY POTENTIAL VECTORS BY FILLING HOLES IN THE GROUND IN AND AROUND THE BIOFILTER FACILITY AND BY INSURING THAT THERE ARE NO AREAS WHERE WATER STANDS LONGER THAN 96 HOURS FOLLOWING A STORM.
OUTLET INLET OR OUTLET STRUCTURE	CLEAR OBSTRUCTIONS.
DAMAGE TO STRUCTURAL COMPONENTS SUCH AS WEIRS, INLET, OR OUTLET STRUCTURES	REPAIR OR REPLACE AS APPLICABLE.
BEFORE THE WET SEASON AND AFTER RAIN EVENTS: REMOVE SEDIMENT AND DEBRIS FROM SCREENS AND OVERFLOW DRAINS AND DOWNSPOUTS: ENSURE PUMPS ARE FUNCTIONING, WHERE APPLICABLE; CHECK INTEGRITY OF MOSQUITO SCREENS; AND; CHECK THAT COVERS ARE PROPERLY SEALED AND LOCKED.	WHERE CISTERNS ARE PART OF THE SYSTEM



LEGEND

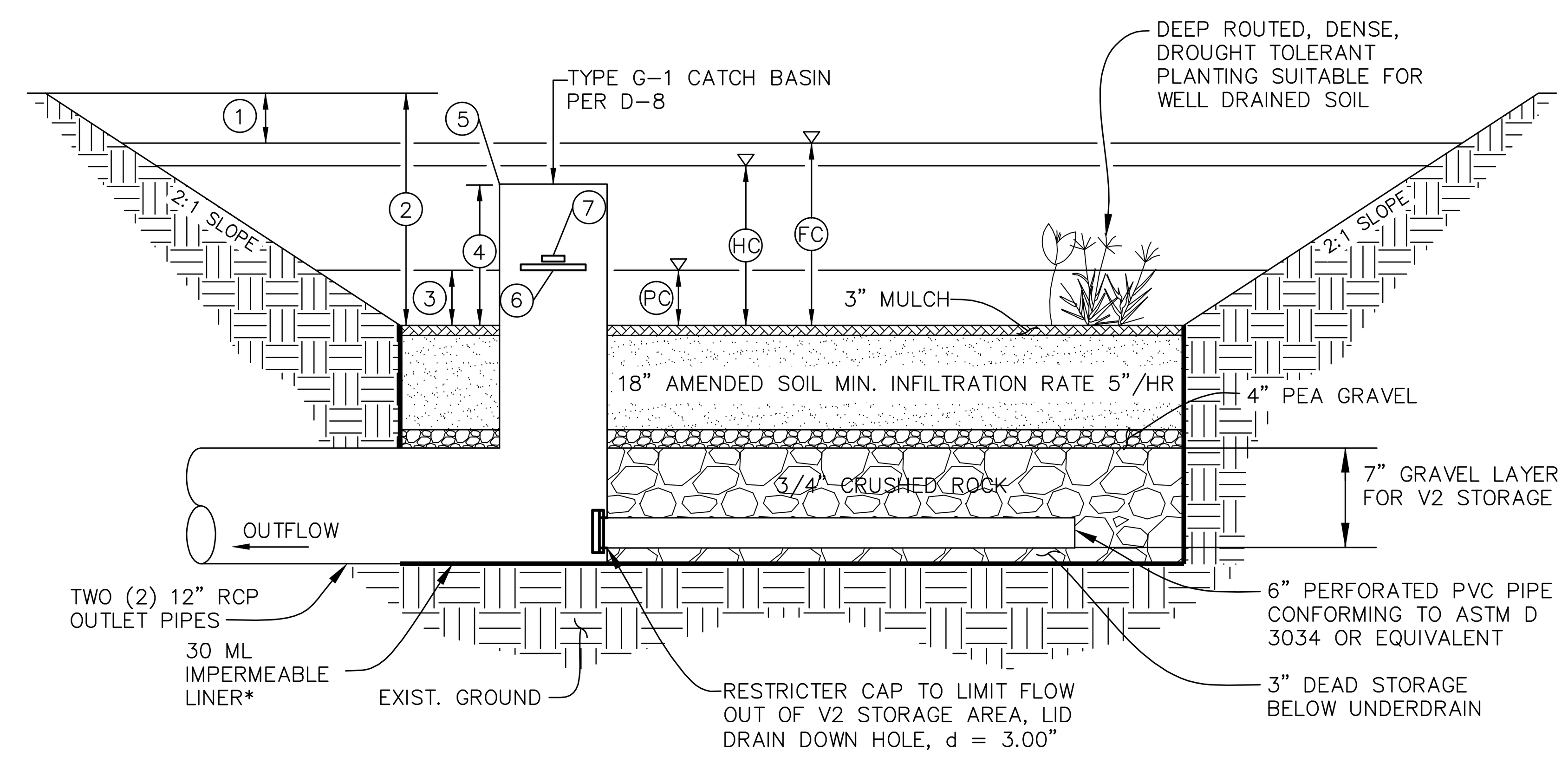
(1) FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
(2) BASIN HEIGHT H_{MAX} = 30.00"
(3) PONDING DEPTH = 6.00"
(4) RISER INVERT H_{TOP} = 18.00"
(5) *EMERGENCY WEIR INVERT = 18.00"
(6) *LOWER SLOT INVERT = 6.00"
1 – 5" HIGH X 34" LONG OPENING
(7) *UPPER SLOT INVERT = 7.00"
1 – 4" HIGH X 10" LONG OPENING
(PC) POLLUTANT CONTROL WSEL = 6.00"
(HC) HYDROMODIFICATION CONTROL WSEL = 13.92"
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 1

NOT TO SCALE

*30 MIL LINER NOTE: 30–MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN–WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN–WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP: //WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



LEGEND

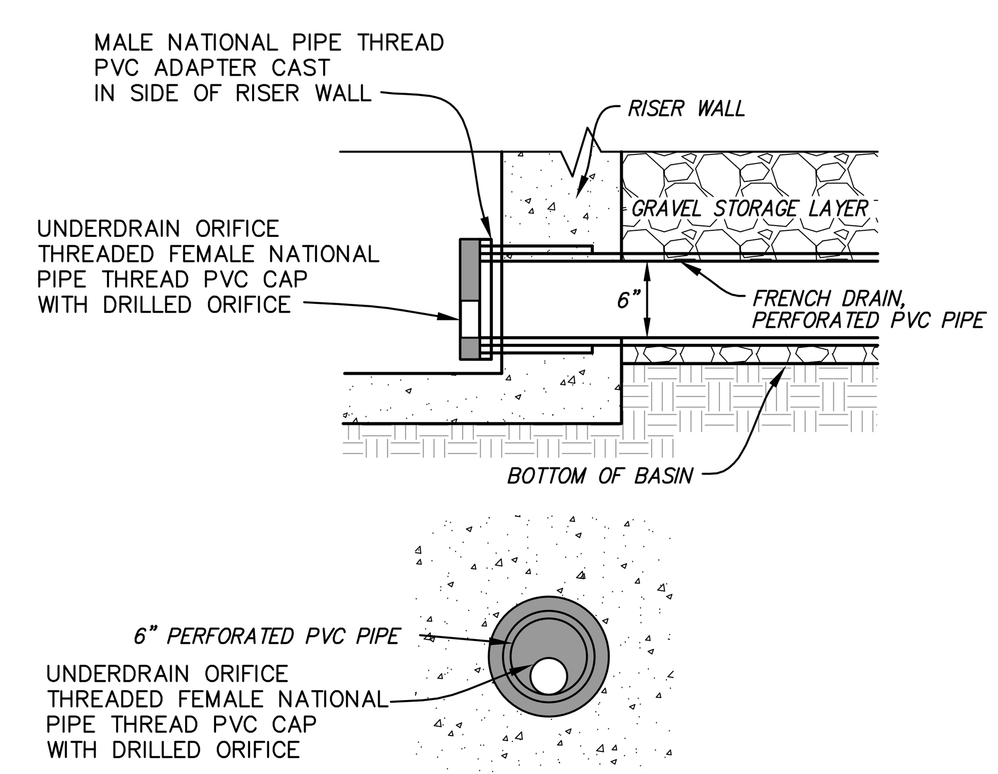
(1) FREEBOARD = 12.00" (CONJUNCTIVE USE FACILITY)
(2) BASIN HEIGHT H_{MAX} = 30.00"
(3) PONDING DEPTH = 6.00"
(4) RISER INVERT H_{TOP} = 18.00"
(5) *EMERGENCY WEIR INVERT = 18.00"
(6) *LOWER SLOT INVERT = 6.00"
1 – 3" HIGH X 32" LONG OPENING
(7) *UPPER SLOT INVERT = 7.00"
1 – 2" HIGH X 6" LONG OPENING
(PC) POLLUTANT CONTROL WSEL = 6.00"
(HC) HYDROMODIFICATION CONTROL WSEL = 6"
(FC) FLOOD CONTROL WSEL = 18.00"

*ELEVATION MEASURED FROM BASIN SURFACE

BIOFILTRATION BASIN DETAIL, BMP 2

NOT TO SCALE

*30 MIL LINER NOTE: 30–MIL IMPERMEABLE LINER FOR BIORETENTION CONFORM TO THE FOLLOWING SPECIFICATIONS: SPECIFIC GRAVITY (ASTM D792): 1.2 (G/CC, MIN.); TENSILE (ASTM D882): 73 (LB/IN–WIDTH, MIN); ELONGATION AT BREAK (ASTM D882): 380 (%, MIN); MODULUS (ASTM D882): 30 (LB/IN–WIDTH, MIN.); AND TEAR STRENGTH (ASTM D1004): 8 (LB/IN, MIN); SEAM SHEAR STRENGTH (ASTM D882) 58.4 (LB/IN, MIN); SEAM PEEL STRENGTH (ASTM D882) 15 (LB/IN, IN). SEE COLORADO LINING INTERNATIONAL PVC 30 HTTP: //WWW.COLORADOLINING.COM/PRODUCTS/PVC.PDF) OR APPROVED EQUAL.



RESTRICTOR CAP DETAIL BMP 1 & 2

NOT TO SCALE

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008–4387
(760) 931–8700

BMP EXHIBIT
CAMINO LARGO
CITY OF VISTA, CALIFORNIA

SHEET 2 OF 2

ATTACHMENT 4 - REQUIREMENTS FOR CONSTRUCTION PLANS

Section 8.2.2 of the *BMP Design Manual* identifies minimum requirements for storm drain construction plan sheets. Use this checklist to ensure project construction plans submitted for review include necessary information for storm drain improvements. Construction plans must include the following:

☒ All items identified in Section 8.2.2 of the *BMP Design Manual*.

CAMINO LARGO WATER SUPPLY STUDY

LN 2021-038

November 15, 2021

Prepared By: Robert Scholl, P.E.

Approvals:____________________

GENERAL POLICY STATEMENT

This water supply study is based on current criteria. It is not a representation, expressed or implied, that the Vista Irrigation District (District) will furnish water at a future date. Applications for service are governed by separate rules and regulations, and are the subject of separate District proceedings, apart from this water supply study.

The location of existing improvements and the recommendations of this hydraulic analysis are presented in schematic form only. It is the responsibility of the Developer/Engineer to design the final improvements, including independent investigation of existing conditions.

This Study is based on the current adopted land use utilized in the City of Vista's General Plan 2030 (General Plan). The study addresses the incremental facility impacts of this Project only and does not include or consider any additional projects within District's service area that have deviated from General Plan land uses. Any land use changes within the vicinity of the Study area may necessitate a revision to the Study. The District shall determine if and when revisions to the Study are necessary. Costs for revising this Study shall be borne by the Developer.

INTRODUCTION AND PURPOSE

The proposed development on the north side of Camino Largo (Project) is a single-family subdivision consisting of 46 dwelling units on approximately 9.3 acres (APN 159-240-07). The property is located adjacent to and east of N. Santa Fe Drive and was within the unincorporated County of San Diego and its North County Metro subplan; however, on October 1, 2018, the San Diego Local Agency Formation Commission approved the annexation of the property into the City of Vista. The Project is also located within the District's Sphere of Influence and water service boundary.

The purpose of this study is to serve as a nexus document for setting development conditions. It evaluates the configuration of the proposed water system, District service rights, and the ability of the existing water distribution system to serve the Project during peak hour and maximum day plus fire flow demand conditions. Evaluation includes:

- Water distribution system; including the need to upsize or install new pipelines and appurtenances.

- Access and utility easements; including evaluation of the adequacy of existing easements, and the need for new easements.

SOURCE OF WATER, PROPOSED FACILITIES, AND EASEMENTS

The proposed Project lies completely within the District's 565 Pressure Zone, which is supplied from the 3.1 million gallon (MG) San Luis Rey Reservoir, the 0.6 MG E-1 Reservoir and multiple pressure regulating stations. Figures 1 through 3 show the development's location, existing water infrastructure within the vicinity of the development, and proposed facilities.

The site supported agricultural uses and is served by a 2-inch meter (account #9995-0950) that is connected to the District's 10-inch pipeline within N. Santa Fe Avenue. Based on the Tentative Subdivision Map provided by the Developer, a public water system is proposed through the project; the water system would connect to the District's existing system within N. Santa Fe Avenue along the western end of the Project. The District reviewed this configuration and finds it suitable for a single-family residential development of this size. The District will require full width (curb to curb) access and utility easements over all private roads within the development.

WATER FLOW PROJECTIONS AND DESIGN CRITERIA

The Project's land use designation by the City of Vista's General Plan 2030 is Rural Residential, which allows up to one dwelling unit per acre. The Project developer is proposing to build 46 single-family residences on 9.3 acres, which equates to approximately five dwelling units per acre. To meet the new density requirements, the developer is proposing a General Plan Amendment to adjust the land use to Medium Density Residential, which would allow up to ten dwelling units per acre.

Based on the unit demand factor of 1,100 gallons per day (gpd)/acre developed in the Master Plan for single-family residential land use and site size of 9.3 acres, the projected average annual water demand for the Project is 10,230 gpd.

The Master Plan outlines the District's water system design criteria, which are as follows:

Peaking Factors

- Maximum day demands: 200% of average annual demands
- Peak hour demands: 300% of average annual demands

System Pressure

- Peak hour demand conditions: 40 pounds per square inch (psi) minimum
- Maximum day demand plus fire flow: 20 psi minimum
- Static: 150 psi maximum

Fire Flow

- The City of Vista Fire Marshal has set the required fire demand at 1,500 gallons per minute (gpm) for the Project.

Pipeline Fluid Velocity

- Peak hour demand conditions: 8 feet per second (fps) maximum
- Maximum day demand plus fire flow: 16 fps maximum

Pipeline Diameter

- Short dead-end, no hydrants: 4-inch diameter minimum
- Feeding hydrants: 8-inch diameter minimum

HYDRAULIC ANALYSES

A hydraulic analysis was performed on the District's distribution system with the proposed Project's water demands and facilities incorporated. The Project proposes a 2,400-foot, 8-inch diameter water system extension within the development, connecting to the District's 10-inch pipeline within N. Santa Fe Avenue as shown in the Tentative Subdivision Map and Figure 3. Two fire hydrants are proposed within the development on Camino Largo to provide fire protection.

The analysis was carried out using the District's InfoWater® v12.4 water distribution computer model. The modeled pressure results at each of the two proposed fire hydrants to be installed and the high point within the development are summarized in the table below.

Hydraulic Modeling Results

Node Location	Elevation (ft)	Static Pressure (psi)	Peak Hour Pressure (psi)	Max Day + FF Pressure (psi)*
VID Pipe @ Fire Hydrant #1	300	115	107	97
VID Pipe @ Fire Hydrant #2	316	108	100	82
VID Pipe @ High Point of Development	345	95	88	N/A

*Simulated fire flows are within the distribution system water mains, analyses do not represent actual flow available through a fire hydrant assembly or fire sprinkler system.

No existing system deficiencies were identified in any pipe segments within the Project limits or in the vicinity of the development during any scenario. Results from the analysis show that the required fire flow demand of 1,500 gpm can be met at both proposed fire hydrants on Camino Largo.

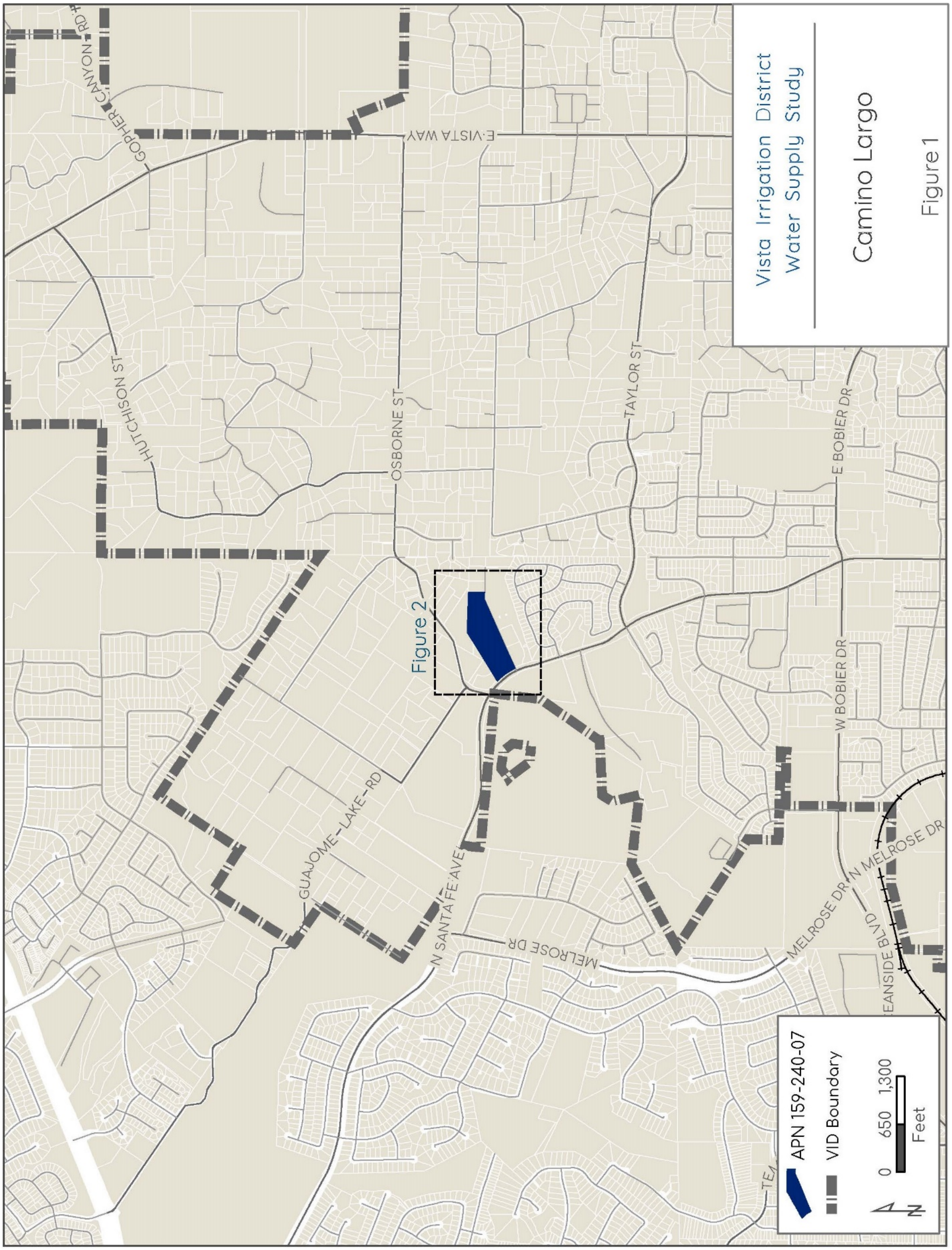
The District makes no guarantee that the available fire flow and pressures are presently available, nor guarantee that the flow and pressure will be available in the future due to continued growth that places additional demands for water on the water distribution system. Availability of flow and pressure is also subject to shutdowns and variations required by the operation of the District's distribution system.

CONCLUSION AND CONDITIONS

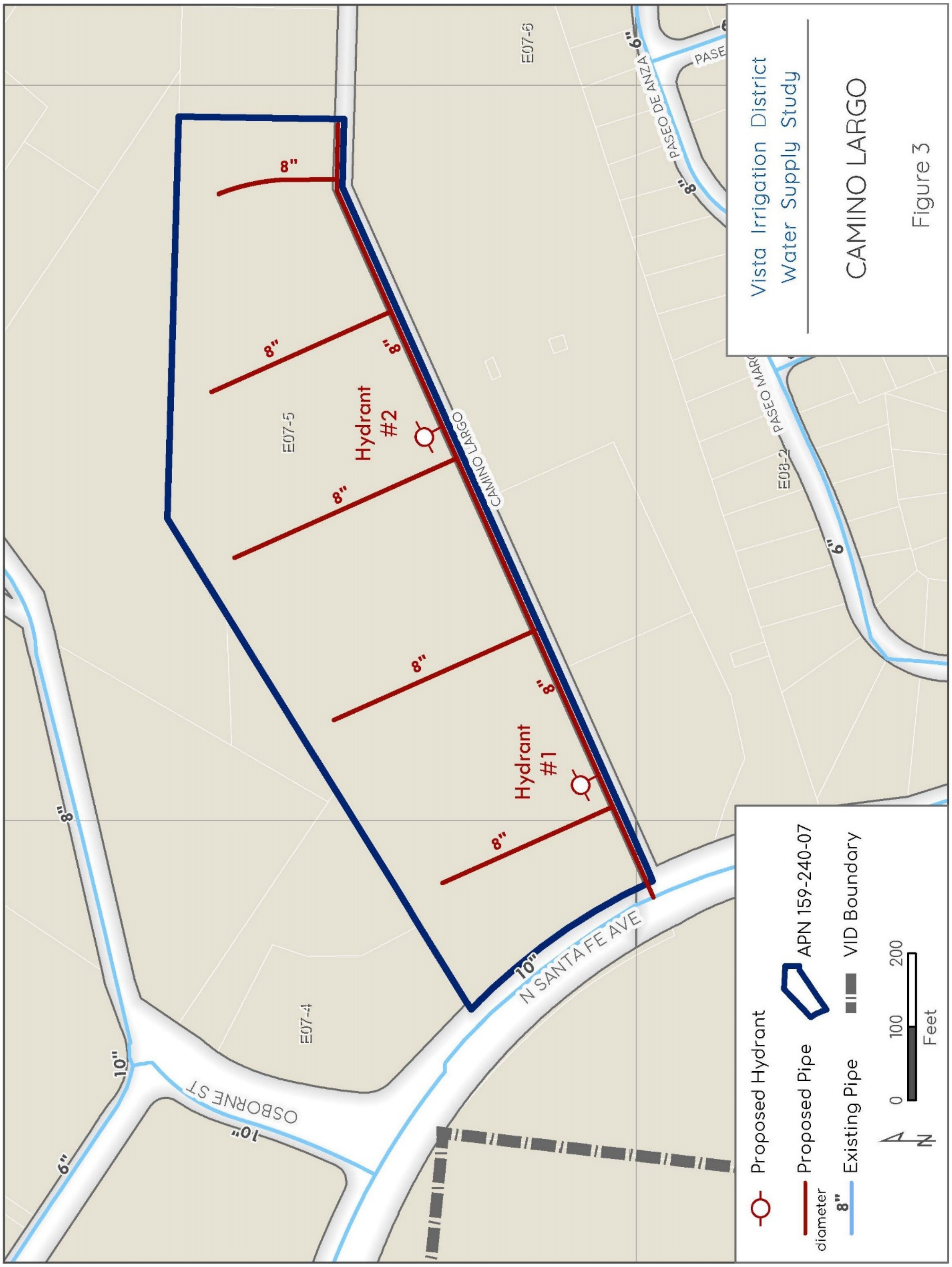
The proposed Project is proposing a General Plan Amendment to adjust the land use to allow up to ten dwelling units per acre. Based on the unit demand factor of 1,100 gpd/acre for single-family residential land use and a site size of 9.3 acres, the projected average annual water demand for the Project is 10,230 gpd.

The Study did not identify any existing system deficiencies within the Project limits or in the vicinity of the development during peak hour demand or maximum day plus fire flow demand scenarios. The following improvements were assumed to be constructed as part of this development:

- The installation of approximately 2,400-feet of public 8-inch pipeline within the Project that will connect to the District's existing 10-inch water main in N. Santa Fe Drive.


Vista Irrigation District
Water Supply Study
Camino Largo
Figure 1
Figure 2
APN 159-240-07
VID Boundary
0 650 1,300
Feet
E VISTA WAY
GOPHER CANYON RD
HUTCHISON ST
OSBORNE ST
TAYLOR ST
E BOBIER DR
W BOBIER DR
GUAJOME LAKE RD
N SANTA FE AVE
MELROSE DR
N MELROSE DR


Vista Irrigation District
Water Supply Study
Camino Largo
Figure 2
E07-6
E07-5
E07-4
E03-2
CAMINO LARGO
PASEO DE ANZA
PASEO CRESTA
PASEO MARGUERITA
N SANTA FE AVE
OSBORNE ST
6"
8"
10"
diameter
Existing Pipe
APN 159-240-07
VID Boundary
0
100
200
Feet


Vista Irrigation District
Water Supply Study
CAMINO LARGO
Figure 3
Proposed Hydrant
Proposed Pipe
diameter
8"
Existing Pipe
APN 159-240-07
VID Boundary
0
100
200
Feet
Hydrant #1
Hydrant #2
CAMINO LARGO
N SANTA FE AVE
OSBORNE ST
PASEO DE ANZA
E07-4
E07-5
E07-6
E03-2