Appendix H. Preliminary Storm Water Quality Management Plan

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CITY OF CARLSBAD

PRIORITY DEVELOPMENT PROJECT (PDP)
PRELIMINARY STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR
MARJA ACRES

PROJECT ID
CT 16-07/PUD 16-09/SDP 2018-0001/CDP
16-33/HDP 16-02/SUP 16-02/EIR 2017-0001
(DEV16038)

ENGINEER OF WORK:

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DATE: **07/10/2018**
Revision #1**: 09/17/2018**
Revision #2**: 12/03/2018**
Revision #3**: 1/17/2019**
Revision #4: **3/04/2019**

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CERTIFICATION PAGE

Project Name: West Coast Self Storage

Project ID: GR2018-0006

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the BMP Design Manual, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 (MS4 Permit) or the current Order.

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 SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design 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 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.

Engineer of Work's Signature PE Number: 81085 Expiration Date: 9/30/19

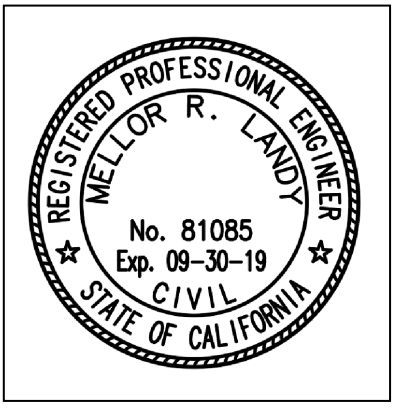
Mel Landy

HOWES WEILER AND ASSOCIATES

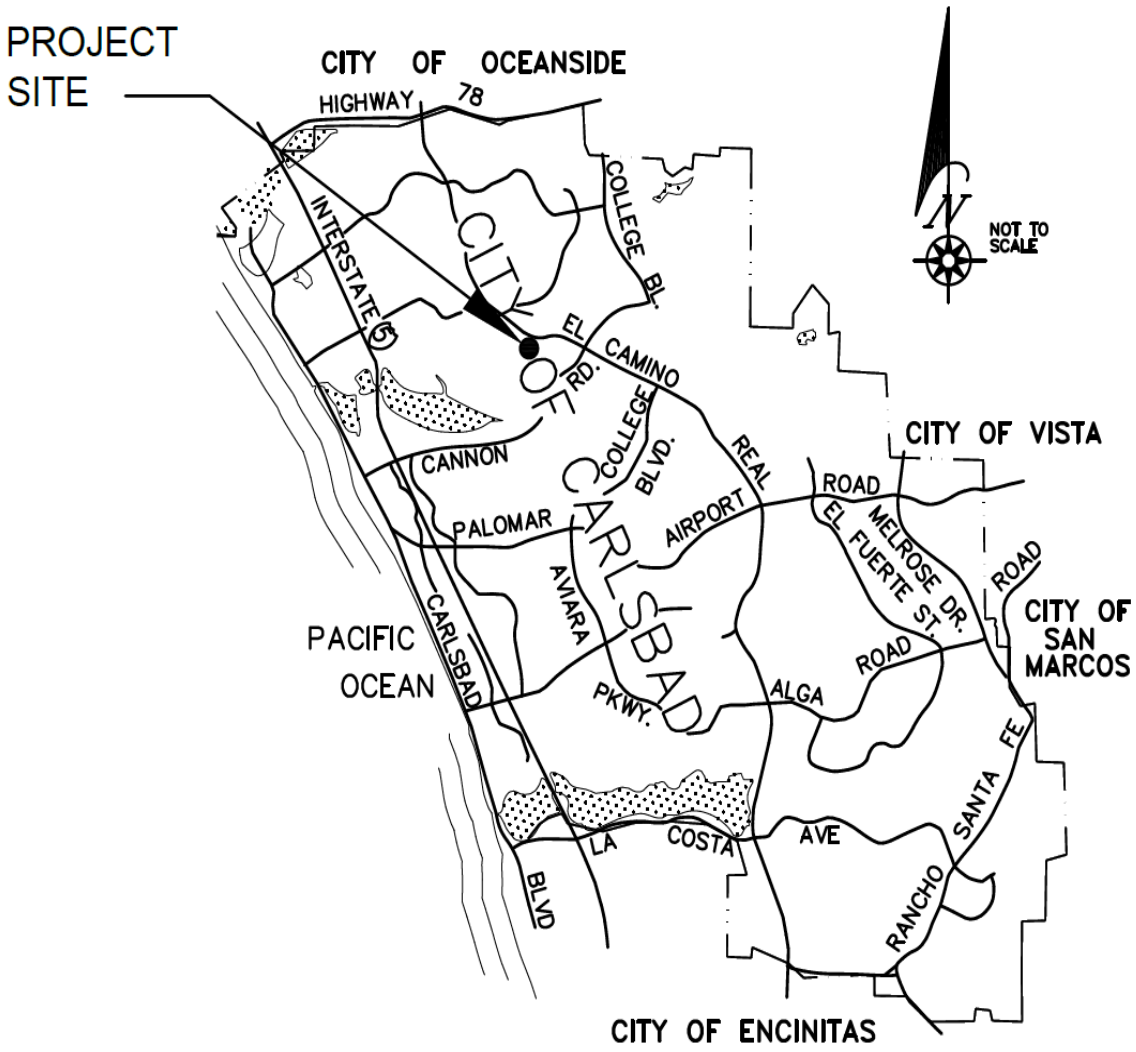
Company

3/04/19

Date



PROJECT VICINITY MAP



VICINITY MAP

STORM WATER STANDARDS QUESTIONNAIRE E-34

Development Services
Land Development Engineering
1635 Faraday Avenue
(760) 602-2750

INSTRUCTIONS:

To address post-development pollutants that may be generated from development projects, the city requires that new development and significant redevelopment priority projects incorporate Permanent Storm Water Best Management Practices (BMPs) into the project design per Carlsbad BMP Design Manual (BMP Manual). To view the BMP Manual, refer to the Engineering Standards (Volume 5).

This questionnaire must be completed by the applicant in advance of submitting for a development application (subdivision, discretionary permits and/or construction permits). The results of the questionnaire determine the level of storm water standards that must be applied to a proposed development or redevelopment project. Depending on the outcome, your project will either be subject to '**STANDARD PROJECT'** requirements or be subject to '**PRIORITY DEVELOPMENT PROJECT' (PDP)** requirements.

Your responses to the questionnaire represent an initial assessment of the proposed project conditions and impacts. City staff has responsibility for making the final assessment after submission of the development application. If staff determines that the questionnaire was incorrectly filled out and is subject to more stringent storm water standards than initially assessed by you, this will result in the return of the development application as incomplete. In this case, please make the changes to the questionnaire and resubmit to the city.

If you are unsure about the meaning of a question or need help in determining how to respond to one or more of the questions, please seek assistance from Land Development Engineering staff.

A completed and signed questionnaire must be submitted with each development project application. Only one completed and signed questionnaire is required when multiple development applications for the same project are submitted concurrently.

PROJECT INFORMATION	
PROJECT NAME: Marja Acres	PROJECT ID: C.T. 16-07
ADDRESS: 4901 El Camino Real, Carlsbad, CA 92008	APN: 207-101-35 & 37
The project is (check one): ☐ New Development ☑ Redevelopment	
The total proposed disturbed area is: 907,355 ft² (20.83) acres	
The total proposed newly created and/or replaced impervious area is: 544845 ft² (12.51) acres	
If your project is covered by an approved SWQMP as part of a larger development project, provide the project ID and the SWQMP # of the larger development project: Project ID N/A SWQMP #: N/A Then, go to Step 1 and follow the instructions. When completed, sign the form at the end and submit this with your application to the city.	

STEP 1
TO BE COMPLETED FOR ALL PROJECTS

To determine if your project is a "development project", please answer the following question:

	YES	NO
Is your project LIMITED TO routine maintenance activity and/or repair/improvements to an existing building or structure that do not alter the size (See Section 1.3 of the BMP Design Manual for guidance)?	☐	✔

If you answered "yes" to the above question, provide justification below then **go to Step 5**, mark the third box stating "my project is **not a 'development project'** and not subject to the requirements of the BMP manual" and complete applicant information.

Justification/discussion: (e.g. the project includes only interior remodels within an existing building):

N/A

If you answered "no" to the above question, the project is a '**development project**', **go to Step 2**.

STEP 2
TO BE COMPLETED FOR ALL DEVELOPMENT PROJECTS

To determine if your project is exempt from PDP requirements pursuant to MS4 Permit Provision E.3.b.(3), please answer the following questions:

Is your project LIMITED to one or more of the following:

	YES	NO
1. Constructing new or retrofitting paved sidewalks, bicycle lanes or trails that meet the following criteria: a) Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; b) Designed and constructed to be hydraulically disconnected from paved streets or roads; c) Designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance?	☐	☑
2. Retrofitting or redeveloping existing paved alleys, streets, or roads that are designed and constructed in accordance with the USEPA Green Streets guidance?	☐	☑
3. Ground Mounted Solar Array that meets the criteria provided in section 1.4.2 of the BMP manual?	☐	☑

If you answered "yes" to one or more of the above questions, provide discussion/justification below, then **go to Step 5**, mark the second box stating "my project is **EXEMPT** from PDP …" and complete applicant information.

Discussion to justify exemption (e.g. the project redeveloping existing road designed and constructed in accordance with the USEPA Green Street guidance):

N/A

If you answered "no" to the above questions, your project is not exempt from PDP, **go to Step 3**.

STEP 3 TO BE COMPLETED FOR ALL NEW OR REDEVELOPMENT PROJECTS		
To determine if your project is a PDP, please answer the following questions (MS4 Permit Provision E.3.b.(1)):	YES	NO
1. Is your project a new development that creates 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.*	☐	☑
2. Is your project a redevelopment project creating and/or replacing 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 surface? *This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.*	☑	☐
3. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface collectively over the entire project site and supports a restaurant? A restaurant is 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).	☑	☐
4. Is your project a new or redevelopment project that creates 5,000 square feet or more of impervious surface collectively over the entire project site and supports a hillside development project? A hillside development project includes development on any natural slope that is twenty-five percent or greater.	☐	☑
5. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface collectively over the entire project site and supports a parking lot? A parking lot is a land area or facility for the temporary parking or storage of motor vehicles used personally for business or for commerce.	☑	☐
6. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface collectively over the entire project site and supports a street, road, highway freeway or driveway? *A street, road, highway, freeway or driveway is any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.*	☑	☐
7. Is your project a new or redevelopment project that creates and/or replaces 2,500 square feet or more of impervious surface collectively over the entire site, and discharges 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).**	☐	☑
8. Is your project a new development or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface that supports an automotive repair shop? *An automotive repair shop is a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.*	☐	☑
9. Is your project a new development or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious area that supports a retail gasoline outlet (RGO)? *This category includes RGO's that meet the following criteria: (a) 5,000 square feet or more or (b) a project Average Daily Traffic (ADT) of 100 or more vehicles per day.*	☐	☑
10. Is your project a new or redevelopment project that results in the disturbance of one or more acres of land and are expected to generate pollutants post construction?	☑	☐
11. Is your project located within 200 feet of the Pacific Ocean and (1) creates 2,500 square feet or more of impervious surface or (2) increases impervious surface on the property by more than 10%? (CMC 21.203.040)	☐	☑
If you answered "yes" to one or more of the above questions, your project is a **PDP**. If your project is a redevelopment project, **go to step 4**. If your project is a new project, **go to step 5,** check the first box stating "My project is a **PDP** …" and complete applicant information. If you answered "no" to all of the above questions, your project is a '**STANDARD PROJECT.**' **Go to step 5**, check the second box stating "My project is a 'STANDARD PROJECT'…" and complete applicant information.		

STEP 4
TO BE COMPLETED FOR REDEVELOPMENT PROJECTS THAT ARE PRIORITY DEVELOPMENT PROJECTS (PDP) ONLY

Complete the questions below regarding your redevelopment project (MS4 Permit Provision E.3.b.(2)):

	YES	NO
Does the redevelopment project result in the creation or replacement of impervious surface in an amount of less than 50% of the surface area of the previously existing development? Complete the percent impervious calculation below: Existing impervious area (A) = 117,612 sq. ft. Total proposed newly created or replaced impervious area (B) = 544,845 sq. ft. Percent impervious area created or replaced (B/A)*100 = 463.25 %	☐	☑

If you answered "yes", the structural BMPs required for PDP apply only to the creation or replacement of impervious surface and not the entire development. **Go to step 5,** check the first box stating "My project is a **PDP** …" and complete applicant information.
If you answered "no," the structural BMP's required for PDP apply to the entire development. **Go to step 5**, check the check the first box stating "My project is a **PDP** …" and complete applicant information.

STEP 5
CHECK THE APPROPRIATE BOX AND COMPLETE APPLICANT INFORMATION

☑ My project **is a PDP** and must comply with **PDP** stormwater requirements of the BMP Manual. I understand I must prepare a Storm Water Quality Management Plan **(SWQMP)** for submittal at time of application.

☐ My project **is a 'STANDARD PROJECT'** OR **EXEMPT** from PDP and must only comply with '**STANDARD PROJECT'** stormwater requirements of the BMP Manual. As part of these requirements, I will submit a "*Standard Project Requirement Checklist Form E-36*" and incorporate low impact development strategies throughout my project.

Note: For projects that are close to meeting the PDP threshold, staff may require detailed impervious area calculations and exhibits to verify if 'STANDARD PROJECT' stormwater requirements apply.

☐ My Project is **NOT a 'development project**' and is not subject to the requirements of the BMP Manual.

Applicant Information and Signature Box

Howes Weiler Planning and Engineering

Applicant Name: Alex Parra Applicant Title: Senior Engineer

Applicant Signature: Alejandro Parra Date: 9/13/18

* Environmentally Sensitive Areas include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); water bodies designated with the RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); areas designated as preserves or their equivalent under the Multi Species Conservation Program within the Cities and County of San Diego; Habitat Management Plan; and any other equivalent environmentally sensitive areas which have been identified by the City.

This Box for City Use Only

City Concurrence:	YES	NO
	☐	☐
By:		
Date:		
Project ID:		

SITE INFORMATION CHECKLIST

Project Summary Information	
Project Name	Marja Acres
Project ID	CT 16-07/PUD 16-09/SDP 2018-0001/CDP 16-33/HDP 16-02/SUP 16-02/EIR 2017-0001 (DEV16038)
Project Address	The site is located on the south side of El Camino Real, between Kelly Drive to the west and Lisa Street to the east.
Assessor's Parcel Number (APN)	APN 207-101-35, 207-101-37, and 207-290-10
Project Watershed (Hydrologic Unit)	Carlsbad 904
Parcel Area	20.83 Acres (907,355 Square Feet)
Existing Impervious Area (subset of Parcel Area)	2.70 Acres (117,612 Square Feet)
Area to be disturbed by the project (Project Area)	20.83 Acres (907,355 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	12.51 Acres (544,845 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	8.32 Acres (362,510 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Description of Existing Site Condition and Drainage Patterns

Current Status of the Site (select all that apply):

☒ Existing development
☒ Previously graded but not built out
☒ Agricultural or other non-impervious use
☒ Vacant, undeveloped/natural

Description / Additional Information:

Marja Acres project is located on the south side of El Camino Real, between Kelly Drive to the west and Lisa Street to the east. Currently the site is partially developed with nursery, mini market store with asphalt parking area and a pottery shop are located along the north portion of the project parallel to El Camino Real, there is an access road to the southern portion of the project site which contains agricultural area, along with a shed. The undeveloped areas are located along the east and the west property lines.

Existing Land Cover Includes (select all that apply):

☒ Vegetative Cover
☒ Non-Vegetated Pervious
☒ Areas Impervious Areas

Description / Additional Information:

The site has two existing driveway access points, located along El Camino Real which are meant for access to the Mini Marked, the nursery and the pottery store, and additional paved access driveway which is located on the southwest corner of the parking lot is the access point for the southern portion of the site which is an agricultural area.

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

Per Geotechnical Report, GW discovered at 14 to 17 below ex. grades

Existing Natural Hydrologic Features (select all that apply):

☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
☒ None

Description / Additional Information: None known

Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? if so, describe]:

On-site storm water drains towards the west of the site with two discharge locations on the westerly property line, the first discharge point is located approximately 200 feet of the southwesterly property corner which conveys roughly 25% of the site flow via surface flow through a natural low point, the second point is approximately 350 feet south of the northwesterly property corner with flows going through an existing on-site storm drain conveyance system that conveys on-site storm water to an off-site storm drain channel that collects storm water from several upstream and downstream properties. Flows from both discharge points ultimately enter the adjacent Agua Hedionda Creek. (See project Drainage Report)

Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The Marja Acres development plan proposes a total number of 299 dwelling units consisting of 237 townhomes within the R-15 General Plan designated area, and 46 age restricted affordable house units, 16 Townhomes, a 4,000 square foot restaurant pad and a 5,700 retail pad area within the GC General Plan designated area. The proposed project has been designed to emphasize superior architecture, views, privacy, walkability, internal connectivity and recreational amenities. See Attachment 1a.

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

The proposed will construct multiple types of impermeable surfaces such as roof tops, roadways, sidewalks, walkways, parking lots and trash enclosures.

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

The site proposes landscape areas exceeding minimum requirements and multiple bio-filtration areas for storm water treatment. See Attachment 1a.

Does the project include grading and changes to site topography?

- ☒ Yes
- ☐ No

Description / Additional Information:

The current land elevations range from approximately 58 feet to 67 feet MSL along El Camino Real raising up to 112 feet at the highest point along the southern border. The current slope alignment is generally in an east to west direction. The proposed design of the site maintains the slope alignment in an east to west direction, yet decreases the extent of the slope heights which ultimately enhances the view of the site from El Camino Real.
Additionally, in order to maximize the privacy of the existing adjacent homes, the upper levels of the site were lowered significantly. By lowering the site to accommodate the privacy concerns, the volume of the grading increases. The design of the site warrants this increase to create a better project for the new residents as well as the existing adjacent residents.

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

- ☒ Yes
- ☐ No

Description / Additional Information:

The project includes the installations of a new storm water conveyance system that will collect, treat and release storm water from the project site to an existing natural creek offsite to the west.
Once in this existing system, the flows connect to public conveyance systems and then enter Agua Hedionda Creek, then Agua Hedionda lagoon, and finally the Pacific Ocean.

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- ☒ On-site storm drain inlets
- ☒ Interior floor drains and elevator shaft sump pumps
- ☐ Interior parking garages
- ☒ Need for future indoor & structural pest control
- ☒ Landscape/Outdoor Pesticide Use
- ☒ Pools, spas, ponds, decorative fountains, and other water features
- ☐ Food service
- ☒ Refuse areas
- ☐ Industrial processes
- ☐ Outdoor storage of equipment or materials
- ☐ Vehicle and Equipment Cleaning
- ☐ Vehicle/Equipment Repair and Maintenance
- ☐ Fuel Dispensing Areas
- ☐ Loading Docks
- ☒ Fire Sprinkler Test Water
- ☐ Miscellaneous Drain or Wash Water
- ☒ Plazas, sidewalks, and parking lots

Identification of Receiving Water Pollutants of Concern

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

The project site drains into the branch of Agua Hedionda creek that drains to Agua Hedionda lagoon. The Agua Hedionda lagoon discharges directly to the Pacific Ocean.

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

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs
Agua Hedionda Creek	Enterococcus, Fecal Coliform, Manganese, phosphorus, selenium, Total Nitrogen as N, TDS, Aquatic Toxicity	Eutrophic, Indicator Bacteria

Identification of Project Site Pollutants

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

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

Hydromodification Management Requirements

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

- ☒ Yes, hydromodification management flow control structural BMPs required.
- ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):
The project is a redevelopment project that discharge directly to an existing storm drain system that already has outlet protection to prevent hydromodification.

Critical Coarse Sediment Yield Areas*
***This Section only required if hydromodification management requirements apply**

Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries?

- ☒ Yes
- ☐ No, No critical coarse sediment yield areas to be protected based on WMAA maps

If yes, have any of the optional analyses presented in Section 6.2 of the 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 8 of the SWQMP.
- ☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit.

Discussion / Additional Information:
A Deposition Analysis of this project site has been done, per guidance from “Appendix H Guidance for Investigating Potential Critical Coarse Sediment Yield Areas” more specific H.1.2 Refinement Option and H.7.1 Depositional Analysis. This has been done to determine whether the Potential Critical Coarse Sediment Yield Areas CCSYAs that are located within the project area at the mid-east section are required to be preserved.

Per the Deposition Analysis Memorandum located under Attachment 2B within this report, it has been determined that the velocity for the 2 year – 24 hour storm event, the velocities are 2.90 ft/s in the first case and 1.00 ft/s in the second case, downstream of the Potential CCSYAs, which is less than the 3.0 ft/s stated in appendix H.1.2.1: Depositional Analysis detailed in section H.7.1 Depositional Analysis. consequently, no measure for protection of CCSYA on-site are necessary.

Flow Control for Post-Project Runoff*
***This Section only required if hydromodification management requirements apply**

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

There is one point of compliance (POC 1) located on the westerly property line, approximately 360 feet south of El Camino Real for hydromodification management see HMP Exhibit Attachment 2a.

In regards to hydromodification compliance for off-site areas along El Camino Real, the following assumption based in two design conditions has been made: (a) the receiving creek is low susceptibility and (b) the BMPs were designed with the conservative sizing tables. Therefore, it has been assumed in this Tentative Map Approval that those basins will be sufficient for HMP compliance in final engineering once a proper continuous simulation model that accounts for the small modification in their drainage caused by this development is prepared, or once an update of the calculations made with the new tables is carried out. The re-design of the outside BMPs is out of the scope of this TMA.

Has a geomorphic assessment been performed for the receiving channel(s)?

☐ No, the low flow threshold is 0.1Q2 (default low flow threshold)
☐ Yes, the result is the low flow threshold is 0.1Q2
☐ Yes, the result is the low flow threshold is 0.3Q2
☒ Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

The low-flow threshold for hydromodification analysis for this project is 50% of Q2 based on a study prepared by Wayne Chang (2018) in terms of the susceptibility for erosion.

Discussion / Additional Information: (optional)

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 City codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements. The soil engineer's recommendation is to provide impervious liner underneath the biofilters due to both the very limited infiltration rate and the proximity to buildings and slopes.
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.

City of Carlsbad

STANDARD PROJECT REQUIREMENT CHECKLIST

E-36

Development Services
Land Development Engineering
1635 Faraday Avenue
(760) 602-2750
www.carlsbadca.gov

Project Information
Project Name: Marja Acres
Project ID: C.T. 16-07
DWG No. or Building Permit No.: TBD

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E.1 of the BMP Design Manual (Volume 5 of City Engineering Standards) for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E.1 of the Model BMP Design Manual. Discussion/justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion/justification must be provided. Please add attachments if more space is needed.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion/justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion/justification if SC-1 not implemented: All proposed impervious areas drain to Biofiltration BMPs, thus mitigating non-storm water discharge to the MS4. Efficient irrigation will also be proposed.			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion/justification if SC-2 not implemented: • Locations of inlets are shown on exhibits. • All inlets will be marked with the words “No dumping! Flows to Bay” or similar. • Maintain and periodically repaint or replace inlet markings. • Provide storm water pollution prevention information to new owners, lessees, or operations.			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion/justification if SC-3 not implemented: There are no proposed Outdoor Material Storage Areas.			

Source Control Requirement (continued)	Applied?		
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	▣ N/A
Discussion/justification if SC-4 not implemented: There are no proposed Outdoor Work Areas.			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	▣ N/A
Discussion/justification if SC-5 not implemented: This project does not propose outdoor Trash Storage Areas.			
SC-6 Additional BMPs based on Potential Sources of Runoff Pollutants must answer for each source listed below and identify additional BMPs. (See Table in Appendix E.1 of BMP Manual for guidance).			
▣ On-site storm drain inlets	▣ Yes	☐ No	☐ N/A
▣ Interior floor drains and elevator shaft sump pumps	▣ Yes	☐ No	☐ N/A
☐ Interior parking garages	☐ Yes	☐ No	▣ N/A
▣ Need for future indoor & structural pest control	▣ Yes	☐ No	☐ N/A
▣ Landscape/Outdoor Pesticide Use	▣ Yes	☐ No	☐ N/A
▣ Pools, spas, ponds, decorative fountains, and other water features	▣ Yes	☐ No	▣ N/A
☐ Food service	☐ Yes	☐ No	▣ N/A
☐ Refuse areas	☐ Yes	☐ No	▣ N/A
☐ Industrial processes	☐ Yes	☐ No	▣ N/A
☐ Outdoor storage of equipment or materials	☐ Yes	☐ No	▣ N/A
☐ Vehicle and Equipment Cleaning	☐ Yes	☐ No	▣ N/A
☐ Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	▣ N/A
☐ Fuel Dispensing Areas	☐ Yes	☐ No	▣ N/A
☐ Loading Docks	☐ Yes	☐ No	▣ N/A
▣ Fire Sprinkler Test Water	▣ Yes	☐ No	☐ N/A
☐ Miscellaneous Drain or Wash Water	☐ Yes	☐ No	▣ N/A
▣ Plazas, sidewalks, and parking lots	▣ Yes	☐ No	☐ N/A
For "Yes" answers, identify the additional BMP per Appendix E.1. Provide justification for "No" answers. Go to next page.			

For on-site storm drain inlets

- Location of inlets is shown in exhibits.
- All inlets will be marked with the words "No dumping! Flows to Bay" or similar.
- Maintain and periodically repaint or replace inlet markings.
- Provide storm water pollution prevention information to new owners, lessees, or operations.

For need for future indoor & structural pest control

- Building shall integrate features that discourage entry of pests.
- Provide integrated pest management information to owners, lessees, and operators.

For landscape/outdoor pesticide use, final landscape plans will accomplish all of the following:

- Design landscaping 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.
- Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of periodic saturated soil conditions.
- Consider using pest-resistant plants, especially adjacent to hardscape.
- To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.
- Maintain landscaping using minimum or no pesticides.

For fire sprinkler test water

- Fire sprinkler test water will be plumbed to sanitary sewer

For plazas, sidewalks, and parking lots:

- Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris
- Debris from pressure washing shall be collected to prevent entry into the storm drain system. Wash-water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

For pools spas and decorative fountains

- Location of water feature and sanitary sewer cleanout will be shown on plans.
- Water feature will be plumbed to the sanitary sewer.
- See applicable operational BMP's in Fact Sheet SC-72, "Fountain and Pool Maintenance" in the CASQA Storm Water Quality Handbooks.

Proposed project is a multi-family apartment complex. There will be no outdoor material storage and/or outdoor work areas. This project does not propose food service areas, refuse areas, industrial processes and fuel dispensing areas are not proposed for this project. Vehicle/equipment repair, maintenance and cleaning are discouraged.

Site Design BMPs

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E.2 thru E.6 of the BMP Design Manual (Volume 5 of City Engineering Standards) for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMPs as described in Chapter 4 and/or Appendix E.2 thru E.6 of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMPs is applicable to the project but it is not feasible to implement. Discussion/justification must be provided. Please add attachments if more space is needed.
- "N/A" means the BMPs is not applicable at the project site because the project does not include the feature that is addressed by the BMPs (e.g., the project site has no existing natural areas to conserve). Discussion/justification may be provided.

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	■ N/A
Discussion/justification if SD-1 not implemented: There are no Natural Drainage Pathways and Hydrologic Features on-site			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	■ N/A
Discussion/justification if SD-2 not implemented: There are no Natural Areas, Soils, and Vegetation to conserve on-site			
SD-3 Minimize Impervious Area	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-3 not implemented: Streets, sidewalks & parking aisles were designed with widths minimized as much as possible. Proposed building is multi-story in an effort to reduce the building footprint.			
SD-4 Minimize Soil Compaction	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-4 not implemented:			
SD-5 Impervious Area Dispersion	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-5 not implemented: Pervious areas are included where project design allows in order to disperse impervious areas; however, dispersion is not implemented such that the DCV can be confidently reduced. The roof, parking structure, drive aisle, driveways and hardscaping are routed through landscaped areas where possible.			

Site Design Requirement (continued)	Applied?		
SD-6 Runoff Collection	▣ Yes	☐ No	☐ N/A
Discussion/justification if SD-6 not implemented: All runoff will be directed towards Bio-filtration Basins, which ultimately drain to the POC			
SD-7 Landscaping with Native or Drought Tolerant Species	▣ Yes	☐ No	☐ N/A
Discussion/justification if SD-7 not implemented: Native and drought tolerant species will be included in landscape design.			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	▣ N/A
Discussion/justification if SD-8 not implemented: Harvest and reuse was deemed infeasible per Form I-7: Harvest and use Feasibility Checklist.			

SUMMARY OF PDP STRUCTURAL BMPS

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 City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the City 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 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 BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated together or separate. The selection of the proposed pollutant control and flow control (hydromodification) BMPs was based on section 5.2 of the BMP Design Manual. From Form I-7 (harvest and Use Feasibility Checklist), Harvest has been deemed infeasible. Per the proposed development's Geotechnical Report prepared by Geo Soils, Inc., partial infiltration is infeasible due to high probability of groundwater mounding which would potentially cause adverse effects to proposed improvements and future adjacent improvements. For the same reason the infiltration rate has been limited to 0.01 in/hr or less. Bio-filtration basins with lined sides and bottoms are recommended. Seven (7) Biofiltration basins denoted as BMP-1 through BMP-7, have been proposed to meet storm water pollutant control requirements and hydromodification management. BMPs 3 and 4 work in conjunction to manage flows for hydromodification and flood control. Regarding the entrance areas, and considering only WQ treatment, a modular wetland will be placed behind the west curb of the east entrance which is meant to treat a portion of (DMA 9C), flows collected from the modular wetland will be conveyed through underground pipes to the relocated curb inlet located west of the entrance. The remainder area which consist of a portion of the entrance improvements and portion of the turn pocket improvements will continue sheet flowing on a westerly direction, these flows will be treated by a proposed tree well located in the ROW of El Camino Real. The on-site and public turn pocket improvements located west of the relocated curb inlet have a super elevated condition consistent with El Camino Real vertical design conditions, the newly impervious areas will naturally want to sheet flow on a northwesterly direction to

the road median where they enter an existing biofiltration facility (BMP 14) which was design to treat flows consistent with the road widening. (Approved Analysis prepared by O'Day + Chang). Although BMP 14 is under sized by 35-s.f. to treat additional flows, further downstream existing biofiltration facilities (BMPs 15 & 16) have the capacity to treat the additional flows. (See attachment 1F for analysis of offsite conditions)

The west entrance will have a modular wetland located behind the curb on the west side of the proposed driveway. This facility will treat DMA 8C for water quality only; it should be noted that is unfeasible to treat on-site the portion of project site area north of (DMA 8C) and the newly created impervious areas created along El Camino Real to allow for the turn pocket. Therefor these areas will be allowed to comingle with existing flows from El Camino Real and sheet flow on a north westerly direction where they will confluence and then be treated by at the existing biofiltration facilities (BMP 15 & 16) located on the road median and constructed for the road widening project of El Camino Real (Approved Analysis prepared by O'Day + Chang). (See exhibits provided on attachment 1F for delineation of additional area being treated by existing BMP 15 and 16 as-well as calculation demonstrating capacity of said basins to treat additional area). A De-minimis area exists at the north west corner of the project site, said area is within El Camino Real improvements and bypasses existing BMP facilities in el Camino Real

Regarding the hydromodification compliance of the entrances, these impervious areas will be considered untreated for the hydromodification point of view, and that extra runoff will be compensated by oversizing the BMPs inside the development. The HMP post-development model will consider the entrances with their existing impervious areas and by-passing the project BMPs but the overall Flow Duration Curve of the project will comply. On regards to the adjacent new road widening, the existing facilities in El Camino Real median will provide hydromodification managagement.

The retention requirements was also considered: an analysis of over-retention by the proposed onsite biofiltration BMPs will be prepared following these assumptions: (a) no frontage area draining into El Camino Real is considered complying with retention requirements, so the impervious area of that frontage (both entrances included) is to be counted, and the 3% of that effective impervious area becomes a deficit, to be covered by, any excess over 3% from other BMPs.

As all onsite proposed BMPs are in excess of 3%, there is an excess of retention therefore the project complies with the retention requirement. (Please refer to Attachment 1G).

(Continued on next page…)

PDP Structural BMPs

SUMMARY OF POST-DEVELOPMENT CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	**20.114**	N/A	

The bio-filtration basins were modeled using the biofiltration LID module within SWMM.

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-1

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-1's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-2

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-2's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-3

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-3's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows and Q_{100} (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-4

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-4's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows and Q_{100} (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-5

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-5's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-6

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-6's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. BMP-7

DWG DMA MAP Sheet No. 1 of 1

Type of structural BMP:

☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☒ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
☐ Detention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:

☐ Pollutant control only
☐ Hydromodification control only
☒ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

Purpose discussion: Although BMP-7's main purpose is pollutant control, a low-flow orifice within the gravel layer is proposed to help manage flows as well as utilize the storage within the basin during hydromodification flows (flood control). Flood control is discussed in this project's Drainage Report.

Who will certify construction of this BMP?
Engineer of Work

Who will be the final owner of this BMP?
Owner

Who will maintain this BMP into perpetuity?
Owner

ATTACHMENT 1

BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.
Check which Items are Included behind this cover sheet:

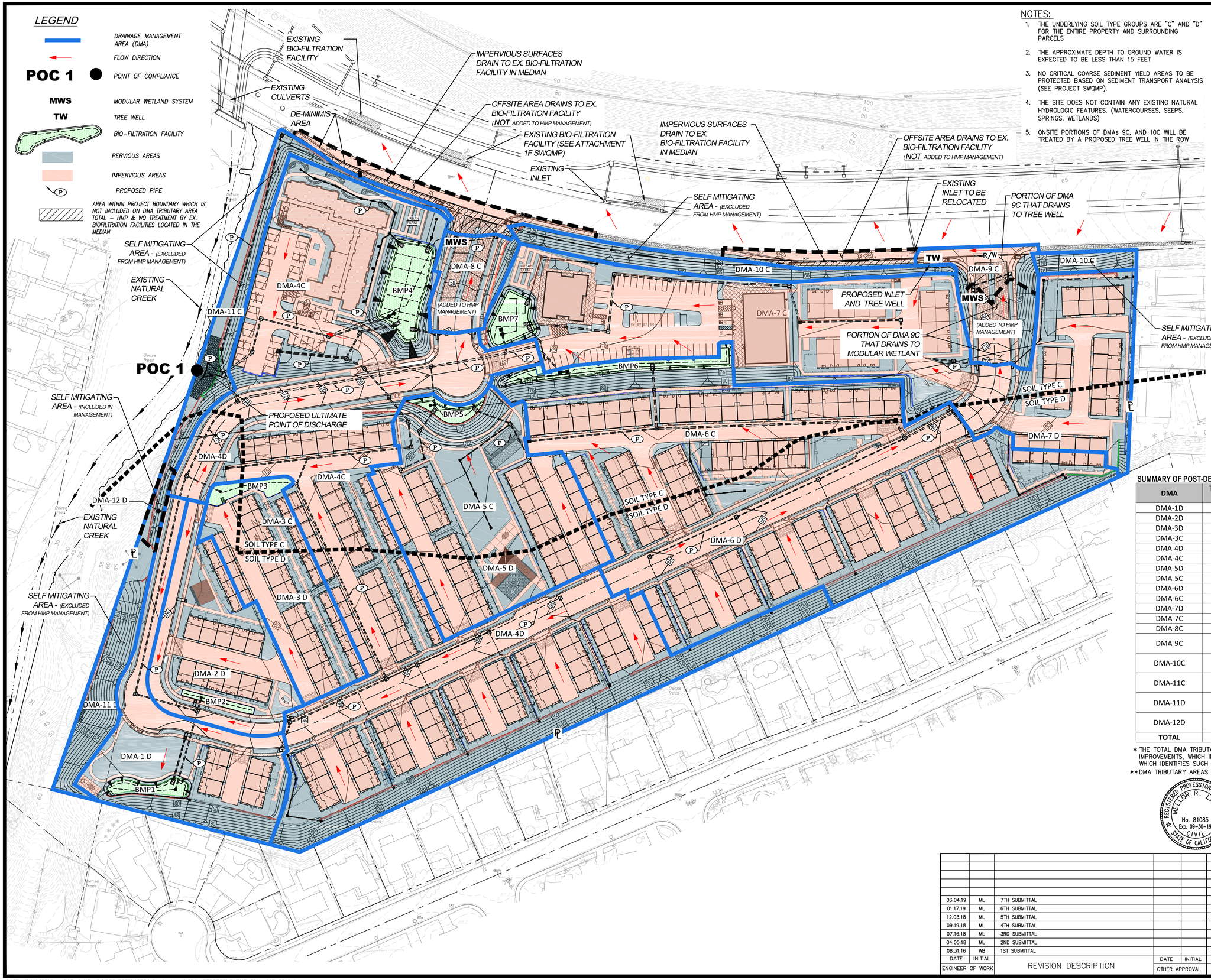
Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet. (24"x36" Exhibit typically required)	Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	Included on DMA Exhibit in Attachment 1a Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	Not Included
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	Included
Attachment 1f	Technical Memorandum, Existing Offsite Biofiltration Capacity Analysis by Alternative Minimum Biofiltration Footprint Ration sizing	Included
Attachment 1g	Structural BMP – Tree Well and Modular Wetland System maintenance information attachments	Included

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

The DMA Exhibit must identify:

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

ATTACHMENT 1A



NOTES:

1. THE UNDERLYING SOIL TYPE GROUPS ARE "C" AND "D" FOR THE ENTIRE PROPERTY AND SURROUNDING PARCELS
2. THE APPROXIMATE DEPTH TO GROUND WATER IS EXPECTED TO BE LESS THAN 15 FEET
3. NO CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED BASED ON SEDIMENT TRANSPORT ANALYSIS (SEE PROJECT SWQMP).
4. THE SITE DOES NOT CONTAIN ANY EXISTING NATURAL HYDROLOGIC FEATURES. (WATERCOURSES, SEEPS, SPRINGS, WETLANDS)
5. ONSITE PORTIONS OF DMAs 9C, AND 10C WILL BE TREATED BY A PROPOSED TREE WELL IN THE ROW

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007

PERMANENT WATER QUALITY TREATMENT FACILITIES ON THIS SITE

KEEPING OUR WATER CLEAN
MAINTAIN WITH CARE
NO MODIFICATIONS WITHOUT CITY OF CARLSBAD APPROVAL

WATER QUALITY ADVISORY SIGN
NTS

NO DUMPING DRAINS TO WATERWAYS

SAMPLE PROHIBITIVE SIGNAGE
NTS

SUMMARY OF POST-DEVELOPED CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	*** 20.114**	N/A	

* THE TOTAL DMA TRIBUTARY AREA, DOES NOT INCLUDE AREAS PART OF THE TURNING LANE IMPROVEMENTS, WHICH INCLUDE SIDEWALK AND LANDSCAPE, ADJACENT TO RETAINING WALLS, SEE LEGEND WHICH IDENTIFIES SUCH AREAS.

**DMA TRIBUTARY AREAS EXCLUDES, BMP SQUARE FOOTAGE.

REGISTERED PROFESSIONAL ENGINEER
MELLOR R. LANDY
No. 81085
Exp. 09-30-19
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DATE	INITIAL	REVISION DESCRIPTION
03.04.19	ML	7TH SUBMITTAL
01.17.19	ML	6TH SUBMITTAL
12.03.18	ML	5TH SUBMITTAL
09.19.18	ML	4TH SUBMITTAL
07.16.18	ML	3RD SUBMITTAL
04.05.18	ML	2ND SUBMITTAL
08.31.16	WB	1ST SUBMITTAL

ENGINEER OF WORK | OTHER APPROVAL | CITY APPROVAL

SHEET 1 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:

MARJA ACRES

DRAWING NAME:

DMA MAP EXHIBIT

DATE: 3/14/2019 ~ FILE NAME: S:\PROJECTS\1204 Marja Acres\CIVIL\REPORTS\SWQMP\DMA MAP 2019.dwg

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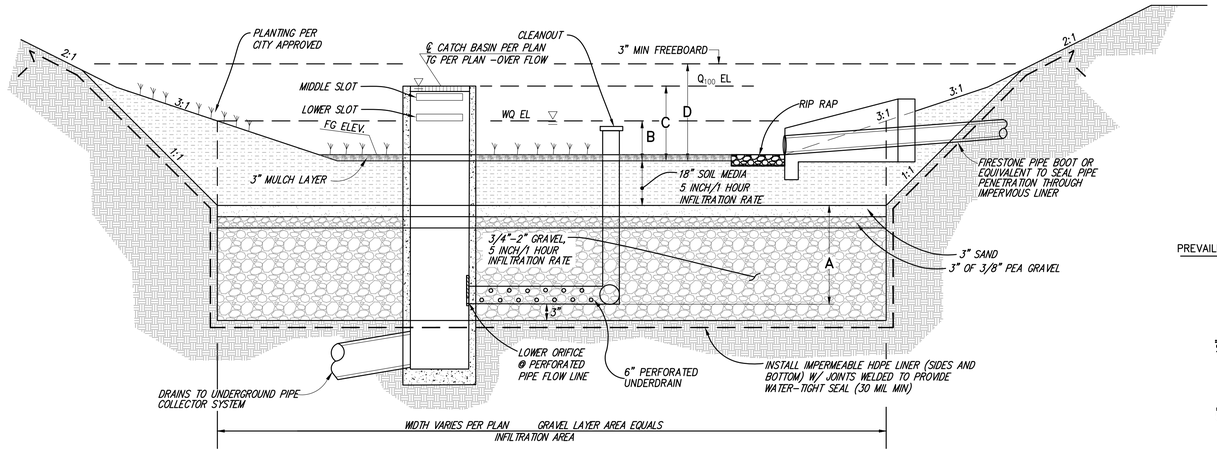
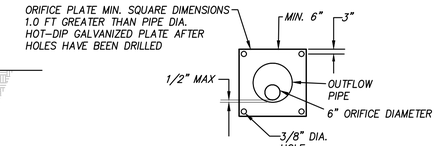
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007



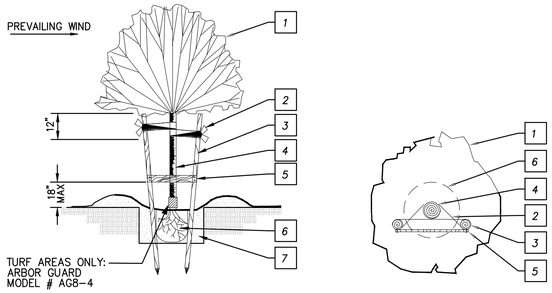
TYPICAL BIO-FILTRATION BASIN DETAIL

NTS



STAINLESS STEEL PLATE / ORIFICE DETAIL

NTS



SECTION VIEW

PLAN VIEW

STREET TREES DETAIL

NTS

TREE WELL NOTES

1. TREE CANOPY
2. (2) CINCH TIES, TACK TO STAKE WITH GALVANIZED NAILS TO PREVENT SLIPPING
3. (2) 2" DIA. X 8' LONG UNTREATED LODGEPOLE PINE STAKES FOR 5 GAL. TREES, OR (2) 2" DIA. X 10' LONG UNTREATED LODGEPOLE PINE TAKES FOR 15 GAL.– 36" BOX TREES, SET STAKES OUTSIDE ROOTBALL. ANGLE TOP OF STAKE AWAY FROM BRANCH STRUCTURE.
4. TREE TRUNK
5. 1 X 4 DOUG. FIR BRACE, TACK TO LODGEPOLE STAKES WITH GALV. NAILS
6. ROOT BALL, DO NOT PENETRATE WITH STAKE.
7. USE AMENDED SOIL WITH MINIMUM DEPTH OF 3' + 1' IN ALL DIRECTIONS OF ROOT BALL PER CITY'S BMP MANUAL APPENDIX PG. E–18.

TREE TIE NOTE:

INSTALL TREE TIES AND STAKES ONLY TO PROPER LEVEL TO HOLD TREE UPRIGHT. PROPER HEIGHT IS 6" ABOVE POINT WHERE THE TREE WILL SNAP TO AN UPRIGHT POSITION BY ITSELF IF TOP IS PULLED TO ONE SIDE AS IF WIND LOADED AND THEN RELEASED. DO NOT TOP TREES IN ORDER TO REDUCE SIZE OR WEIGHT OF TREE CROWN, CONTACT LANDSCAPE ARCHITECT PRIOR TO ANY PRUNING OF TREES.

SUMMARY OF RISER DETAILS

BMP	Lower Slot			Middle Slot			Top Riser		Emergency weir
	Width (ft)	Height (ft)	Elevation[1] (ft) B	Width (ft)	Height (ft)	Elevation[1] (ft)	Length[2] (ft)	Elev.[1] (ft)	Length[3] (ft)
BMP 3	1	0.167	1	--	----	-----	12	2.25	
BMP 4	1	0.167	1.5	4	0.167	3.25	12	3.75	8
BMP 5	1.5	0.167	1	8	0.25	1.33	12	1.75	8
BMP 6	1.5	0.167	1	8	0.25	1.33	12	1.75	10
BMP 7	1.5	0.167	1	8	0.25	1.33	12	1.75	8

(1): Basin ground surface elevation assumed to be 0.00 ft elevation.

Notes: (2): Overflow length is the internal perimeter of the riser structure.

(3): Additional Overflow length for peak flow discharges

SUMMARY OF DEVELOPED DUAL AND TRIPLE PURPOSE BMPs

BMP	Tributary Area (Ac)[7]	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2.] A	Lower Orif. D (in)[3]	Depth Riser Invert (in)[4] C	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] D
BMP 1	1.060	1949	33	0.8	12	12	18
BMP 2	0.901	1098	33	0.9	6	12	12
BMP 3	0.772	2360	36	0.9	27	12	33
BMP 4	6.098	7724	48	2.3	45	12	63
BMP 5	1.66	1692	36	2.2	21	12	30
BMP 6	4.444	4347	36	2.4	21	12	31.5
BMP 7	3.206	3567	48	2	21	12	37.5

Notes:

(1): Area of amended soil equal to area of gravel. 18" thick and in conformance with specifications listed on Fa·

(2): Gravel depth needed to comply with hydromodification purposes

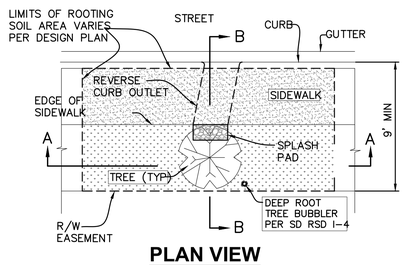
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.5 \cdot Q_2$).

(4): Depth of ponding beneath riser structure's surface spillway.

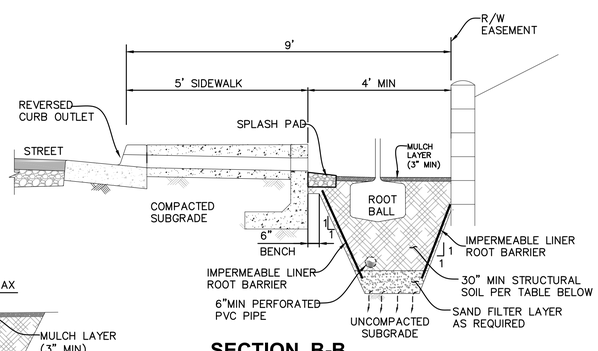
(5): Overflow length, the internal perimeter of the riser internal dimensions

(6): Total surface depth of BMP from top crest elevation to surface invert.

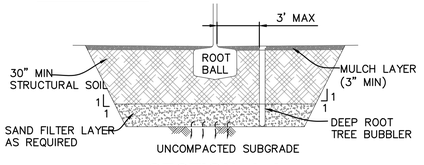
(7): Tributary area to basin not including area of BMP.



PLAN VIEW



SECTION B-B



SECTION A-A

NTS

STRUCTURAL SOIL					
BSM COMPOSITION	SAND	SANDY LOAM			COMPOST
		SAND	SILT	CLAY	
VOLUME	65%	20%			15%
WEIGHT	75–80%	10% MAX		3% MAX	9% MAX

TYPICAL TREE WELL DETAILS

REGISTERED PROFESSIONAL ENGINEER MELLOR R. LANDY No. 81085 Exp. 09-30-19 CIVIL STATE OF CALIFORNIA

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ENGINEER OF WORK | OTHER APPROVAL | CITY APPROVAL

SHEET 2 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:

MARJA ACRES

DRAWING NAME:

DMA MAP EXHIBIT

DATE: 3/14/2019 – FILE NAME: S:\PROJECTS\12764 Marja Acres\CIVIL\REPORTS\SWQMP\DMA MAP 2019.dwg

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

Category	#	Description	*i*	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	DMA 9C	unitless
	1	Basin Drains to the Following BMP Type	n/a	unitless
	2	85th Percentile 24-hr Storm Depth	0.60	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	5,959	sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)		sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	4,720	sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)		sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)		sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)		sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)		sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	Yes	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)		sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)		sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)		sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	19	Number of Tree Wells Proposed per SD-A	1	#
	20	Average Mature Tree Canopy Diameter	26	ft
	21	Number of Rain Barrels Proposed per SD-E		#
	22	Average Rain Barrel Size		gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series		unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas		percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	10,679	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.55	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	unitless
	31	Initial Weighted Runoff Factor	0.55	unitless
	32	Initial Design Capture Volume	294	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	sq-ft
	34	Total Pervious Dispersion Area	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.55	unitless
	38	Design Capture Volume After Dispersion Techniques	294	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	316	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.00	unitless
	42	Final Effective Tributary Area	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	316	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	0	cubic-feet

Worksheet B.1-1 General Notes:

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

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description	*i*	Units
General Info	0	Drainage Basin ID or Name	DMA 9C	unitless
	1	85th Percentile Storm Depth	0.60	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	in/hr
	3	Total Tributary Area	10,679	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	534	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.55	unitless
	6	Initial Design Capture Volume	294	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	cubic-feet
	8	Tree Well and Rain Barrel Reductions	316	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	0	square feet
	10	Final Design Capture Volume Tributary to BMP	0	cubic-feet
	11	Basin Drains to the Following BMP Type	n/a	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	0	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	1.07	fraction
	14	Percent of Average Annual Runoff Retention Provided	82.3%	%
	15	Percent of Average Annual Runoff Retention Required	4.5%	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	cubic-feet

Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted

-Congratulations, all specified drainage basins and BMPs are in compliance with stormwater pollutant control requirements. Include 11x17 color prints of this summary sheet and supporting worksheet calculations as part of the

False

DMA-8C

Design Capture Volume		Worksheet B-2.1		
1	85th Percentile 24-hr storm depth from Figure B.1-1	d=	0.6	inches
2	Areas tributary to BMP(s)	A=	0.299	acres
3	Runoff Factor	C=	0.66	unitless
4	Street Trees Reduction Volume	TCV=	0	cubic-feet
5	Rain Barrels Reduction Volume	RCV=	0	cubic-feet
6	Calculated DCV	DCV=	430	cubic-feet

DMA-8C

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV	430	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	$DCV_{flow-thru}$	430	cubic-feet
5	Adjustment factor (Line 4 / Line 1)	AF=	1	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP (s)	A=	0.299	acres
8	Runoff Factor	C=	0.66	unitless
9	Calculate Flow Rate = 1.5 AF x (C x i x A)	Q=	0.059	cfs

Modular Wetlands System 4'x6' has a flow treatment rate of 0.073 cfs which exceeds the treatment flow rate calculated above.

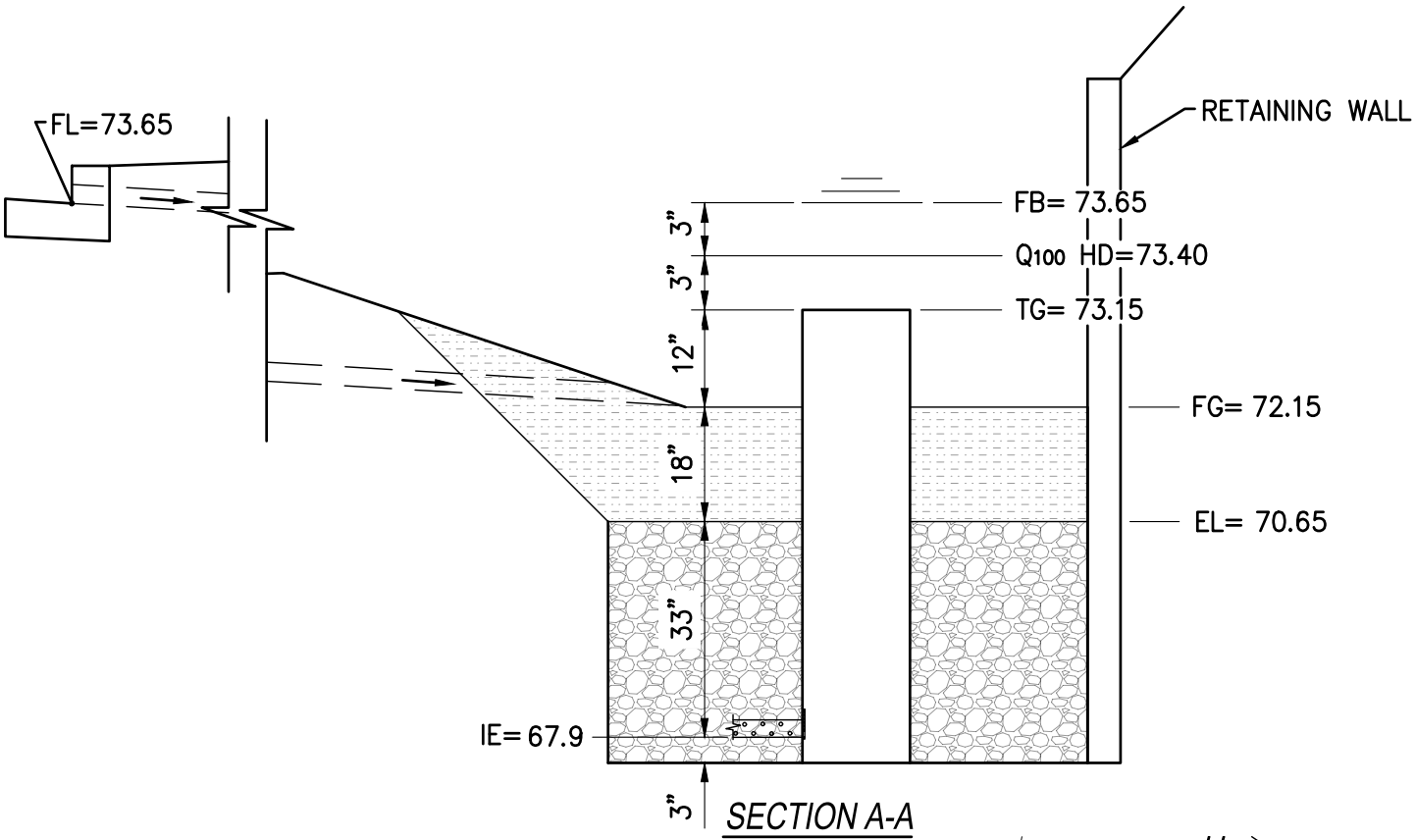
DMA-9C (Only the portion of this DMA Area that drains to MWS)

Design Capture Volume		Worksheet B-2.1		
1	85th Percentile 24-hr storm depth from Figure B.1-1	d=	0.6	inches
2	Areas tributary to BMP(s)	A=	0.192	acres
3	Runoff Factor	C=	0.75	unitless
4	Street Trees Reduction Volume	TCV=	0	cubic-feet
5	Rain Barrels Reduction Volume	RCV=	0	cubic-feet
6	Calculated DCV	DCV=	314	cubic-feet

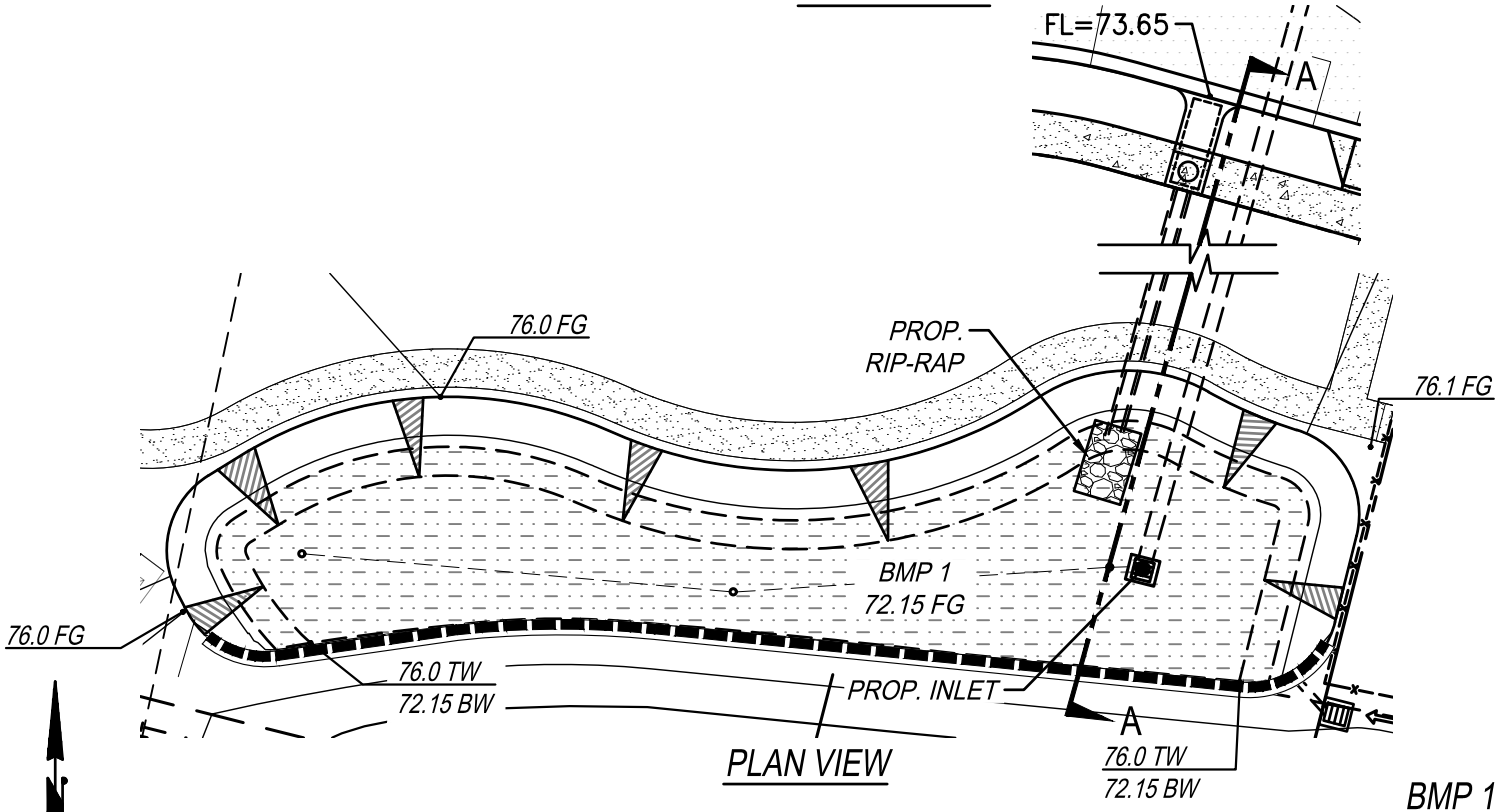
DMA-9C (Only the portion of this DMA Area that drains to MWS)

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV	314	cubic-feet
2	DCV retained	$DCV_{retained}$	0	cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$	0	cubic-feet
4	DCV requiring flow-thru (Line 1 - Line 2 - 0.67*Line 3)	$DCV_{flow-thru}$	314	cubic-feet
5	Adjustment factor (Line 4 / Line 1)	AF=	1	unitless
6	Design rainfall intensity	i=	0.2	in/hr
7	Area tributary to BMP (s)	A=	0.192	acres
8	Runoff Factor	C=	0.75	unitless
9	Calculate Flow Rate = 1.5 AF x (C x i x A)	Q=	0.043	cfs

Modular Wetlands System 4'x4' has a flow treatment rate of 0.052 cfs which exceeds the treatment flow rate calculated above.



SECTION A-A



PLAN VIEW

BMP 1

SCALE: 1" = 20'

20 10 0 20

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2888 LOKER AVENUE EAST SUITE 217
CARLSBAD, CA 92010

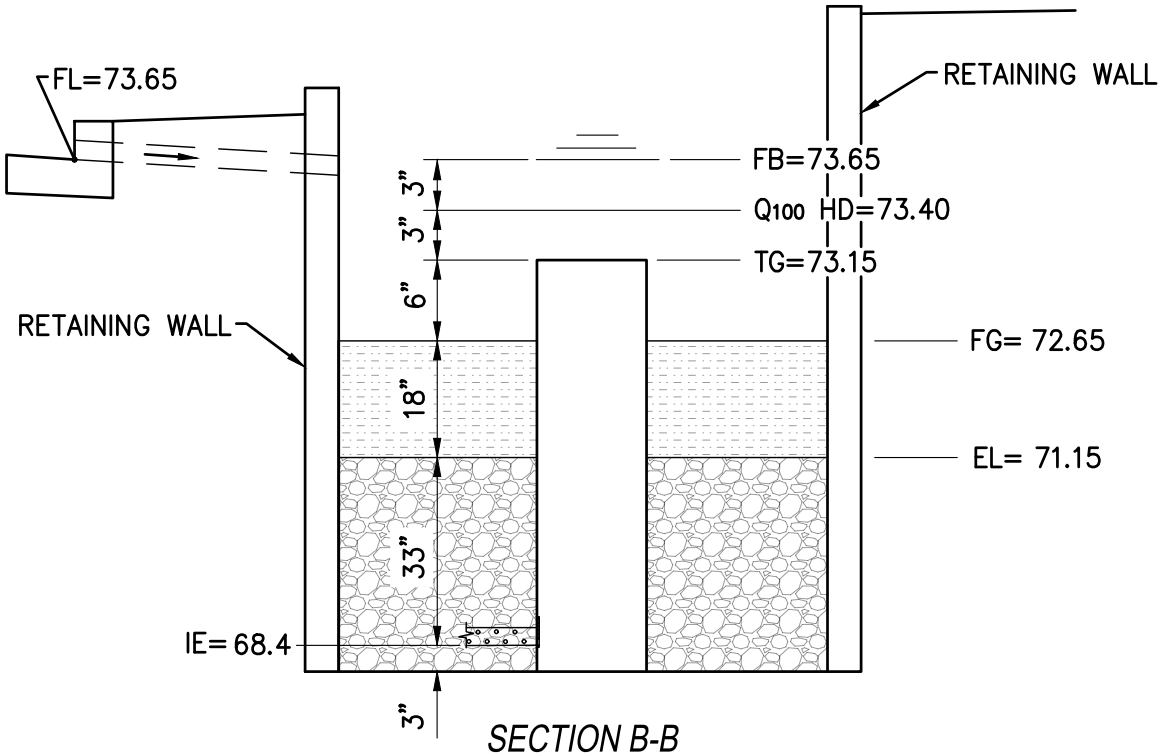
MARJA ACRES

BMP DETAILS

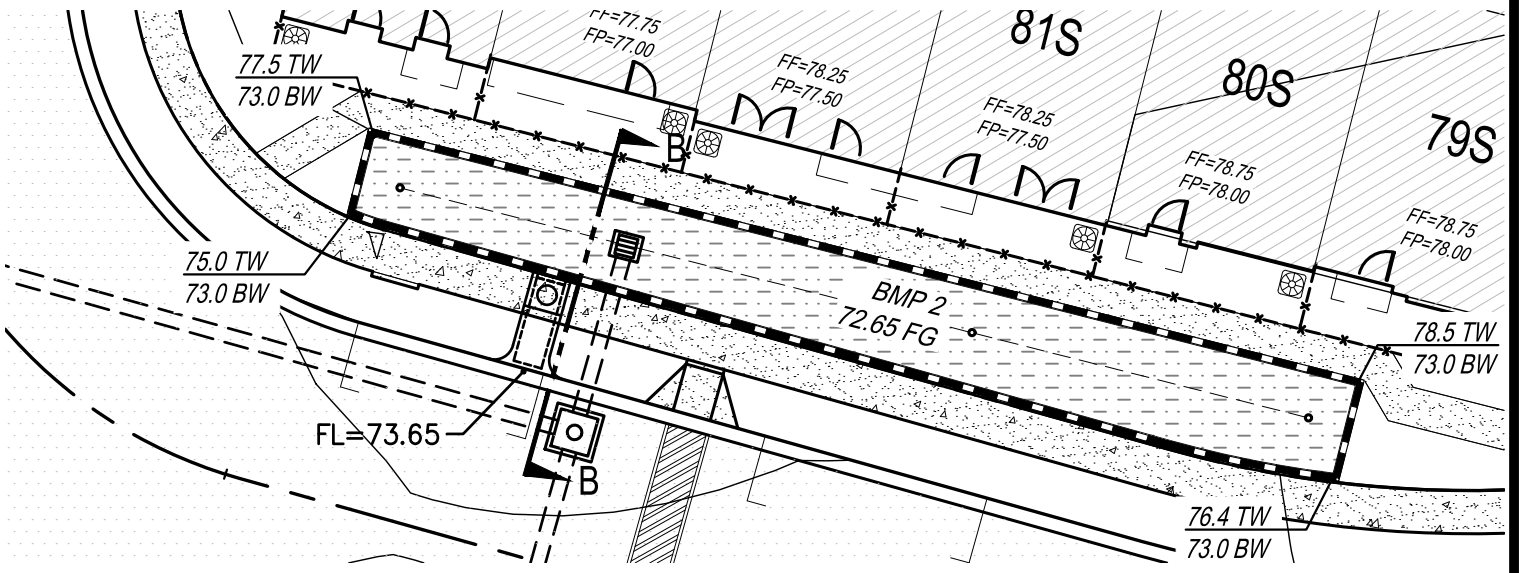
DATE: 2/28/19

DRAWING:

SHEET 1 OF 7



SECTION B-B



PLAN VIEW

BMP 2

SCALE: 1" = 20'

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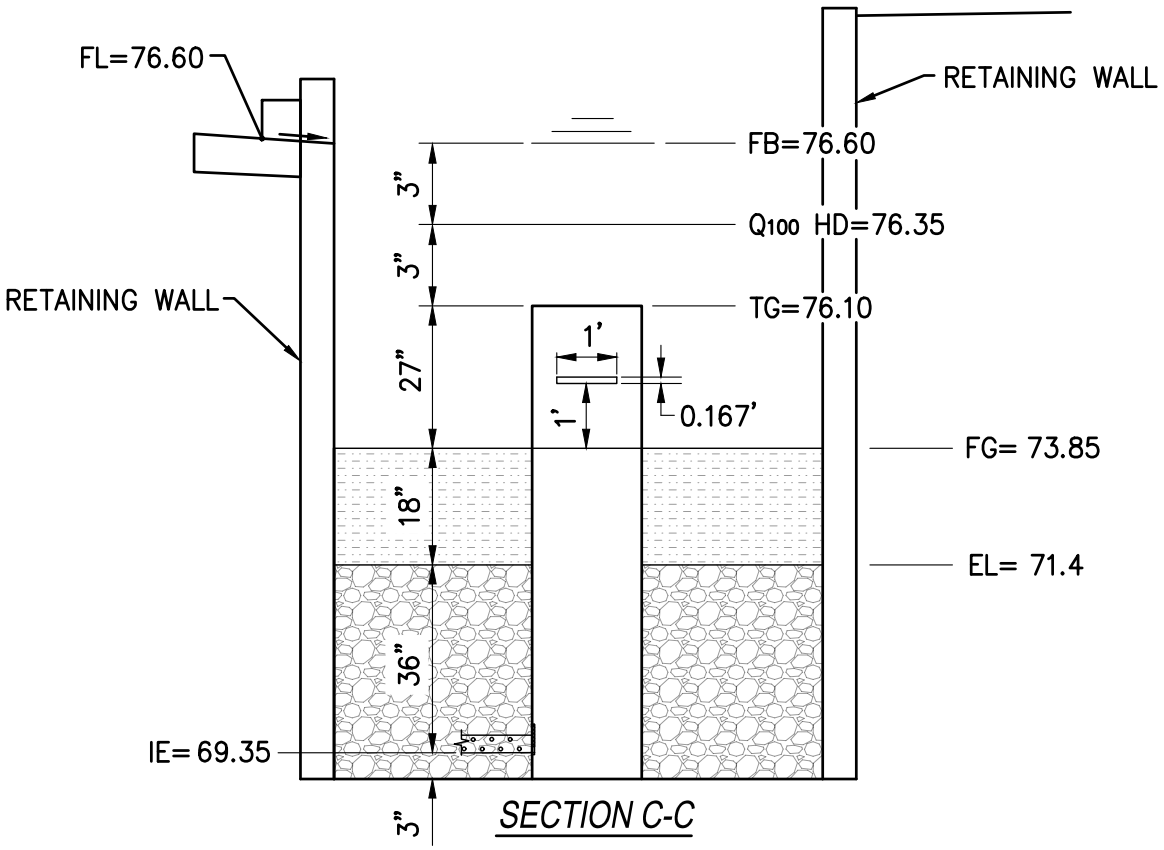
MARJA ACRES

BMP DETAILS

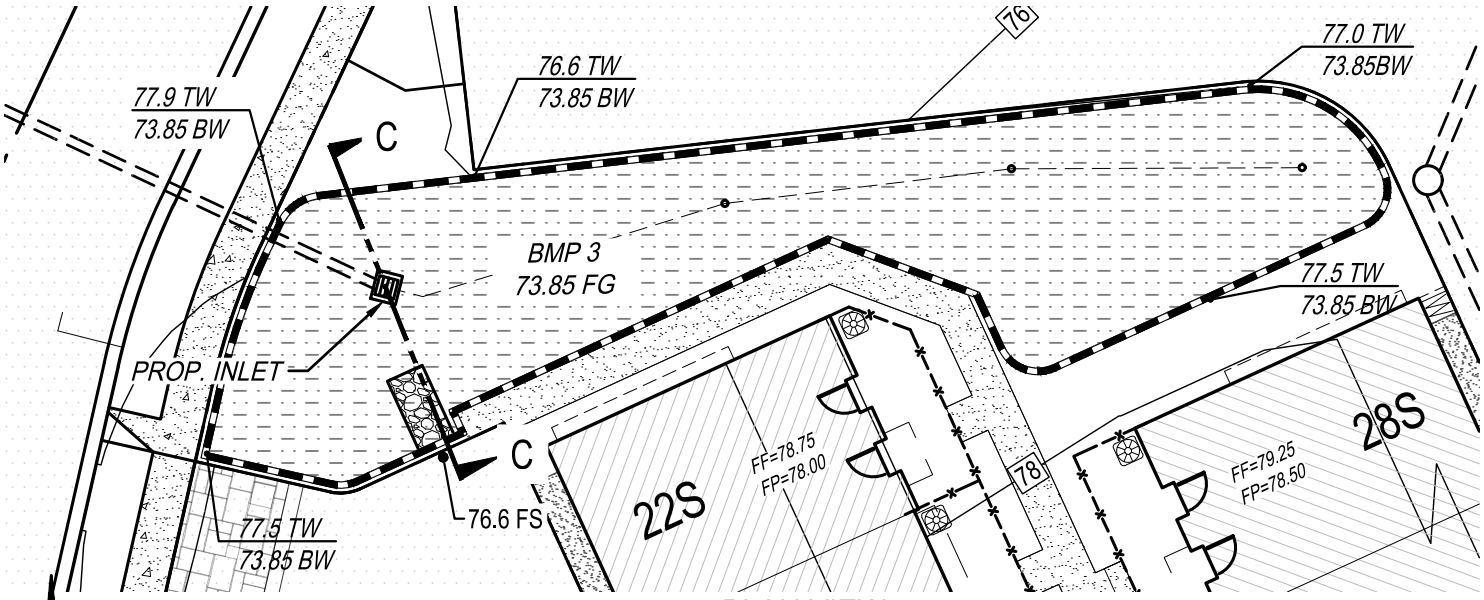
DATE: 2/26/19

DRAWING:

SHEET 2 OF 7



SECTION C-C



PLAN VIEW

BMP 3

SCALE: 1" = 20'

20 10 0 20

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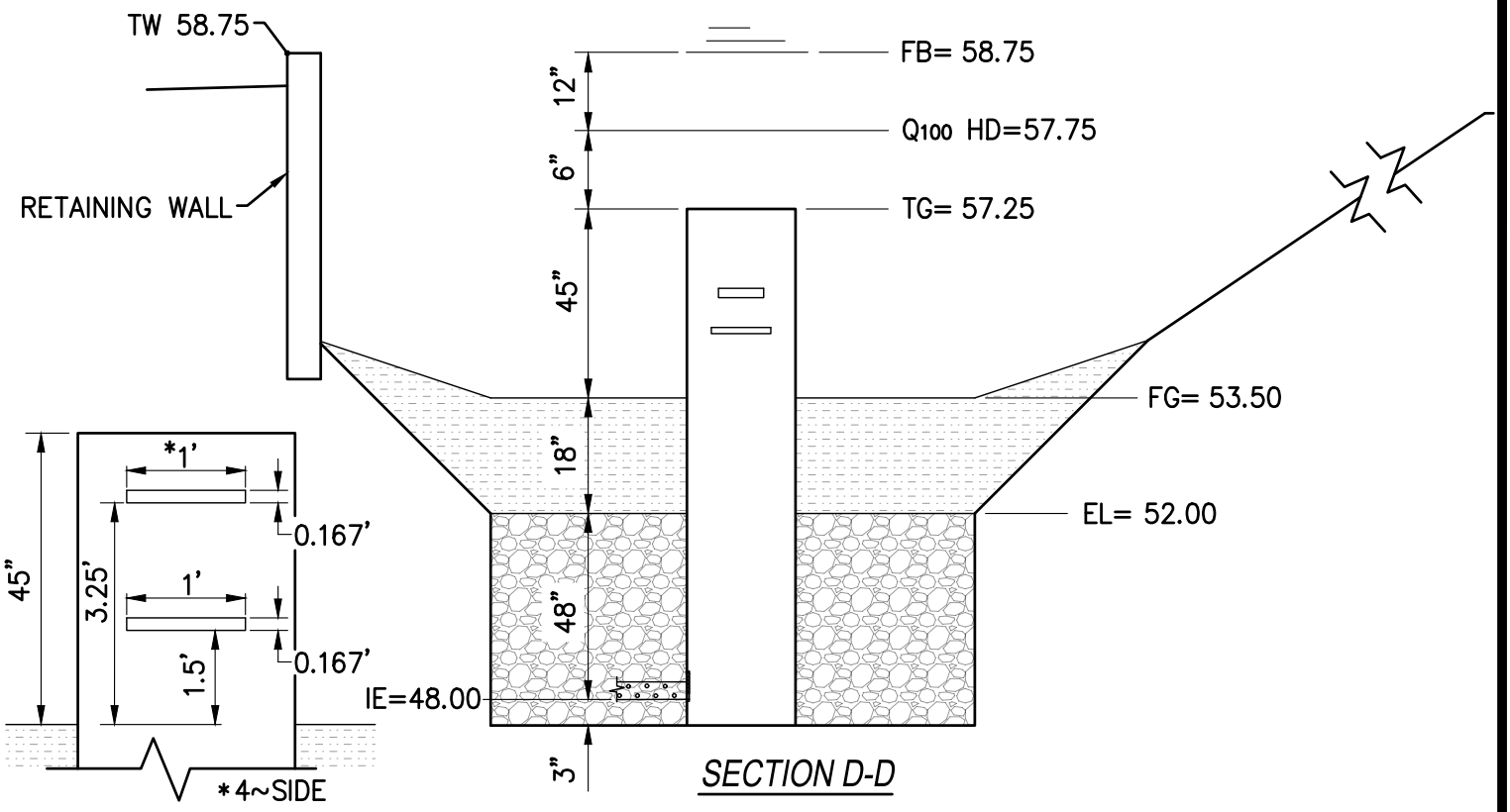
MARJA ACRES

BMP DETAILS

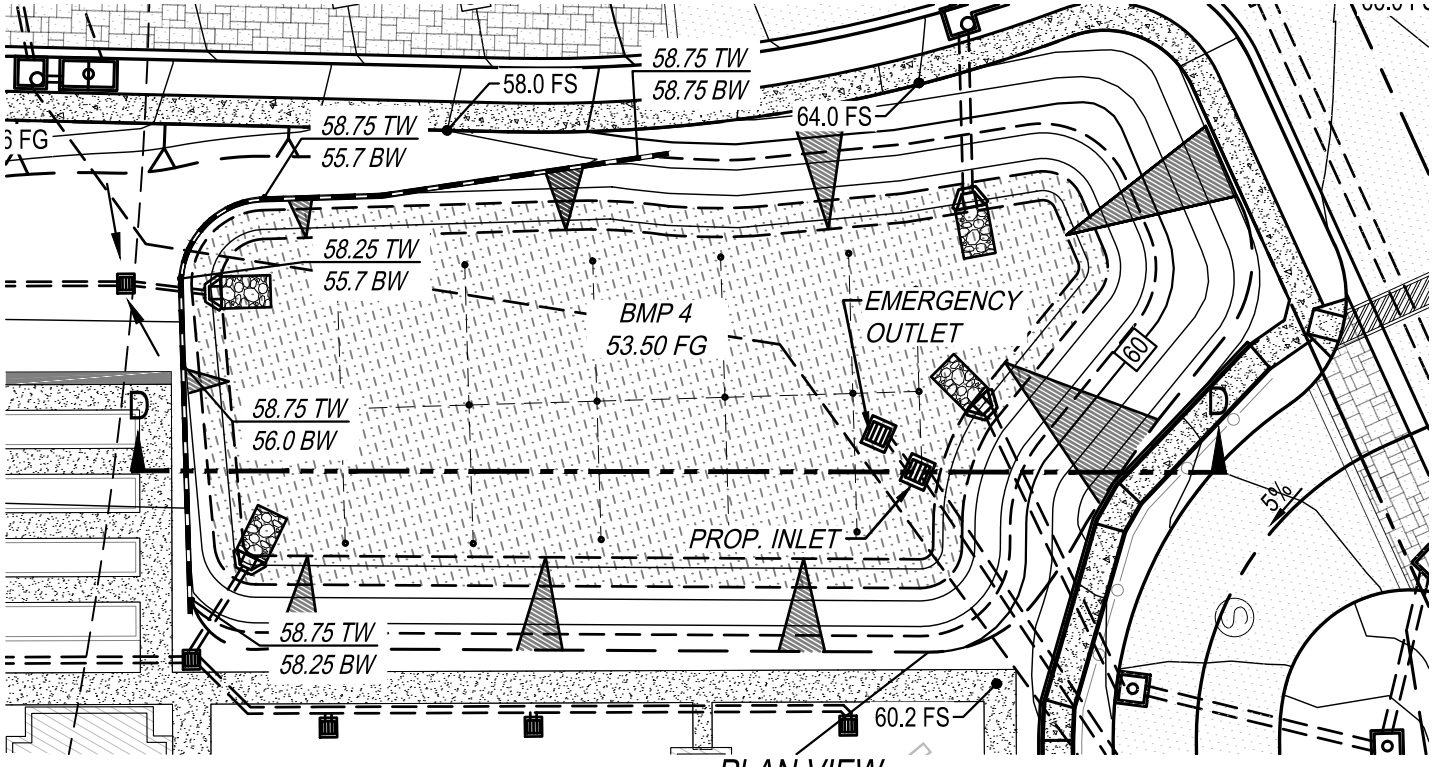
DATE: 2/26/19

DRAWING:

SHEET 3 OF 7



SECTION D-D



PLAN VIEW

BMP 4

SCALE: 1" = 30'

30 15 0 30

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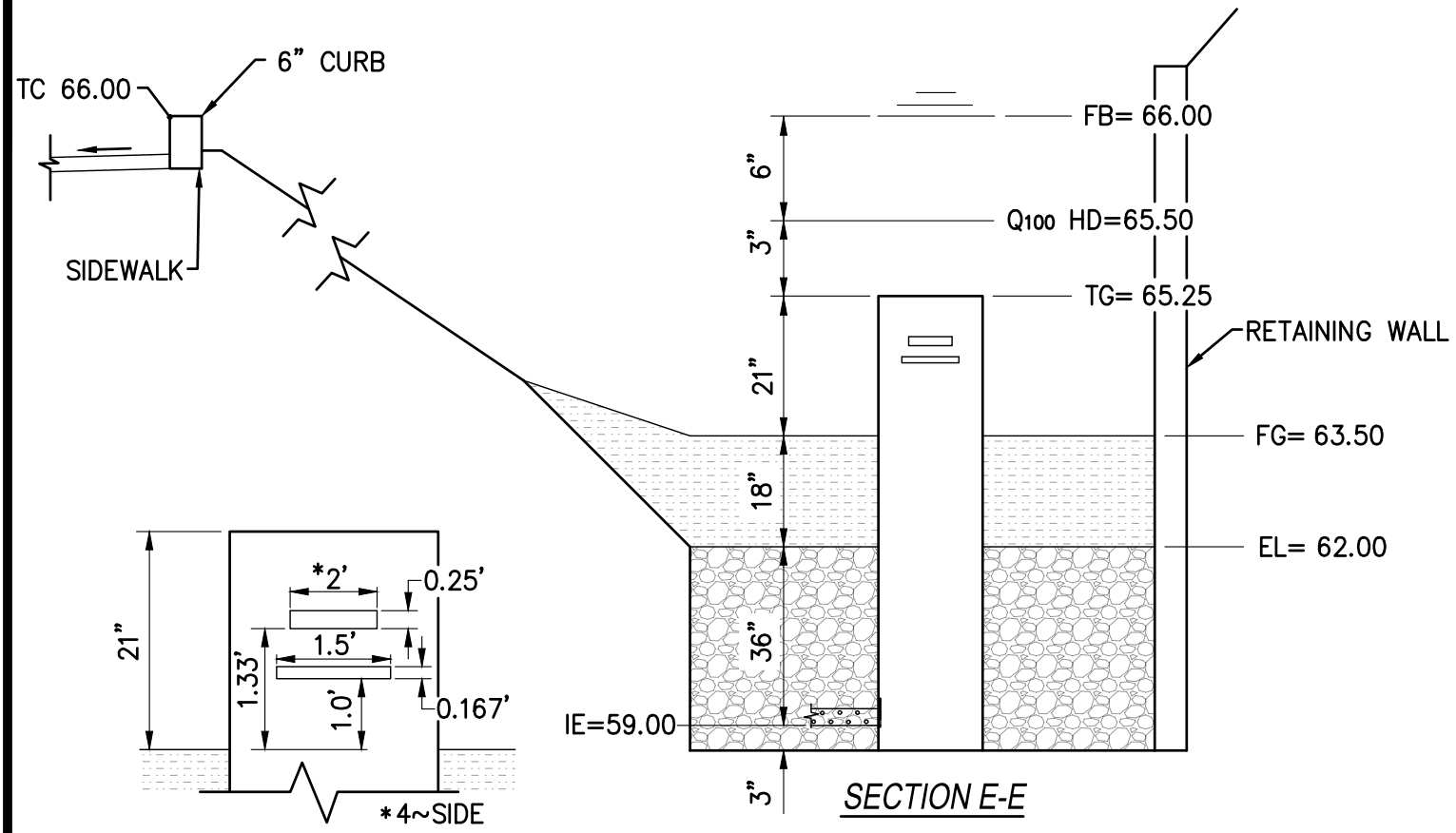
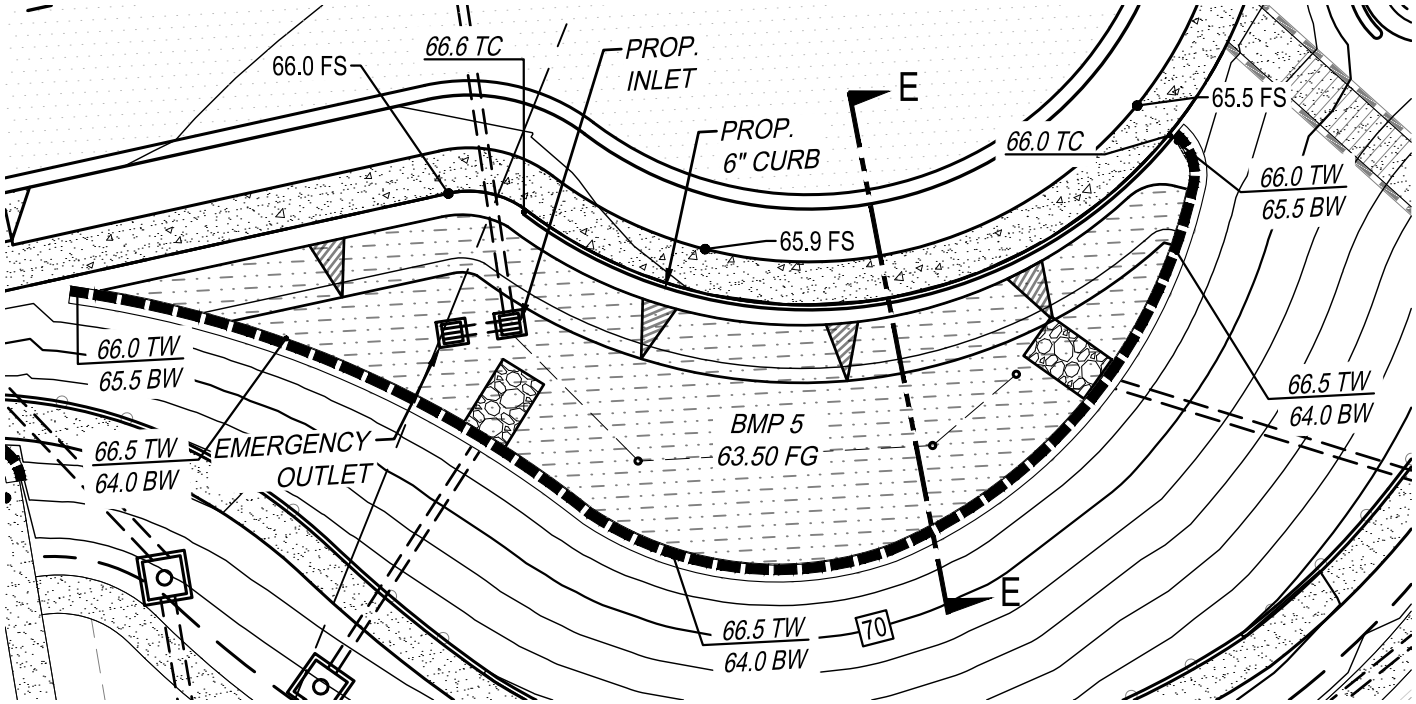


SECTION E-E



PLAN VIEW

BMP 5

SCALE: 1" = 20'

20 10 0 20

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2888 LOKER AVENUE EAST SUITE 217
CARLSBAD, CA 92010

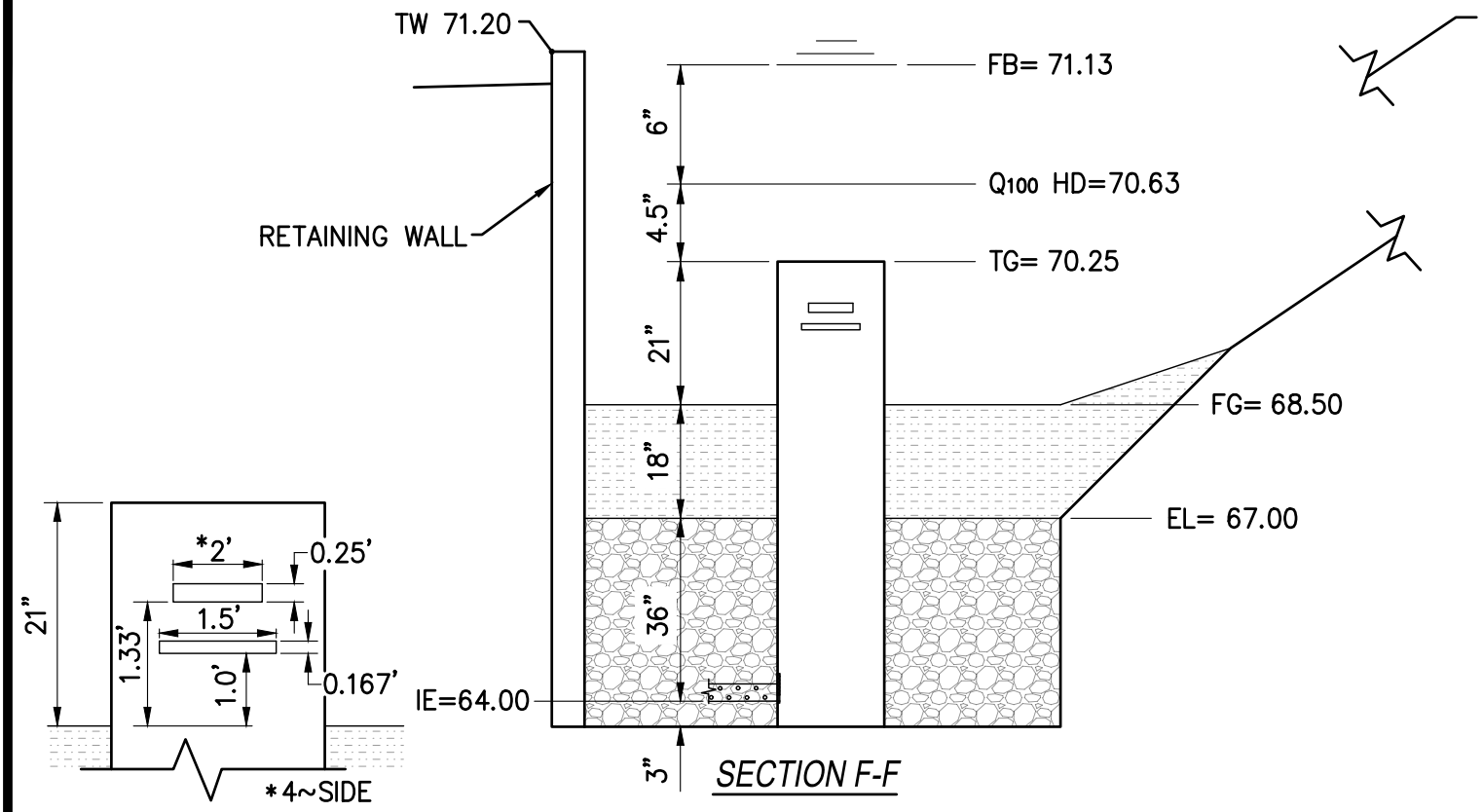
MARJA ACRES

BMP DETAILS

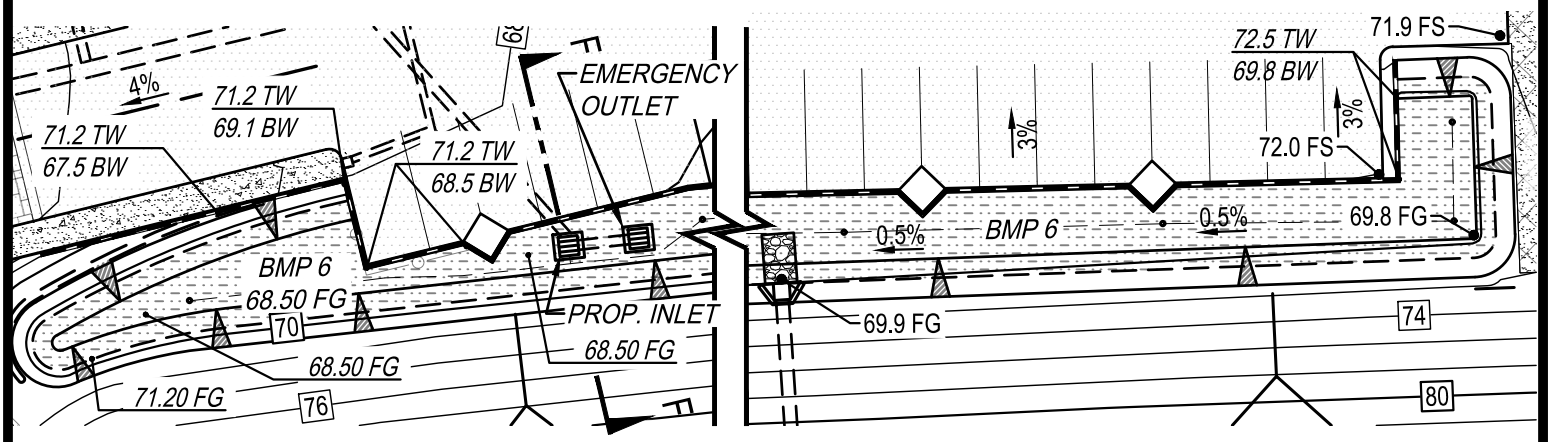
DATE: 2/28/19

DRAWING:

SHEET 5 OF 7



SECTION F-F



PLAN VIEW

BMP 6

SCALE: 1" = 30'

30 15 0 30

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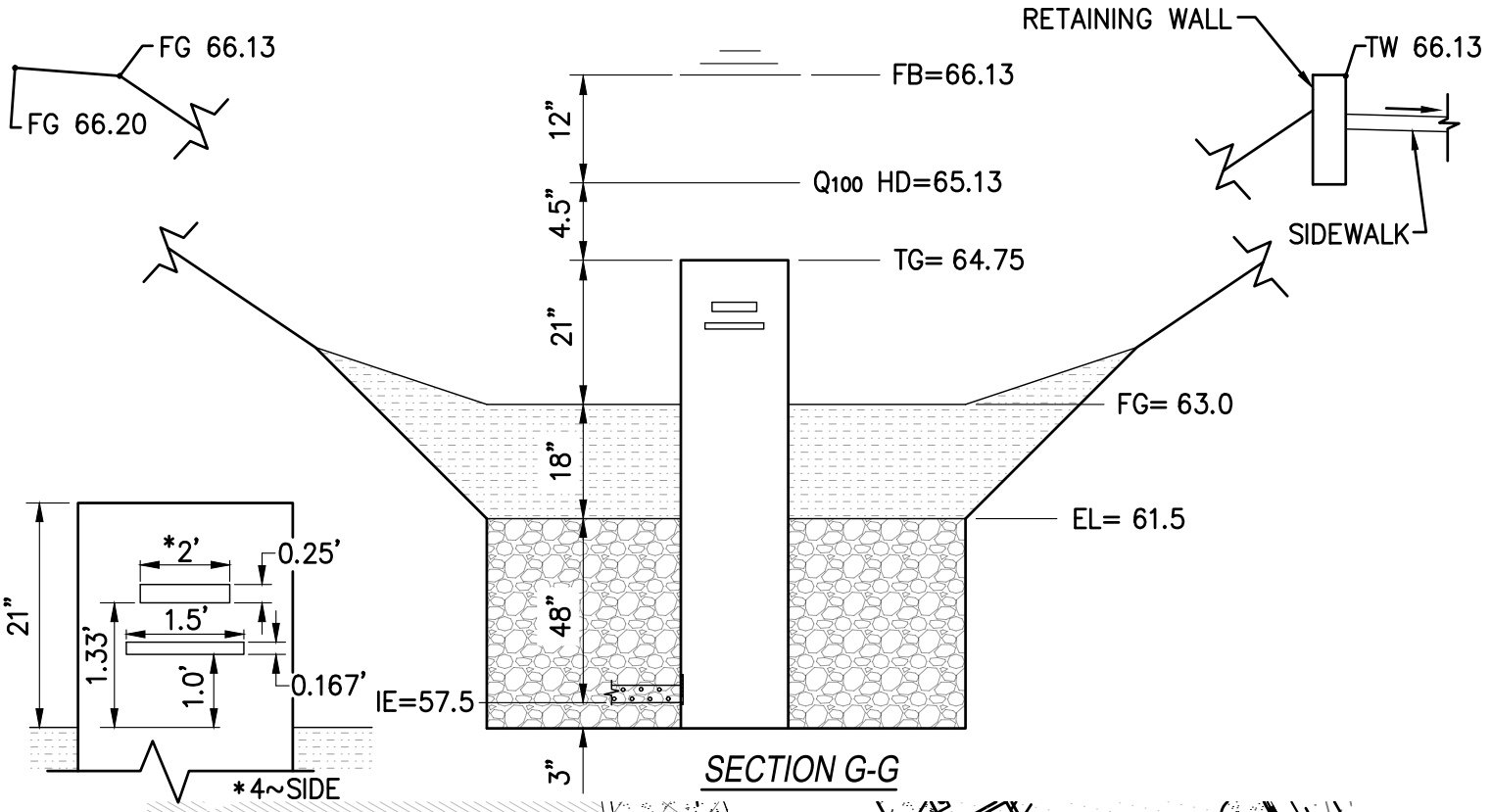
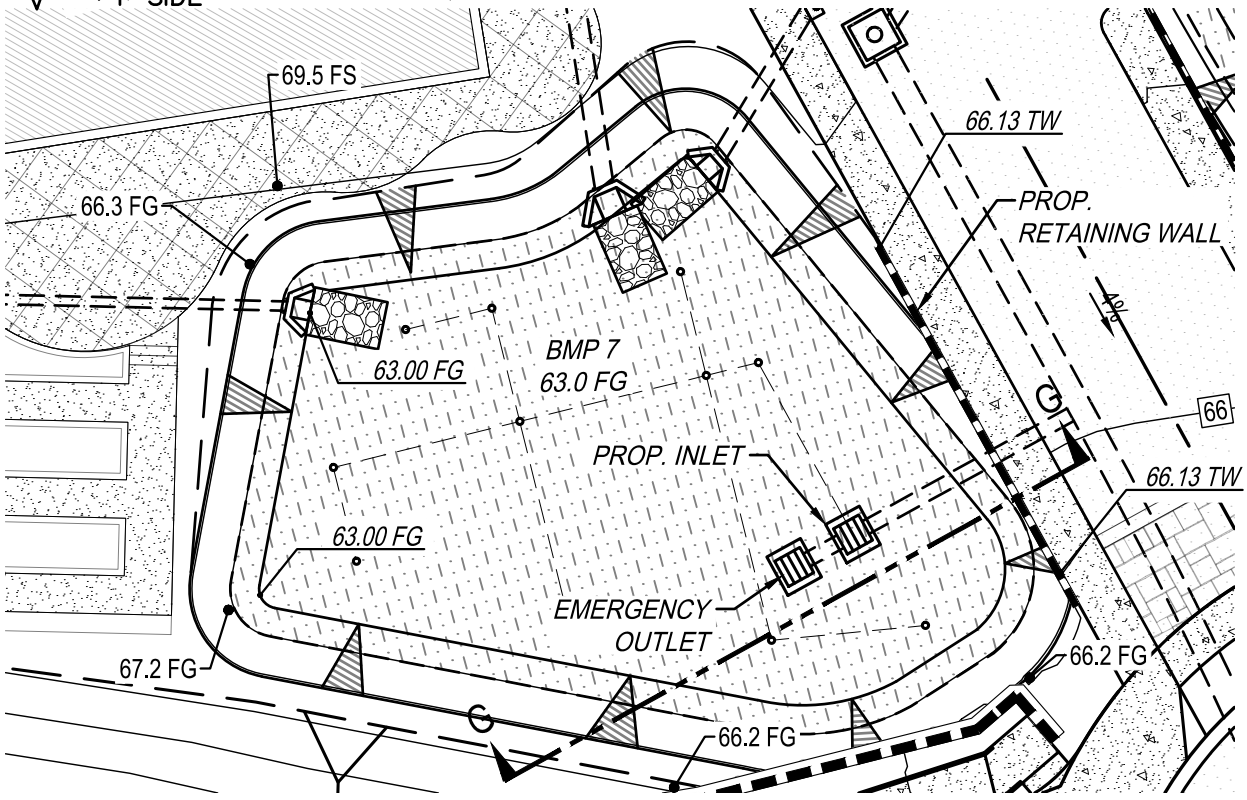
BMP DETAILS

DATE: 2/28/19

DRAWING:



SECTION G-G



PLAN VIEW

BMP 7

SCALE: 1" = 20'

20 10 0 20

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MARJA ACRES

BMP DETAILS

DATE: 2/28/19

DRAWING:

SHEET 7 OF 7

ATTACHMENT 1B

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

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	25,107	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	180	#
	3	Total Planted Area within Development	300,499	sq-ft
	4	Water Use Category for Proposed Planted Areas	Moderate	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	Yes	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	Yes	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	No	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.86	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	336	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	196.52	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	1,356	cubic-feet
	13	Total Anticipated Use Over 36 Hours	1,691	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.07	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	No	yes/no
Result	18	Feasibility Category	5	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

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

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

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

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

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

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

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

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

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*x*	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7		unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration		unitless
	2	85th Percentile 24-hr Storm Depth	0.60	0.60	0.60	0.60	0.60	0.60	0.60		inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	0.000		in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	21,479	28,368	25,769	176,018	42,286	133,814	96,696		sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)									sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	26,656	11,983	10,254	97,220	32,010	67,238	46,374		sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)									sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)									sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)									sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)									sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)									sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)									sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)									sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)									sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)									sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)									sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)									sq-ft
	19	Number of Tree Wells Proposed per SD-A									#
	20	Average Mature Tree Canopy Diameter									ft
	21	Number of Rain Barrels Proposed per SD-E									#
	22	Average Rain Barrel Size									gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	No	No	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series									unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas									percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	48,135	40,351	36,023	273,238	74,296	201,052	143,070	0	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.46	0.66	0.67	0.62	0.56	0.63	0.64	0.00	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	31	Initial Weighted Runoff Factor	0.46	0.66	0.67	0.62	0.56	0.63	0.64	0.00	unitless
	32	Initial Design Capture Volume	1,107	1,332	1,207	8,470	2,080	6,333	4,578	0	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.46	0.66	0.67	0.62	0.56	0.63	0.64	n/a	unitless
	38	Design Capture Volume After Dispersion Techniques	1,107	1,332	1,207	8,470	2,080	6,333	4,578	0	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.46	0.66	0.67	0.62	0.56	0.63	0.64	0.00	unitless
	42	Final Effective Tributary Area	22,142	26,632	24,135	169,408	41,606	126,663	91,565	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	1,107	1,332	1,207	8,470	2,080	6,333	4,578	0	cubic-feet

Worksheet B.1-1 General Notes:

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

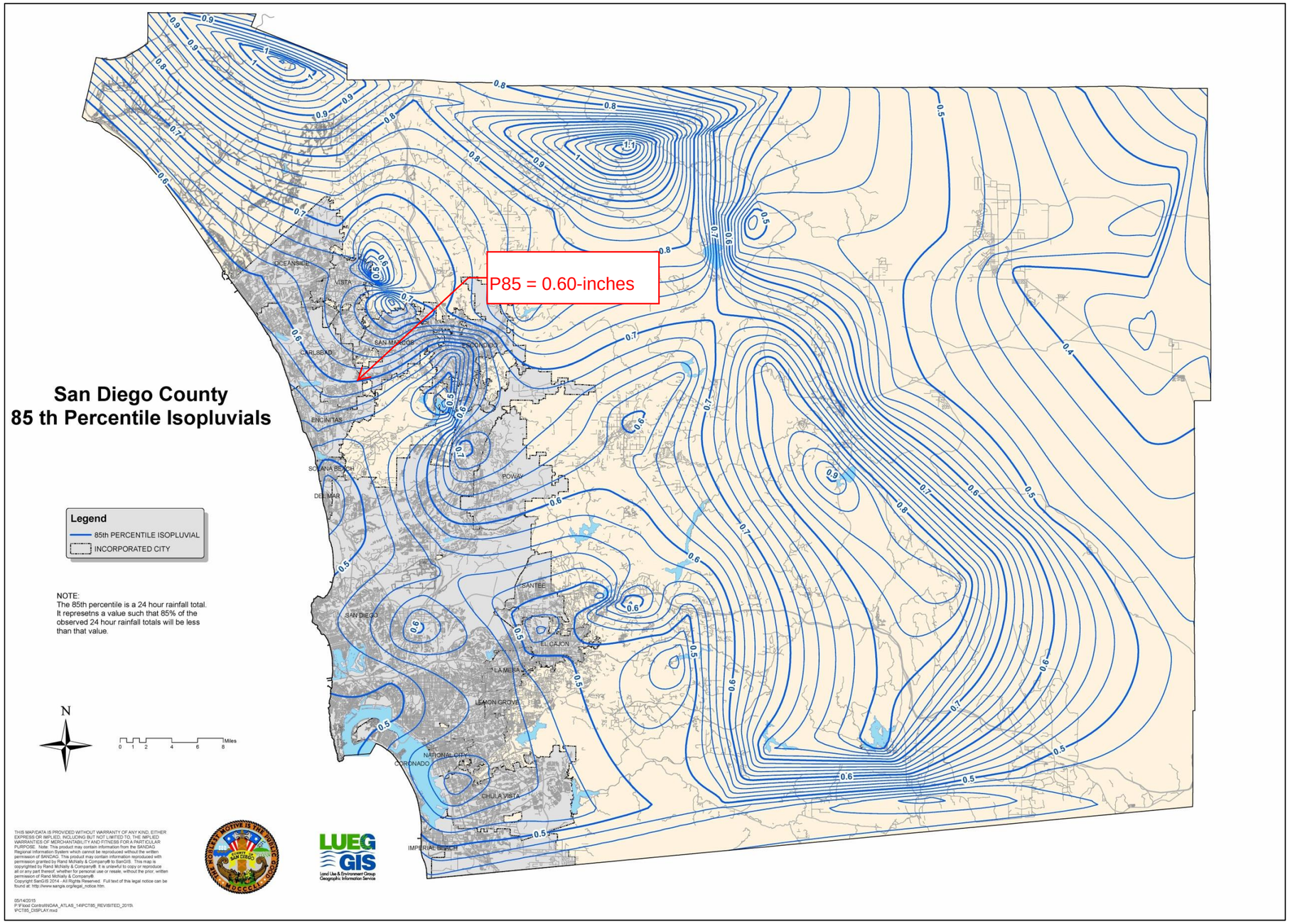


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

ATTACHMENT 1C

Harvest and Use Feasibility Checklist	Form I-7

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.

Toilet and urinal flushing demand: $\left(\frac{9.3gal}{person-day}\right)\left(\frac{1ft^3}{7.48gal}\right)(302\ Building)\left(\frac{3\ person}{buidling}\right)(1.5day) = 1670ft^3$

Irrigation demand: $\left(\frac{1470gal}{acre-1.5day}\right)\left(\frac{1ft^3}{7.48gal}\right)(1.5day)(7.85acre) = 2{,}314ft^3$

Total: 3984 cubic-feet

3. Calculate the DCV using worksheet B-2.1.

DCV= 26,578 cubic-feet

3a. Is the 36-hour demand greater than or equal to the DCV?	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36-hour demand less than 0.25DCV?
☐ Yes / ☒ No ⇨ ⇩	☐ Yes / ☒ No ⇨ ⇩	☒ 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. 0.25*(8629)>468 2157>468

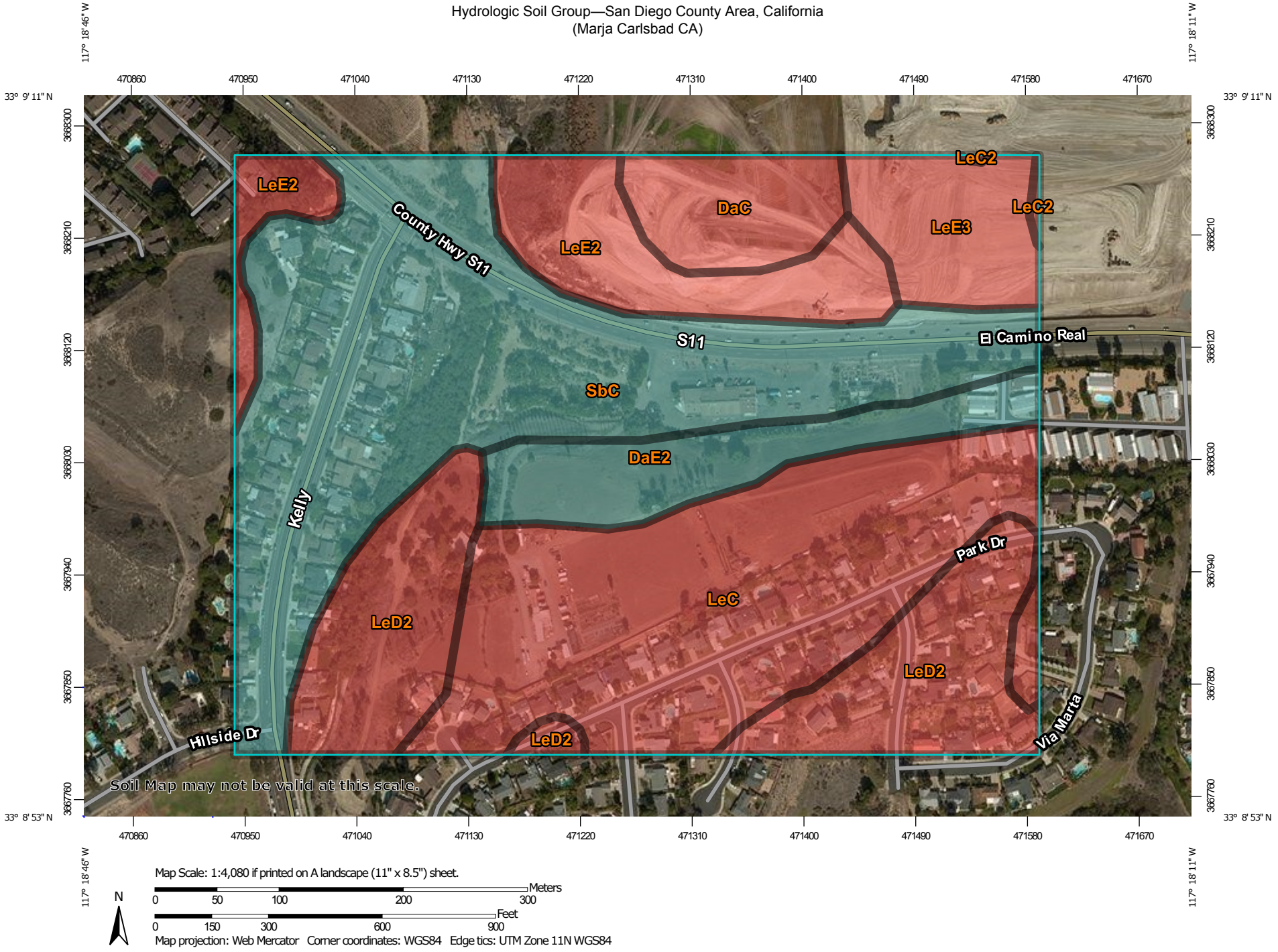
Is harvest and use feasible based on further evaluation?

☐ Yes, refer to Appendix E to select and size harvest and use BMPs.
☒ No, select alternate BMPs.

Note: All rainwater harvest and use must comply with the California Plumbing Code (Sections 1702.9.3, 1702.9.4, etc.).

ATTACHMENT 1D

Hydrologic Soil Group—San Diego County Area, California
(Marja Carlsbad CA)



Map Scale: 1:4,080 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DaC	Diablo clay, 2 to 9 percent slopes	D	3.6	4.7%
DaE2	Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT, MLRA 20	C	5.4	7.0%
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes	D	19.3	25.0%
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded	D	0.1	0.1%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	D	12.2	15.7%
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded	D	7.0	9.1%
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded	D	4.1	5.3%
SbC	Salinas clay loam, 2 to 9 percent slopes	C	25.5	33.0%
Totals for Area of Interest			**77.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Categorization of Infiltration Feasibility Condition — Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

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

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

Provide basis:

The United States Department of Agriculture (USDA) has evaluated the infiltration rate of natural surface soils as ranging from 0.00 to about 0.57 inches/hr (Hydrologic Soil Groups C and D). Furthermore, future development will result in the removal/recompaction of a natural surface soils, and/or the presence of cut areas exposing relatively dense formational soils consisting of clays, sandy clays, and sandstone. The resultant infiltration rates for these much denser (and proportionally less permeable) formational materials would be expected to be very near, or below the rate evaluated by the USDA. Artificial fill, created through removal/recompaction of onsite soils would also be considered to be of a similar, very low permeability. See text for other related discussions and references.

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

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

Provide basis:

The limited permeability of formational soils will tend to result in the lateral migration of water and saturated conditions at, or near the surface, increasing the potential for distress to foundations, floor slabs, etc. Onsite soils are expansive. Saturation of some onsite soils can likely generate adverse uplift pressures on floor slabs, or lightly loaded foundation. There is an increased potential for the creation of perched groundwater (mounding) conditions along zones of contrasting permeabilities, including shallow cut/fill contacts, and transitions between relatively clayey and sandy formational materials, and shallow groundwater in low lying areas. Due to the likelihood of strong permeability contrasts between formation and fill, utility trenches can potentially act as french drains and provide conduits for the movement of excessive moisture beneath the structure(s). Graded slopes in close proximity to infiltration areas can become saturated, losing soil strength and becoming more susceptible to slope instability and failure. See text for other related discussions and references.

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

Worksheet C.4.1 Page 2 of 4			
Criteria	**Screening Question**	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensible evaluation of the factors presented in Appendix C.3.		X
Provide basis: While this study did no include an environmental assessment, visual observation did not indicate the presence of potential contaminants. The infiltration rate is generally less than 0.5 inches per hour. The regional groundwater table is considered a factor in the development of this site, the creation of a shallow "perched" water table can occur through infiltration. 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 a change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: The infiltration rate is generally anticipated to be less than 0.5 inches per hour. The site currently drains offsite and no runoff appears to be retained onsite. The regional groundwater table is considered a factor in the development of this site. 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 the answers to rows 1-4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		

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

Worksheet C.4.1 Page 3 of 4

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

Would infiltration of water in an 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:

No. Onsite soils are typically fine grained and clayey. The United States Department of Agriculture (USDA) has evaluated the infiltration rate of natural surface soils in the vicinity to be as low as 0.00. Subsequent development of the site will likely result in the removal/recompaction/densification of a natural surface soils, or the exposure of denser and less permeable formational soils at depth. The resultant infiltration rates for these much denser formational materials would be expected to be very near, or below the rate evaluated by the USDA. See text of report for other related discussions and references.

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

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

Provide basis:

No. The limited permeability of the relatively dense, fine grained formational soils will tend to result in the lateral migration of water and saturated conditions at, or near the surface, increasing the potential for distress to foundations, floor slabs, etc. Onsite soils are expansive, saturation of onsite soils may generate adverse uplift pressures on floor slabs, or lightly loaded foundation. There is an increased potential for the creation of perched groundwater (mounding) conditions along zones of contrasting permeabilities, including shallow cut/fill contacts, and transitions between clayey and sandy formational materials within the sedimentary bedrock, and shallow groundwater in low lying areas. Due to the strung permeability contrast between formation and fill, utility trenches can potentially act as french drains and provide conduits for the movement of excessive moisture beneath the structure(s). Graded slopes in close proximity to infiltration areas can become saturated, losing soil strength and becoming more susceptible to slope instability and failure. See text of report for other related discussions and references.

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

Worksheet C.4.1 Page 4 of 4			
Criteria	**Screening Question**	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: While the regional groundwater table is not considered a factor in the development of this site, the creation of a shallow "perched" water table can occur and increase the potential for distress to the structure(s) due to water vapor transmission through foundations, slabs, and any resultant corrosive effects on metal conduit in trenches. See text of report for other related discussions and references. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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: The site currently drains offsite and no runoff appears to be retained onsite. The regional groundwater table is not considered a factor in the development of this site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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**

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

ATTACHMENT 1E

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	Units
BMP Inputs	0	Drainage Basin ID or Name	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	2	Effective Tributary Area	22,142	26,632	24,135	169,408	41,606	126,663	91,565	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.030	0.030	0.030	0.030	0.030	0.030	0.030	ratio
	4	Design Capture Volume Tributary to BMP	1,107	1,332	1,207	8,470	2,080	6,333	4,578	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined	Lined	Lined	Lined	Lined	Lined	Lined	unitless
	6	Provided Biofiltration BMP Surface Area	1,949	1,098	2,360	7,724	1,692	4,347	3,567	sq-ft
	7	Provided Surface Ponding Depth	12	6	12	18	12	12	21	inches
	8	Provided Soil Media Thickness	18	18	18	18	18	18	18	inches
	9	Provided Depth of Gravel Above Underdrain Invert	33	33	36	48	36	36	48	inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	0.80	0.90	0.90	2.30	2.20	2.40	2.00	inches
	11	Provided Depth of Gravel Below the Underdrain	3	3	3	3	3	3	3	inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	15	Effective Retention Depth	0.90	0.90	0.90	0.90	0.90	0.90	0.90	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	120	120	120	120	120	120	hours
	17	Volume Retained by BMP	146	82	177	579	127	326	268	cubic-feet
	18	Fraction of DCV Retained	0.13	0.06	0.15	0.07	0.06	0.05	0.06	ratio
	19	Portion of Retention Performance Standard Satisfied	0.15	0.07	0.17	0.08	0.07	0.06	0.07	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.07	0.03	0.08	0.04	0.03	0.03	0.03	ratio
	21	Design Capture Volume Remaining for Biofiltration	1,030	1,292	1,110	8,131	2,018	6,143	4,441	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.0384	0.0462	0.0497	0.3650	0.2956	0.3515	0.2812	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.85	1.82	0.91	2.04	7.55	3.49	3.41	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	0.85	1.82	0.91	2.04	5.00	3.49	3.41	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	5.11	10.90	5.46	12.25	30.00	20.96	20.43	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	28.80	22.80	30.00	40.80	30.00	30.00	43.80	inches
	29	Drawdown Time for Surface Ponding	14	3	13	9	2	3	6	hours
	30	Drawdown Time for Effective Biofiltration Depth	34	13	33	20	6	9	13	hours
	31	Total Depth Biofiltered	33.91	33.70	35.46	53.05	60.00	50.96	64.23	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	1,545	1,938	1,665	12,197	3,027	9,215	6,662	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	1,545	1,938	1,665	12,197	3,027	9,215	6,662	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	773	969	833	6,098	1,514	4,607	3,331	cubic-feet
	35	Option 2 - Provided Storage Volume	773	969	833	6,098	1,514	4,607	3,331	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	-	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	cubic-feet

Worksheet B.5-1 General Notes:

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

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*x*	Units
General Info	0	Drainage Basin ID or Name	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	-	unitless
	1	85th Percentile Storm Depth	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	in/hr
	3	Total Tributary Area	48,135	40,351	36,023	273,238	74,296	201,052	143,070	-	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	2,407	2,018	1,801	13,662	3,715	10,053	7,154	-	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.46	0.66	0.67	0.62	0.56	0.63	0.64	-	unitless
	6	Initial Design Capture Volume	1,107	1,332	1,207	8,470	2,080	6,333	4,578	-	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	0	0	0	0	0	-	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	0	0	0	0	0	0	-	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	22,142	26,632	24,135	169,408	41,606	126,663	91,565	-	square feet
	10	Final Design Capture Volume Tributary to BMP	1,107	1,332	1,207	8,470	2,080	6,333	4,578	-	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	-	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	77	40	97	339	62	190	137	-	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.07	0.03	0.08	0.04	0.03	0.03	0.03	-	fraction
	14	Percent of Average Annual Runoff Retention Provided	10.7%	4.6%	12.2%	6.1%	4.6%	4.6%	4.6%	-	%
	15	Percent of Average Annual Runoff Retention Required	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	-	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	-	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	-	-	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	0	0	0	0	0	0	-	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	0	0	0	0	0	0	-	cubic-feet

Summary Notes:

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

ATTACHMENT 1F

TECHNICAL MEMORANDUM

Existing Offsite Biofiltration Capacity Analysis by Alternative Minimum Biofiltration Footprint Ratio sizing

Marja Acres

CT 16-07, PUD 16-08, CDP 16-33, HDP 16-02, SUP 16-02, SDP 2018-0001

Camino Del Norte, Carlsbad CA 92008

PREPARE BY:

HOWES | WEILER | LANDY
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Jose Sanchez, Civil Engineer

Prepared : January, 2019

Introduction

This memorandum is to determine if the existing bio-filtration facilities areas at El Camino Real median have the capacity for treatment of the additional paved and landscape areas associated with the widening of El Camino Real. (See Storm Water Management Plan for El Camino Real Widening Rancho Costera CDP 11-10, CT 13-03, SWMP 13-03 By O'DAY Consultants Dated February 15, 2013 – A copy can be obtained from the City's Public Record Access Website)

Site Condition

The existing BMPs in El Camino Real were designed using a low susceptibility approach and the tables. Therefore, they are very small. However, all flows can be considered as low susceptibility as it is clear that a susceptibility analysis was made. (See Hydromodification Screening for Rancho Costera and El Camino Real by Chang Consultants Dated June 19, 2013)

Methodology

The method of analysis was based on the guidance provided by the County Wide BMP Manual for Alternative Minimum Biofiltration Footprint Ratio and the County of San Diego Automated Worksheets.

The below are biofiltration clogging inputs:

Land Use: Low Traffic & Vacant/Open Space

Load to Clog: 4.0 (Based on a dense vegetated bio-filtration basin and permeable media with outlet control)

Time allowed to accumulate clogging: 10 years (Default)

Summary

A total of 6,015-sf on new impervious areas and a total of 1,416-sf of pervious areas has been added to the existing facilities. It should be noted that some existing impervious surfaces will be landscaped areas after development. The automated worksheets combined all areas existing and proposed for the purpose of the overall watershed area analysis. See attachment A for area exhibits, tables and charts.

Conclusion

The findings show that existing BMP 14 (numbering per said O'DAY report) does not have the required treatment facility as it is short by approximately 35-sf. However, existing biofiltration facilities 15 and 16 have the treatment capacity to treat all new impervious and pervious areas and can compensate for the said deficit in BMP 14.

BMP ID	EXISTING BIORETENTION AREA (SF)	BIORETENTION AREA REQUIRED (SF)	DEFICIT (SF)
14	410	445	-35
15	260	210	+50
16	300	195	+110

It should be noted that the existing facilities do not meet the minimum annual retention criteria due to the lack of depth of gravel (minimum 3 inches) below the underdrain. A separate retention analysis will show that retention requirements by new offsite impervious surfaces along with onsite impervious surfaces within DMAs 8C & 9C will be compensated by excess of retention onsite.

Attachment A

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

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	2,489	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	0	#
	3	Total Planted Area within Development	18,405	sq-ft
	4	Water Use Category for Proposed Planted Areas	Low	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	Yes	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	Yes	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	No	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.86	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	0	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	52.14	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	22	cubic-feet
	13	Total Anticipated Use Over 36 Hours	22	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.01	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	No	yes/no
Result	18	Feasibility Category	5	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

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

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

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

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

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

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

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

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

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

Category	#	Description	*i*	*ii*	*iii*	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	BMP14	BMP15	BMP16	unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	Biofiltration	unitless
	2	85th Percentile 24-hr Storm Depth	0.60	0.60	0.60	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	27,940	13,246	12,310	sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)				sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	7,922	4,685	5,798	sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)				sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)				sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)				sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)				sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)				sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)				sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)				sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)				sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)				sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)				sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)				sq-ft
	19	Number of Tree Wells Proposed per SD-A				#
	20	Average Mature Tree Canopy Diameter				ft
	21	Number of Rain Barrels Proposed per SD-E				#
	22	Average Rain Barrel Size				gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series				unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas				percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	35,862	17,931	18,108	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.72	0.69	0.64	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	unitless
	31	Initial Weighted Runoff Factor	0.72	0.69	0.64	unitless
	32	Initial Design Capture Volume	1,291	619	579	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.72	0.69	0.64	unitless
	38	Design Capture Volume After Dispersion Techniques	1,291	619	579	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.72	0.69	0.64	unitless
	42	Final Effective Tributary Area	25,821	12,372	11,589	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	1,291	619	579	cubic-feet

Worksheet B.1-1 General Notes:

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

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

Category	#	Description	*i*	*ii*	*iii*	Units
BMP Inputs	0	Drainage Basin ID or Name	BMP14	BMP15	BMP16	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	in/hr
	2	Effective Tributary Area	25,821	12,372	11,589	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.012	0.009	0.010	ratio
	4	Design Capture Volume Tributary to BMP	1,291	619	579	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined	Lined	Lined	unitless
	6	Provided Biofiltration BMP Surface Area	445	210	195	sq-ft
	7	Provided Surface Ponding Depth	10	10	10	inches
	8	Provided Soil Media Thickness	18	18	18	inches
	9	Provided Depth of Gravel Above Underdrain Invert	18	18	18	inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	2.00	2.00	1.00	inches
	11	Provided Depth of Gravel Below the Underdrain	3	3	3	inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.00	0.00	0.00	unitless
	15	Effective Retention Depth	0.90	0.90	0.90	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	120	120	hours
	17	Volume Retained by BMP	33	16	15	cubic-feet
	18	Fraction of DCV Retained	0.03	0.03	0.03	ratio
	19	Portion of Retention Performance Standard Satisfied	0.04	0.04	0.04	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.01	0.01	0.01	ratio
	21	Design Capture Volume Remaining for Biofiltration	1,278	613	573	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.2034	0.2034	0.0511	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	19.75	41.85	11.33	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	5.00	5.00	5.00	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	30.00	30.00	30.00	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	20.80	20.80	20.80	inches
	29	Drawdown Time for Surface Ponding	2	2	2	hours
	30	Drawdown Time for Effective Biofiltration Depth	4	4	4	hours
	31	Total Depth Biofiltered	50.80	50.80	50.80	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	1,917	920	860	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	1,884	889	826	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	959	460	430	cubic-feet
	35	Option 2 - Provided Storage Volume	771	364	338	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	0.98	0.97	0.96	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	No	No	No	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	1.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**0**	cubic-feet

Worksheet B.5-1 General Notes:

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

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

Category	#	Description	*i*	*ii*	*iii*	Units
Drainage Basin Info	0	Drainage Basin ID or Name	BMP14	BMP15	BMP16	unitless
	1	Drains to following BMP Type	Biofiltration	Biofiltration	Biofiltration	unitless
	2	Final Effective Tributary Area	25,821	12,372	11,589	sq-ft
Biofiltration Clogging Inputs	3	Is Proposed Biofiltration BMP <3% of Effective Tributary Area Desired?	Yes	Yes	Yes	yes/no
	4	Average Annual Precipitation	11.9	11.9	11.9	inches
	5	Load to Clog (default =2.0)	3.0	4.0	4.0	lb/sq-ft
	6	Allowable Period to Accumulate Clogging Load (default =10)	10	10	10	years
	7	Pretreatment Measures Included?	No	No	No	yes/no
	8	Commercial: TSS=128 mg/L, C= 0.80				sq-ft
	9	Education: TSS=132 mg/L, C= 0.50				sq-ft
	10	Industrial: TSS=125 mg/L, C= 0.90				sq-ft
	11	Low Traffic Areas: TSS=50 mg/L, C= 0.50	20,117	9,140	7,878	sq-ft
	12	Multi-Family Residential: TSS=40 mg/L, C= 0.60				sq-ft
	13	Roof Areas: TSS=14 mg/L, C= 0.90				sq-ft
	14	Single Family Residential: TSS=123 mg/L, C= 0.40				sq-ft
	15	Transportation: TSS=78 mg/L, C= 0.90				sq-ft
	16	Vacant/Open Space: TSS=216 mg/L, C= 0.10	5,704	3,232	3,711	sq-ft
Minimum Footprint Calculations	17	Effective-Area Based on Specified Land Use Coefficients	10,629	4,893	4,310	sq-ft
	18	Average TSS Concentration for Tributary	59	61	64	mg/L
	19	Average Annual Runoff	25,606	12,217	11,444	cubic-feet
	20	Average Annual TSS Load	94	47	46	lb/yr
	21	Average Annual TSS Load After Pretreatment Measures	94	47	46	lb/yr
	22	Minimum Allowable Biofiltration Footprint Ratio	0.012	0.009	0.010	ratio

Worksheet B.5-3 General Notes:

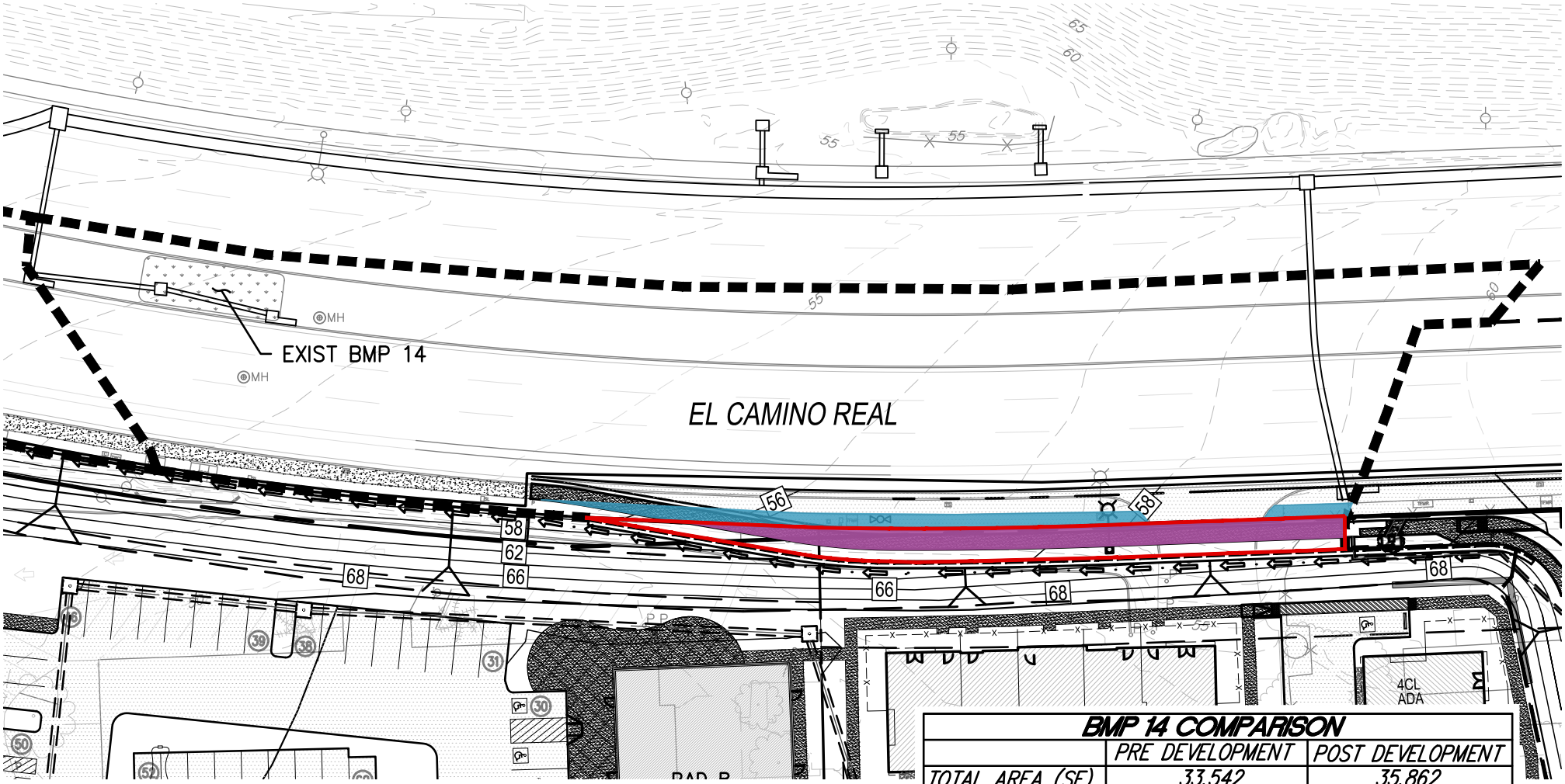
A. Applicants may use this worksheet to calculate Alternate Minimum Biofiltration Footprint Ratios for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will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

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description	*i*	*ii*	*iii*	Units
General Info	0	Drainage Basin ID or Name	BMP14	BMP15	BMP16	unitless
	1	85th Percentile Storm Depth	0.60	0.60	0.60	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	in/hr
	3	Total Tributary Area	35,862	17,931	18,108	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	1,793	897	905	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.72	0.69	0.64	unitless
	6	Initial Design Capture Volume	1,291	619	579	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	0	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	0	0	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	25,821	12,372	11,589	square feet
	10	Final Design Capture Volume Tributary to BMP	1,291	619	579	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	Biofiltration	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	13	6	6	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.01	0.01	0.01	fraction
	14	Percent of Average Annual Runoff Retention Provided	1.5%	1.5%	1.5%	%
	15	Percent of Average Annual Runoff Retention Required	4.5%	4.5%	4.5%	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	100.0%	100.0%	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	0	0	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	0	0	cubic-feet

Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted in orange and summairzed in the red text below. If all drainage basins



BMP 14 COMPARISON		
	PRE DEVELOPMENT	POST DEVELOPMENT
TOTAL AREA (SF)	33,542	35,862
IMPERVIOUS (SF)	26,572	27,940
PERVIOUS (SF)	6,970	7,922

LEGEND

ITEM	SYMBOL
EXISTING OFFSITE BASIN BOUNDARY	
ADDITIONAL AREA BASIN BOUNDARY	
IMPERVIOUS AREA PER NEW BASIN	
EXISTING AREA CONVERTED TO IMPERVIOUS	

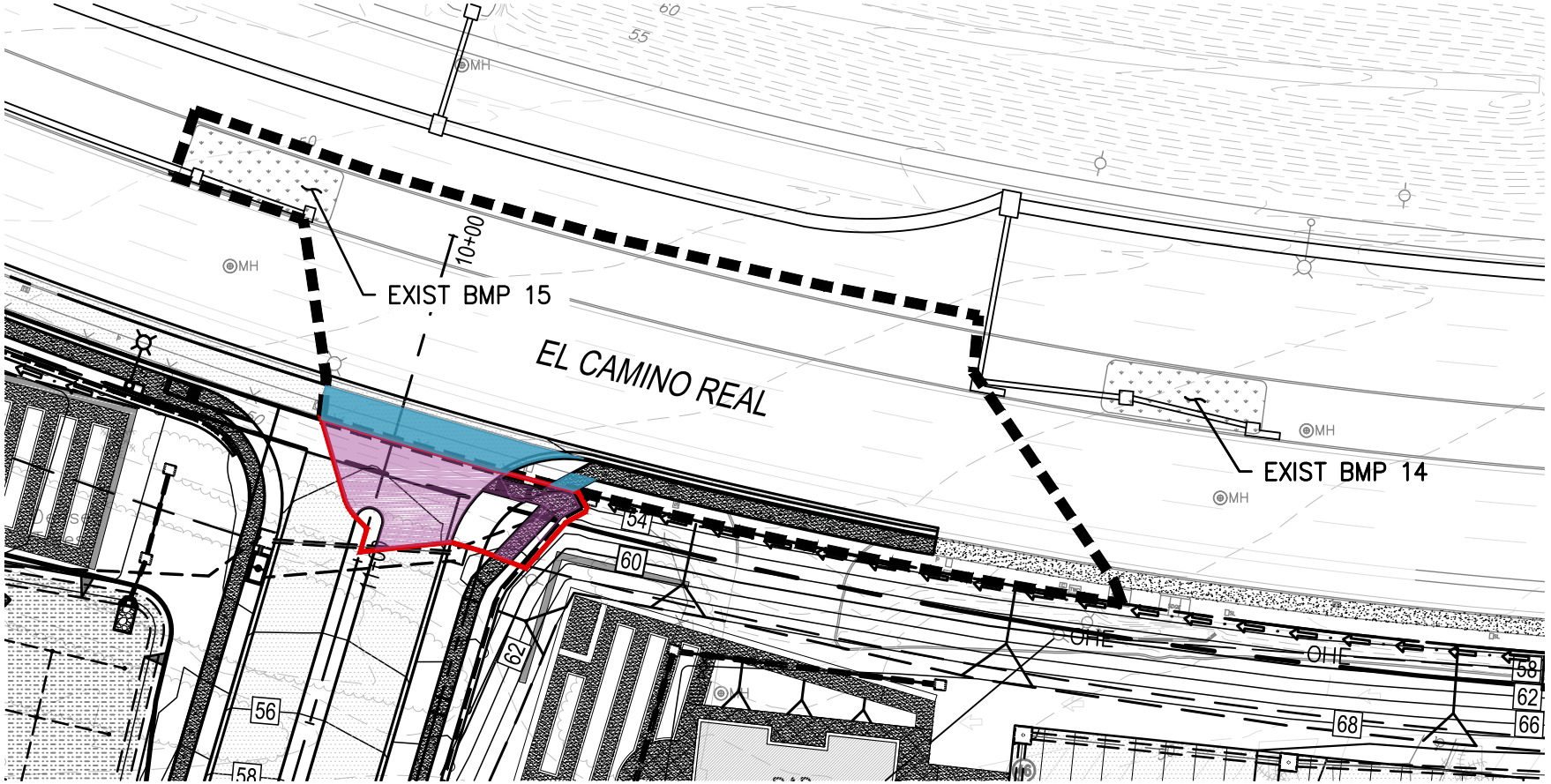
N

SCALE: 1" = 40'

40 20 0 40

MARJA ACRES
EXISTING OFF SITE BMP 14
CAPACITY ANALYSIS

DATE:	DRAWING:
1/15/19	SHEET 1 OF 1



BMP 15 COMPARISON		
	PRE DEVELOPMENT	POST DEVELOPMENT
TOTAL AREA (SF)	16,118	17,931
IMPERVIOUS (SF)	11,326	13,246
PERVIOUS (SF)	4,792	4,685

LEGEND

ITEM	SYMBOL
EXISTING OFFSITE BASIN BOUNDARY	
ADDITIONAL AREA BASIN BOUNDARY	
IMPERVIOUS AREA PER NEW BASIN	
EXISTING AREA CONVERTED TO IMPERVIOUS	

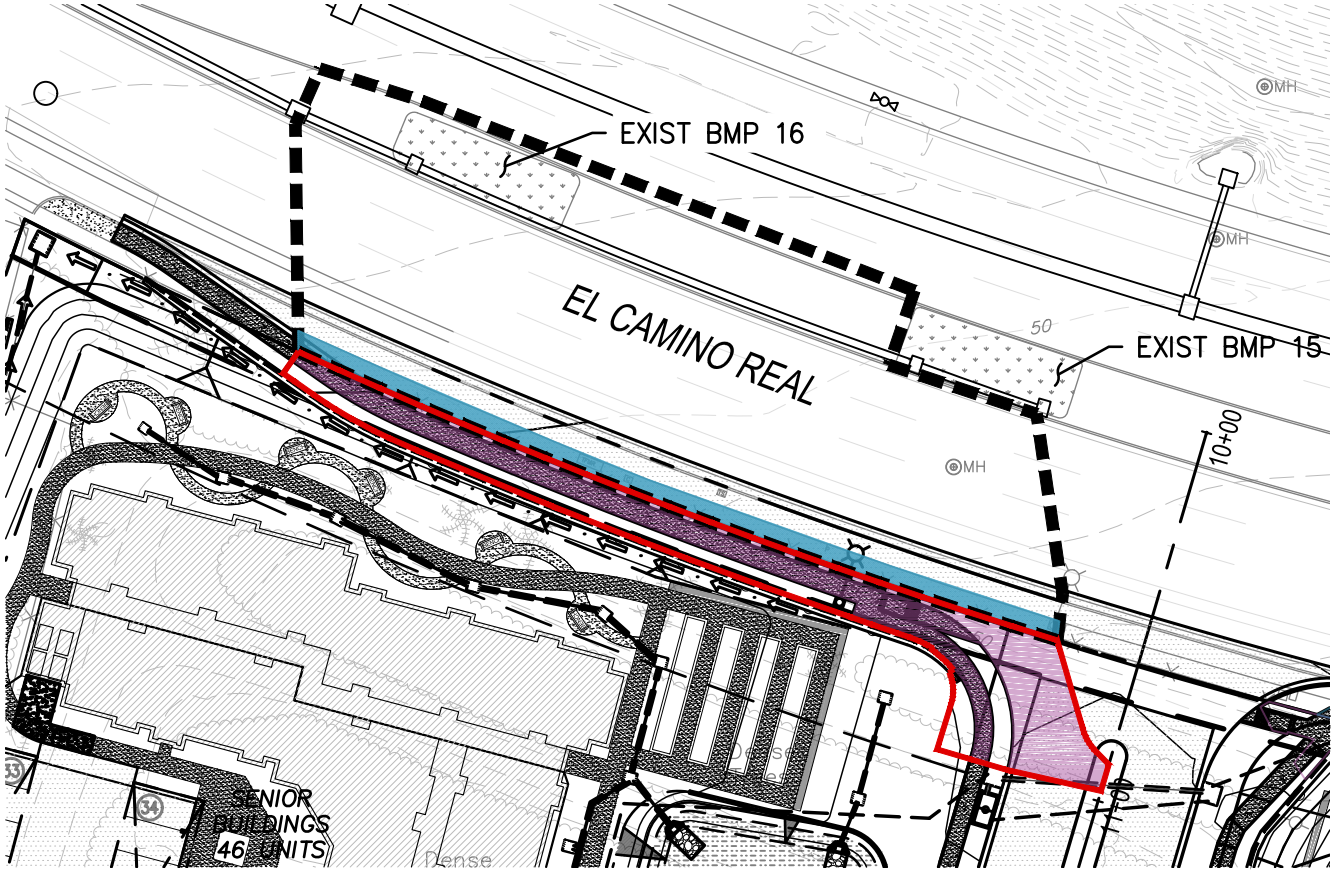
N

SCALE: 1" = 40'

40 20 0 40

MARJA ACRES
EXISTING OFF SITE BMP 15
CAPACITY ANALYSIS

DATE:	DRAWING:
1/15/19	SHEET 1 OF 1



BMP 16 COMPARISON		
	PRE DEVELOPMENT	POST DEVELOPMENT
TOTAL AREA (SF)	14,810	18,108
IMPERVIOUS (SF)	9,583	12,310
PERVIOUS (SF)	5,227	5,798

LEGEND

ITEM	SYMBOL
EXISTING OFFSITE BASIN BOUNDARY	
ADDITIONAL AREA BASIN BOUNDARY	
IMPERVIOUS AREA PER NEW BASIN	
EXISTING AREA CONVERTED TO IMPERVIOUS	

N

SCALE: 1" = 40'

40 20 0 40

MARJA ACRES
EXISTING OFF SITE BMP 16
CAPACITY ANALYSIS

DATE: 1/15/19

DRAWING:

SHEET 1 OF 1

B.5.2.1 Alternative Minimum Sizing factor for Clogging Risk

Worksheet B.5-4 below must be used to support a request for an alternative minimum footprint sizing factor (for clogging) in **Worksheet B.5-1**. Based on a review of the submitted worksheet and supporting documentation, the use of a smaller footprint sizing factor may be approved at the discretion of the City Engineer. If approved, the estimated footprint from the worksheet below can be used in line 20 of **Worksheet B.5-1** in lieu of the 3 percent minimum footprint value.

This worksheet includes the following general steps to calculate the minimum footprint sizing factor:

- Select a "load to clog" that is representative of the type of BMP proposed
- Select a target life span (i.e., frequency of major maintenance) that is acceptable to the City Engineer. A default value of 10 years is recommended.
- Compile information about the DMA from other parts of the SWQMP development process.
- Determine the event mean concentration (EMC) of TSS that is appropriate for the DMA
- Perform calculations to determine the minimum footprint to provide the target lifespan.

Table B.5-3: Typical land use total suspended solids (TSS) event mean concentration (EMC) values.

Land Use	TSS EMC[4], mg/L
Single Family Residential	123
Commercial	128
Industrial	125
Education (Municipal)	132
Transportation[5]	78
Multi-family Residential	40
Roof Runoff[6]	14
Low Traffic Areas[7]	50
Open Space	216

[4] EMCs are from SBPAT datasets for SLR and SDR Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics for San Diego, unless otherwise noted.

[5] EMCs are based on Los Angeles region default SBPAT datasets due to lack of available San Diego data.

[6] Value represents the average first flush concentration for roof runoff (Charters et al., 2015).

[7] Davis and McCuen (2005)

TableB.5-4: Guidance for Selecting Load to Clog (LC)

BMP Configuration	Load to Clog, L_c, lb/sq-ft
Baseline: Approximately 50 percent vegetative cover; typical fine sand and compost blend	2
Baseline + increase vegetative cover to at least 75 percent	3
Baseline + include coarser sand to increase initial permeability to 20 to 30 in/hr; control flowrate with outlet control	3
Baseline + increase vegetative cover and include more permeable media with outlet control, per above	4

References

Charters, F.J., Cochrane, T.A., and O'Sullivan, A.D., (2015). Particle Size Distribution Variance in Untreated Urban Runoff and its implication on treatment selection. Water Research, 85 (2015), pg. 337-345.

Davis, A.P. and McCuen, R.H., (2005). Stormwater Management for Smart Growth. Springer Science & Business Media, pg. 155.

Maniquiz-Redillas, M.C., Geronimo, F.K.F, and Kim, L-H. Investigation on the Effectiveness of Pretreatment in Stormwater Management Technologies. Journal of Environmental Sciences, 26 (2014), pg. 1824-1830.

Pitt, R. and Clark, S.E., (2010). Evaluation of Biofiltration Media for Engineered Natural Treatment Systems. Geosyntec Consultants and The Boeing Company.

RECORD COPY

JLR Initial 6/15/15 Date

STORM WATER MANAGEMENT PLAN

For

EL CAMINO REAL WIDENING
RANCHO COSTERA
CDP 11-10
CT 13-03
SWMP 13-03

Revised: April 21, 2015
Revised: October 31, 2014
Revised: May 6, 2014
Revised: December 10, 2013
Prepared: February 15, 2013

RECEIVED
MAY 01 2015
LAND DEVELOPMENT
ENGINEERING

J.N. 10-1307-5

Prepared By:
O'DAY CONSULTANTS, INC.
2710 Loker Avenue West, Suite 100
Carlsbad, CA 92010-6609
(760) 931-7700

REGISTERED PROFESSIONAL ENGINEER
GEORGE O'DAY
No. 32014
Exp. 12/31/16
CIVIL
STATE OF CALIFORNIA

George O'Day
George O'Day, RCE 32014, Exp. 12/31/16

April 22, 2015
Date

FILE COPY

HYDROMODIFICATION SCREENING

FOR

RANCHO COSTERA

(ROBERTSON RANCH PLANNING AREAS 1-11, 13, & 23A-C)

AND

EL CAMINO REAL WIDENING

June 19, 2013

Wayne W. Chang, MS, PE 46548

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

P.O. Box 9496
Rancho Santa Fe, CA 92067
(858) 692-0760

ATTACHMENT 1G

TECHNICAL MEMORANDUM

Retention Compensation Analysis for

Marja Acres

CT 16-07, PUD 16-08, CDP 16-33, HDP 16-02, SUP 16-02, SDP 2018-0001

Camino Del Norte, Carlsbad CA 92008

PREPARE BY:

HowesWeiler & Associates
LAND USE PLANNING AND ENGINEERING
Tel. 760.929.2288 Fax. 760.929.2287 Email. info@hwplanning.com
2888 LOKER AVENUE EAST SUITE 217, CARLSBAD, CA 92010 www.hwplanning.com

Alex Parra, Civil Engineer

Introduction

This memorandum is to determine the retention compensation requirements for new offsite impervious surfaces, onsite DMAs 8C and 9C. Proposed on-site biofiltration facilities provide over-retention due to a larger sizing that the minimum 3% requirement.

Proposed Site Condition

The retention requirements is being considered: an analysis of over-retention by the proposed BMPs will be prepared following these assumptions: (a) no frontage area draining into El Camino Real is considered complying with retention requirements, so the impervious area of that frontage (both entrances included) is to be counted, and the 3% of that effective impervious area becomes a deficit.

As all onsite proposed BMPs are in excess of 3%, there is an excess of retention therefore the project complies with the retention requirement.

SUMMARY TABLE

	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	
	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	Biofiltration	
DMA Impervious Surfaces (C=0.90)	21479	28368	25769	176018	42286	133814	96696	sq-ft
DMA Engineered Pervious Surfaces (C=0.10)	26656	11983	10254	97220	32010	67238	46374	sq-ft
Total Tributary Area	48135	40351	36023	273238	74296	201052	143070	sq-ft
Initial Runoff Factor for Standard Drainage Areas	0.46	0.66	0.67	0.62	0.56	0.63	0.64	
Minimum Biofiltration Footprint Sizing Factor	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Effective Tributary Area	22142	26632	24135	169408	41606	126663	91565	sq-ft
3% footprint requirement	664	799	724	5082	1248	3800	2747	sq-ft
Provided Biofiltration BMP Surface Area	1949	1098	2360	7554	1692	4347	3567	sq-ft
Excess Footprint Area	**1285**	**299**	**1636**	**2472**	**444**	**547**	**820**	sq-ft

TOTAL Required	15065	sq-ft
TOTAL Provided	22567	sq-ft
TOTAL Excess Footprint Area	**7502**	sq-ft

TOTAL Non Retained Areas		
Effective DMA Impervious Surfaces (C=0.90) (OFFSITE NEW, DMA 8C & DMA 9C)	20997	sq-ft
Effective DMA Engineered Pervious Surfaces (C=0.10) (OFFSITE NEW, DMA 8C & DMA 9C)	1616	sq-ft
TOTAL Footprint Area Required	**678**	sq-ft

ATTACHMENT 2

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

[This is the cover sheet for Attachment 2.]

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 2a	Hydromodification Management Exhibit (Required)	Included YES See HMP Exhibit Checklist on the back of this Attachment cover sheet. (24"x36" Exhibit typically required)
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional)	Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map Included, Deposition Analysis exhibit is provided.
Attachment 2c	Geomorphic Assessment of Receiving Channels	Included
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required)	See Hydromodification Drawing

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

The Hydromodification Management Exhibit must identify:

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

ATTACHMENT 2A

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
HDP 16-02
SUP 16-02

LEGEND

- DRAINAGE MANAGEMENT AREA (DMA)
- FLOW DIRECTION
- POC 1 — POINT OF COMPLIANCE
- EX. IMPERVIOUS (SOIL CONDUCTIVITY ADJUSTMENT)

NOTES:

1. THE UNDERLYING SOIL TYPE GROUPS ARE "C" AND "D" FOR THE ENTIRE PROPERTY AND SURROUNDING PARCELS
2. THE APPROXIMATE DEPTH TO GROUND WATER IS EXPECTED TO BE LESS THAN 15 FEET.
3. NO CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED BASED ON VERIFICATION OF GLUs ONSITE (SEE PROJECT SWQMP).
4. THE SITE DOES NOT CONTAIN ANY EXISTING NATURAL HYDROLOGIC FEATURES. (WATERCOURSES, SEEPS, SPRINGS, WETLANDS.

DRAINAGE MANAGEMENT AREAS

DMA	TRIBUTARY AREA (AC)	IMPERVIOUS AREAS (AC)	PERVIOUS AREAS (AC)	% IMPERVIOUS	HYDROLOGIC SOIL TYPE
1C	10.216	---	10.216	0	C
1D	10.430	---	10.430	0	D

Notes: (1) - Per the 2013 RWQCB permit, existing condition impervious surfaces are not to be accounted for in existing conditions analysis.

KELLY DRIVE
EL CAMINO REAL
PARK DRIVE
EXISTING CULVERTS
EXISTING INLET
EXISTING INLET
EXISTING INLET
EXISTING NATURAL CREEK
EXISTING BLDG AND PARKING LOT
EXISTING BLDG.
EXISTING PAVED ROAD
EXISTING NATURAL CREEK
EXISTING BLDG.
EXISTING BLDG.
POC1
R/W
S87°53'49"W 397.21'
N13°57'24"E 977.24'
N65°22'26"E 1291.68'
N24°49'5"E 315.68'
DMA 1C
SOIL TYPE C
SOIL TYPE D
DMA 1D
SOIL TYPE 'D'
BASIN A.2
15.21 ACRES Q=21.20 CFS
BASIN A.1
0.20 ACRES Q=0.31 CFS
BASIN B.1
0.03 ACRES Q=0.05 CFS
BASIN B.2
5.01 ACRES Q=7.12 CFS
BASIN C.1
0.01 ACRES Q=0.016 CFS
BASIN C.2
0.20 ACRES Q=0.26 CFS
MAP 1085
MAP 1289
MAP 1451

N

SCALE: 1" = 60'
GRAPHIC SCALE
60 30 0 60 120 180

REGISTERED PROFESSIONAL ENGINEER
MELLOR R. LANDY
No. 81085
Exp. 09-30-19
CIVIL
STATE OF CALIFORNIA

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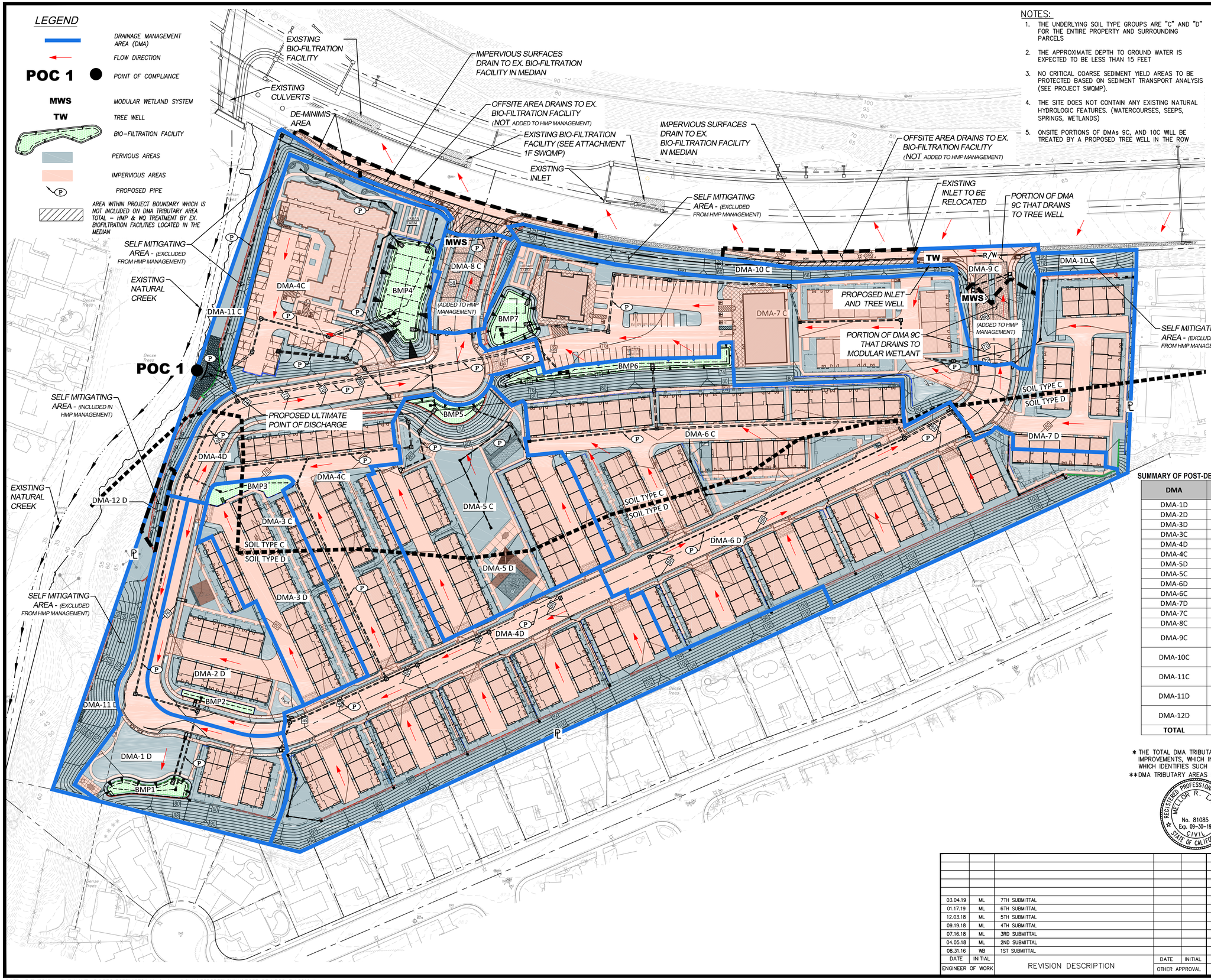
SHEET	CITY OF CARLSBAD PLANNING DEPARTMENT	SHEETS
1		1

TENTATIVE MAP FOR:
MARJA ACRES

DRAWING NAME:
HMP – POC
EXISTING



NOTES:

1. THE UNDERLYING SOIL TYPE GROUPS ARE "C" AND "D" FOR THE ENTIRE PROPERTY AND SURROUNDING PARCELS
2. THE APPROXIMATE DEPTH TO GROUND WATER IS EXPECTED TO BE LESS THAN 15 FEET
3. NO CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED BASED ON SEDIMENT TRANSPORT ANALYSIS (SEE PROJECT SWQMP).
4. THE SITE DOES NOT CONTAIN ANY EXISTING NATURAL HYDROLOGIC FEATURES. (WATERCOURSES, SEEPS, SPRINGS, WETLANDS)
5. ONSITE PORTIONS OF DMAs 9C, AND 10C WILL BE TREATED BY A PROPOSED TREE WELL IN THE ROW

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007

PERMANENT WATER QUALITY TREATMENT FACILITIES ON THIS SITE

KEEPING OUR WATER CLEAN
MAINTAIN WITH CARE
NO MODIFICATIONS WITHOUT CITY OF CARLSBAD APPROVAL

WATER QUALITY ADVISORY SIGN
NTS

NO DUMPING DRAINS TO WATERWAYS

SAMPLE PROHIBITIVE SIGNAGE
NTS

SUMMARY OF POST-DEVELOPED CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	***20.114**	N/A	

* THE TOTAL DMA TRIBUTARY AREA, DOES NOT INCLUDE AREAS PART OF THE TURNING LANE IMPROVEMENTS, WHICH INCLUDE SIDEWALK AND LANDSCAPE, ADJACENT TO RETAINING WALLS, SEE LEGEND WHICH IDENTIFIES SUCH AREAS.
**DMA TRIBUTARY AREAS EXCLUDES, BMP SQUARE FOOTAGE.

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DATE	INITIAL	REVISION DESCRIPTION
03.04.19	ML	7TH SUBMITTAL
01.17.19	ML	6TH SUBMITTAL
12.03.18	ML	5TH SUBMITTAL
09.19.18	ML	4TH SUBMITTAL
07.16.18	ML	3RD SUBMITTAL
04.05.18	ML	2ND SUBMITTAL
08.31.16	WB	1ST SUBMITTAL

ENGINEER OF WORK | OTHER APPROVAL | CITY APPROVAL

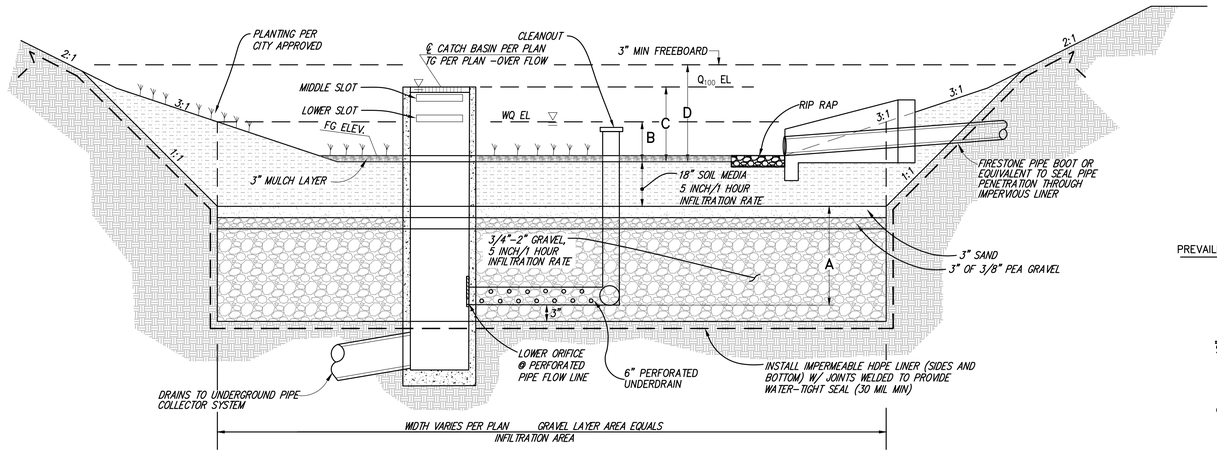
SHEET 1 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:
MARJA ACRES

DRAWING NAME:
HMP – POC
PROPOSED

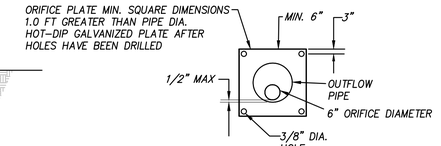
DATE: 3/5/2019 ~ FILE NAME: S:\PROJECTS\12704 Marja Acres\CIVIL\REPORTS\SWMM\POST_DEV POC_Feb2019.dwg

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007



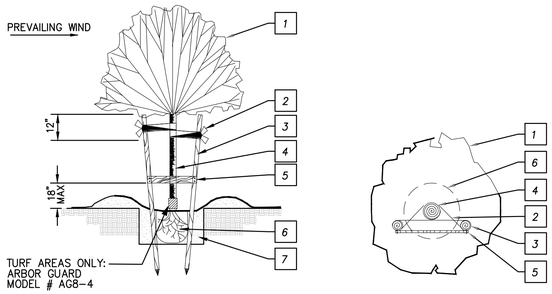
TYPICAL BIO-FILTRATION BASIN DETAIL

NTS



STAINLESS STEEL PLATE / ORIFICE DETAIL

NTS



SECTION VIEW

PLAN VIEW

STREET TREES DETAIL

NTS

TREE WELL NOTES

1. TREE CANOPY
2. (2) CINCH TIES, TACK TO STAKE WITH GALVANIZED NAILS TO PREVENT SLIPPING
3. (2) 2" DIA. X 8' LONG UNTREATED LODGEPOLE PINE STAKES FOR 5 GAL. TREES, OR (2) 2" DIA. X 10' LONG UNTREATED LODGEPOLE PINE TAKES FOR 15 GAL.– 36" BOX TREES, SET STAKES OUTSIDE ROOTBALL. ANGLE TOP OF STAKE AWAY FROM BRANCH STRUCTURE.
4. TREE TRUNK
5. 1 X 4 DOUG. FIR BRACE, TACK TO LODGEPOLE STAKES WITH GALV. NAILS
6. ROOT BALL, DO NOT PENETRATE WITH STAKE.
7. USE AMENDED SOIL WITH MINIMUM DEPTH OF 3' + 1' IN ALL DIRECTIONS OF ROOT BALL PER CITY'S BMP MANUAL APPENDIX PG. E–18.

TREE TIE NOTE:

INSTALL TREE TIES AND STAKES ONLY TO PROPER LEVEL TO HOLD TREE UPRIGHT. PROPER HEIGHT IS 6" ABOVE POINT WHERE THE TREE WILL SNAP TO AN UPRIGHT POSITION BY ITSELF IF TOP IS PULLED TO ONE SIDE AS IF WIND LOADED AND THEN RELEASED. DO NOT TOP TREES IN ORDER TO REDUCE SIZE OR WEIGHT OF TREE CROWN, CONTACT LANDSCAPE ARCHITECT PRIOR TO ANY PRUNING OF TREES.

SUMMARY OF RISER DETAILS

BMP	Lower Slot			Middle Slot			Top Riser		Emergency weir
	Width (ft)	Height (ft)	Elevation[1] (ft) B	Width (ft)	Height (ft)	Elevation[1] (ft)	Length[2] (ft)	Elev.[1] (ft)	Length[3] (ft)
BMP 3	1	0.167	1	--	----	-----	12	2.25	
BMP 4	1	0.167	1.5	4	0.167	3.25	12	3.75	8
BMP 5	1.5	0.167	1	8	0.25	1.33	12	1.75	8
BMP 6	1.5	0.167	1	8	0.25	1.33	12	1.75	10
BMP 7	1.5	0.167	1	8	0.25	1.33	12	1.75	8

(1): Basin ground surface elevation assumed to be 0.00 ft elevation.

Notes: (2): Overflow length is the internal perimeter of the riser structure.

(3): Additional Overflow length for peak flow discharges

SUMMARY OF DEVELOPED DUAL AND TRIPLE PURPOSE BMPs

BMP	Tributary Area (Ac)[7]	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2.] A	Lower Orif. D (in)[3]	Depth Riser Invert (in)[4] C	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] D
BMP 1	1.060	1949	33	0.8	12	12	18
BMP 2	0.901	1098	33	0.9	6	12	12
BMP 3	0.772	2360	36	0.9	27	12	33
BMP 4	6.098	7724	48	2.3	45	12	63
BMP 5	1.66	1692	36	2.2	21	12	30
BMP 6	4.444	4347	36	2.4	21	12	31.5
BMP 7	3.206	3567	48	2	21	12	37.5

Notes:

(1): Area of amended soil equal to area of gravel. 18" thick and in conformance with specifications listed on Fa

(2): Gravel depth needed to comply with hydromodification purposes

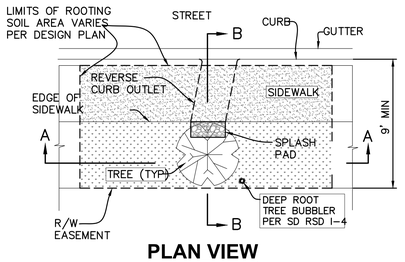
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.5 \cdot Q_{25}$).

(4): Depth of ponding beneath riser structure's surface spillway.

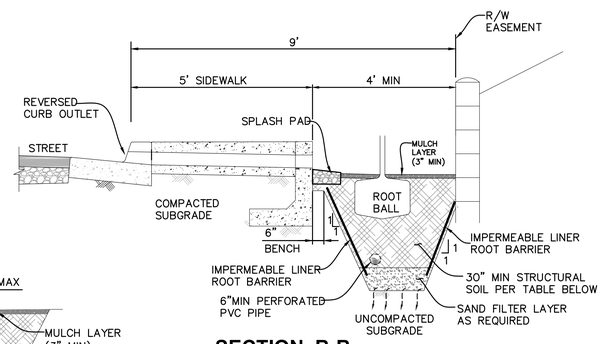
(5): Overflow length, the internal perimeter of the riser internal dimensions

(6): Total surface depth of BMP from top crest elevation to surface invert.

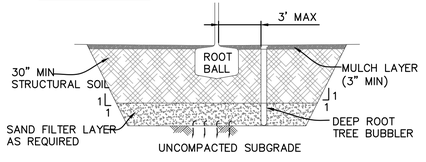
(7): Tributary area to basin not including area of BMP.



PLAN VIEW



SECTION B-B



SECTION A-A

NTS

STRUCTURAL SOIL					
BSM COMPOSITION	SAND	SANDY LOAM			COMPOST
		SAND	SILT	CLAY	
VOLUME	65%	20%			15%
WEIGHT	75–80%	10% MAX	3% MAX		9% MAX

TYPICAL TREE WELL DETAILS

REGISTERED PROFESSIONAL ENGINEER MELLOR R. LANDY No. 81085 Exp. 09-30-19 CIVIL STATE OF CALIFORNIA

HOWES | WEILER | LANDY
PLANNING & ENGINEERING
Tel. 760.929.2288 Fax. 760.929.2287 Email. info@HWL-PE.com
2888 LOKER AVENUE EAST SUITE 217, CARLSBAD, CA 92010 www.HWL-PE.com

DATE	INITIAL	REVISION DESCRIPTION
03.04.19	ML	7TH SUBMITTAL
01.17.19	ML	6TH SUBMITTAL
12.03.18	ML	5TH SUBMITTAL
09.19.18	ML	4TH SUBMITTAL
07.16.18	ML	3RD SUBMITTAL
04.05.18	ML	2ND SUBMITTAL
08.31.16	WB	1ST SUBMITTAL

ENGINEER OF WORK	DATE	INITIAL	OTHER APPROVAL	DATE	INITIAL	CITY APPROVAL

SHEET 2 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:

MARJA ACRES

DRAWING NAME:

HMP – POC

PROPOSED

DATE: 3/5/2019 – FILE NAME: S:\PROJECTS\12704 Marja Acres\GIS\REPORTS\SWMP\POST_DEV POC_Feb2019.dwg

ATTACHMENT 2B

TECHNICAL MEMORANDUM

DEPOSITION ANALYSIS MEMORANDUM

Marja Acres

CT 16-07, PUD 16-08, CDP 16-33, HDP 16-02, SUP 16-02, SDP 2018-0001

Camino Del Norte, Carlsbad CA 92008

PREPARE BY:

HowesWeiler & Associates
LAND USE PLANNING AND ENGINEERING
Tel. 760.929.2288 Fax. 760.929.2287 Email. info@hwplanning.com
2888 LOKER AVENUE EAST SUITE 217, CARLSBAD, CA 92010 www.hwplanning.com

Jose Sanchez, Civil Engineer

Introduction

This memorandum is to determine if the CCSYA identified within the project site needs to be preserved, based on the BMP Design manual requirements. Our determination is based on the guidance from "Appendix H Guidance for Investigating Potential Critical Coarse Sediment Yield Areas" more specific H.1.2 Refinement Option and H.7.1 Depositional Analysis.

Site Condition

The site is located on the south side of El Camino Real, between Kelly Drive to the west and Lisa Street to the east. The subject site consists of three parcels totaling 20.85 acres (APN 207-101-35, 207-101-37, and 207-290-10). Two small areas located on the north east portion of the site and identified as part of Basin A.3 on the Deposition Analysis Exhibit included within this memorandum, have been identified as Potential Critical Coarse Sediment Yield Area (CCSYA) per the WMAA map.

Velocity Determination

The method of analysis was based on the Rational Method according to the San Diego County Design manual. The Rational Method is a physically-based numerical method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage. CivilDesign software was utilized in calculating runoff for all basins smaller than 0.5 square miles in size. The outputs provided by said software include the velocity at each reach. See Attachment A for results.

Summary

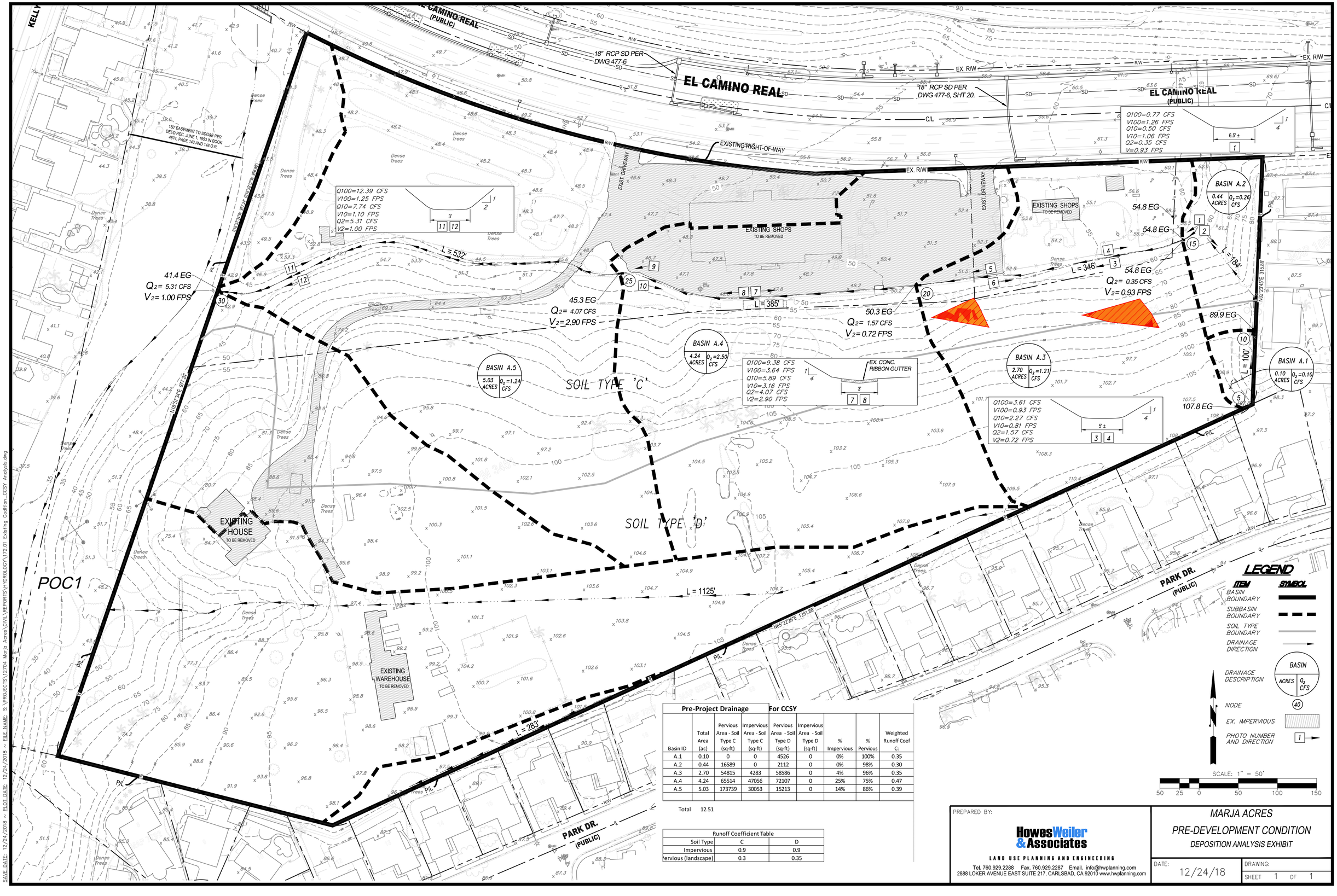
A sensitivity analysis has been made for a typical value of the Manning's coefficient. Per Appendix G of the BMP Design Manual, a Manning's Coefficient of n=0.10 is acceptable for pervious overland flows. Based on said determination the calculated 2 year – 24 hour storm event, the velocity at Node 20 has been determined to be 0.72 ft/s, this location represents the immediate downstream point of the Potential CCSYAs. Flows enter a concrete brow ditch which convey flow on a westerly direction between node 20 and 25 at which point the velocity increases to 2.90 ft/s. At the last reach of channel before flows leave the site, between node 25 and 30 the velocity is reduced to 1.00 ft/s. Consequently, and following Appendix H of the BMP Manual, the system is depositional and coarse sediments will never reach the first unlined water of the state downstream (the refinement option H.1.2.1: Depositional Analysis detailed in section H.7.1 shows the system is depositional).

Conclusion

The PCCSYA identified in the WMAA Map (red area) is a Non-CCSYA and there is no requirement to preserve such area. For channel cross sections varication see Deposition Analysis exhibit under attachment A and Field Verification Photos included under attachment B.

Attachment A

Calculations & Deposition Analysis Exhibit



LEGEND

ITEM	SYMBOL
BASIN BOUNDARY	
SUBBASIN BOUNDARY	
SOIL TYPE BOUNDARY	
DRAINAGE DIRECTION	
DRAINAGE DESCRIPTION	BASIN (ACRES | Q_2 CFS)
NODE	(40)
EX. IMPERVIOUS	
PHOTO NUMBER AND DIRECTION	1

SCALE: 1" = 50'

50 25 0 50 100 150

Pre-Project Drainage For CCSY

Basin ID	Total Area (ac)	Pervious Area - Soil Type C (sq-ft)	Impervious Area - Soil Type C (sq-ft)	Pervious Area - Soil Type D (sq-ft)	Impervious Area - Soil Type D (sq-ft)	% Impervious	% Pervious	Weighted Runoff Coef C:
A.1	0.10	0	0	4526	0	0%	100%	0.35
A.2	0.44	16589	0	2112	0	0%	98%	0.30
A.3	2.70	54815	4283	58586	0	4%	96%	0.35
A.4	4.24	65514	47056	72107	0	25%	75%	0.47
A.5	5.03	173739	30053	15213	0	14%	86%	0.39

Total 12.51

Runoff Coefficient Table		
Soil Type	C	D
Impervious	0.9	0.9
Pervious (landscape)	0.3	0.35

PREPARED BY:

HowesWeiler & Associates

LAND USE PLANNING AND ENGINEERING

Tel. 760.929.2288 Fax. 760.929.2287 Email. info@hwplanning.com

2888 LOKER AVENUE EAST SUITE 217, CARLSBAD, CA 92010 www.hwplanning.com

MARJA ACRES

PRE-DEVELOPMENT CONDITION

DEPOSITION ANALYSIS EXHIBIT

DATE: 12/24/18

DRAWING: SHEET 1 OF 1

SAVE DATE: 12/24/2018 – PLOT DATE: 12/24/2018 – FILE NAME: S:\PROJECTS\12704 Marja Acres\CIVIL\REPORTS\HYDROLOGY\172.01 Existing Codition_CCSY Analysis.dwg

```
      San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 12/24/18
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********
------------------------------------------------------------------------
Program License Serial Number 6290
------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  1.300
24 hour precipitation(inches) =  2.000
P6/P24 =    65.0%
San Diego hydrology manual 'C' values used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
A.1
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  107.800(Ft.)
Lowest elevation =   89.900(Ft.)
Elevation difference =   17.900(Ft.) Slope = 17.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  17.90 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
Rainfall intensity (I) =      2.783(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.097(CFS)
Total initial stream area =        0.100(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME ****
A.2
Upstream point elevation =    89.900(Ft.)
Downstream point elevation =    54.800(Ft.)
Channel length thru subarea  =   184.000(Ft.)
Channel base width      =    6.500(Ft.)
Slope or 'Z' of left channel bank =   4.000
```

```
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      0.270(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      0.270(CFS)
Depth of flow =   0.048(Ft.), Average velocity =   0.840(Ft/s)
Channel flow top width =    6.884(Ft.)
Flow Velocity =    0.84(Ft/s)
Travel time  =    3.65 min.
Time of concentration =   10.55 min.
Critical depth =      0.038(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.116(In/Hr) for a     2.0 year storm
User specified 'C' value of 0.300 given for subarea
Rainfall intensity =      2.116(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.309  CA =      0.167
Subarea runoff =      0.256(CFS) for      0.440(Ac.)
Total runoff =      0.353(CFS)      Total area =       0.540(Ac.)
Depth of flow =   0.056(Ft.), Average velocity =   0.932(Ft/s)
Critical depth =      0.045(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       20.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

A.3

```
Upstream point elevation =    54.800(Ft.)
Downstream point elevation =    50.300(Ft.)
Channel length thru subarea  =   346.000(Ft.)
Channel base width      =    5.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      1.001(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      1.001(CFS)
Depth of flow =   0.265(Ft.), Average velocity =   0.624(Ft/s)
Channel flow top width =    7.118(Ft.)
Flow Velocity =    0.62(Ft/s)
Travel time  =    9.24 min.
Time of concentration =   19.80 min.
Critical depth =      0.104(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      1.410(In/Hr) for a     2.0 year storm
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      1.410(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      1.112
Subarea runoff =      1.215(CFS) for      2.700(Ac.)
Total runoff =      1.568(CFS)      Total area =       3.240(Ac.)
Depth of flow =   0.341(Ft.), Average velocity =   0.722(Ft/s)
Critical depth =      0.140(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       25.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
```

A.4

```
Estimated mean flow rate at midpoint of channel =      2.788(CFS)
Depth of flow =   0.249(Ft.), Average velocity =   2.661(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              3.38
      2              5.00              0.38
      3             10.00              0.13
      4             11.50              0.00
      5             13.00              0.13
      6             23.00              0.33
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      2.788(CFS)
  '     '    flow top width =     11.330(Ft.)
  '     '    velocity=    2.661(Ft/s)
  '     '    area =      1.048(Sq.Ft)
  '     '    Froude number =     1.542

Upstream point elevation =    50.300(Ft.)
Downstream point elevation =    45.300(Ft.)
Flow length =   385.000(Ft.)
Travel time  =    2.41 min.
Time of concentration =   22.21 min.
Depth of flow =   0.249(Ft.)
Average velocity =   2.661(Ft/s)
Total irregular channel flow =     2.788(CFS)
Irregular channel normal depth above invert elev. =   0.249(Ft.)
Average velocity of channel(s) =   2.661(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      1.309(In/Hr) for a     2.0 year storm
User specified 'C' value of 0.470 given for subarea
Rainfall intensity =      1.309(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.415  CA =      3.105
Subarea runoff =      2.497(CFS) for      4.240(Ac.)
Total runoff =      4.065(CFS)      Total area =       7.480(Ac.)
Depth of flow =   0.278(Ft.), Average velocity =   2.899(Ft/s)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       30.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

A.5

```
Covered channel
Upstream point elevation =    45.300(Ft.)
Downstream point elevation =    41.400(Ft.)
Channel length thru subarea  =   532.000(Ft.)
Channel base width      =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      4.711(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      4.711(CFS)
Depth of flow =   0.983(Ft.), Average velocity =   0.965(Ft/s)
Channel flow top width =    6.933(Ft.)
```

```
Flow Velocity =    0.96(Ft/s)
Travel time  =    9.19 min.
Time of concentration =   31.40 min.
Critical depth =      0.387(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      1.047(In/Hr) for a     2.0 year storm
User specified 'C' value of 0.390 given for subarea
Rainfall intensity =      1.047(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.405  CA =      5.067
Subarea runoff =      1.240(CFS) for      5.030(Ac.)
Total runoff =      5.305(CFS)      Total area =      12.510(Ac.)
Depth of flow =   1.045(Ft.), Average velocity =   0.997(Ft/s)
Critical depth =      0.418(Ft.)
End of computations, total study area =          12.510 (Ac.)



San Diego County Rational Hydrology Program
CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8
Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 12/24/18
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

--------------------------------------------------------------------------
Program License Serial Number 6290
--------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  1.800
24 hour precipitation(inches) =  3.050
P6/P24 =    59.0%
San Diego hydrology manual 'C' values used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
A.1
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  107.800(Ft.)
Lowest elevation =   89.900(Ft.)
Elevation difference =   17.900(Ft.) Slope = 17.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  17.90 %, in a development type of
 Permanent Open Space
```

```
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
Rainfall intensity (I) =      3.853(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.135(CFS)
Total initial stream area =        0.100(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

A.2

```
Upstream point elevation =    89.900(Ft.)
Downstream point elevation =    54.800(Ft.)
Channel length thru subarea  =   184.000(Ft.)
Channel base width      =    6.500(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      0.348(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      0.348(CFS)
Depth of flow =   0.056(Ft.), Average velocity =   0.926(Ft/s)
Channel flow top width =    6.947(Ft.)
Flow Velocity =    0.93(Ft/s)
Travel time  =    3.31 min.
Time of concentration =   10.21 min.
Critical depth =      0.044(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.992(In/Hr) for a    10.0 year storm
User specified 'C' value of 0.300 given for subarea
Rainfall intensity =      2.992(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.309  CA =      0.167
Subarea runoff =      0.365(CFS) for      0.440(Ac.)
Total runoff =      0.500(CFS)      Total area =       0.540(Ac.)
Depth of flow =   0.069(Ft.), Average velocity =   1.064(Ft/s)
Critical depth =      0.056(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       20.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

A.3

```
Upstream point elevation =    54.800(Ft.)
Downstream point elevation =    50.300(Ft.)
Channel length thru subarea  =   346.000(Ft.)
Channel base width      =    5.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      1.413(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      1.413(CFS)
Depth of flow =   0.322(Ft.), Average velocity =   0.698(Ft/s)
Channel flow top width =    7.575(Ft.)
Flow Velocity =    0.70(Ft/s)
Travel time  =    8.26 min.
```

```
Time of concentration =   18.47 min.
Critical depth =      0.131(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      2.042(In/Hr) for a    10.0 year storm
User specified 'C' value of 0.350 given for subarea
Rainfall intensity =      2.042(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      1.112
Subarea runoff =      1.771(CFS) for      2.700(Ac.)
Total runoff =      2.270(CFS)      Total area =       3.240(Ac.)
Depth of flow =   0.419(Ft.), Average velocity =   0.811(Ft/s)
Critical depth =      0.176(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       25.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
```

A.4

```
Estimated mean flow rate at midpoint of channel =      4.039(CFS)
Depth of flow =   0.277(Ft.), Average velocity =   2.894(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              3.38
      2              5.00              0.38
      3             10.00              0.13
      4             11.50              0.00
      5             13.00              0.13
      6             23.00              0.33
Manning's 'N' friction factor =   0.013
----------------------------------------------------------------
Sub-Channel flow  =      4.039(CFS)
  '     '    flow top width =     13.307(Ft.)
  '     '    velocity=    2.895(Ft/s)
  '     '    area =      1.396(Sq.Ft)
  '     '    Froude number =     1.575

Upstream point elevation =    50.300(Ft.)
Downstream point elevation =    45.300(Ft.)
Flow length =   385.000(Ft.)
Travel time  =    2.22 min.
Time of concentration =   20.69 min.
Depth of flow =   0.277(Ft.)
Average velocity =   2.894(Ft/s)
Total irregular channel flow =     4.039(CFS)
Irregular channel normal depth above invert elev. =   0.277(Ft.)
Average velocity of channel(s) =   2.894(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      1.898(In/Hr) for a    10.0 year storm
User specified 'C' value of 0.470 given for subarea
Rainfall intensity =      1.898(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.415  CA =      3.105
Subarea runoff =      3.622(CFS) for      4.240(Ac.)
Total runoff =      5.892(CFS)      Total area =       7.480(Ac.)
Depth of flow =   0.310(Ft.), Average velocity =   3.161(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       30.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

A.5

```
Covered channel
Upstream point elevation =    45.300(Ft.)
Downstream point elevation =    41.400(Ft.)
Channel length thru subarea  =   532.000(Ft.)
Channel base width      =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      6.850(CFS)
Manning's 'N'    = 0.100
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      6.850(CFS)
Depth of flow =   1.191(Ft.), Average velocity =   1.069(Ft/s)
Channel flow top width =    7.764(Ft.)
Flow Velocity =    1.07(Ft/s)
Travel time  =    8.30 min.
Time of concentration =   28.98 min.
Critical depth =      0.484(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      1.527(In/Hr) for a    10.0 year storm
User specified 'C' value of 0.390 given for subarea
Rainfall intensity =      1.527(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.405  CA =      5.067
Subarea runoff =      1.843(CFS) for      5.030(Ac.)
Total runoff =      7.735(CFS)      Total area =      12.510(Ac.)
Depth of flow =   1.266(Ft.), Average velocity =   1.104(Ft/s)
Critical depth =      0.523(Ft.)
End of computations, total study area =          12.510 (Ac.)
```

Attachment B

Field Verification Photos

Photo #1 - at Node 15 looking West (Channel Bottom width Approx. 6.5')

Photo #2 - at Node 15 looking South East

Photo #3 – Looking West

Photo #4 – Looking East (Channel Bottom Width Approx. 5’)

Photo #5 – Looking West

Photo #6 – Looking East

Photo #7 – Looking West

Photo #8 – Looking East

Photo #9 – Looking South West (Channel Bottom Width Approx. 7’)

Photo #10 – Looking East

Photo #8 – Looking West

Photo #9 – Looking East (Channel Bottom Width Appox. 3’)

Attachment C

Reference Material

H.1.1.2 WMAA Mapping Method

It is anticipated that most applicants will elect to identify critical coarse sediment yield areas through the RPO Method presented in the section above; however, applicants are not expressly forbidden from utilizing the Watershed Management Area Analysis PCCSYA maps that were developed through previous regional analysis. Applicants electing to pursue this alternate method must identify onsite and/or upstream sources of critical coarse sediment through examination of the PCCSYA maps provided in Appendix H.6.

H.1.2 Refinement Options

After identifying PCCSYAs using one of the methods above, the applicant may either accept the PCCSYA mapping as final, or may elect to further refine the results of the mapping through consideration of one or more of the refinement methods outlined below.

H.1.2.1 Depositional Analysis

Areas identified as PCCSYAs may be removed from consideration if it is demonstrated that these sources are deposited into existing systems prior to reaching the first downstream unlined water of the state. Systems resulting in deposition may include existing natural sinks, existing structural BMPs, existing hardened MS4 systems, or other existing similar features that produce a peak velocity from the discrete 2-year, 24 hour runoff event of less than three feet per second in the system being analyzed. Applicants electing to perform depositional analysis to refine PCCSYA mapping must refer to the detailed guidance provided in Appendix H.7.1.

H.1.2.2 Threshold Channel Analysis

Areas identified as PCCSYAs may be removed from consideration if they discharge to a "threshold channel" that does not exhibit characteristics associated with significant bed load movement during design flows. Applicants electing to perform threshold channel analysis to refine PCCSYA mapping must refer to the detailed guidance provided in Appendix H.7.2.

H.1.2.3 Coarse Sediment Source Area Verification

Areas identified as PCCSYAs may be removed from consideration if an applicant demonstrates that these areas actually consist of fine grained sediment. Applicants electing to perform coarse sediment source area verification to refine PCCSYA mapping must refer to the detailed guidance provided in Appendix H.7.3.

H.1.2.4 Verification of Geomorphic Landscape Units (GLUs)

If an applicant has identified sources of critical coarse sediment via the alternate WMAA Method discussed in Appendix H.1.1, PCCSYAs mapping may be refined through verification of GLUs. If this method is used, applicants must refer to detailed guidance provided in Appendix H.6.1.

H.7 PCCSYAs: Refinement Options

If an applicant has identified onsite and/or upstream PCCSYAs and elects to perform additional optional analyses to refine the PCCSYA designation, the guidance presented below should be followed. Protection of critical coarse sediment yield areas is a necessary element of hydromodification management because coarse sediment supply is as much an issue for causing erosive conditions to receiving streams as are accelerated flows. However, not all downstream systems warrant preservation of coarse sediment supply nor all source areas need to be protected. The following guidance shall be used to refine PCCSYA designations:

- Depositional Analysis (Appendix H.7.1)
- Threshold Channel Analysis (Appendix H.7.2)
- Coarse Sediment Source Area Verification (Appendix H.7.3)

H.7.1 Depositional Analysis

Areas identified as PCCSYAs may be removed from consideration if it is demonstrated that these sources are deposited into existing systems prior to reaching the first downstream unlined water of the state. Systems resulting in deposition may include existing natural sinks, existing structural BMPs, existing hardened MS4 systems, or other existing similar features. Applicants electing to perform depositional analysis to refine PCCSYA mapping must meet the following criteria to qualify for exemption from CCSYA designation:

- The existing hardened MS4 system that is being analyzed should be upstream of the first downstream unlined waters of the state; and
- The peak velocity from the discrete 2-year, 24-hour runoff event for the existing hardened MS4 system that is being analyzed is less than three feet per second.

The three feet per second criteria is consistent with the recommended minimum velocity for storm and sanitary sewers in ASCE Manual of Engineering Practice No. 37 (ASCE, 1970).

In limited scenarios, applicant may have the option to establish site specific minimum self-cleansing velocity using Equation H.7-1 or other appropriate equations instead of using the default three feet per second criteria. This site specific analysis must be documented in the SWQMP and the County has the discretion to request additional analysis prior to approving a site specific minimum self-cleansing velocity. If an applicant chooses to establish a site specific minimum self-cleansing velocity for refinement, then the applicant must design any new bypass hardened conveyance systems proposed by the project to meet the site specific criteria.

Equation H.7-1: Minimum Self Cleansing Velocity

$$V = \frac{1.486}{n} R^{1/6}\left[B\left(s_g - 1\right)D_g\right]^{1/2}$$

Where:

V = minimum self-cleansing velocity (ft/sec)
R = hydraulic radius (ft)
n = Manning's roughness coefficient (unitless)
B = constant equal to 0.04 for clean granular particles (unitless)
s_g = specific gravity of sediment particle (unitless): **Use 2.65**
D_g = sediment particle diameter (inches): **Use 0.20 in**

H.7.2 Threshold Channel Analysis

A threshold channel is a stream channel in which channel boundary material has no significant movement during the design flow. If there is no movement of bed load in the stream channel, then it is not anticipated that reductions in sediment supply will be detrimental to stream stability because the channel bed consists of the parent material and not coarse sediment supplied from upstream. In such a situation, changes in sediment supply are not considered a geomorphic condition of concern. SCCWRP Technical Report 562 (2008) states the following in regards to sand vs. gravel bed behavior/threshold vs. live-bed contrasts:

> "Sand and gravel systems are quite varied in their transport of sediment and their sensitivity to sediment supply. On the former, sand-bed channels typically have live beds, which transport sediment continuously even at relatively low flows. Conversely, gravel/cobble-bed channels generally transport the bulk of their bed sediment load more episodically, requiring higher flow events for bed mobility (i.e., threshold behavior)."
>
> "Sand-bed streams without vertical control are much more sensitive to perturbations in flow and sediment regimes than coarse-grain (gravel/cobble) threshold channels. This has clear implications in their respective management regarding hydromodification (i.e., sand systems being relatively more susceptible than coarser systems). This also has direct implications for the issue of sediment trapping by storm water practices in watersheds draining to sand-bed streams, as well as general loss of sediment supply following the conversion from undeveloped sparsely-vegetated to developed well-vegetated via irrigation."

The following provides guidance for evaluating whether a stream channel is a threshold channel or not. This determination is important because while accounting for changes in bed sediment supply is appropriate for quantifying geomorphic impacts in non-threshold stream channels, it is not considered appropriate for threshold channels. The domain of analysis for this evaluation shall be the same as that used to evaluate susceptibility, per SCCWRP Technical Report 606, Field Manual

PCCSYA MAP
MARJA ACRES
CARLSBAD, CALIFORNIA
Julie Pl
LEGEND
CRITICAL COARSE SEDIMENT YIELD AREAS
PROPERTY LINE

ATTACHMENT 2C

TECHNICAL MEMORANDUM
HYDROMODIFICATION MANAGEMENT
Marja Acres
CT 16-07, PUD 16-08, CDP 16-33, HDP 16-02, SUP 16-02, SDP 2018-0001
Camino Del Norte, Carlsbad CA 92008

PREPARE BY:

Alex Parra, Civil Engineer

1.0 INTRODUCTION

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

2.0 SWMM MODEL DEVELOPMENT

The Marja Acres development plan proposes a total number of 299 dwelling units consisting of 237 townhomes within the R-15 General Plan designated area, and 46 age restricted affordable house units, 16 Townhomes, a 4,000-square foot restaurant pad and a 5,700-retail pad area within the GC General Plan designated area. The proposed project has been designed to emphasize superior architecture, views, privacy, walkability, internal connectivity and recreational amenities.
The semi-developed site was previously graded and has 2:1 cut and fill slopes around the perimeter.

Two (2) SWMM models were prepared for this study: the first for the pre-development and the second for the post-developed conditions. The project site drains to a single Point of Compliance (POC) located just offsite to the northeast of the project site.

The SWMM model was used since we have found it to be more comparable to San Diego area watersheds than the alternative San Diego Hydrology Model (SDHM) and also because it is a non-proprietary model approved by the HMP document. For both SWMM models, flow duration curves were prepared to determine if the proposed HMP facilities are sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Oceanside Rain Gauge 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.

Evaporation for the site was modeled using average monthly values from Table G.1-1 of City of Carlsbad BMP Manual. The site was modeled with soil Type **D & C** hydrologic soils as this is the existing soils determined from the NRCS Soil Survey. Soils have been assumed to be compacted in the existing condition to represent the current land use of the site, while fully compacted in the post developed conditions.

The range of flows to control for hydromodification management depends on the erosion susceptibility of the receiving stream. A geomorphic study had been prepared by Chang Consultants (Hydromodification Screening for Rancho Costera and El Camino Real by Chang Consultants Dated June 19, 2013) just upstream of our proposed POC that discharges development runoff into the creek. Mr. Chang's findings suggest that the range of flows to control for this project would fall also under the $0.5Q_2$ to Q_{10} range.

Other SWMM inputs for the subareas are discussed in the appendices to this document, where the selection of the parameters is explained in detail.

3.0 HMP MODELING

PRE- DEVELOPED CONDITIONS

In current existing conditions, runoff from the partially developed site discharges via surface flow to an existing natural creek to the west, as such, there are two (2) points of compliance POC 1 & POC 2.
POC 2 encompasses 5.59 ac of land at the southwest corner of the site, this point of compliance has been excluded from the HMP modeling since it does not drain to POC 1 in post development condition. Also, some perimeter areas to the west and north of the project site have been excluded in both the pre and post development condition as these areas are considered natural or self-mitigating. These areas are also either unchanged in post development condition or hydro-modified by the existing facilities in El Camino Real median. (Please see SWQMP attachment 1F)

Table 1 below illustrates the pre-developed area and impervious percentage accordingly for the point of compliance under consideration, POC 1. In pre-development conditions, existing onsite impervious surfaces have been excluded from the impervious percentage.

TABLE 1 – SUMMARY OF PRE-DEVELOPED CONDITIONS

POC	DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (1)
1	DMA-1C	4.582	0%
1	DMA-1D	9.688	0%
	TOTAL	**14.270**	----

Notes: (1) – Per the 2013 RWQCB permit, existing condition impervious surfaces are not to be accounted for in existing conditions analysis.

DEVELOPED CONDITIONS

Storm water runoff from the propose project site is routed to one (1) POC located at the northwest corner of the project site. Runoff from the developed project site is drained to seven (7) onsite receiving bio-filtration LID BMPs. Once flows are routed via the proposed LID BMPs, all onsite flows are then conveyed via storm drain to the existing point of discharge. Hydromodification management for DMAs 8 & 9 do not drain to POC but the areas are accounted for in the model as runoff will be compensated by providing additional facility onsite treatment area. DMAs 10 & 11 are excluded from HMP calculations as these areas are either unchanged in post development condition or hydro-modified by the existing facilities in El Camino Real median. Runoff will be compensated onsite by providing additional facility onsite treatment area.

Table 2 summarizes the post-developed area and impervious percentage accordingly.

TABLE 2 – SUMMARY OF POST-DEVELOPED CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	**20.114**	N/A	

Seven (7) LID bio-filtration basins are located within the project site and are responsible for handling hydromodification requirements for the project site. In developed conditions, the basins will have a surface depth and a riser spillway structure set to variable elevations (see dimensions in Table 3). Flows

will then discharge from the basins via a low flow orifice outlet within the gravel layer. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

The following is the profile of a typical bio-filtration facility from top to bottom: 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) minimum of 36-inch layer of gravel for additional detention and to accommodate the French drain system that is to be located beneath the bio-filtration layers to intercept treated storm water and convey these flows to a small diameter lower outlet orifice and a 3" offsite below the orifice.

On regards to the 3-inch layer of mulch, the equivalent depth has been updated to account for the increase in volume by the voids in the amended soils slope and the reduce of volume by the mulch.

All facilities will have an impermeable liner on both sides and bottom. Once flows have been routed by the outlet structure, flows are then drained to the receiving storm drain structures prior to discharging to the POC. The bio-filtration facilities were modeled using the bioretention LID module within SWMM. The bioretention module can model the underground gravel storage layer, underdrain with an orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the spillway.

Detailed outlet structure location and elevations will be shown on the construction/building plans based on the recommendations of this study.

4.0 BMP MODELING FOR HMP PURPOSES

Modeling of five (5) dual purpose Water Pollution Control/Hydromodification and two (2) triple purpose BMPs, for POC-1

Three (3) LID BMP bio-filtration basins are proposed for water quality treatment and hydromodification conformance for the project site. Four (4) LID BMP bio-filtration basins are proposed for water quality treatment, hydromodification conformance and Q100 peak flow attenuation for the project site.

Table 3 illustrates the dimensions required for HMP compliance according to the SWMM model that was undertaken for the project.

TABLE 3 – SUMMARY OF DEVELOPED DUAL AND TRIPLE PURPOSE BMPs

BMP	Tributary Area (Ac)[7]	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2] (in)	Lower Orif. D (in)[3]	Depth Riser Invert (in)[4]	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] (in)
BMP 1	1.060	1949	33	0.8	12	12	18
BMP 2	0.901	1098	33	0.9	6	12	12
BMP 3	0.827	2360	36	0.9	27	12	33
BMP 4	6.098	7724	48	2.3	45	12	63
BMP 5	1.660	1692	36	2.2	21	12	30
BMP 6	4.444	4347	36	2.4	21	12	31.5
BMP 7	3.206	3567	48	2.0	21	12	31.5

Notes:
(1): Area of amended soil equal to area of gravel. 18" thick and in conformance with specifications listed on Fact Sheet BF-2: Nutrient Sensitive Media Design.
(2): Gravel depth needed to comply with hydromodification purposes
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.5 \cdot Q_2$).
(4): Depth of ponding beneath riser structure's surface spillway.
(5): Overflow length, the internal perimeter of the riser internal dimensions.
(6): Total surface depth of BMP from top crest elevation to surface invert.
(7): Tributary area to basin not including area of BMP.

TABLE 4 – SUMMARY OF RISER DETAILS

BMP	Lower Slot			Middle Slot			Top Riser		Emergency weir
	Width (ft)	Height (ft)	Elev.(1) (ft)	Width (ft)	Height (ft)	Elev(1) (ft)	Length(2) (ft)	Elev.(1) (ft)	Length(3) (ft)
BMP 3	1.0	0.167	1.00	--	----	-----	12	2.25	
BMP 4	1.0	0.167	1.50	4.0	0.167	3.25	12	3.75	8
BMP 5	1.5	0.167	1.00	8.0	0.250	1.33	12	1.75	8
BMP 6	1.5	0.167	1.00	8.0	0.250	1.33	12	1.75	10
BMP 7	1.5	0.167	1.00	8.0	0.250	1.33	12	1.75	8

(1): Basin ground surface elevation assumed to be 0.00 ft elevation.

Notes: (2): Overflow length is the internal perimeter of the riser structure.

(3): Additional Overflow length for peak flow discharges, BMPs 1 through 4 do not need additional overflow length.

Drawdown Calculations

To ensure compliance with the 96-hour drawdown requirements per Section 6.4.6 of the Final HMP dated March 2011, drawdown calculations are provided in Attachment 4 of this report.

5.0 FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at the POC by exporting the hourly runoff time series results from SWMM to a spreadsheet.

Q_2 and Q_{10} were determined with a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Cunnane plotting position method (which is the preferred plotting methodology in the HMP Permit). As the SWMM Model includes a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The range between 50% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate. FDC comparison at each POC is illustrated in Figure 1 in both normal and logarithmic scale. Attachment 5 provides a detailed drainage exhibit for the post-developed condition.

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

6.0 SUMMARY

This study has demonstrated that the proposed HMP BMPs provided for the proposed project is sufficient to meet the current HMP criteria for the Point of Compliance (POC), if the cross-section areas and volumes recommended within this technical memorandum, and the respective orifices and outlet structures are incorporated as specified within the proposed project site.

7.0 HYDROMODIFICATION COMPLIANCE FOR OFF-SITE AREAS

In regard to hydromodification compliance for off-site areas along El Camino Real, the following assumption based in two design conditions has been made: (a) the receiving creek is low susceptibility and (b) the BMPs were designed with the conservative sizing tables. Therefore, it has been assumed in this Tentative Map Approval that those basins will be sufficient for HMP compliance in final engineering once a proper continuous simulation model that accounts for the small modification in their drainage caused by this development is prepared, or once an update of the calculations made with the new tables is carried out. The re-design of the outside BMPs is out of the scope of this TMA.

8.0 ASSUMPTIONS

1. Type D &C Soils are representative of the majority of the existing condition site.

9.0 ATTACHMENTS

I. Q_2 to Q_{10} Comparison Tables

II. FDC Plots (log and natural "x" scale) and Flow Duration Table.

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

IV. Elevations vs. Discharge Curves to be used in SWMM, Draw Down Calculations

V. Pre & Post Development Maps, Project plan and section sketches

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

VII. SWMM Screens and Explanation of Significant Variables

VIII. Geotechnical Soil Survey

IX. Summary files from the SWMM Model

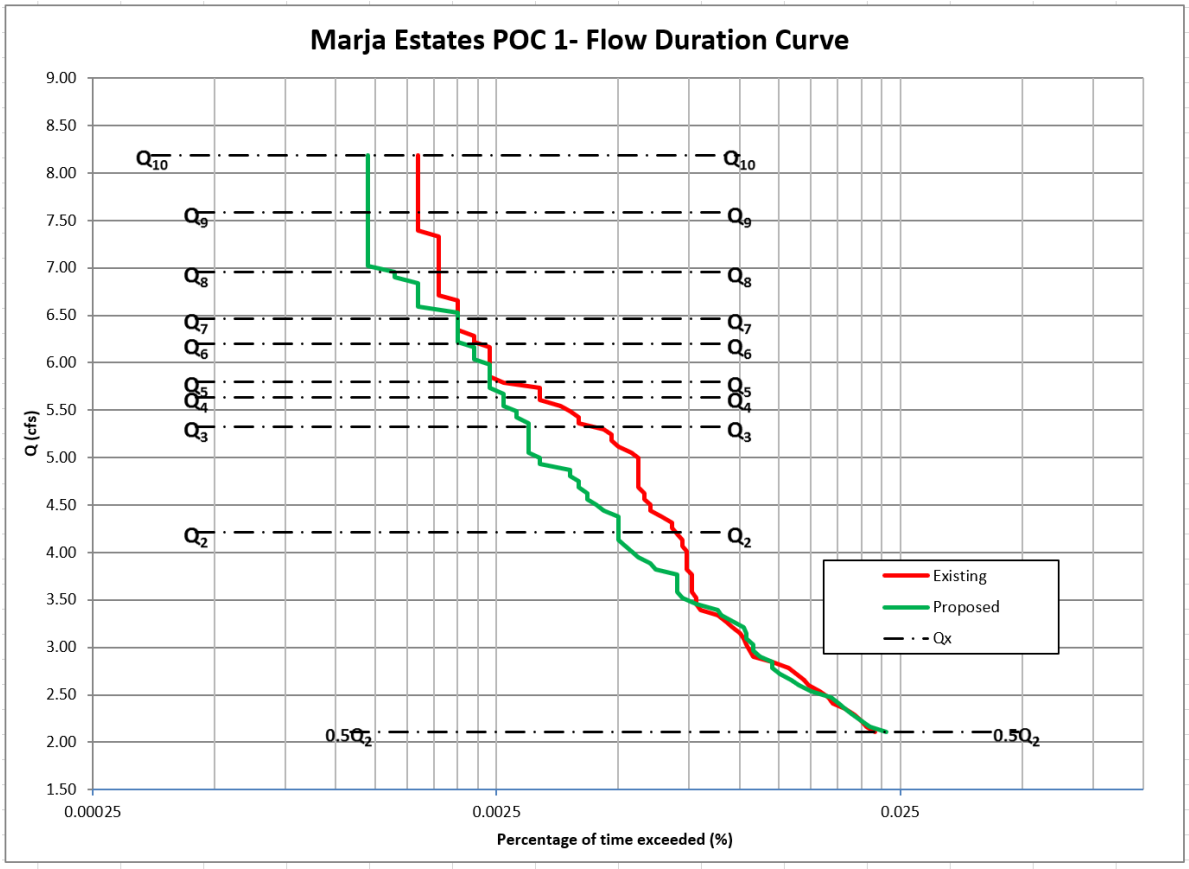
10. REFERENCES

[1] – *"City of Carlsbad BMP Design Manual Appendix G- Guidance for Continuous Simulation and Hydromodification management Sizing Factors*.

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

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

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



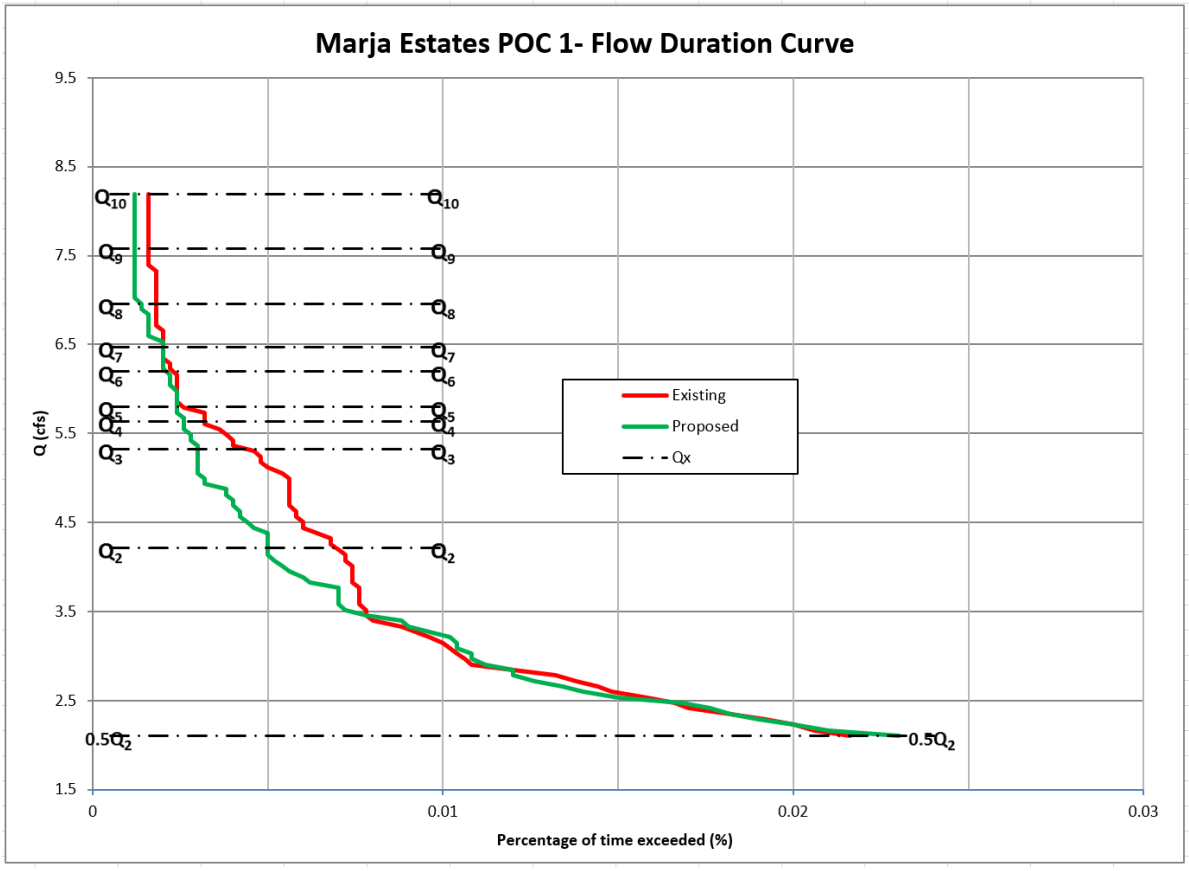


Figure 1a and 1b. Flow Duration Curve Comparison (logarithmic and normal "x" scale)

ATTACHMENT I.

Q_2 to Q_{10} Comparison Table – POC 1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
10	8.190	6.985	1.205
9	7.582	6.914	0.669
8	6.959	6.691	0.268
7	6.468	6.213	0.254
6	6.199	5.727	0.472
5	5.796	5.076	0.720
4	5.637	4.723	0.914
3	5.325	4.018	1.308
2	4.210	2.860	1.350

ATTACHMENT II

FLOW DURATION CURVE ANALYSIS

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

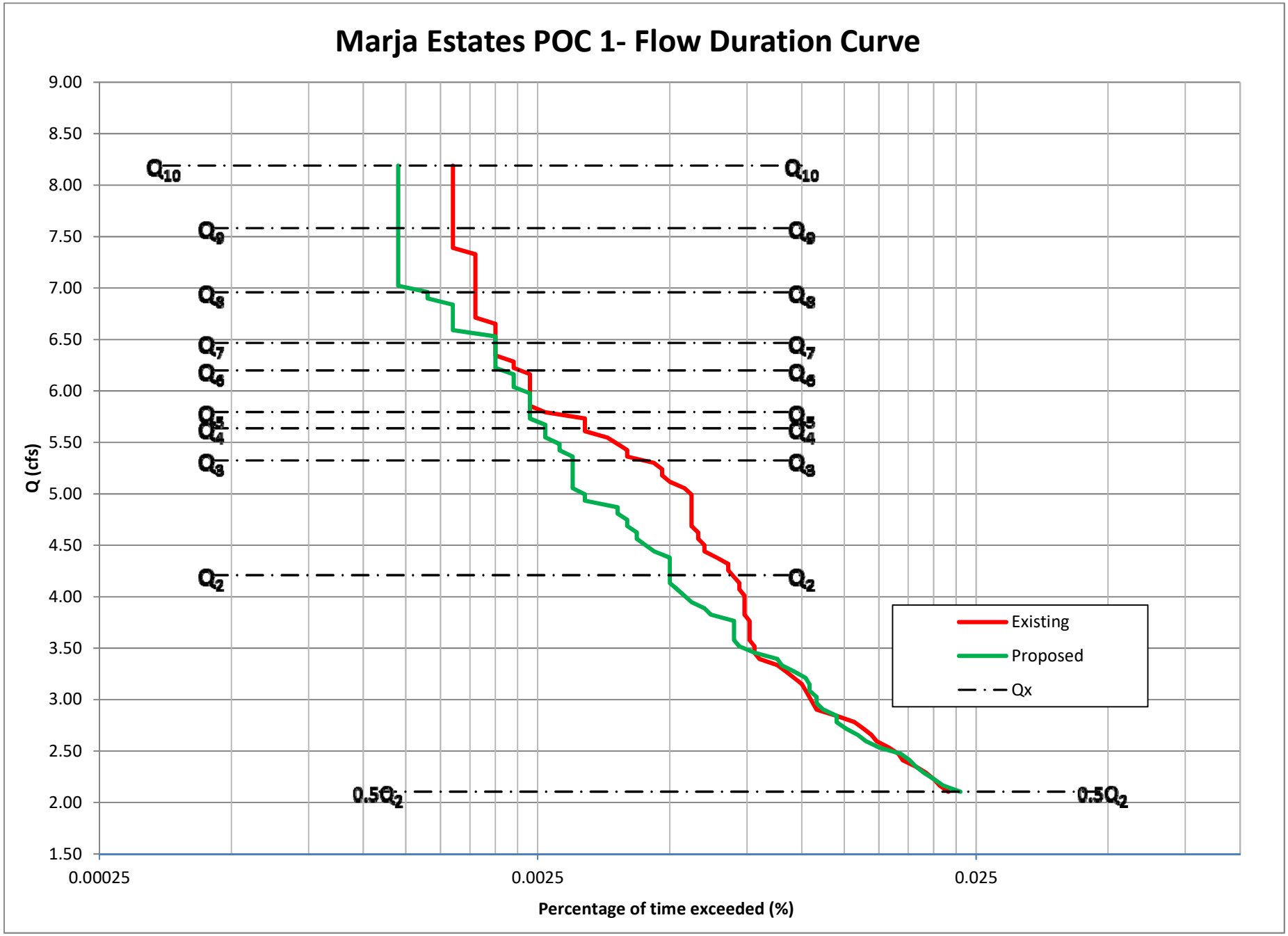
The figures on the following pages illustrate that the flow duration curve in post-development conditions after the proposed BMP is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval $0.50Q_2 – Q_{10}$ is divided in 100 sub-intervals, then a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and b) there are no more than 10 intervals in the range 101%-110% which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

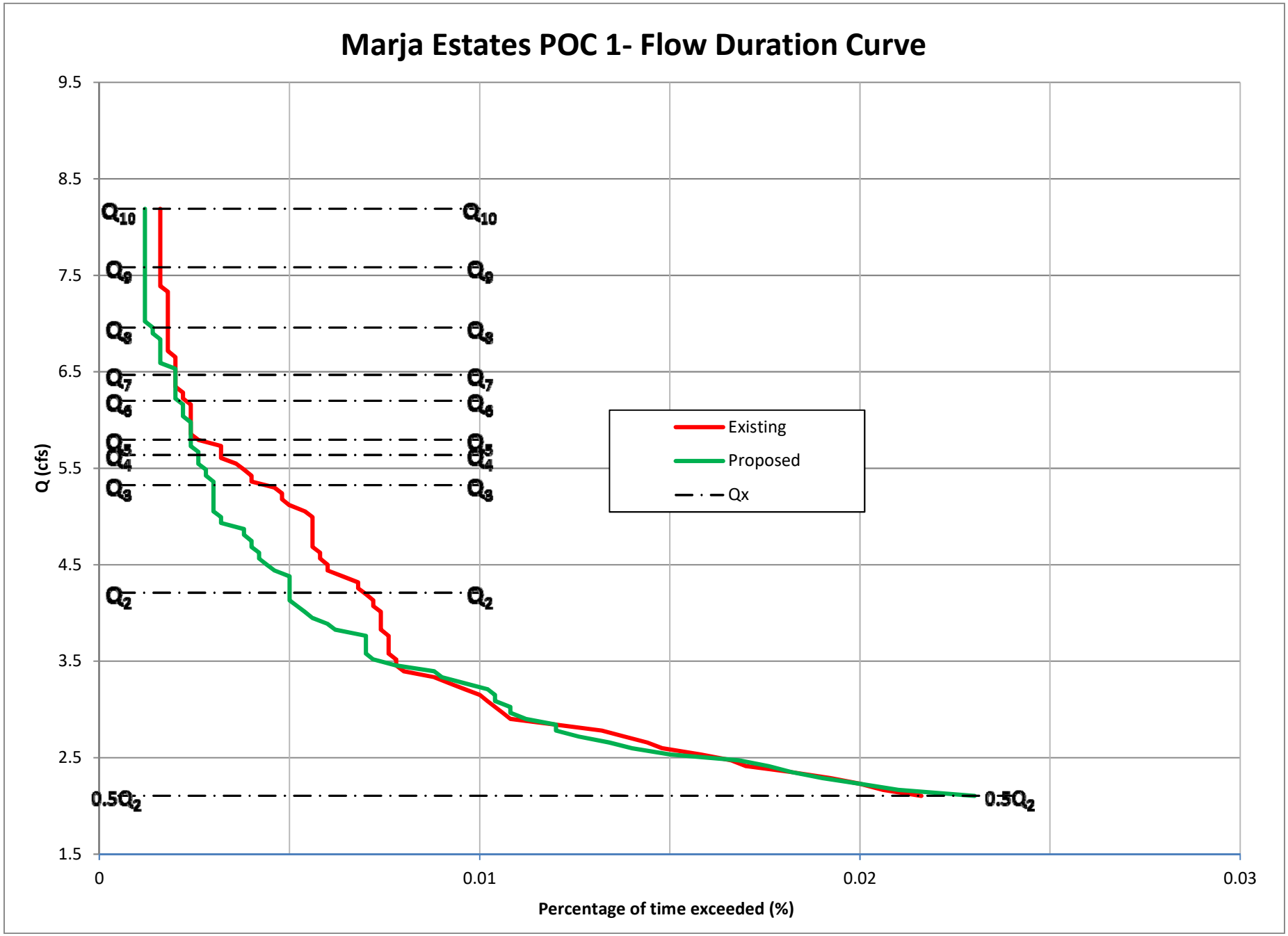
Consequently, the design passes the hydromodification test.

It is important to note that the flow duration curve can be expressed in the "x" axis as percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by a multiplying constant, their plot in logarithmic scale is going to look exactly the same, and compliance can be observed regardless of the variable selected. However, in order to satisfy the 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, 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). Analysis were performed using the Cunnane Plotting position Method (the preferred method in the HMP permit) from the "n" largest independent peak flows obtained from the continuous time series.

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


Marja Estates POC 1- Flow Duration Curve
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
Q (cfs)
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.5Q2
Existing
Proposed
Qx
0.00025
0.0025
0.025
Percentage of time exceeded (%)


Marja Estates POC 1- Flow Duration Curve
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
Q (cfs)
Q_{10}
Q_9
Q_8
Q_7
Q_6
Q_5
Q_4
Q_3
Q_2
$0.5Q_2$
Existing
Proposed
Qx
0
0.01
0.02
0.03
Percentage of time exceeded (%)

Flow Duration Curve Data for Marja Estates POC-1 , City of Carlsbad CA

Q2 =	4.21	cfs	Fraction	50 %
Q10 =	8.19	cfs		
Step =	0.0615	cfs		
Count =	499678	hours		
	57.00	years		

	Existing Condition			Detention Optimized			Pass or
Interval	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	Fail?
1	2.105	108	2.16E-02	115	2.30E-02	106%	Pass
2	2.166	103	2.06E-02	105	2.10E-02	102%	Pass
3	2.228	100	2.00E-02	100	2.00E-02	100%	Pass
4	2.289	96	1.92E-02	95	1.90E-02	99%	Pass
5	2.351	91	1.82E-02	91	1.82E-02	100%	Pass
6	2.412	85	1.70E-02	88	1.76E-02	104%	Pass
7	2.474	83	1.66E-02	84	1.68E-02	101%	Pass
8	2.535	79	1.58E-02	75	1.50E-02	95%	Pass
9	2.597	74	1.48E-02	70	1.40E-02	95%	Pass
10	2.658	72	1.44E-02	67	1.34E-02	93%	Pass
11	2.720	69	1.38E-02	63	1.26E-02	91%	Pass
12	2.781	66	1.32E-02	60	1.20E-02	91%	Pass
13	2.843	60	1.20E-02	60	1.20E-02	100%	Pass
14	2.904	54	1.08E-02	56	1.12E-02	104%	Pass
15	2.965	53	1.06E-02	54	1.08E-02	102%	Pass
16	3.027	52	1.04E-02	54	1.08E-02	104%	Pass
17	3.088	51	1.02E-02	52	1.04E-02	102%	Pass
18	3.150	50	1.00E-02	52	1.04E-02	104%	Pass
19	3.211	48	9.61E-03	51	1.02E-02	106%	Pass
20	3.273	46	9.21E-03	48	9.61E-03	104%	Pass
21	3.334	44	8.81E-03	45	9.01E-03	102%	Pass
22	3.396	40	8.01E-03	44	8.81E-03	110%	Pass
23	3.457	39	7.81E-03	39	7.81E-03	100%	Pass
24	3.519	39	7.81E-03	36	7.20E-03	92%	Pass
25	3.580	38	7.60E-03	35	7.00E-03	92%	Pass
26	3.642	38	7.60E-03	35	7.00E-03	92%	Pass
27	3.703	38	7.60E-03	35	7.00E-03	92%	Pass
28	3.765	38	7.60E-03	35	7.00E-03	92%	Pass
29	3.826	37	7.40E-03	31	6.20E-03	84%	Pass
30	3.887	37	7.40E-03	30	6.00E-03	81%	Pass
31	3.949	37	7.40E-03	28	5.60E-03	76%	Pass
32	4.010	37	7.40E-03	27	5.40E-03	73%	Pass
33	4.072	36	7.20E-03	26	5.20E-03	72%	Pass
34	4.133	36	7.20E-03	25	5.00E-03	69%	Pass
35	4.195	35	7.00E-03	25	5.00E-03	71%	Pass
36	4.256	34	6.80E-03	25	5.00E-03	74%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
37	4.318	34	6.80E-03	25	5.00E-03	74%	Pass
38	4.379	32	6.40E-03	25	5.00E-03	78%	Pass
39	4.441	30	6.00E-03	23	4.60E-03	77%	Pass
40	4.502	30	6.00E-03	22	4.40E-03	73%	Pass
41	4.564	29	5.80E-03	21	4.20E-03	72%	Pass
42	4.625	29	5.80E-03	21	4.20E-03	72%	Pass
43	4.686	28	5.60E-03	20	4.00E-03	71%	Pass
44	4.748	28	5.60E-03	20	4.00E-03	71%	Pass
45	4.809	28	5.60E-03	19	3.80E-03	68%	Pass
46	4.871	28	5.60E-03	19	3.80E-03	68%	Pass
47	4.932	28	5.60E-03	16	3.20E-03	57%	Pass
48	4.994	28	5.60E-03	16	3.20E-03	57%	Pass
49	5.055	27	5.40E-03	15	3.00E-03	56%	Pass
50	5.117	25	5.00E-03	15	3.00E-03	60%	Pass
51	5.178	24	4.80E-03	15	3.00E-03	63%	Pass
52	5.240	24	4.80E-03	15	3.00E-03	63%	Pass
53	5.301	23	4.60E-03	15	3.00E-03	65%	Pass
54	5.363	20	4.00E-03	15	3.00E-03	75%	Pass
55	5.424	20	4.00E-03	14	2.80E-03	70%	Pass
56	5.485	19	3.80E-03	14	2.80E-03	74%	Pass
57	5.547	18	3.60E-03	13	2.60E-03	72%	Pass
58	5.608	16	3.20E-03	13	2.60E-03	81%	Pass
59	5.670	16	3.20E-03	13	2.60E-03	81%	Pass
60	5.731	16	3.20E-03	12	2.40E-03	75%	Pass
61	5.793	13	2.60E-03	12	2.40E-03	92%	Pass
62	5.854	12	2.40E-03	12	2.40E-03	100%	Pass
63	5.916	12	2.40E-03	12	2.40E-03	100%	Pass
64	5.977	12	2.40E-03	12	2.40E-03	100%	Pass
65	6.039	12	2.40E-03	11	2.20E-03	92%	Pass
66	6.100	12	2.40E-03	11	2.20E-03	92%	Pass
67	6.162	12	2.40E-03	11	2.20E-03	92%	Pass
68	6.223	11	2.20E-03	10	2.00E-03	91%	Pass
69	6.284	11	2.20E-03	10	2.00E-03	91%	Pass
70	6.346	10	2.00E-03	10	2.00E-03	100%	Pass
71	6.407	10	2.00E-03	10	2.00E-03	100%	Pass
72	6.469	10	2.00E-03	10	2.00E-03	100%	Pass
73	6.530	10	2.00E-03	10	2.00E-03	100%	Pass
74	6.592	10	2.00E-03	8	1.60E-03	80%	Pass
75	6.653	10	2.00E-03	8	1.60E-03	80%	Pass
76	6.715	9	1.80E-03	8	1.60E-03	89%	Pass
77	6.776	9	1.80E-03	8	1.60E-03	89%	Pass
78	6.838	9	1.80E-03	8	1.60E-03	89%	Pass
79	6.899	9	1.80E-03	7	1.40E-03	78%	Pass
80	6.961	9	1.80E-03	7	1.40E-03	78%	Pass
81	7.022	9	1.80E-03	6	1.20E-03	67%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
82	7.084	9	1.80E-03	6	1.20E-03	67%	Pass
83	7.145	9	1.80E-03	6	1.20E-03	67%	Pass
84	7.206	9	1.80E-03	6	1.20E-03	67%	Pass
85	7.268	9	1.80E-03	6	1.20E-03	67%	Pass
86	7.329	9	1.80E-03	6	1.20E-03	67%	Pass
87	7.391	8	1.60E-03	6	1.20E-03	75%	Pass
88	7.452	8	1.60E-03	6	1.20E-03	75%	Pass
89	7.514	8	1.60E-03	6	1.20E-03	75%	Pass
90	7.575	8	1.60E-03	6	1.20E-03	75%	Pass
91	7.637	8	1.60E-03	6	1.20E-03	75%	Pass
92	7.698	8	1.60E-03	6	1.20E-03	75%	Pass
93	7.760	8	1.60E-03	6	1.20E-03	75%	Pass
94	7.821	8	1.60E-03	6	1.20E-03	75%	Pass
95	7.883	8	1.60E-03	6	1.20E-03	75%	Pass
96	7.944	8	1.60E-03	6	1.20E-03	75%	Pass
97	8.005	8	1.60E-03	6	1.20E-03	75%	Pass
98	8.067	8	1.60E-03	6	1.20E-03	75%	Pass
99	8.128	8	1.60E-03	6	1.20E-03	75%	Pass
100	8.190	8	1.60E-03	6	1.20E-03	75%	Pass

Peak Flows calculated with Cunnane Plotting Position

Return Period (years)	Pre-dev. Q (cfs)	Post-Dev. Q (cfs)	Reduction (cfs)
10	8.190	6.985	1.205
9	7.582	6.914	0.669
8	6.959	6.691	0.268
7	6.468	6.213	0.254
6	6.199	5.727	0.472
5	5.796	5.076	0.720
4	5.637	4.723	0.914
3	5.325	4.018	1.308
2	4.210	2.860	1.350

ATTACHMENT III

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

Basic Probabilistic Equation:

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

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

Cunnane Equation:

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

Weibull Equation:

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

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

n: number of years analyzed.

Explanation of Variables for the Tables in this Attachment

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

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

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

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

List of Peak events and Determination of Q2 and Q10 (Pre-Development)

Marja Estates - POC 1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**8.19**	**8.67**
9	**7.58**	**7.87**
8	**6.96**	**7.18**
7	**6.47**	**6.56**
6	**6.20**	**6.24**
5	**5.80**	**5.81**
4	**5.64**	**5.68**
3	**5.33**	**5.33**
2	**4.21**	**4.21**

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

Peaks (cfs)	Date	Posit	Period of Return (Years) Weibull	Cunnane
2.7	2/6/1969	57	1.02	1.01
2.74	3/8/1968	56	1.04	1.03
2.74	2/26/2004	55	1.05	1.05
2.75	12/24/1971	54	1.07	1.07
2.8	8/17/1977	53	1.09	1.09
2.8	11/11/1985	52	1.12	1.11
2.83	2/12/2003	51	1.14	1.13
2.84	12/5/1966	50	1.16	1.15
2.84	1/15/1978	49	1.18	1.18
2.84	1/15/1993	48	1.21	1.20
2.85	1/12/1960	47	1.23	1.23
2.85	3/1/1991	46	1.26	1.25
2.88	2/22/1998	45	1.29	1.28
2.95	1/6/1979	44	1.32	1.31
3.03	2/4/1994	43	1.35	1.34
3.11	2/23/2005	42	1.38	1.38
3.16	1/11/2005	41	1.41	1.41
3.17	9/18/1963	40	1.45	1.44
3.25	12/2/1961	39	1.49	1.48
3.26	3/11/1995	38	1.53	1.52
3.33	1/9/2005	37	1.57	1.56
3.38	1/18/1993	36	1.61	1.61
3.38	2/14/1998	35	1.66	1.65
3.39	3/2/1980	34	1.71	1.70
3.52	2/15/1986	33	1.76	1.75
3.81	1/29/1983	32	1.81	1.81
4.03	2/16/1980	31	1.87	1.87
4.18	2/17/1998	30	1.93	1.93
4.21	12/30/1991	29	2.00	2.00
4.33	2/27/1983	28	2.07	2.07
4.34	1/29/1980	27	2.15	2.15
4.38	10/20/2004	26	2.23	2.23
4.55	1/16/1978	25	2.32	2.33
4.64	2/23/1998	24	2.42	2.42
5.05	11/15/1952	23	2.52	2.53
5.16	2/3/1998	22	2.64	2.65
5.28	3/17/1982	21	2.76	2.78
5.32	10/27/2004	20	2.90	2.92
5.33	11/22/1965	19	3.05	3.08
5.36	1/16/1952	18	3.22	3.25
5.44	10/29/2000	17	3.41	3.45
5.57	4/1/1958	16	3.63	3.67
5.58	12/19/1970	15	3.87	3.92
5.78	2/10/1978	14	4.14	4.21
5.78	3/1/1978	13	4.46	4.54
5.79	9/23/1986	12	4.83	4.93
5.83	1/14/1993	11	5.27	5.40
6.19	2/18/2005	10	5.80	5.96
6.34	2/20/1980	9	6.44	6.65
6.66	2/4/1958	8	7.25	7.53
7.38	2/25/1969	7	8.29	8.67
8.32	2/25/2003	6	9.67	10.21
10.37	1/15/1979	5	11.60	12.43
10.38	1/4/1978	4	14.50	15.89
11.97	10/1/1983	3	19.33	22.00
12.08	1/4/1995	2	29.00	35.75
13.9	4/14/2003	1	58.00	95.33

List of Peak events and Determination of Q2 and Q10 (Post-Development)
Marja Estates - POC-1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**6.98**	**7.43**
9	**6.91**	**6.95**
8	**6.69**	**6.80**
7	**6.21**	**6.38**
6	**5.73**	**5.80**
5	**5.08**	**5.19**
4	**4.72**	**4.77**
3	**4.02**	**4.04**
2	**2.86**	**2.86**

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

Peaks (cfs)	Date	Posit	Period of Return (Years)	
			Weibull	Cunnane
1.88	2/13/1954	57	1.02	1.01
1.91	3/17/1963	56	1.04	1.03
1.92	1/25/1969	55	1.05	1.05
1.93	1/12/1960	54	1.07	1.07
1.94	12/24/1971	53	1.09	1.09
1.96	12/25/1983	52	1.12	1.11
1.97	3/5/1995	51	1.14	1.13
1.98	1/22/1967	50	1.16	1.15
2.01	2/18/1980	49	1.18	1.18
2.03	9/18/1963	48	1.21	1.20
2.06	2/16/1980	47	1.23	1.23
2.06	1/29/1983	46	1.26	1.25
2.11	1/14/1993	45	1.29	1.28
2.14	4/1/1958	44	1.32	1.31
2.14	2/26/2004	43	1.35	1.34
2.17	2/23/1998	42	1.38	1.38
2.2	2/23/2005	41	1.41	1.41
2.27	2/3/1998	40	1.45	1.44
2.3	1/16/1972	39	1.49	1.48
2.32	12/30/1991	38	1.53	1.52
2.36	12/19/1970	37	1.57	1.56
2.51	10/29/2000	36	1.61	1.61
2.56	3/2/1980	35	1.66	1.65
2.58	3/1/1983	34	1.71	1.70
2.63	1/13/1957	33	1.76	1.75
2.71	10/20/2004	32	1.81	1.81
2.74	2/18/2005	31	1.87	1.87
2.85	3/11/1995	30	1.93	1.93
2.86	12/5/1966	29	2.00	2.00
2.86	1/11/1980	28	2.07	2.07
2.94	9/23/1986	27	2.15	2.15
3.03	1/9/2005	26	2.23	2.23
3.06	1/15/1978	25	2.32	2.33
3.32	2/4/1958	24	2.42	2.42
3.55	2/20/1980	23	2.52	2.53
3.81	1/20/1962	22	2.64	2.65
3.81	11/22/1996	21	2.76	2.78
3.95	1/16/1993	20	2.90	2.92
4.08	2/15/1986	19	3.05	3.08
4.43	8/17/1977	18	3.22	3.25
4.48	2/10/1978	17	3.41	3.45
4.55	1/16/1978	16	3.63	3.67
4.66	1/16/1952	15	3.87	3.92
4.88	11/22/1965	14	4.14	4.21
4.9	3/8/1968	13	4.46	4.54
5	1/6/1979	12	4.83	4.93
5.51	2/25/1969	11	5.27	5.40
5.71	10/27/2004	10	5.80	5.96
5.99	3/17/1982	9	6.44	6.65
6.55	2/25/2003	8	7.25	7.53
6.89	3/1/1978	7	8.29	8.67
7	1/29/1980	6	9.67	10.21
9.49	1/4/1978	5	11.60	12.43
12.55	1/15/1979	4	14.50	15.89
13.1	10/1/1983	3	19.33	22.00
15.24	4/14/2003	2	29.00	35.75
16.19	1/4/1995	1	58.00	95.33

ATTACHMENT IV

AREA VS ELEVATION

Volume provided above the first surface outlet is accounted for in the basin Module within SWMM. A stage-storage relationship is provided within this Module, a copy of which is located on the following pages.

DISCHARGE VS ELEVATION

Discharge vs. elevation relationships were not required as the low flow orifice discharge has been accounted for within the aforementioned LID Module.

The orifices have been selected to maximize their size while still restricting flows to conform with the required 50% of the Q2 event flow as mandated in the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011.

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

A stage-discharge relationship is provided on the following pages for the surface outlet structure. The LID low flow orifice discharge relationship is addressed within the LID Module within SWMM – please refer to Attachment VII for further information.

DRAWDOWN CALCULATIONS

Drawdown calculations are provided on the following pages to illustrate the LID BMPs ability to not exceed the 96 hour requirement for standing water.

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	Units
BMP Inputs	0	Drainage Basin ID or Name	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	2	Effective Tributary Area	22,142	26,632	24,135	169,408	41,606	126,663	91,565	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.030	0.030	0.030	0.030	0.030	0.030	0.030	ratio
	4	Design Capture Volume Tributary to BMP	1,107	1,332	1,207	8,470	2,080	6,333	4,578	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined	Lined	Lined	Lined	Lined	Lined	Lined	unitless
	6	Provided Biofiltration BMP Surface Area	1,949	1,098	2,360	7,554	1,692	4,347	3,567	sq-ft
	7	Provided Surface Ponding Depth	12	6	12	18	12	12	12	inches
	8	Provided Soil Media Thickness	18	18	18	18	18	18	18	inches
	9	Provided Depth of Gravel Above Underdrain Invert	33	33	36	48	36	36	48	inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	0.80	0.90	0.90	2.30	2.20	2.40	2.00	inches
	11	Provided Depth of Gravel Below the Underdrain	3	3	3	3	3	3	3	inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	15	Effective Retention Depth	0.90	0.90	0.90	0.90	0.90	0.90	0.90	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	120	120	120	120	120	120	hours
	17	Volume Retained by BMP	146	82	177	567	127	326	268	cubic-feet
	18	Fraction of DCV Retained	0.13	0.06	0.15	0.07	0.06	0.05	0.06	ratio
	19	Portion of Retention Performance Standard Satisfied	0.15	0.07	0.17	0.08	0.07	0.06	0.07	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.07	0.03	0.08	0.04	0.03	0.03	0.03	ratio
	21	Design Capture Volume Remaining for Biofiltration	1,030	1,292	1,110	8,131	2,018	6,143	4,441	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.0393	0.0474	0.0497	0.3650	0.2956	0.3515	0.2661	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.87	1.86	0.91	2.09	7.55	3.49	3.22	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	0.87	1.86	0.91	2.09	5.00	3.49	3.22	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	5.23	11.19	5.46	12.53	30.00	20.96	19.34	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	30.00	24.00	30.00	40.80	30.00	30.00	34.80	inches
	29	Drawdown Time for Surface Ponding	14	3	13	9	2	3	4	hours
	30	Drawdown Time for Effective Biofiltration Depth	34	13	33	20	6	9	11	hours
	31	Total Depth Biofiltered	35.23	35.19	35.46	53.33	60.00	50.96	54.14	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	1,545	1,938	1,665	12,197	3,027	9,215	6,662	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	1,545	1,938	1,665	12,197	3,027	9,215	6,662	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	773	969	833	6,098	1,514	4,607	3,331	cubic-feet
	35	Option 2 - Provided Storage Volume	773	969	833	6,098	1,514	4,607	3,331	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	-	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	cubic-feet

DRAWDOWN TIME ←

Worksheet B.5-1 General Notes:

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

DISCHARGE EQUATIONS

1) Weir:

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

2) Slot:

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

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

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

3) Vertical Orifices

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

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

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

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

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

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

The following are the variables used above:

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

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

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

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

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

MARJA BASIN

Project: MARJA BASIN 1

Basin Description: REV

Contour Elevation	Contour Area (sq. ft)	Volume Conic (cu. ft)	
72.15	634.93	0	bottom
72.2	1,524.57	46.14	
72.25	1,545.94	116.88	
72.3	1,567.42	188.69	
72.35	1,589.00	261.57	
72.4	1,610.70	335.54	
72.45	1,632.73	410.6	
72.5	1,654.84	486.76	
72.55	1,677.02	564.03	
72.6	1,699.27	642.42	
72.65	1,721.60	721.91	
72.7	1,744.01	802.53	
72.75	1,766.49	884.27	
72.8	1,789.04	967.13	
72.85	1,811.67	1051.12	
72.9	1,834.37	1136.25	
72.95	1,857.15	1222.51	
73	1,880.00	1309.91	
73.05	1,902.92	1398.46	
73.1	1,925.92	1488.16	
73.15	1,949.00	1579.01	first outlet
73.2	1,972.14	1671.01	
73.25	1,995.37	1764.17	
73.3	2,018.66	1858.5	
73.35	2,042.04	1953.99	
73.4	2,065.48	2050.65	
73.45	2,081.17	2148.29	
73.5	2,096.90	2246.72	
73.55	2,112.65	2345.93	
73.6	2,128.44	2445.94	
73.65	2,144.27	2546.73	crest

MARJA BASIN

Project: MARJA BASIN 2

Basin Description: REV

Contour Elevation	Contour Area (sq. ft)	Cumulative Volume Conic (cu. ft)	
72.65	1949	0	bottom
72.75	1949	194.9	
72.85	1949	389.8	
72.95	1949	584.7	
73.05	1949	779.6	
73.15	1949	974.5	first outlet
73.25	1949	1169.4	
73.35	1949	1364.3	
73.45	1949	1559.2	
73.55	1949	1754.1	
73.65	1949	1949	crest

MARJA BASIN

Project:	MARJA
Basin Description:	BASIN 3 REV

Contour Elevation	Contour Area (sq. ft)	Cumulative Volume Conic (cu. ft)	
73.85	2360	0	bottom
73.95	2360	236	
74.05	2360	472	
74.15	2360	708	
74.25	2360	944	
74.35	2360	1180	
74.45	2360	1416	
74.55	2360	1652	
74.65	2360	1888	
74.75	2360	2124	
74.85	2360	2360	first outlet
74.95	2360	2596	
75.05	2360	2832	
75.15	2360	3068	
75.25	2360	3304	
75.35	2360	3540	
75.45	2360	3776	
75.55	2360	4012	
75.65	2360	4248	
75.75	2360	4484	
75.85	2360	4720	
75.95	2360	4956	
76.05	2360	5192	emergency weir
76.15	2360	5428	
76.25	2360	5664	
76.35	2360	5900	
76.45	2360	6136	
76.55	2360	6372	crest
76.65	2361	6608.1	crest

MARJA BASIN

Project:	MARJA ACRES
Basin Description:	BASIN 4 REV

Contour Elevation	Contour Area (sq. ft)	Cumulative Volume Conic (cu. ft)	
53.5	6,100.65	0	bottom
53.6	6,204.97	615.27	
53.7	6,309.87	1241.01	
53.8	6,415.32	1877.26	
53.9	6,521.34	2524.09	
54	6,627.93	3181.54	
54.1	6,735.08	3849.69	
54.2	6,842.79	4528.57	
54.3	6,951.07	5218.26	
54.4	7,059.91	5918.8	
54.5	7,169.32	6630.26	
54.6	7,279.29	7352.68	
54.7	7,389.83	8086.13	
54.8	7,500.93	8830.66	
54.9	7,612.59	9586.33	
55	7,724.82	10353.19	First Outlet
55.1	7,799.89	11129.42	
55.2	7,875.22	11913.18	
55.3	7,950.79	12704.47	
55.4	8,026.62	13503.34	
55.5	8,102.70	14309.8	
55.6	8,179.03	15123.89	
55.7	8,251.64	15945.42	
55.8	8,319.83	16773.99	
55.9	8,387.30	17609.34	
56	8,454.06	18451.41	second outlet
56.1	8,516.43	19299.93	
56.2	8,578.52	20154.68	
56.3	8,640.34	21015.62	
56.4	8,701.89	21882.73	
56.5	8,763.17	22755.98	
56.6	8,824.17	23635.35	
56.7	8,884.91	24520.8	
56.75	8,915.17	24965.97	
56.8	8,945.37	25412.31	
56.9	9,005.56	26309.86	
57	9,065.48	27213.41	
57.1	9,125.13	28122.93	
57.2	9,184.51	29038.42	emergency weir
57.3	9,243.61	29959.82	
57.4	9,302.44	30887.12	
57.5	9,361.00	31820.29	
57.6	9,419.29	32759.3	
57.7	9,477.31	33704.13	
57.8	9,535.06	34654.75	
57.9	9,592.53	35611.13	
58	9,649.73	36573.24	
58.1	9,706.66	37541.06	
58.2	9,763.32	38514.56	crest

MARJA BASIN

Project: MARJA BASIN 5

Basin Description: REV

Contour Elevation	Contour Area (sq. ft)	Cumulative Volume Conic (cu. ft)	
63.5	1,359.06	0	bottom
63.6	1,391.38	133.82	
63.7	1,423.92	270.88	
63.8	1,456.69	411.21	
63.9	1,489.68	554.82	
64	1,522.90	701.75	
64.1	1,556.35	852.01	
64.2	1,590.02	1005.62	
64.3	1,623.92	1162.62	
64.4	1,658.05	1323.01	
64.5	1,692.40	1486.83	first outlet
64.6	1,715.81	1653.54	
64.7	1,739.40	1822.6	
64.8	1,763.18	1994.03	second outlet
64.9	1,787.13	2167.84	
65	1,811.28	2344.06	
65.1	1,835.60	2522.71	
65.2	1,860.11	2703.79	emergency weir
65.3	1,884.78	2887.33	
65.4	1,909.48	3073.35	
65.5	1,934.18	3261.83	
65.6	1,958.87	3452.78	
65.7	1,983.57	3646.2	
65.8	2,008.28	3842.09	
65.9	2,032.98	4040.45	
66	2,057.69	4241.28	crest

MARJA BASIN

Project: MARJA BASIN 6

Basin Description: REV

Contour Elevation	Contour Area (sq. ft)	Volume Conic (cu. ft)	
68.5	2,286.51	0	bottom
68.6	2,490.13	241.66	
68.7	2,694.29	503.72	
68.8	2,899.01	786.22	
68.9	3,104.27	1089.22	
69	3,310.09	1412.79	
69.1	3,516.46	1756.96	
69.2	3,723.38	2121.81	
69.3	3,930.85	2507.37	
69.4	4,138.88	2913.72	
69.5	4,347.45	3340.89	first outlet
69.6	4,556.57	3788.95	
69.7	4,766.25	4257.95	
69.8	4,976.48	4747.95	second outlet
69.9	5,187.25	5259	
70	5,398.58	5791.16	
70.1	5,610.53	6344.48	
70.2	5,823.04	6919.03	emergency weir
70.3	6,036.10	7514.85	
70.4	6,249.72	8132.01	
70.5	6,463.91	8770.56	
70.6	6,590.05	9279.08	
70.7	6,724.70	9800.32	
70.8	6,877.00	10335.91	
70.9	7,046.96	10887.6	
71	7,234.45	11457.17	
71.1	7,438.33	12046.29	crest

MARJA BASIN

Project:	MARJA BASIN 7
Basin Description:	REV

Contour Elevation	Contour Area (sq. ft)	Volume Conic (cu. ft)	
63	2,857.36	0	bottom
63.1	2,921.90	288.96	
63.2	2,986.99	584.4	
63.3	3,052.65	886.37	
63.4	3,118.87	1194.94	
63.5	3,185.65	1510.16	
63.6	3,252.98	1832.09	
63.7	3,320.88	2160.77	
63.8	3,389.35	2496.28	
63.9	3,458.37	2838.66	
64	3,566.95	3187.97	first outlet
64.1	3,593.73	3543.05	
64.2	3,620.99	3902.79	
64.3	3,668.23	4267.24	second outlet
64.4	3,715.45	4636.43	
64.5	3,762.66	5010.33	
64.6	3,809.84	5388.95	
64.7	3,856.93	5772.29	emergency weir
64.8	3,902.69	6160.27	
64.9	3,947.01	6552.75	
65	3,991.01	6949.65	
65.1	4,034.83	7350.94	
65.2	4,078.47	7756.6	
65.3	4,121.92	8166.62	
65.4	4,165.12	8580.97	
65.5	4,208.02	8999.62	
65.6	4,250.60	9422.55	
65.7	4,292.87	9849.72	
65.8	4,334.80	10281.11	
65.9	4,376.39	10716.66	
66	4,417.65	11156.36	
66.1	4,458.58	11600.17	crest

Outlet structure for Discharge of Detention Basin BF-3

Discharge vs Elevation Table

Lower slot		Emergency Weir	
Invert:	0.00 ft	Invert:	1.250 ft
B	1.00 ft	B:	12 ft
h	0.167 ft		
Upper slot			
Invert:	0.000 ft		
B:	0.00 ft		
h	0.000 ft		

h (ft)	H/D-low -	H/D-mid -	Qtot-med (cfs)	Qslot-low (cfs)	Qemer (cfs)	Qtot (cfs)	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	FIRST OUTLET - 1' ABOVE BIOFILTRATION
0.042	0.500	0.000	0.000	0.026	0.000	0.026	
0.083	1.000	0.000	0.000	0.075	0.000	0.075	
0.125	1.500	0.000	0.000	0.137	0.000	0.137	
0.167	2.000	0.000	0.000	0.211	0.000	0.211	
0.208	2.500	0.000	0.000	0.288	0.000	0.288	
0.250	3.000	0.000	0.000	0.333	0.000	0.333	
0.292	3.500	0.500	0.000	0.372	0.000	0.372	
0.333	4.000	1.000	0.000	0.408	0.000	0.408	
0.375	4.500	1.500	0.000	0.441	0.000	0.441	
0.417	5.000	2.000	0.000	0.471	0.000	0.471	
0.458	5.500	2.500	0.000	0.500	0.000	0.500	
0.500	6.000	3.000	0.000	0.527	0.000	0.527	
0.542	6.500	3.500	0.000	0.552	0.000	0.552	
0.583	7.000	4.000	0.000	0.577	0.000	0.577	
0.625	7.500	4.500	0.000	0.600	0.000	0.600	
0.667	8.000	5.000	0.000	0.623	0.000	0.623	
0.708	8.500	5.500	0.000	0.645	0.000	0.645	
0.750	9.000	6.000	0.000	0.666	0.000	0.666	
0.792	9.500	6.500	0.000	0.687	0.000	0.687	
0.833	10.000	7.000	0.000	0.707	0.000	0.707	
0.875	10.500	7.500	0.000	0.726	0.000	0.726	
0.917	11.000	8.000	0.000	0.745	0.000	0.745	
0.958	11.500	8.500	0.000	0.763	0.000	0.763	
1.000	12.000	9.000	0.000	0.781	0.000	0.781	
1.042	12.500	9.500	0.000	0.799	0.000	0.799	
1.083	13.000	10.000	0.000	0.816	0.000	0.816	
1.125	13.500	10.500	0.000	0.833	0.000	0.833	
1.167	14.000	11.000	0.000	0.849	0.000	0.849	
1.208	14.500	11.500	0.000	0.865	0.000	0.865	
1.250	15.000	12.000	0.000	0.881	0.000	0.881	EMERGENCY WEIR
1.292	15.500	12.500	0.000	0.897	0.316	1.213	
1.333	16.000	13.000	0.000	0.912	0.895	1.807	
1.375	16.500	13.500	0.000	0.927	1.644	2.571	
1.417	17.000	14.000	0.000	0.942	2.531	3.473	
1.458	17.500	14.500	0.000	0.957	3.537	4.494	
1.500	18.000	15.000	0.000	0.971	4.650	5.621	
1.542	18.500	15.500	0.000	0.985	5.860	6.845	

1.583	19.000	16.000	0.000	0.999	7.159	8.158	
1.625	19.500	16.500	0.000	1.013	8.543	9.556	
1.667	20.000	17.000	0.000	1.027	10.005	11.032	
1.708	20.500	17.500	0.000	1.040	11.543	12.583	
1.750	21.000	18.000	0.000	1.053	13.152	14.205	
1.792	21.500	18.500	0.000	1.066	14.830	15.896	
1.833	22.000	19.000	0.000	1.079	16.574	17.653	
1.875	22.500	19.500	0.000	1.092	18.381	19.473	
1.917	23.000	20.000	0.000	1.105	20.249	21.354	
1.958	23.500	20.500	0.000	1.117	22.177	23.294	
2.000	24.000	21.000	0.000	1.130	24.162	25.292	
2.042	24.500	21.500	0.000	1.142	26.203	27.345	
2.083	25.000	22.000	0.000	1.154	28.299	29.453	
2.125	25.500	22.500	0.000	1.166	30.448	31.614	
2.167	26.000	23.000	0.000	1.178	32.648	33.826	
2.208	26.500	23.500	0.000	1.189	34.899	36.089	
2.250	27.000	24.000	0.000	1.201	37.200	38.401	
2.292	27.500	24.500	0.000	1.212	39.549	40.761	
2.333	28.000	25.000	0.000	1.224	41.946	43.169	
2.375	28.500	25.500	0.000	1.235	44.389	45.624	
2.417	29.000	26.000	0.000	1.246	46.877	48.124	
2.458	29.500	26.500	0.000	1.257	49.411	50.668	
2.500	30.000	27.000	0.000	1.268	51.989	53.257	
2.542	30.500	27.500	0.000	1.279	54.610	55.889	
2.583	31.000	28.000	0.000	1.290	57.273	58.563	
2.625	31.500	28.500	0.000	1.301	59.979	61.279	
2.667	32.000	29.000	0.000	1.311	62.726	64.037	
2.708	32.500	29.500	0.000	1.322	65.513	66.835	
2.750	33.000	30.000	0.000	1.332	68.341	69.673	CREST

Outlet structure for Discharge of Detention Basin BF-4

Discharge vs Elevation Table

Lower slot		Emergency Weir	
Invert:	0.00 ft	Invert:	2.250 ft
B	1.50 ft	B:	12 ft
h	0.167 ft		
Upper slot			
Invert:	1.750 ft		
B:	4.00 ft		
h	0.167 ft		

h (ft)	H/D-low -	H/D-mid -	Qslot-low (cfs)	Qslot-upp (cfs)	Qemer (cfs)	Qtot (cfs)	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	FIRST OUTLET - 1.5' ABOVE BIOFILTRATION
0.042	0.500	0.000	0.040	0.000	0.000	0.040	
0.083	1.000	0.000	0.112	0.000	0.000	0.112	
0.125	1.500	0.000	0.206	0.000	0.000	0.206	
0.167	2.000	0.000	0.316	0.000	0.000	0.316	
0.208	2.500	0.000	0.433	0.000	0.000	0.433	
0.250	3.000	0.000	0.500	0.000	0.000	0.500	
0.292	3.500	0.500	0.559	0.000	0.000	0.559	
0.333	4.000	1.000	0.612	0.000	0.000	0.612	
0.375	4.500	1.500	0.661	0.000	0.000	0.661	
0.417	5.000	2.000	0.707	0.000	0.000	0.707	
0.458	5.500	2.500	0.749	0.000	0.000	0.749	
0.500	6.000	3.000	0.790	0.000	0.000	0.790	
0.542	6.500	3.500	0.829	0.000	0.000	0.829	
0.583	7.000	4.000	0.865	0.000	0.000	0.865	
0.625	7.500	4.500	0.901	0.000	0.000	0.901	
0.667	8.000	5.000	0.935	0.000	0.000	0.935	
0.708	8.500	5.500	0.968	0.000	0.000	0.968	
0.750	9.000	6.000	0.999	0.000	0.000	0.999	
0.792	9.500	6.500	1.030	0.000	0.000	1.030	
0.833	10.000	7.000	1.060	0.000	0.000	1.060	
0.875	10.500	7.500	1.089	0.000	0.000	1.089	
0.917	11.000	8.000	1.117	0.000	0.000	1.117	
0.958	11.500	8.500	1.145	0.000	0.000	1.145	
1.000	12.000	9.000	1.172	0.000	0.000	1.172	
1.042	12.500	9.500	1.198	0.000	0.000	1.198	
1.083	13.000	10.000	1.224	0.000	0.000	1.224	
1.125	13.500	10.500	1.249	0.000	0.000	1.249	
1.167	14.000	11.000	1.274	0.000	0.000	1.274	
1.208	14.500	11.500	1.298	0.000	0.000	1.298	
1.250	15.000	12.000	1.322	0.000	0.000	1.322	
1.292	15.500	12.500	1.345	0.000	0.000	1.345	
1.333	16.000	13.000	1.368	0.000	0.000	1.368	
1.375	16.500	13.500	1.391	0.000	0.000	1.391	
1.417	17.000	14.000	1.413	0.000	0.000	1.413	
1.458	17.500	14.500	1.435	0.000	0.000	1.435	
1.500	18.000	15.000	1.457	0.000	0.000	1.456621	
1.542	18.500	15.500	1.478	0.000	0.000	1.478	
1.583	19.000	16.000	1.499	0.000	0.000	1.499	

1.625	19.500	16.500	1.520	0.000	0.000	1.520	
1.667	20.000	17.000	1.540	0.000	0.000	1.540	
1.708	20.500	17.500	1.560	0.000	0.000	1.560	
1.750	21.000	18.000	1.580	0.000	0.000	1.580	
1.792	21.500	18.500	1.600	0.105	0.000	1.705	
1.833	22.000	19.000	1.619	0.298	0.000	1.917	
1.875	22.500	19.500	1.638	0.548	0.000	2.186	
1.917	23.000	20.000	1.657	0.844	0.000	2.501	
1.958	23.500	20.500	1.676	1.155	0.000	2.831	
2.000	24.000	21.000	1.694	1.334	0.000	3.029	
2.042	24.500	21.500	1.713	1.492	0.000	3.205	
2.083	25.000	22.000	1.731	1.634	0.000	3.365	
2.125	25.500	22.500	1.749	1.766	0.000	3.514	
2.167	26.000	23.000	1.766	1.887	0.000	3.654	
2.208	26.500	23.500	1.784	2.002	0.000	3.786	
2.250	27.000	24.000	1.801	2.110	0.000	3.912	EMERGENCY WEIR
2.292	27.500	24.500	1.819	2.213	0.316	4.348	
2.333	28.000	25.000	1.836	2.312	0.895	5.042	
2.375	28.500	25.500	1.853	2.406	1.644	5.903	
2.417	29.000	26.000	1.869	2.497	2.531	6.898	
2.458	29.500	26.500	1.886	2.585	3.537	8.008	
2.500	30.000	27.000	1.902	2.670	4.650	9.222	
2.542	30.500	27.500	1.919	2.752	5.860	10.530	
2.583	31.000	28.000	1.935	2.832	7.159	11.926	
2.625	31.500	28.500	1.951	2.909	8.543	13.403	
2.667	32.000	29.000	1.967	2.985	10.005	14.957	
2.708	32.500	29.500	1.983	3.059	11.543	16.584	
2.750	33.000	30.000	1.998	3.131	13.152	18.281	
2.792	33.500	30.500	2.014	3.201	14.830	20.045	
2.833	34.000	31.000	2.029	3.270	16.574	21.873	
2.875	34.500	31.500	2.045	3.337	18.381	23.763	
2.917	35.000	32.000	2.060	3.403	20.249	25.712	
2.958	35.500	32.500	2.075	3.468	22.177	27.720	
3.000	36.000	33.000	2.090	3.532	24.162	29.784	
3.042	36.500	33.500	2.105	3.594	26.203	31.903	
3.083	37.000	34.000	2.120	3.656	28.299	34.074	
3.125	37.500	34.500	2.134	3.716	30.448	36.298	
3.167	38.000	35.000	2.149	3.776	32.648	38.573	
3.208	38.500	35.500	2.163	3.834	34.899	40.897	
3.250	39.000	36.000	2.178	3.892	37.200	43.270	CREST

Outlet structure for Discharge of Detention Basin BF-5

Discharge vs Elevation Table

Lower slot		Emergency Weir	
Invert:	0.00 ft	Invert:	0.750 ft
B	1.50 ft	B:	12 ft
h	0.167 ft		
Upper slot			
Invert:	0.333 ft		
B:	8.00 ft		
h	0.250 ft		

h (ft)	H/D-low -	H/D-mid -	Qslot-low (cfs)	Qslot-upp (cfs)	Qemer (cfs)	Qtot (cfs)	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	FIRST OUTLET - 1' ABOVE BIOFILTRATION
0.042	0.500	0.000	0.040	0.000	0.000	0.040	
0.083	1.000	0.000	0.112	0.000	0.000	0.112	
0.125	1.500	0.000	0.206	0.000	0.000	0.206	
0.167	2.000	0.000	0.316	0.000	0.000	0.316	
0.208	2.500	0.000	0.433	0.000	0.000	0.433	
0.250	3.000	0.000	0.500	0.000	0.000	0.500	
0.292	3.500	0.500	0.559	0.000	0.000	0.559	
0.333	4.000	1.000	0.612	0.000	0.000	0.612	
0.375	4.500	1.500	0.661	0.211	0.000	0.872	
0.417	5.000	2.000	0.707	0.597	0.000	1.303	
0.458	5.500	2.500	0.749	1.096	0.000	1.845	
0.500	6.000	3.000	0.790	1.687	0.000	2.477	
0.542	6.500	3.500	0.829	2.358	0.000	3.187	
0.583	7.000	4.000	0.865	3.100	0.000	3.965	
0.625	7.500	4.500	0.901	3.906	0.000	4.807	
0.667	8.000	5.000	0.935	4.469	0.000	5.403	
0.708	8.500	5.500	0.968	4.895	0.000	5.863	
0.750	9.000	6.000	0.999	5.287	0.000	6.287	EMERGENCY WEIR
0.792	9.500	6.500	1.030	5.653	0.316	6.999	
0.833	10.000	7.000	1.060	5.995	0.895	7.950	
0.875	10.500	7.500	1.089	6.320	1.644	9.053	
0.917	11.000	8.000	1.117	6.628	2.531	10.276	
0.958	11.500	8.500	1.145	6.923	3.537	11.605	
1.000	12.000	9.000	1.172	7.206	4.650	13.027	
1.042	12.500	9.500	1.198	7.478	5.860	14.535	
1.083	13.000	10.000	1.224	7.740	7.159	16.123	
1.125	13.500	10.500	1.249	7.994	8.543	17.786	
1.167	14.000	11.000	1.274	8.240	10.005	19.519	
1.208	14.500	11.500	1.298	8.479	11.543	21.320	
1.250	15.000	12.000	1.322	8.711	13.152	23.185	
1.292	15.500	12.500	1.345	8.937	14.830	25.113	
1.333	16.000	13.000	1.368	9.158	16.574	27.100	
1.375	16.500	13.500	1.391	9.374	18.381	29.145	
1.417	17.000	14.000	1.413	9.584	20.249	31.247	
1.458	17.500	14.500	1.435	9.790	22.177	33.402	
1.500	18.000	15.000	1.457	9.992	24.162	35.611	CREST

Outlet structure for Discharge of Detention Basin BF-6

Discharge vs Elevation Table

Lower slot		Emergency Weir	
Invert:	0.00 ft	Invert:	0.750 ft
B	1.50 ft	B:	12 ft
h	0.167 ft		
Upper slot			
Invert:	0.333 ft		
B:	8.00 ft		
h	0.250 ft		

h (ft)	H/D-low -	H/D-mid -	Qslot-low (cfs)	Qslot-upp (cfs)	Qemer (cfs)	Qtot (cfs)	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	FIRST OUTLET - 1' ABOVE BIOFILTRATION
0.042	0.500	0.000	0.040	0.000	0.000	0.040	
0.083	1.000	0.000	0.112	0.000	0.000	0.112	
0.125	1.500	0.000	0.206	0.000	0.000	0.206	
0.167	2.000	0.000	0.316	0.000	0.000	0.316	
0.208	2.500	0.000	0.433	0.000	0.000	0.433	
0.250	3.000	0.000	0.500	0.000	0.000	0.500	
0.292	3.500	0.500	0.559	0.000	0.000	0.559	
0.333	4.000	1.000	0.612	0.000	0.000	0.612	
0.375	4.500	1.500	0.661	0.211	0.000	0.872	
0.417	5.000	2.000	0.707	0.597	0.000	1.303	
0.458	5.500	2.500	0.749	1.096	0.000	1.845	
0.500	6.000	3.000	0.790	1.687	0.000	2.477	
0.542	6.500	3.500	0.829	2.358	0.000	3.187	
0.583	7.000	4.000	0.865	3.100	0.000	3.965	
0.625	7.500	4.500	0.901	3.906	0.000	4.807	
0.667	8.000	5.000	0.935	4.469	0.000	5.403	
0.708	8.500	5.500	0.968	4.895	0.000	5.863	
0.750	9.000	6.000	0.999	5.287	0.000	6.287	EMERGENCY WEIR
0.792	9.500	6.500	1.030	5.653	0.316	6.999	
0.833	10.000	7.000	1.060	5.995	0.895	7.950	
0.875	10.500	7.500	1.089	6.320	1.644	9.053	
0.917	11.000	8.000	1.117	6.628	2.531	10.276	
0.958	11.500	8.500	1.145	6.923	3.537	11.605	
1.000	12.000	9.000	1.172	7.206	4.650	13.027	
1.042	12.500	9.500	1.198	7.478	5.860	14.535	
1.083	13.000	10.000	1.224	7.740	7.159	16.123	
1.125	13.500	10.500	1.249	7.994	8.543	17.786	
1.167	14.000	11.000	1.274	8.240	10.005	19.519	
1.208	14.500	11.500	1.298	8.479	11.543	21.320	
1.250	15.000	12.000	1.322	8.711	13.152	23.185	
1.292	15.500	12.500	1.345	8.937	14.830	25.113	
1.333	16.000	13.000	1.368	9.158	16.574	27.100	
1.375	16.500	13.500	1.391	9.374	18.381	29.145	
1.417	17.000	14.000	1.413	9.584	20.249	31.247	
1.458	17.500	14.500	1.435	9.790	22.177	33.402	
1.500	18.000	15.000	1.457	9.992	24.162	35.611	
1.542	18.500	15.500	1.478	10.190	26.203	37.871	
1.583	19.000	16.000	1.499	10.384	28.299	40.182	
1.625	19.500	16.500	1.520	10.575	30.448	42.542	CREST

Outlet structure for Discharge of Detention Basin BF-7

Discharge vs Elevation Table

Lower slot		Emergency Weir	
Invert:	0.00 ft	Invert:	0.750 ft
B	1.50 ft	B:	12 ft
h	0.167 ft		
Upper slot			
Invert:	0.333 ft		
B:	8.00 ft		
h	0.250 ft		

h (ft)	H/D-low -	H/D-mid -	Qslot-low (cfs)	Qslot-upp (cfs)	Qemer (cfs)	Qtot (cfs)	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	FIRST OUTLET - 1' ABOVE BIOFILTRATION
0.042	0.500	0.000	0.040	0.000	0.000	0.040	
0.083	1.000	0.000	0.112	0.000	0.000	0.112	
0.125	1.500	0.000	0.206	0.000	0.000	0.206	
0.167	2.000	0.000	0.316	0.000	0.000	0.316	
0.208	2.500	0.000	0.433	0.000	0.000	0.433	
0.250	3.000	0.000	0.500	0.000	0.000	0.500	
0.292	3.500	0.500	0.559	0.000	0.000	0.559	
0.333	4.000	1.000	0.612	0.000	0.000	0.612	
0.375	4.500	1.500	0.661	0.211	0.000	0.872	
0.417	5.000	2.000	0.707	0.597	0.000	1.303	
0.458	5.500	2.500	0.749	1.096	0.000	1.845	
0.500	6.000	3.000	0.790	1.687	0.000	2.477	
0.542	6.500	3.500	0.829	2.358	0.000	3.187	
0.583	7.000	4.000	0.865	3.100	0.000	3.965	
0.625	7.500	4.500	0.901	3.906	0.000	4.807	
0.667	8.000	5.000	0.935	4.469	0.000	5.403	
0.708	8.500	5.500	0.968	4.895	0.000	5.863	
0.750	9.000	6.000	0.999	5.287	0.000	6.287	EMERGENCY WEIR
0.792	9.500	6.500	1.030	5.653	0.316	6.999	
0.833	10.000	7.000	1.060	5.995	0.895	7.950	
0.875	10.500	7.500	1.089	6.320	1.644	9.053	
0.917	11.000	8.000	1.117	6.628	2.531	10.276	
0.958	11.500	8.500	1.145	6.923	3.537	11.605	
1.000	12.000	9.000	1.172	7.206	4.650	13.027	
1.042	12.500	9.500	1.198	7.478	5.860	14.535	
1.083	13.000	10.000	1.224	7.740	7.159	16.123	
1.125	13.500	10.500	1.249	7.994	8.543	17.786	
1.167	14.000	11.000	1.274	8.240	10.005	19.519	
1.208	14.500	11.500	1.298	8.479	11.543	21.320	
1.250	15.000	12.000	1.322	8.711	13.152	23.185	
1.292	15.500	12.500	1.345	8.937	14.830	25.113	
1.333	16.000	13.000	1.368	9.158	16.574	27.100	
1.375	16.500	13.500	1.391	9.374	18.381	29.145	
1.417	17.000	14.000	1.413	9.584	20.249	31.247	
1.458	17.500	14.500	1.435	9.790	22.177	33.402	
1.500	18.000	15.000	1.457	9.992	24.162	35.611	
1.542	18.500	15.500	1.478	10.190	26.203	37.871	

1.583	19.000	16.000	1.499	10.384	28.299	40.182	
1.625	19.500	16.500	1.520	10.575	30.448	42.542	
1.667	20.000	17.000	1.540	10.762	32.648	44.950	
1.708	20.500	17.500	1.560	10.946	34.899	47.406	
1.750	21.000	18.000	1.580	11.127	37.200	49.907	
1.792	21.500	18.500	1.600	11.305	39.549	52.454	
1.833	22.000	19.000	1.619	11.480	41.946	55.045	
1.875	22.500	19.500	1.638	11.653	44.389	57.680	
1.917	23.000	20.000	1.657	11.823	46.877	60.357	
1.958	23.500	20.500	1.676	11.991	49.411	63.078	
2.000	24.000	21.000	1.694	12.156	51.989	65.839	
2.042	24.500	21.500	1.713	12.319	54.610	68.642	
2.083	25.000	22.000	1.731	12.480	57.273	71.484	
2.125	25.500	22.500	1.749	12.639	59.979	74.367	CREST

ATTACHMENT V

Pre & Post-Developed Maps, Bio-FILTRATION Facility details

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007

LEGEND

- DRAINAGE MANAGEMENT AREA (DMA)
- FLOW DIRECTION
- POC 1 — POINT OF COMPLIANCE
- EX. IMPERVIOUS (SOIL CONDUCTIVITY ADJUSTMENT)

NOTES:

1. THE UNDERLYING SOIL TYPE GROUPS ARE "C" AND "D" FOR THE ENTIRE PROPERTY AND SURROUNDING PARCELS
2. THE APPROXIMATE DEPTH TO GROUND WATER IS EXPECTED TO BE LESS THAN 15 FEET.
3. NO CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED BASED ON SEDIMENT TRANSPORT ANALYSIS (SEE PROJECT SWQMP).
4. THE SITE DOES NOT CONTAIN ANY EXISTING NATURAL HYDROLOGIC FEATURES. (WATERCOURSES, SEEPS, SPRINGS, WETLANDS.

EXISTING BIO-FILTRATION FACILITY
EXISTING CULVERTS
EL CAMINO REAL
KELLY DRIVE
EXISTING BIO-FILTRATION FACILITIES
AREA NOT INCLUDED AS PART OF THE HMP MODEL IN PRE AND POST DEVELOPMENT CONDITIONS AS ARE EITHER UN CHANGED OR HYDROMODIFIED BY EXISTING FACILITIES ON EL CAMINO REAL
AREA NOT INCLUDED AS PART OF THE HMP MODEL IN PRE AND POST DEVELOPMENT CONDITIONS AS IS CONSIDERED NATURAL
EXISTING INLET
EXISTING INLET
EXISTING NATURAL CREEK
EXISTING BLDG AND PARKING LOT
EXISTING BLDG.
POC 1
DMA 1C
EXISTING PAVED ROAD
SOIL TYPE C
SOIL TYPE D
DMA 1D
EXISTING NATURAL CREEK
EXISTING BLDG.
AREA NOT INCLUDED AS PART OF THE HMP MODEL IN PRE DEVELOPMENT CONDITIONS
EXISTING BLDG.
PARK DRIVE
R/W
P/L
OHE
S87°53'49"W 397.21'
N89°22'45"E 1291.68'
N89°22'45"E 315.68'
N89°37'34"E 617.34'

SUMMARY OF PRE-DEVELOPED CONDITIONS

POC	DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip [1]	Hydrologic Soil Type
1	DMA-1C	4.582	0%	C
1	DMA-1D	9.688	0%	D
	TOTAL	14.27	----	----

REGISTERED PROFESSIONAL ENGINEER
MELLOR R. LANDY
No. 81085
Exp. 09-30-19
CIVIL
STATE OF CALIFORNIA

SCALE: 1" = 60'
GRAPHIC SCALE

HowesWeiler & Associates
LAND USE PLANNING AND ENGINEERING
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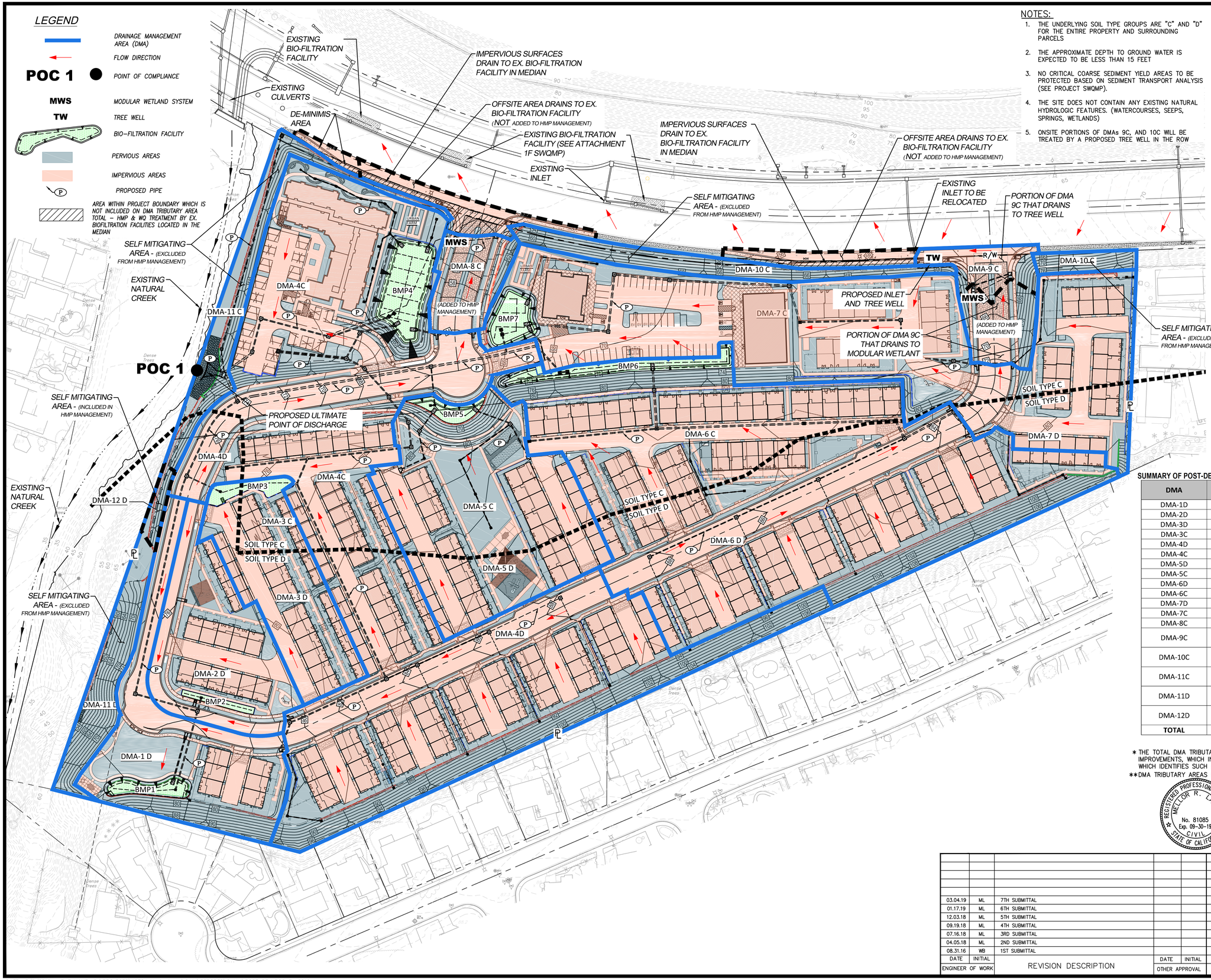
SHEET 1 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 1

TENTATIVE MAP FOR:
MARJA ACRES

DRAWING NAME:
HMP – POC
EXISTING

DATE: 12/7/2018 – FILE NAME: S:\PROJECTS\1204 Marja Acres\CIVIL\REPORTS\WMP\PRE_DEV_POC_Nov2018.dwg



NOTES:

1. THE UNDERLYING SOIL TYPE GROUPS ARE "C" AND "D" FOR THE ENTIRE PROPERTY AND SURROUNDING PARCELS
2. THE APPROXIMATE DEPTH TO GROUND WATER IS EXPECTED TO BE LESS THAN 15 FEET
3. NO CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED BASED ON SEDIMENT TRANSPORT ANALYSIS (SEE PROJECT SWQMP).
4. THE SITE DOES NOT CONTAIN ANY EXISTING NATURAL HYDROLOGIC FEATURES. (WATERCOURSES, SEEPS, SPRINGS, WETLANDS)
5. ONSITE PORTIONS OF DMAs 9C, AND 10C WILL BE TREATED BY A PROPOSED TREE WELL IN THE ROW

CDP 16-33 CT 16-07
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007

PERMANENT WATER QUALITY TREATMENT FACILITIES ON THIS SITE

KEEPING OUR WATER CLEAN
MAINTAIN WITH CARE
NO MODIFICATIONS WITHOUT CITY OF CARLSBAD APPROVAL

WATER QUALITY ADVISORY SIGN
NTS

NO DUMPING DRAINS TO WATERWAYS

SAMPLE PROHIBITIVE SIGNAGE
NTS

SUMMARY OF POST-DEVELOPED CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	***20.114**	N/A	

* THE TOTAL DMA TRIBUTARY AREA, DOES NOT INCLUDE AREAS PART OF THE TURNING LANE IMPROVEMENTS, WHICH INCLUDE SIDEWALK AND LANDSCAPE, ADJACENT TO RETAINING WALLS, SEE LEGEND WHICH IDENTIFIES SUCH AREAS.
**DMA TRIBUTARY AREAS EXCLUDES, BMP SQUARE FOOTAGE.

REGISTERED PROFESSIONAL ENGINEER — MELLOR R. LANDY — No. 81085 Exp. 09-30-19 — CIVIL — STATE OF CALIFORNIA

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DATE	INITIAL	REVISION DESCRIPTION
03.04.19	ML	7TH SUBMITTAL
01.17.19	ML	6TH SUBMITTAL
12.03.18	ML	5TH SUBMITTAL
09.19.18	ML	4TH SUBMITTAL
07.16.18	ML	3RD SUBMITTAL
04.05.18	ML	2ND SUBMITTAL
08.31.16	WB	1ST SUBMITTAL

ENGINEER OF WORK | OTHER APPROVAL | CITY APPROVAL

SHEET 1 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:
MARJA ACRES

DRAWING NAME:
HMP – POC
PROPOSED

DATE: 3/5/2019 ~ FILE NAME: S:\PROJECTS\12704 Marja Acres\CIVIL\REPORTS\SWMM\POST_DEV POC_Feb2019.dwg

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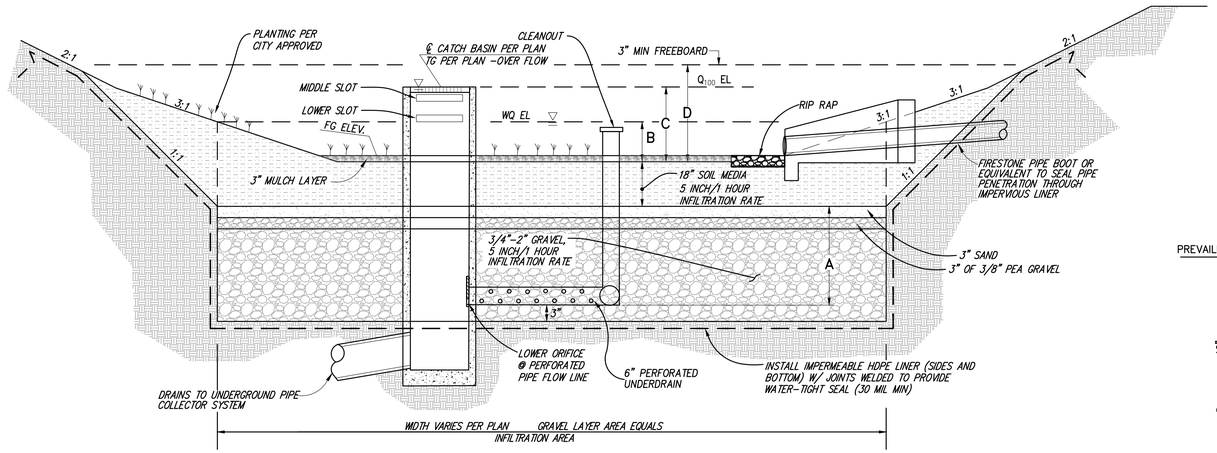
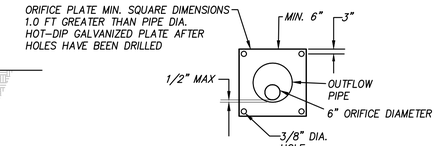
SDP 2018-0001 PUD 16-09
EIR 2017-001 HDP 16-02
DEV16038 SUP 16-02
PUD 2018-0007



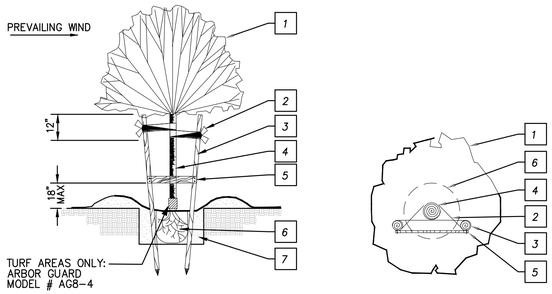
TYPICAL BIO-FILTRATION BASIN DETAIL

NTS



STAINLESS STEEL PLATE / ORIFICE DETAIL

NTS



SECTION VIEW

PLAN VIEW

STREET TREES DETAIL

NTS

TREE WELL NOTES

1. TREE CANOPY
2. (2) CINCH TIES, TACK TO STAKE WITH GALVANIZED NAILS TO PREVENT SLIPPING
3. (2) 2" DIA. X 8' LONG UNTREATED LODGEPOLE PINE STAKES FOR 5 GAL. TREES, OR (2) 2" DIA. X 10' LONG UNTREATED LODGEPOLE PINE TAKES FOR 15 GAL.– 36" BOX TREES, SET STAKES OUTSIDE ROOTBALL. ANGLE TOP OF STAKE AWAY FROM BRANCH STRUCTURE.
4. TREE TRUNK
5. 1 X 4 DOUG. FIR BRACE, TACK TO LODGEPOLE STAKES WITH GALV. NAILS
6. ROOT BALL, DO NOT PENETRATE WITH STAKE.
7. USE AMENDED SOIL WITH MINIMUM DEPTH OF 3' + 1' IN ALL DIRECTIONS OF ROOT BALL PER CITY'S BMP MANUAL APPENDIX PG. E–18.

TREE TIE NOTE:

INSTALL TREE TIES AND STAKES ONLY TO PROPER LEVEL TO HOLD TREE UPRIGHT. PROPER HEIGHT IS 6" ABOVE POINT WHERE THE TREE WILL SNAP TO AN UPRIGHT POSITION BY ITSELF IF TOP IS PULLED TO ONE SIDE AS IF WIND LOADED AND THEN RELEASED. DO NOT TOP TREES IN ORDER TO REDUCE SIZE OR WEIGHT OF TREE CROWN, CONTACT LANDSCAPE ARCHITECT PRIOR TO ANY PRUNING OF TREES.

SUMMARY OF RISER DETAILS

BMP	Lower Slot			Middle Slot			Top Riser		Emergency weir
	Width (ft)	Height (ft)	Elevation[1] (ft) B	Width (ft)	Height (ft)	Elevation[1] (ft)	Length[2] (ft)	Elev.[1] (ft)	Length[3] (ft)
BMP 3	1	0.167	1	--	----	-----	12	2.25	
BMP 4	1	0.167	1.5	4	0.167	3.25	12	3.75	8
BMP 5	1.5	0.167	1	8	0.25	1.33	12	1.75	8
BMP 6	1.5	0.167	1	8	0.25	1.33	12	1.75	10
BMP 7	1.5	0.167	1	8	0.25	1.33	12	1.75	8

(1): Basin ground surface elevation assumed to be 0.00 ft elevation.

Notes: (2): Overflow length is the internal perimeter of the riser structure.

(3): Additional Overflow length for peak flow discharges

SUMMARY OF DEVELOPED DUAL AND TRIPLE PURPOSE BMPs

BMP	Tributary Area (Ac)[7]	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2.] A	Lower Orif. D (in)[3]	Depth Riser Invert (in)[4] C	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] D
BMP 1	1.060	1949	33	0.8	12	12	18
BMP 2	0.901	1098	33	0.9	6	12	12
BMP 3	0.772	2360	36	0.9	27	12	33
BMP 4	6.098	7724	48	2.3	45	12	63
BMP 5	1.66	1692	36	2.2	21	12	30
BMP 6	4.444	4347	36	2.4	21	12	31.5
BMP 7	3.206	3567	48	2	21	12	37.5

Notes:

(1): Area of amended soil equal to area of gravel. 18" thick and in conformance with specifications listed on Fa

(2): Gravel depth needed to comply with hydromodification purposes

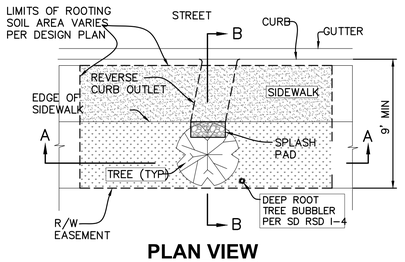
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.5 \cdot Q_{25}$).

(4): Depth of ponding beneath riser structure's surface spillway.

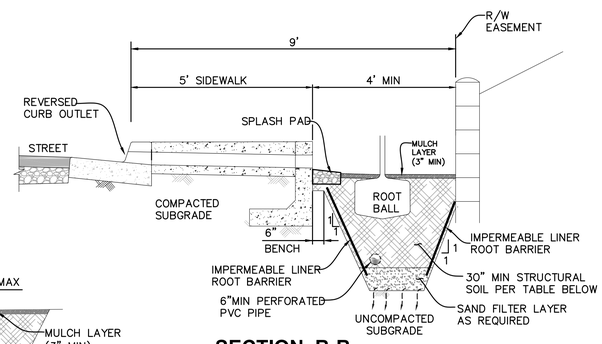
(5): Overflow length, the internal perimeter of the riser internal dimensions

(6): Total surface depth of BMP from top crest elevation to surface invert.

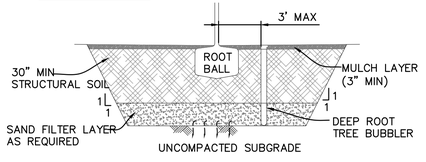
(7): Tributary area to basin not including area of BMP.



PLAN VIEW



SECTION B-B



SECTION A-A

NTS

STRUCTURAL SOIL					
BSM COMPOSITION	SAND	SANDY LOAM			COMPOST
		SAND	SILT	CLAY	
VOLUME	65%	20%			15%
WEIGHT	75–80%	10% MAX	3% MAX		9% MAX

TYPICAL TREE WELL DETAILS

REGISTERED PROFESSIONAL ENGINEER MELLOR R. LANDY No. 81085 Exp. 09-30-19 CIVIL STATE OF CALIFORNIA

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01.17.19	ML	6TH SUBMITTAL
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09.19.18	ML	4TH SUBMITTAL
07.16.18	ML	3RD SUBMITTAL
04.05.18	ML	2ND SUBMITTAL
08.31.16	WB	1ST SUBMITTAL

ENGINEER OF WORK	DATE	INITIAL	OTHER APPROVAL	DATE	INITIAL	CITY APPROVAL

SHEET 2 | CITY OF CARLSBAD PLANNING DEPARTMENT | SHEETS 2

TENTATIVE MAP FOR:

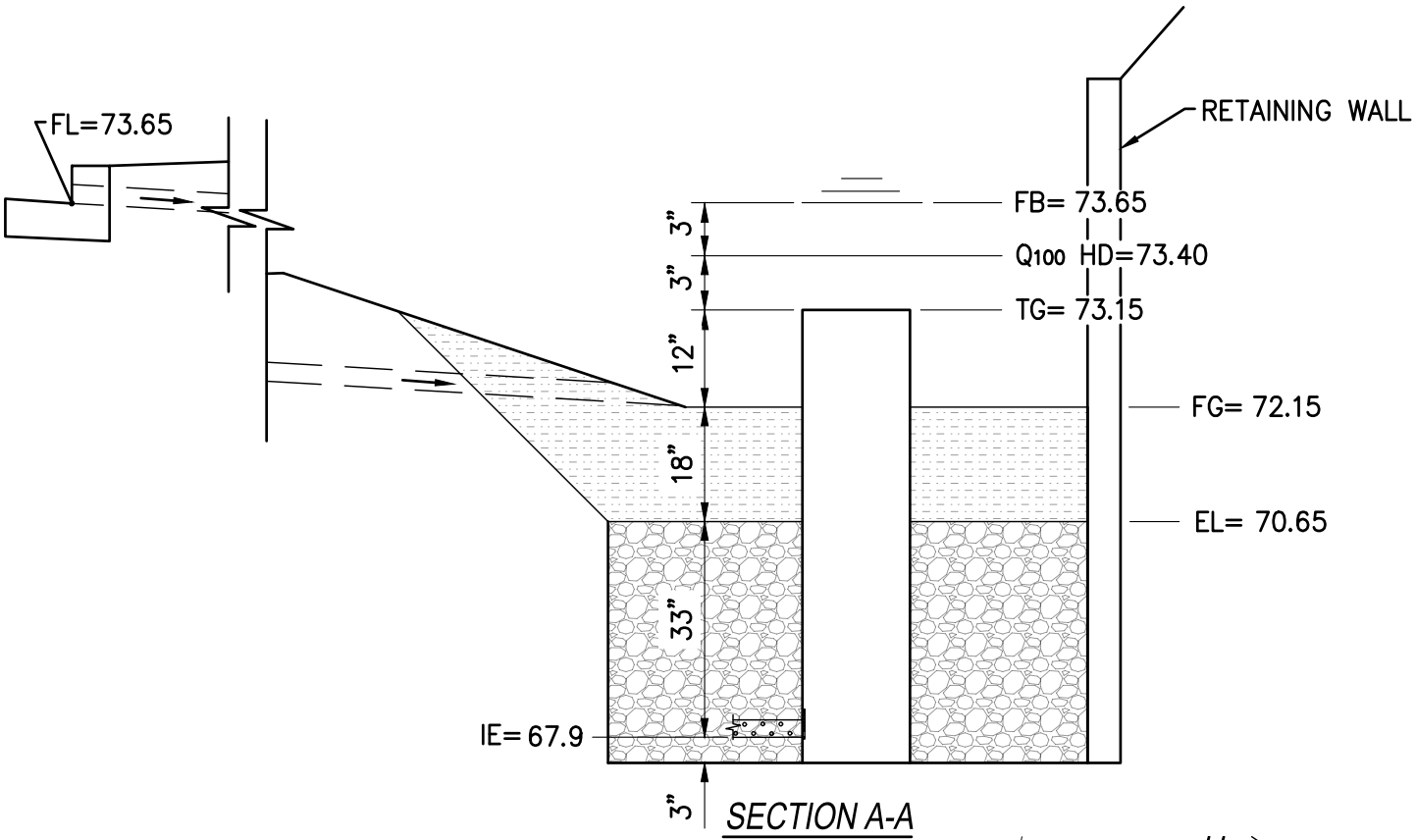
MARJA ACRES

DRAWING NAME:

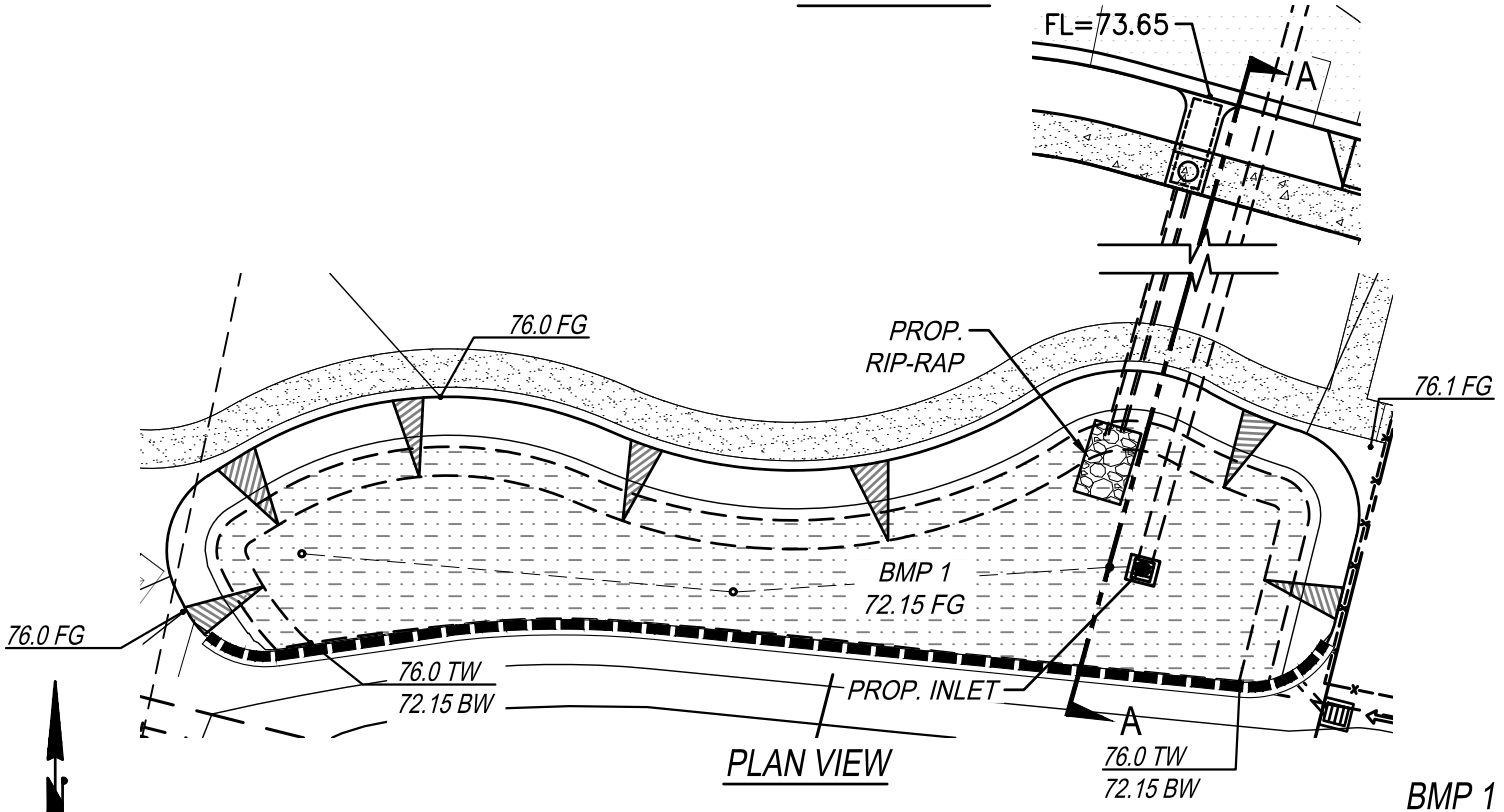
HMP – POC

PROPOSED

DATE: 3/5/2019 – FILE NAME: S:\PROJECTS\12704 Marja Acres\GIS\REPORTS\SWMP\POST_DEV POC_Feb2019.dwg



SECTION A-A



PLAN VIEW

BMP 1

SCALE: 1" = 20'

20 10 0 20

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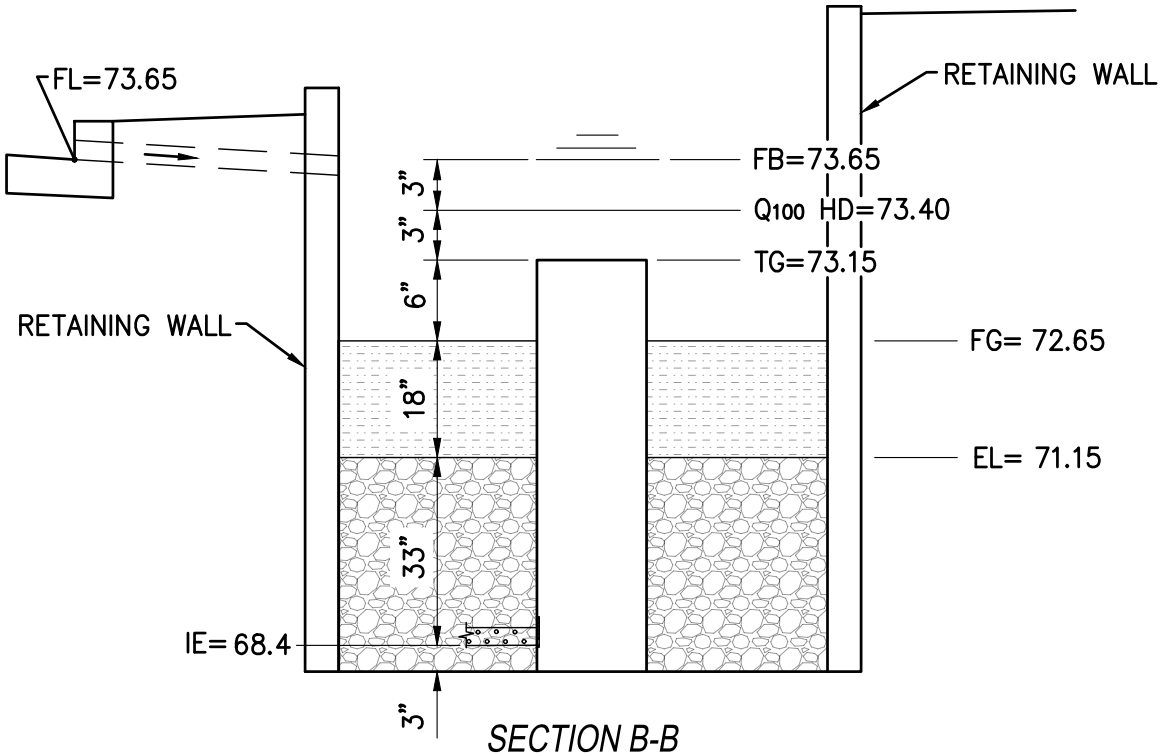
MARJA ACRES

BMP DETAILS

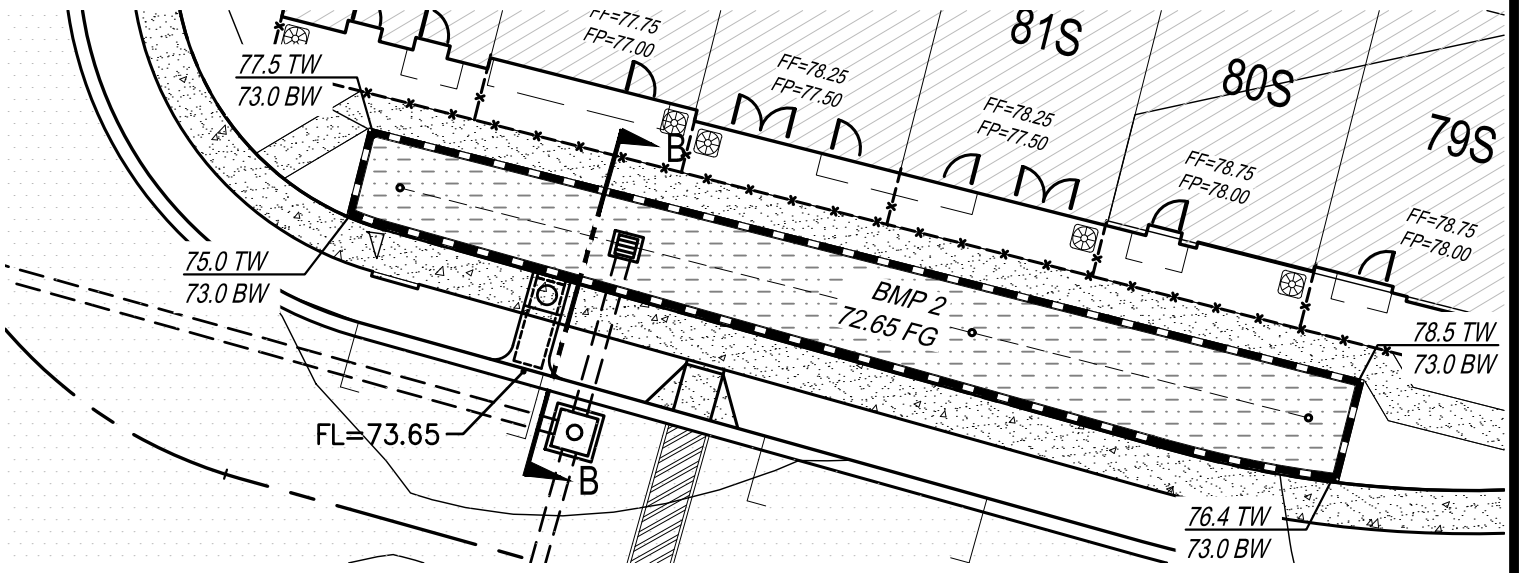
DATE: 2/28/19

DRAWING:

SHEET 1 OF 7



SECTION B-B



PLAN VIEW

BMP 2

SCALE: 1" = 20'

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CARLSBAD, CA 92010

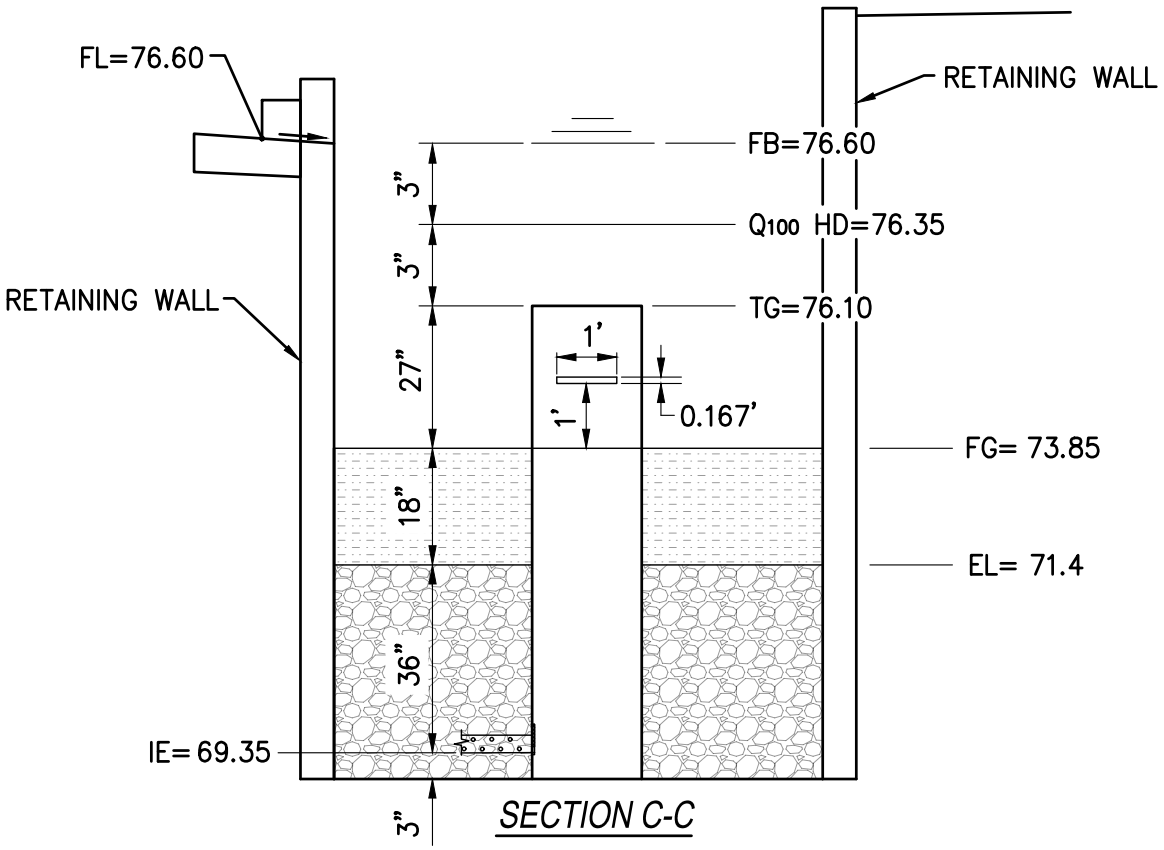
MARJA ACRES

BMP DETAILS

DATE: 2/26/19

DRAWING:

SHEET 2 OF 7



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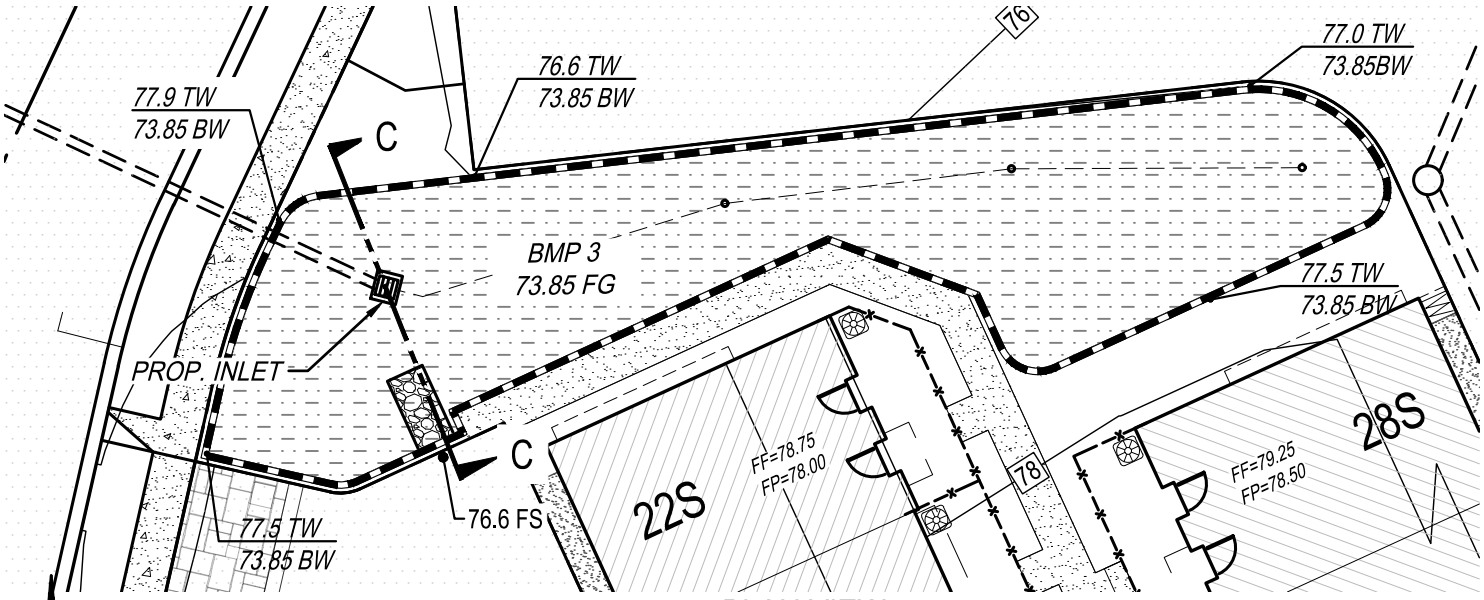

PLAN VIEW

BMP 3

SCALE: 1" = 20'

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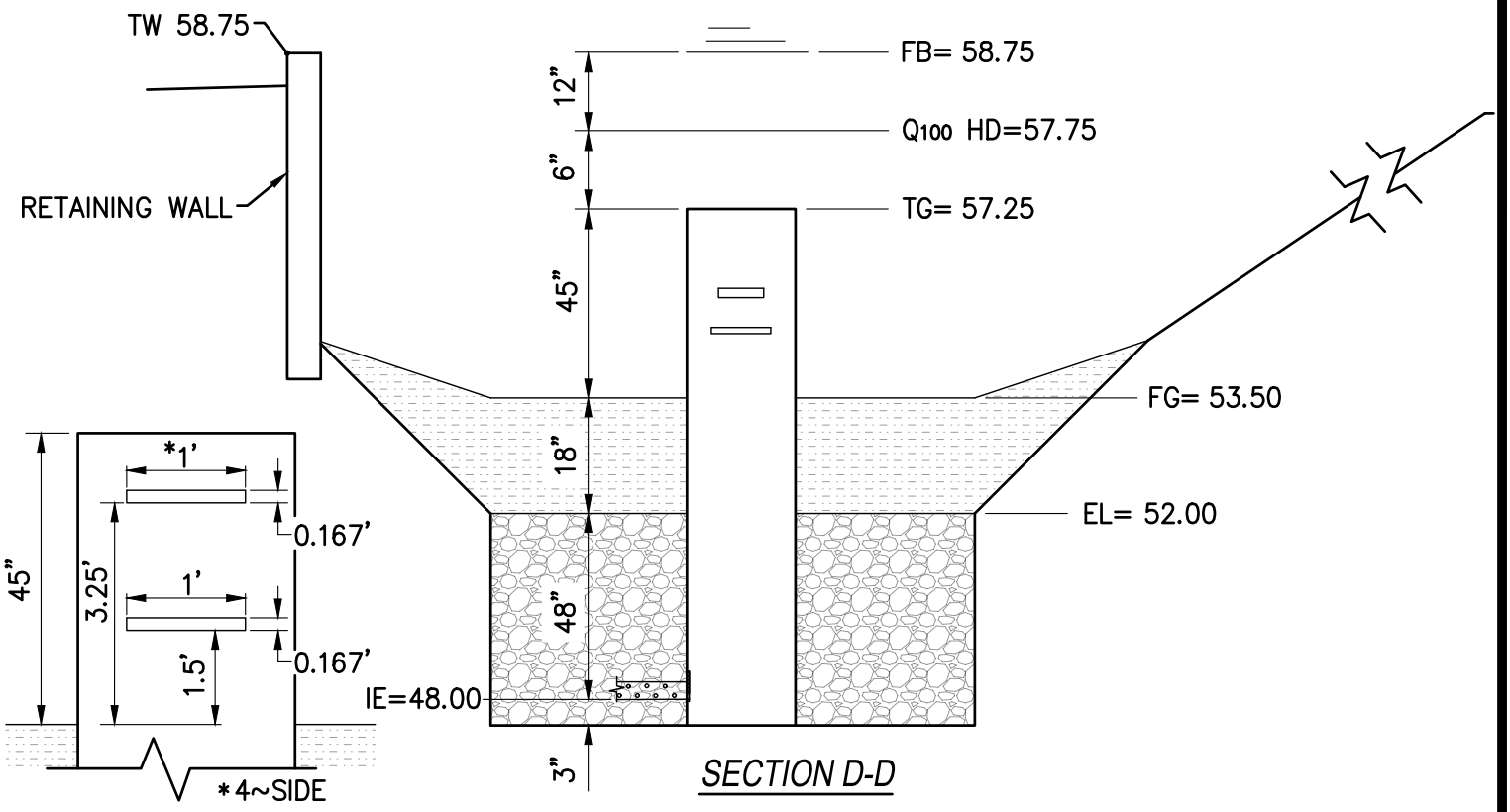
MARJA ACRES

BMP DETAILS

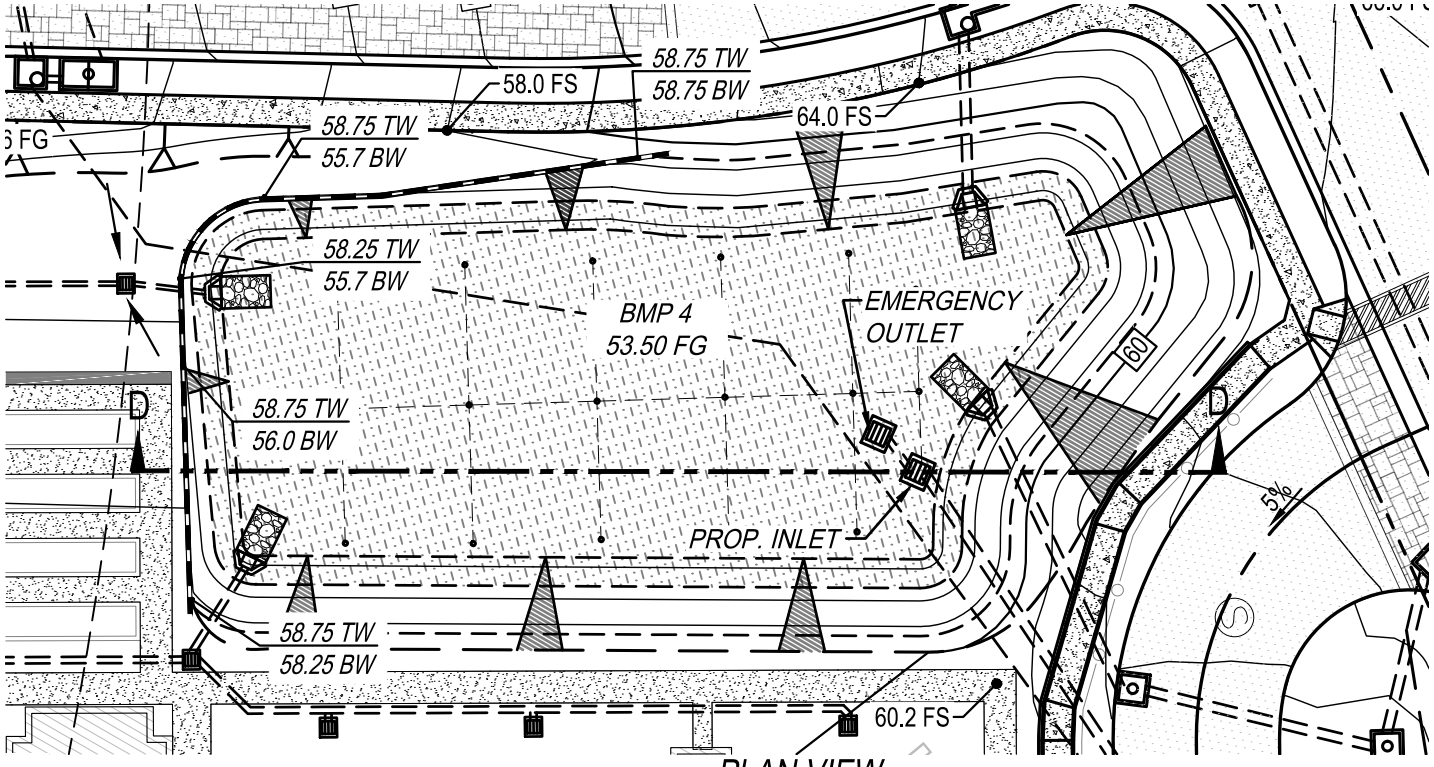
DATE: 2/26/19

DRAWING:

SHEET 3 OF 7



SECTION D-D



PLAN VIEW

BMP 4

SCALE: 1" = 30'

30 15 0 30

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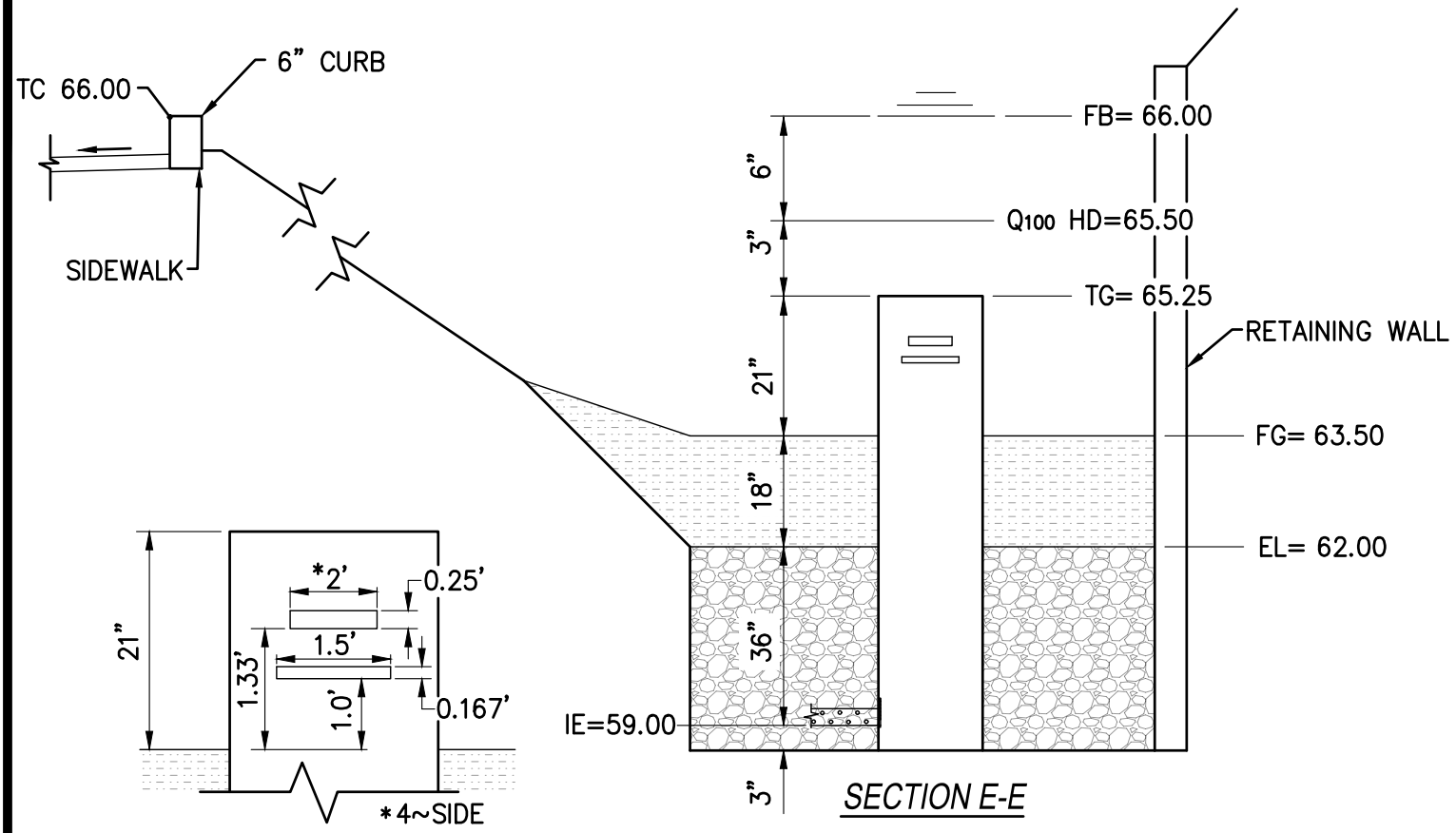
CARLSBAD, CA 92010

MARJA ACRES

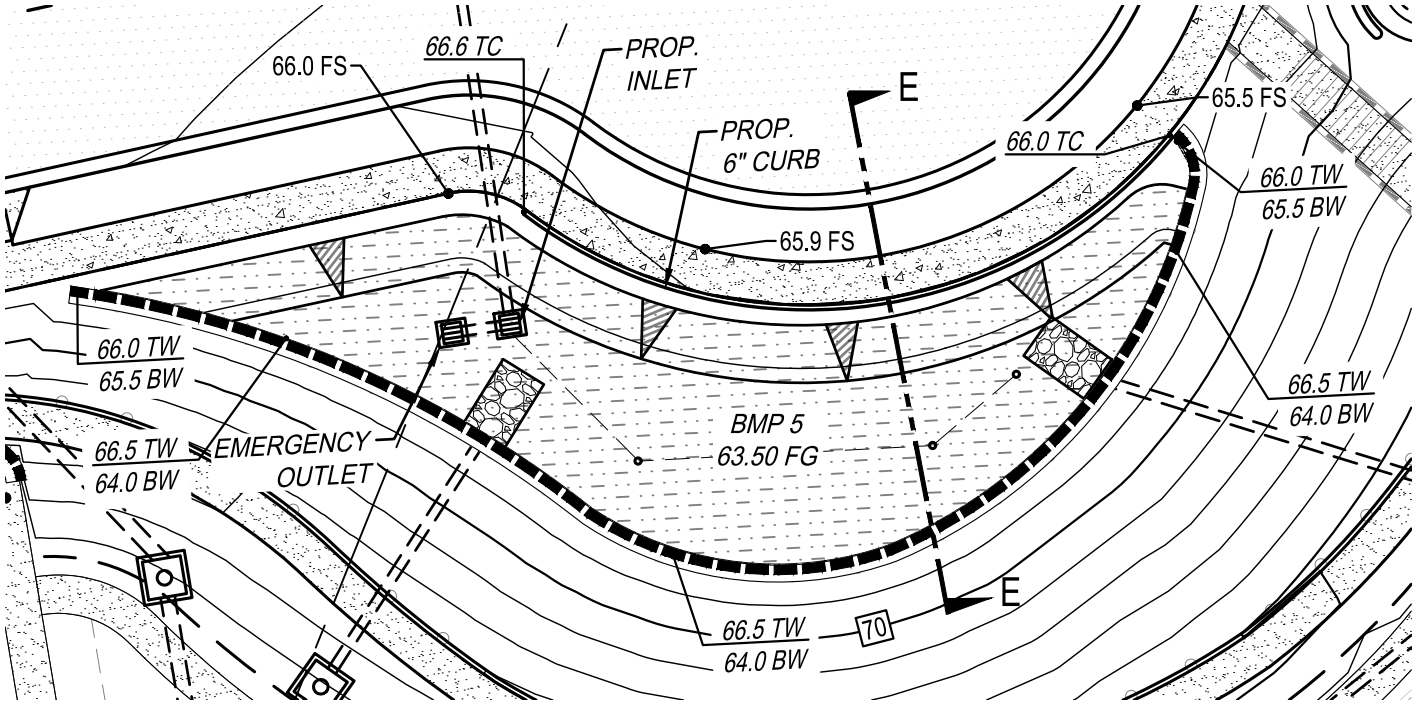
BMP DETAILS

DATE: 2/28/19

DRAWING:



SECTION E-E



PLAN VIEW

BMP 5

SCALE: 1" = 20'

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CARLSBAD, CA 92010

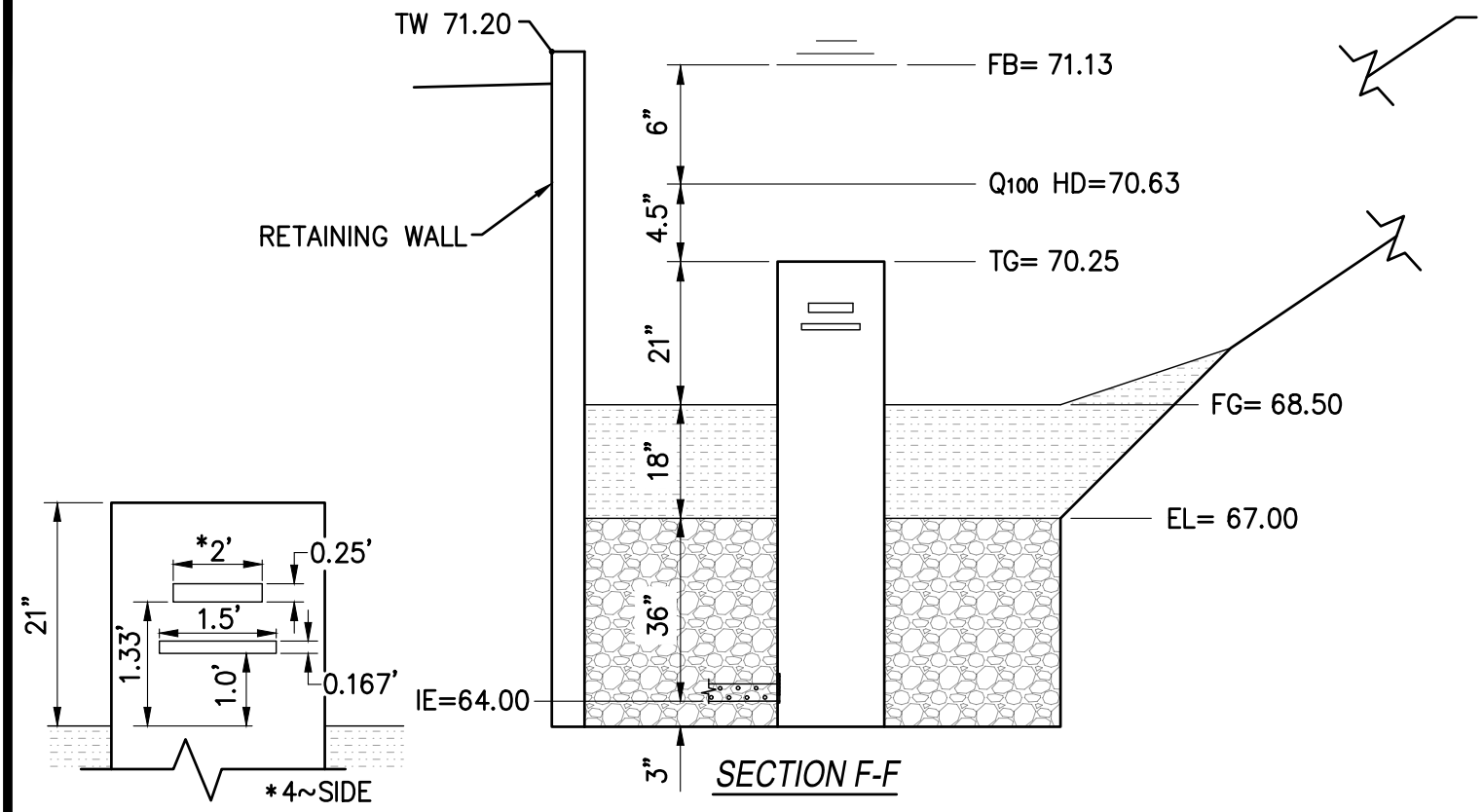
MARJA ACRES

BMP DETAILS

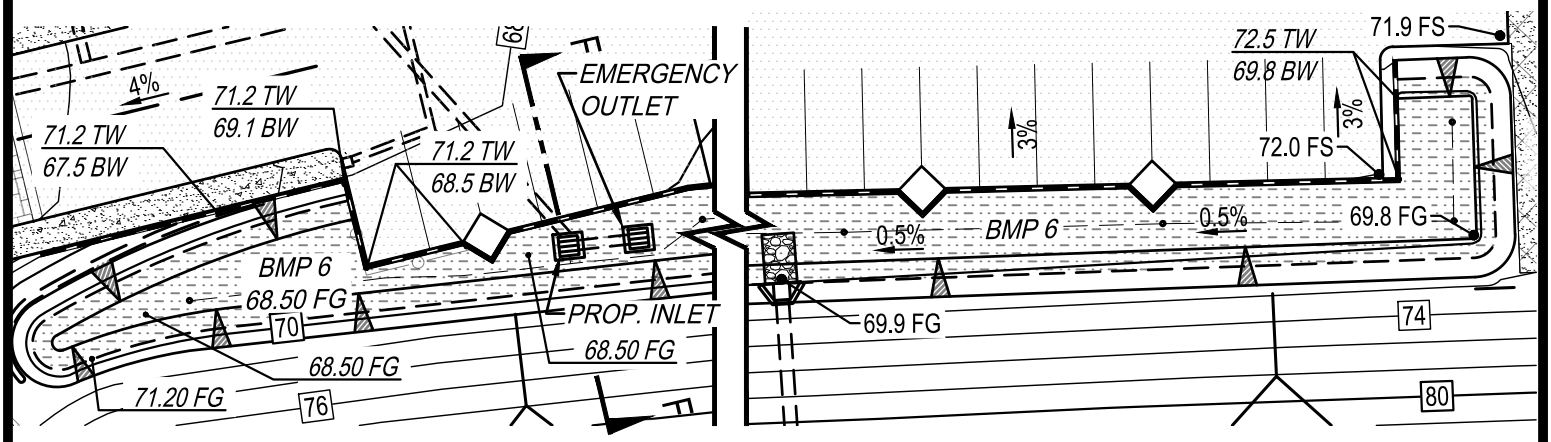
DATE: 2/28/19

DRAWING:

SHEET 5 OF 7



SECTION F-F



PLAN VIEW

BMP 6

SCALE: 1" = 30'

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MARJA ACRES

BMP DETAILS

DATE: 2/28/19

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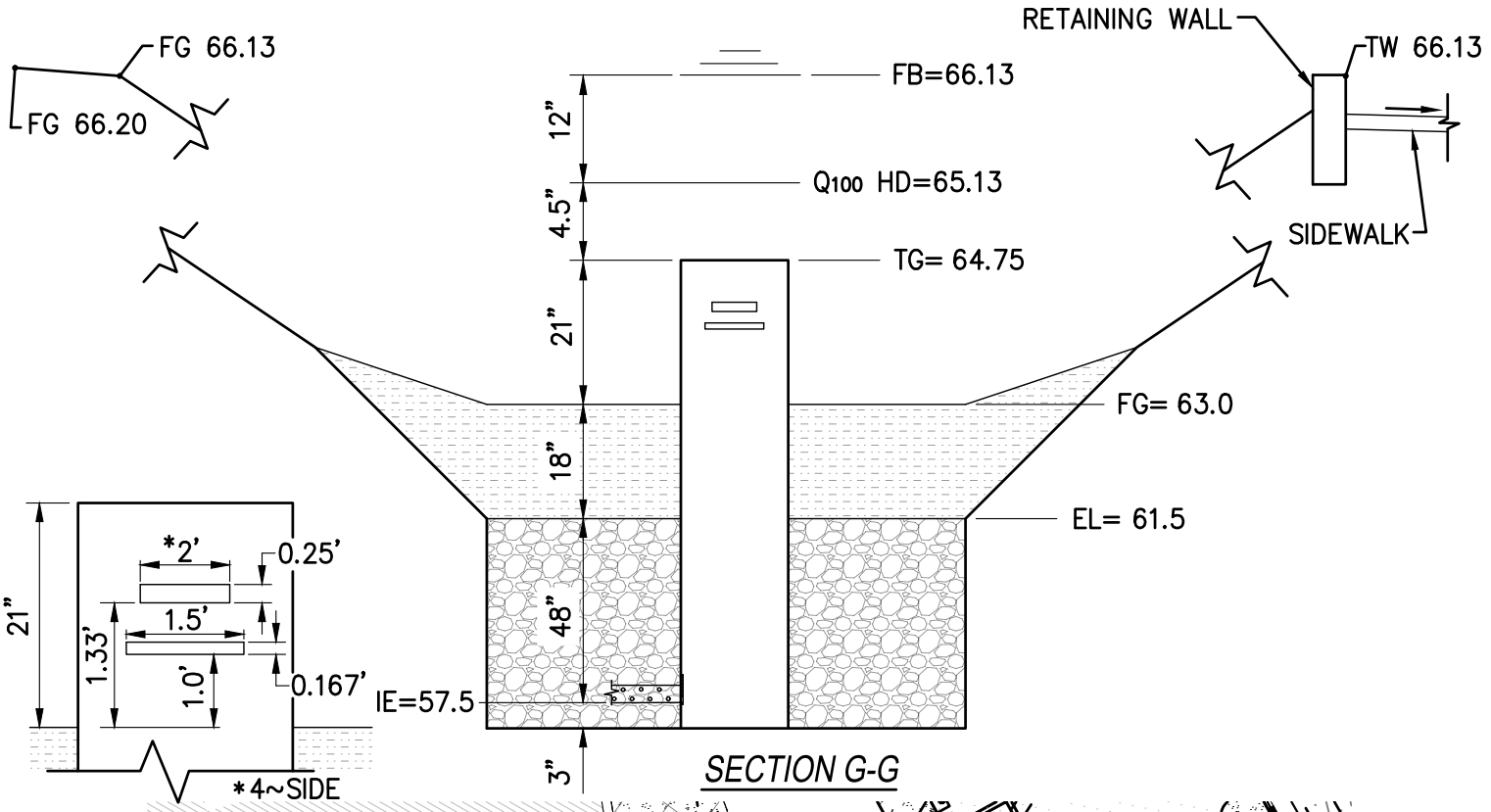

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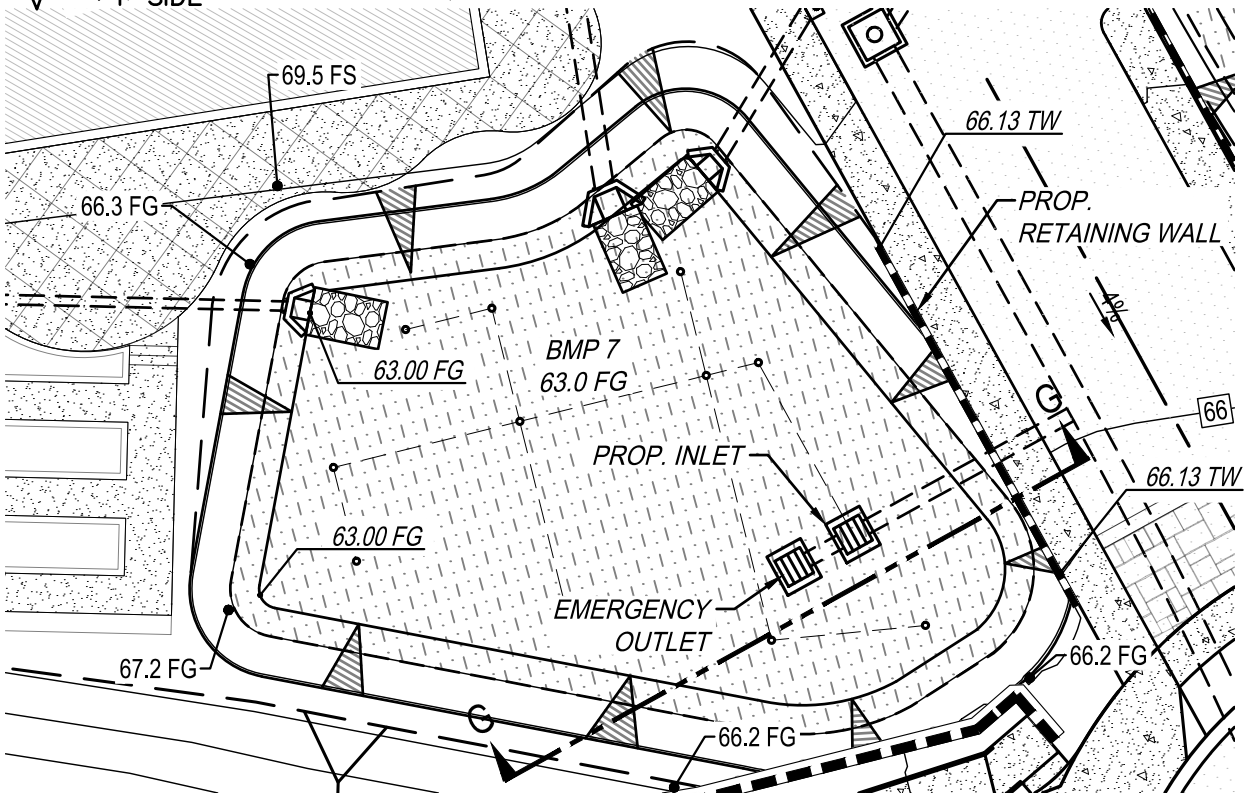

PLAN VIEW

BMP 7

SCALE: 1" = 20'

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MARJA ACRES

BMP DETAILS

DATE: 2/28/19

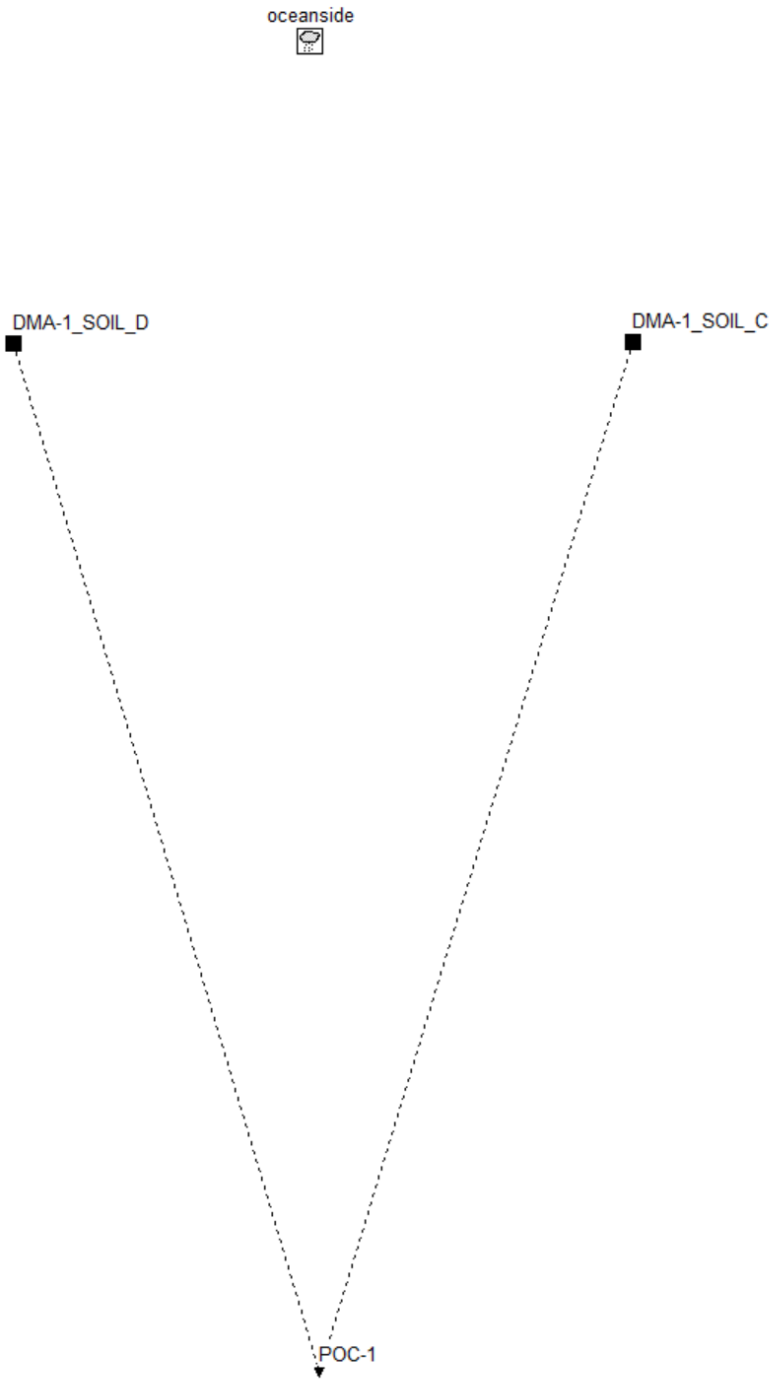
DRAWING:

SHEET 7 OF 7

ATTACHMENT VI

SWMM MODEL input/output data format (Existing & Proposed Models)

Marja Estates - Pre Development
SWMM MODEL



Marja Estates -Pre Development

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[TITLE]
Marja Estates -Pre Development

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FLOW_ROUTING         KINWAVE
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START_TIME           00:00:00
REPORT_START_DATE    10/05/1948
REPORT_START_TIME    00:00:00
END_DATE             10/05/2005
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.060  0.080  0.110  0.150  0.170  0.190  0.190  0.180  0.150  0.110  0.080  0.060
DRY_ONLY     NO

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

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
DMA-1_SOIL_D     oceanside        POC-1            4.582    0        560      11.94    0
DMA-1_SOIL_C     oceanside        POC-1            9.688    0        160      11.88    0

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

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA-1_SOIL_D     9          0.0249     0.30
DMA-1_SOIL_C     6          0.0949     0.31

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

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Oceanside        FILE "S:\PROJECTS\12704 Marja Acres\CIVIL\REPORTS\SWMM\OsideRain.prn"

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

[TAGS]

[MAP]
DIMENSIONS -2332.031 5700.000 3253.906 12300.000
Units      None
```

Marja Estates -Pre Development

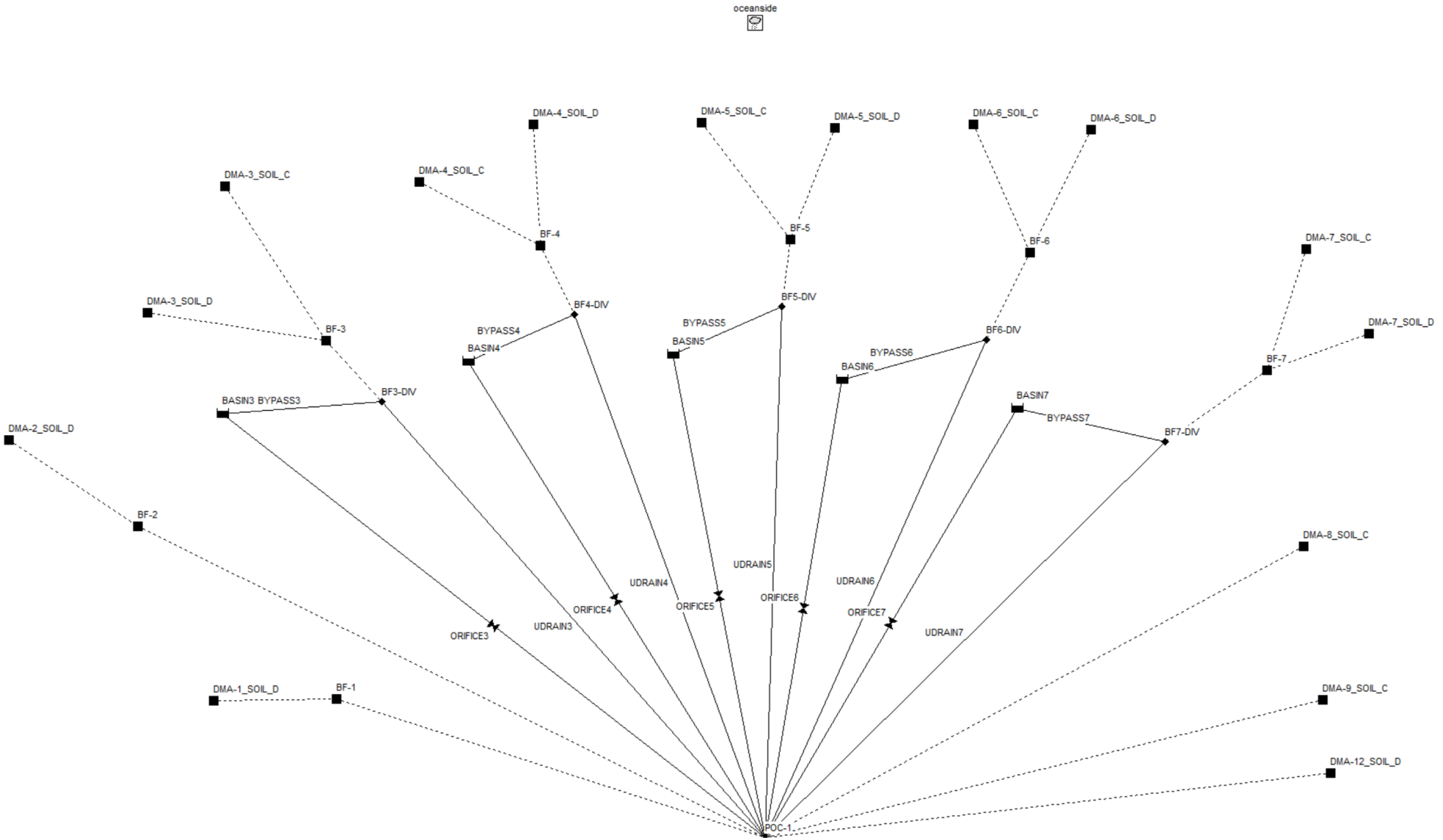
```
[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            750.000            6000.000

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1_SOIL_D     -300.128           9524.130
DMA-1_SOIL_C     1825.112           9531.310

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
oceanside        726.593            10550.851
```

Marja Estates - Proposed



Marja Estates - Proposed

```
[TITLE]
Marja Estates - Proposed

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           10/17/1948
START_TIME           00:00:00
REPORT_START_DATE    10/05/1948
REPORT_START_TIME    00:00:00
END_DATE             10/05/2005
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.060  0.080  0.110  0.150  0.170  0.190  0.190  0.180  0.150  0.110  0.080  0.060
DRY_ONLY     NO

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

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.            Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width   Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- ------- -------- -------- --------
DMA-1_SOIL_D     oceanside        BF-1             1.0603   44.62    210     2        0
DMA-2_SOIL_D     oceanside        BF-2             0.9011   70.30    105     2.0      0
DMA-3_SOIL_D     oceanside        BF-3             0.6663   75.24    115     2.0      0
DMA-3_SOIL_C     oceanside        BF-3             0.1064   56.18    118     2.0      0
DMA-4_SOIL_C     oceanside        BF-4             2.7996   63.85    210     2.0      0
DMA-4_SOIL_D     oceanside        BF-4             3.3035   63.85    250     2.0      0
DMA-5_SOIL_C     oceanside        BF-5             1.1348   47.75    230     2.0      0
DMA-5_SOIL_D     oceanside        BF-5             0.5318   77.15    210     2.0      0
DMA-6_SOIL_C     oceanside        BF-6             1.5963   66.75    180     2.0      0
DMA-6_SOIL_D     oceanside        BF-6             2.9193   66.45    225     2.0      0
DMA-7_SOIL_C     oceanside        BF-7             2.7477   66.28    135     2.0      0
DMA-7_SOIL_D     oceanside        BF-7             0.4548   75.70    130     2.0      0
DMA-8_SOIL_C     oceanside        POC-1            0.2993   62.81    90      7.5      0
DMA-9_SOIL_C     oceanside        POC-1            0.4373   48.12    82      4.5      0
DMA-12_SOIL_D    oceanside        POC-1            0.044    0        55      30       0
BF-1             oceanside        POC-1            0.044743 0        15      0        0
BF-2             oceanside        POC-1            0.025207 0        10      0        0
BF-3             oceanside        BF3-DIV          0.054178 0        15      0        0
BF-4             oceanside        BF4-DIV          0.177318 0        23      0        0
BF-5             oceanside        BF5-DIV          0.038843 0        15      0        0
BF-6             oceanside        BF6-DIV          0.099793 0        15      0        0
BF-7             oceanside        BF7-DIV          0.08191  0        48      0        0

[SUBAREAS]
```

Marja Estates - Proposed

```
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-2_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-3_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-3_SOIL_C     0.012      0.10       0.05       0.1        25         OUTLET
DMA-4_SOIL_C     0.012      0.10       0.05       0.1        25         OUTLET
DMA-4_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-5_SOIL_C     0.012      0.10       0.05       0.1        25         OUTLET
DMA-5_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-6_SOIL_C     0.012      0.10       0.05       0.1        25         OUTLET
DMA-6_SOIL_D     0.012      0.10       0.05       0.1        25         OUTLET
DMA-7_SOIL_C     0.012      0.10       0.05       0.10       25         OUTLET
DMA-7_SOIL_D     0.012      0.10       0.05       0.10       25         OUTLET
DMA-8_SOIL_C     0.012      0.10       0.05       0.10       25         OUTLET
DMA-9_SOIL_C     0.012      0.10       0.05       0.10       25         OUTLET
DMA-12_SOIL_D    0.012      0.10       0.05       0.10       25         OUTLET
BF-1             0.012      0.10       0.05       0.10       25         OUTLET
BF-2             0.012      0.10       0.05       0.10       25         OUTLET
BF-3             0.012      0.10       0.05       0.10       25         OUTLET
BF-4             0.012      0.10       0.05       0.10       25         OUTLET
BF-5             0.012      0.10       0.05       0.10       25         OUTLET
BF-6             0.012      0.10       0.05       0.10       25         OUTLET
BF-7             0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA-1_SOIL_D     9          0.01875    0.30
DMA-2_SOIL_D     9          0.01875    0.30
DMA-3_SOIL_D     9          0.01875    0.30
DMA-3_SOIL_C     6          0.075      0.31
DMA-4_SOIL_C     6          0.075      0.31
DMA-4_SOIL_D     9          0.01875    0.30
DMA-5_SOIL_C     6          0.075      0.31
DMA-5_SOIL_D     9          0.01875    0.30
DMA-6_SOIL_C     6          0.075      0.31
DMA-6_SOIL_D     9          0.01875    0.30
DMA-7_SOIL_C     6.0        0.075      0.31
DMA-7_SOIL_D     9          0.01875    0.30
DMA-8_SOIL_C     6.0        0.075      0.31
DMA-9_SOIL_C     6.0        0.075      0.31
DMA-12_SOIL_D    9.0        0.01875    0.30
BF-1             9          0.01875    0.30
BF-2             9.0        0.01875    0.30
BF-3             6.0        0.075      0.31
BF-4             6.0        0.075      0.31
BF-5             6.0        0.075      0.31
BF-6             6.0        0.075      0.31
BF-7             6.0        0.075      0.31

[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
BF-1             BC
BF-1             SURFACE    9.72       0          0          0          5
BF-1             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-1             STORAGE    36         0.67       0          0
BF-1             DRAIN      0.2067     0.5        3          6

BF-2             BC
BF-2             SURFACE    6          0          0          0          5
BF-2             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-2             STORAGE    36         0.67       0          0
BF-2             DRAIN      0.2456     0.5        3          6

BF-3             BC
BF-3             SURFACE    12         0.0        0          0          5
BF-3             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-3             STORAGE    39         0.67       0          0
BF-3             DRAIN      0.1143     0.5        3          6
```

```
BF-4             BC
BF-4             SURFACE    16.08      0.0        0          0          5
BF-4             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-4             STORAGE    51         0.67       0          0
BF-4             DRAIN      0.2332     0.5        3          6

BF-5             BC
BF-5             SURFACE    10.53      0.0        0          0          5
BF-5             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-5             STORAGE    39         0.67       0          0
BF-5             DRAIN      0.9524     0.5        3          6

BF-6             BC
BF-6             SURFACE    9.22       0.0        0          0          5
BF-6             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-6             STORAGE    39         0.67       0          0
BF-6             DRAIN      0.4412     0.5        3          6

BF-7             BC
BF-7             SURFACE    10.72      0.0        0          0          5
BF-7             SOIL       18         0.40       0.2        0.1        5          5          1.5
BF-7             STORAGE    51         0.67       0          0
BF-7             DRAIN      0.3734     0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report File
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- -----------
BF-1             BF-1             1       1949.0     15         0          100        0
BF-2             BF-2             1       1098       10         0          100        0
BF-3             BF-3             1       2360       15         0          100        0
BF-4             BF-4             1       7724       23         0          100        0
BF-5             BF-5             1       1692       15         0          100        0
BF-6             BF-6             1       4347       15         0          100        0
BF-7             BF-7             1       3567       48         0          100        0

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

[DIVIDERS]
;;               Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
BF3-DIV          0          BYPASS3          CUTOFF     0.03736    0          0          0          0
BF4-DIV          0          BYPASS4          CUTOFF     0.27838    0          0          0          0
BF5-DIV          0          BYPASS5          CUTOFF     0.21905    0          0          0          0
BF6-DIV          0          BYPASS6          CUTOFF     0.25991    0          0          0          0
BF7-DIV          0          BYPASS7          CUTOFF     0.21119    0          0          0          0

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                    Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                   Area     Frac.    Infiltration Paramet
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- --------------------
BASIN3           0        2.75     0        TABULAR    BASIN3                    2360     1
BASIN4           0        3.25     0        TABULAR    BASIN4                    9763     1
BASIN5           0        1.5      0        TABULAR    BASIN5                    2057     1
BASIN6           0        1.63     0        TABULAR    BASIN6                    7438     1
BASIN7           0        2.125    0        TABULAR    BASIN7                    4458     1

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
UDRAIN3          BF3-DIV          POC-1            10         0.01       0          0          0          0
UDRAIN4          BF4-DIV          POC-1            10         0.01       0          0          0          0
UDRAIN5          BF5-DIV          POC-1            10         0.01       0          0          0          0
UDRAIN6          BF6-DIV          POC-1            10         0.01       0          0          0          0
UDRAIN7          BF7-DIV          POC-1            10         0.01       0          0          0          0
```

```
BYPASS3          BF3-DIV          BASIN3           10         0.01       0          0          0          0
BYPASS4          BF4-DIV          BASIN4           10         0.01       0          0          0          0
BYPASS5          BF5-DIV          BASIN5           10         0.01       0          0          0          0
BYPASS6          BF6-DIV          BASIN6           10         0.01       0          0          0          0
BYPASS7          BF7-DIV          BASIN7           10         0.01       0          0          0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                    Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon    Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
ORIFICE3         BASIN3           POC-1            0          TABULAR/DEPTH    OUTLET-3                    NO
ORIFICE4         BASIN4           POC-1            0          TABULAR/DEPTH    OUTLET-4                    NO
ORIFICE5         BASIN5           POC-1            0          TABULAR/DEPTH    OUTLET-5                    NO
ORIFICE6         BASIN6           POC-1            0          TABULAR/DEPTH    OUTLET-6                    NO
ORIFICE7         BASIN7           POC-1            0          TABULAR/DEPTH    OUTLET-7                    NO

[XSECTIONS]
;;Link            Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
UDRAIN3          DUMMY        0                0          0          0          1
UDRAIN4          DUMMY        0                0          0          0          1
UDRAIN5          DUMMY        0                0          0          0          1
UDRAIN6          DUMMY        0                0          0          0          1
UDRAIN7          DUMMY        0                0          0          0          1
BYPASS3          DUMMY        0                0          0          0          1
BYPASS4          DUMMY        0                0          0          0          1
BYPASS5          DUMMY        0                0          0          0          1
BYPASS6          DUMMY        0                0          0          0          1
BYPASS7          DUMMY        0                0          0          0          1

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

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
OUTLET-3         Rating     0.000      0.000
OUTLET-3                    0.042      0.026
OUTLET-3                    0.083      0.075
OUTLET-3                    0.125      0.137
OUTLET-3                    0.167      0.211
OUTLET-3                    0.208      0.288
OUTLET-3                    0.250      0.333
OUTLET-3                    0.292      0.372
OUTLET-3                    0.333      0.408
OUTLET-3                    0.375      0.441
OUTLET-3                    0.417      0.471
OUTLET-3                    0.458      0.500
OUTLET-3                    0.500      0.527
OUTLET-3                    0.542      0.552
OUTLET-3                    0.583      0.577
OUTLET-3                    0.625      0.600
OUTLET-3                    0.667      0.623
OUTLET-3                    0.708      0.645
OUTLET-3                    0.750      0.666
OUTLET-3                    0.792      0.687
OUTLET-3                    0.833      0.707
OUTLET-3                    0.875      0.726
OUTLET-3                    0.917      0.745
OUTLET-3                    0.958      0.763
OUTLET-3                    1.000      0.781
OUTLET-3                    1.042      0.799
OUTLET-3                    1.083      0.816
OUTLET-3                    1.125      0.833
OUTLET-3                    1.167      0.849
OUTLET-3                    1.208      0.865
OUTLET-3                    1.250      0.881
OUTLET-3                    1.292      1.213
OUTLET-3                    1.333      1.807
OUTLET-3                    1.375      2.571
```

OUTLET-3		1.417	3.473
OUTLET-3		1.458	4.494
OUTLET-3		1.500	5.621
OUTLET-3		1.542	6.845
OUTLET-3		1.583	8.158
OUTLET-3		1.625	9.556
OUTLET-3		1.667	11.032
OUTLET-3		1.708	12.583
OUTLET-3		1.750	14.205
OUTLET-3		1.792	15.896
OUTLET-3		1.833	17.653
OUTLET-3		1.875	19.473
OUTLET-3		1.917	21.354
OUTLET-3		1.958	23.294
OUTLET-3		2.000	25.292
OUTLET-3		2.042	27.345
OUTLET-3		2.083	29.453
OUTLET-3		2.125	31.614
OUTLET-3		2.167	33.826
OUTLET-3		2.208	36.089
OUTLET-3		2.250	38.401
OUTLET-3		2.292	40.761
OUTLET-3		2.333	43.169
OUTLET-3		2.375	45.624
OUTLET-3		2.417	48.124
OUTLET-3		2.458	50.668
OUTLET-3		2.500	53.257
OUTLET-3		2.542	55.889
OUTLET-3		2.583	58.563
OUTLET-3		2.625	61.279
OUTLET-3		2.667	64.037
OUTLET-3		2.708	66.835
OUTLET-3		2.750	69.673
OUTLET-4	Rating	0.000	0.000
OUTLET-4		0.042	0.040
OUTLET-4		0.083	0.112
OUTLET-4		0.125	0.206
OUTLET-4		0.167	0.316
OUTLET-4		0.208	0.433
OUTLET-4		0.250	0.500
OUTLET-4		0.292	0.559
OUTLET-4		0.333	0.612
OUTLET-4		0.375	0.661
OUTLET-4		0.417	0.707
OUTLET-4		0.458	0.749
OUTLET-4		0.500	0.790
OUTLET-4		0.542	0.829
OUTLET-4		0.583	0.865
OUTLET-4		0.625	0.901
OUTLET-4		0.667	0.935
OUTLET-4		0.708	0.968
OUTLET-4		0.750	0.999
OUTLET-4		0.792	1.030
OUTLET-4		0.833	1.060
OUTLET-4		0.875	1.089
OUTLET-4		0.917	1.117
OUTLET-4		0.958	1.145
OUTLET-4		1.000	1.172
OUTLET-4		1.042	1.198
OUTLET-4		1.083	1.224
OUTLET-4		1.125	1.249
OUTLET-4		1.167	1.274
OUTLET-4		1.208	1.298
OUTLET-4		1.250	1.322
OUTLET-4		1.292	1.345
OUTLET-4		1.333	1.368
OUTLET-4		1.375	1.391
OUTLET-4		1.417	1.413
OUTLET-4		1.458	1.435
OUTLET-4		1.500	1.457

OUTLET-4		1.542	1.478
OUTLET-4		1.583	1.499
OUTLET-4		1.625	1.520
OUTLET-4		1.667	1.540
OUTLET-4		1.708	1.560
OUTLET-4		1.750	1.580
OUTLET-4		1.792	1.705
OUTLET-4		1.833	1.917
OUTLET-4		1.875	2.186
OUTLET-4		1.917	2.501
OUTLET-4		1.958	2.831
OUTLET-4		2.000	3.029
OUTLET-4		2.042	3.205
OUTLET-4		2.083	3.365
OUTLET-4		2.125	3.514
OUTLET-4		2.167	3.654
OUTLET-4		2.208	3.786
OUTLET-4		2.250	3.912
OUTLET-4		2.292	4.348
OUTLET-4		2.333	5.042
OUTLET-4		2.375	5.903
OUTLET-4		2.417	6.898
OUTLET-4		2.458	8.008
OUTLET-4		2.500	9.222
OUTLET-4		2.542	10.530
OUTLET-4		2.583	11.926
OUTLET-4		2.625	13.403
OUTLET-4		2.667	14.957
OUTLET-4		2.708	16.584
OUTLET-4		2.750	18.281
OUTLET-4		2.792	20.045
OUTLET-4		2.833	21.873
OUTLET-4		2.875	23.763
OUTLET-4		2.917	25.712
OUTLET-4		2.958	27.720
OUTLET-4		3.000	29.784
OUTLET-4		3.042	31.903
OUTLET-4		3.083	34.074
OUTLET-4		3.125	36.298
OUTLET-4		3.167	38.573
OUTLET-4		3.208	40.897
OUTLET-4		3.250	43.270
OUTLET-5	Rating	0.000	0.000
OUTLET-5		0.042	0.040
OUTLET-5		0.083	0.112
OUTLET-5		0.125	0.206
OUTLET-5		0.167	0.316
OUTLET-5		0.208	0.433
OUTLET-5		0.250	0.500
OUTLET-5		0.292	0.559
OUTLET-5		0.333	0.612
OUTLET-5		0.375	0.872
OUTLET-5		0.417	1.303
OUTLET-5		0.458	1.845
OUTLET-5		0.500	2.477
OUTLET-5		0.542	3.187
OUTLET-5		0.583	3.965
OUTLET-5		0.625	4.807
OUTLET-5		0.667	5.403
OUTLET-5		0.708	5.863
OUTLET-5		0.750	6.287
OUTLET-5		0.792	6.999
OUTLET-5		0.833	7.950
OUTLET-5		0.875	9.053
OUTLET-5		0.917	10.276
OUTLET-5		0.958	11.605
OUTLET-5		1.000	13.027
OUTLET-5		1.042	14.535
OUTLET-5		1.083	16.123
OUTLET-5		1.125	17.786

OUTLET-5		1.167	19.519
OUTLET-5		1.208	21.320
OUTLET-5		1.250	23.185
OUTLET-5		1.292	25.113
OUTLET-5		1.333	27.100
OUTLET-5		1.375	29.145
OUTLET-5		1.417	31.247
OUTLET-5		1.458	33.402
OUTLET-5		1.500	35.611
OUTLET-6	Rating	0.000	0.000
OUTLET-6		0.042	0.040
OUTLET-6		0.083	0.112
OUTLET-6		0.125	0.206
OUTLET-6		0.167	0.316
OUTLET-6		0.208	0.433
OUTLET-6		0.250	0.500
OUTLET-6		0.292	0.559
OUTLET-6		0.333	0.612
OUTLET-6		0.375	0.872
OUTLET-6		0.417	1.303
OUTLET-6		0.458	1.845
OUTLET-6		0.500	2.477
OUTLET-6		0.542	3.187
OUTLET-6		0.583	3.965
OUTLET-6		0.625	4.807
OUTLET-6		0.667	5.403
OUTLET-6		0.708	5.863
OUTLET-6		0.750	6.287
OUTLET-6		0.792	6.999
OUTLET-6		0.833	7.950
OUTLET-6		0.875	9.053
OUTLET-6		0.917	10.276
OUTLET-6		0.958	11.605
OUTLET-6		1.000	13.027
OUTLET-6		1.042	14.535
OUTLET-6		1.083	16.123
OUTLET-6		1.125	17.786
OUTLET-6		1.167	19.519
OUTLET-6		1.208	21.320
OUTLET-6		1.250	23.185
OUTLET-6		1.292	25.113
OUTLET-6		1.333	27.100
OUTLET-6		1.375	29.145
OUTLET-6		1.417	31.247
OUTLET-6		1.458	33.402
OUTLET-6		1.500	35.611
OUTLET-6		1.542	37.871
OUTLET-6		1.583	40.182
OUTLET-6		1.625	42.542
OUTLET-7	Rating	0.000	0.000
OUTLET-7		0.042	0.040
OUTLET-7		0.083	0.112
OUTLET-7		0.125	0.206
OUTLET-7		0.167	0.316
OUTLET-7		0.208	0.433
OUTLET-7		0.250	0.500
OUTLET-7		0.292	0.559
OUTLET-7		0.333	0.612
OUTLET-7		0.375	0.872
OUTLET-7		0.417	1.303
OUTLET-7		0.458	1.845
OUTLET-7		0.500	2.477
OUTLET-7		0.542	3.187
OUTLET-7		0.583	3.965
OUTLET-7		0.625	4.807
OUTLET-7		0.667	5.403
OUTLET-7		0.708	5.863
OUTLET-7		0.750	6.287
OUTLET-7		0.792	6.999

```
OUTLET-7                  0.833      7.950
OUTLET-7                  0.875      9.053
OUTLET-7                  0.917      10.276
OUTLET-7                  0.958      11.605
OUTLET-7                  1.000      13.027
OUTLET-7                  1.042      14.535
OUTLET-7                  1.083      16.123
OUTLET-7                  1.125      17.786
OUTLET-7                  1.167      19.519
OUTLET-7                  1.208      21.320
OUTLET-7                  1.250      23.185
OUTLET-7                  1.292      25.113
OUTLET-7                  1.333      27.100
OUTLET-7                  1.375      29.145
OUTLET-7                  1.417      31.247
OUTLET-7                  1.458      33.402
OUTLET-7                  1.500      35.611
OUTLET-7                  1.542      37.871
OUTLET-7                  1.583      40.182
OUTLET-7                  1.625      42.542
OUTLET-7                  1.667      44.950
OUTLET-7                  1.708      47.406
OUTLET-7                  1.750      49.907
OUTLET-7                  1.792      52.454
OUTLET-7                  1.833      55.045
OUTLET-7                  1.875      57.680
OUTLET-7                  1.917      60.357
OUTLET-7                  1.958      63.078
OUTLET-7                  2.000      65.839
OUTLET-7                  2.042      68.642
OUTLET-7                  2.083      71.484
OUTLET-7                  2.125      74.367

BASIN3           Storage  0          2360
BASIN3                    1          2360
BASIN3                    1.5        2360
BASIN3                    2.0        2360
BASIN3                    2.5        2360
BASIN3                    2.75       2360

BASIN4           Storage  0          7724
BASIN4                    0.5        8102
BASIN4                    1.0        8454
BASIN4                    1.5        8763
BASIN4                    2.0        9065
BASIN4                    2.5        9361
BASIN4                    3.0        9649
BASIN4                    3.25       9763

BASIN5           Storage  0          1692
BASIN5                    0.5        1811
BASIN5                    1.0        1934
BASIN5                    1.5        2057

BASIN6           Storage  0          4347
BASIN6                    0.5        5398
BASIN6                    1.0        6464
BASIN6                    1.5        7234
BASIN6                    1.6        7438

BASIN7           Storage  0          3567
BASIN7                    0.5        3762
BASIN7                    1.0        3991
BASIN7                    1.5        4208
BASIN7                    2.0        4418
BASIN7                    2.1        4458

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
Oceanside        FILE "C:\Users\Alex Parra\OneDrive\Alex recents\IN FROM REC AUGUST 2015\New folder\palomar_OCEANSIDE\Os
```

Marja Estates - Proposed

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

[TAGS]

[MAP]
DIMENSIONS -2332.031 5700.000 3253.906 12300.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            1171.263           5914.932
BF3-DIV          -1134.611          8551.727
BF4-DIV          25.327             9073.446
BF5-DIV          1271.375           9124.098
BF6-DIV          2502.227           8921.489
BF7-DIV          3576.056           8308.596
BASIN3           -2097.006          8480.814
BASIN4           -617.957           8794.858
BASIN5           617.960            8835.380
BASIN6           1631.007           8683.423
BASIN7           2686.275           8509.849

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

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1_SOIL_D     -2147.085          6753.693
DMA-2_SOIL_D     -3378.510          8318.726
DMA-3_SOIL_D     -2547.812          9088.642
DMA-3_SOIL_C     -2076.745          9848.427
DMA-4_SOIL_C     -911.741           9873.753
DMA-4_SOIL_D     -222.869           10218.189
DMA-5_SOIL_C     790.178            10228.319
DMA-5_SOIL_D     1590.485           10197.928
DMA-6_SOIL_C     2426.248           10218.189
DMA-6_SOIL_D     3130.316           10187.797
DMA-7_SOIL_C     4427.016           9468.534
DMA-7_SOIL_D     4801.843           8962.011
DMA-8_SOIL_C     4410.977           7681.573
DMA-9_SOIL_C     4526.307           6758.936
DMA-12_SOIL_D    4573.908           6317.959
BF-1             -1407.927          6764.178
BF-2             -2603.529          7802.072
BF-3             -1470.834          8918.745
BF-4             -182.347           9488.795
BF-5             1322.027           9529.317
BF-6             2765.619           9448.273
BF-7             4188.950           8739.140

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
oceanside        1118.841           10821.684
```

ATTACHMENT VII

EXPLANATION OF SELECTED VARIABLES

Sub Catchment Areas:

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

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

Sub-catchment BMP:

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

Pre- Development POC 1 - Green_Ampt condutivity adjustment

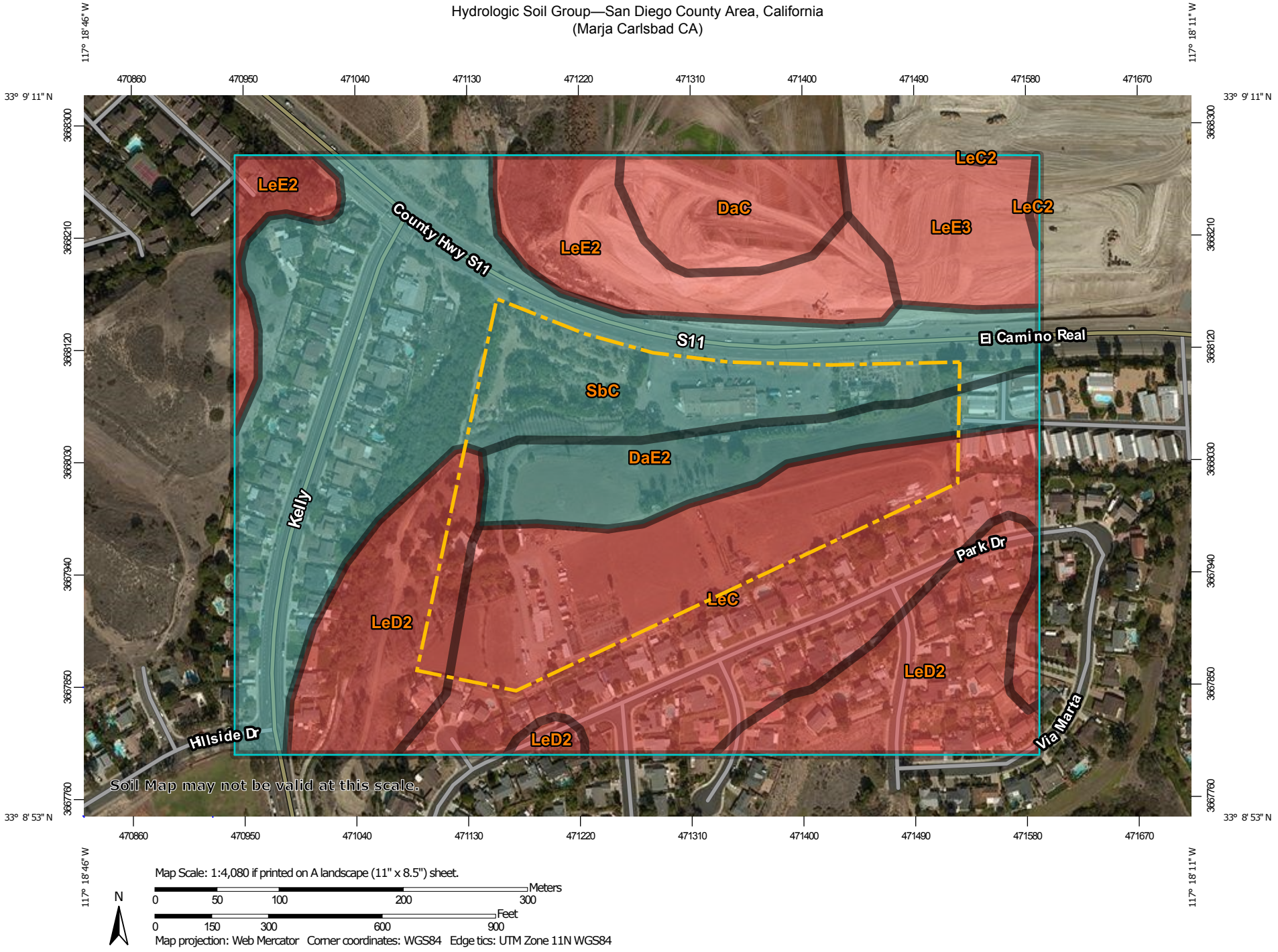
Basin ID	Total Area (ac)	Pervious Area - Soil Type C (sq-ft)	Impervious Area - Soil Type C (sq-ft)	Pervious Area - Soil Type D (sq-ft)	Impervious Area - Soil Type D (sq-ft)	Weighted Conductivity
DMA-1 D	4.63	0	0	198845	2838	**0.0249**
DMA-1 C	10.43	362122	92209			**0.0949**
Total	15.06					

Conductivity Table		
Soil Type	C	D
Impervious	0.075	0.01875
Pervious (landscape)	0.1	0.025

ATTACHMENT VII

Geotechnical - Web Soils Survey

Hydrologic Soil Group—San Diego County Area, California
(Marja Carlsbad CA)



Map Scale: 1:4,080 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DaC	Diablo clay, 2 to 9 percent slopes	D	3.6	4.7%
DaE2	Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT, MLRA 20	C	5.4	7.0%
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes	D	19.3	25.0%
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded	D	0.1	0.1%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	D	12.2	15.7%
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded	D	7.0	9.1%
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded	D	4.1	5.3%
SbC	Salinas clay loam, 2 to 9 percent slopes	C	25.5	33.0%
Totals for Area of Interest			**77.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT VIII

Summary files from SWMM Model

Marja Estates -Pre Development

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

Marja Estates -Pre Development

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

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ OCT-17-1948 00:00:00
Ending Date .............. OCT-05-2005 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 ......       772.637       649.730
Evaporation Loss .........        14.010        11.781
Infiltration Loss ........       685.296       576.282
Surface Runoff ...........        79.544        66.890
Final Surface Storage ....         0.000         0.000
Continuity Error (%) .....        -0.804


*************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        79.544        25.921
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        79.544        25.921
Internal Outflow .........         0.000         0.000
Storage Losses ...........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total      Total       Total     Peak  Runoff
                        Precip      Runon       Evap      Infil     Runoff      Runoff   Runoff   Coeff
Subcatchment                in         in         in         in         in    10^6 gal      CFS
-----------------------------------------------------------------------------------------------------------
DMA-1_SOIL_D            649.73       0.00      24.66     495.54     142.29       17.70     5.14   0.219
DMA-1_SOIL_C            649.73       0.00       5.69     614.47      31.23        8.21     8.76   0.048


Analysis begun on:  Sun Dec 02 10:28:43 2018
Analysis ended on:  Sun Dec 02 10:28:55 2018
Total elapsed time: 00:00:12
```

Marja Estates - Proposed

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

Marja Estates - Proposed

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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ OCT-17-1948 00:00:00
Ending Date .............. OCT-05-2005 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
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	1057.137	649.730
Evaporation Loss	155.520	95.585
Infiltration Loss	302.631	186.001
Surface Runoff	613.632	377.146
Final Surface Storage	0.030	0.018
Continuity Error (%)	-1.388	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	613.632	199.961
Groundwater Inflow	0.000	0.000

RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	613.418	199.892
Internal Outflow	0.000	0.000
Storage Losses	0.154	0.050
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.010	

****
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

****
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_SOIL_D	649.73	0.00	56.28	255.42	344.69	9.92	1.24	0.531
DMA-2_SOIL_D	649.73	0.00	77.84	136.80	441.79	10.81	1.07	0.680
DMA-3_SOIL_D	649.73	0.00	80.66	113.29	463.65	8.39	0.79	0.714
DMA-3_SOIL_C	649.73	0.00	56.02	254.60	347.66	1.00	0.12	0.535
DMA-4_SOIL_C	649.73	0.00	67.83	212.80	374.07	28.44	3.29	0.576
DMA-4_SOIL_D	649.73	0.00	73.97	168.19	413.06	37.05	3.89	0.636
DMA-5_SOIL_C	649.73	0.00	49.95	306.02	299.77	9.24	1.32	0.461
DMA-5_SOIL_D	649.73	0.00	80.23	103.81	475.41	6.86	0.63	0.732
DMA-6_SOIL_C	649.73	0.00	69.48	194.93	391.31	16.96	1.88	0.602
DMA-6_SOIL_D	649.73	0.00	76.08	155.83	423.40	33.56	3.45	0.652
DMA-7_SOIL_C	649.73	0.00	71.92	199.21	382.72	28.55	3.22	0.589
DMA-7_SOIL_D	649.73	0.00	79.77	110.67	468.37	5.78	0.54	0.721
DMA-8_SOIL_C	649.73	0.00	62.67	216.36	379.18	3.08	0.35	0.584
DMA-9_SOIL_C	649.73	0.00	49.88	303.21	303.08	3.60	0.51	0.466
DMA-12_SOIL_D	649.73	0.00	21.74	452.38	185.71	0.22	0.05	0.286
BF-1	649.73	8168.30	960.12	0.00	7918.57	9.62	1.16	0.898
BF-2	649.73	15793.24	1043.67	0.00	15526.68	10.63	1.09	0.944
BF-3	649.73	6384.92	954.94	0.00	6109.80	8.99	0.78	0.869
BF-4	649.73	13601.48	1026.29	0.00	13338.36	64.22	6.88	0.936
BF-5	649.73	15266.61	1049.52	0.00	15029.28	15.85	1.98	0.944
BF-6	649.73	18645.39	1058.52	0.00	18429.40	49.94	5.32	0.955
BF-7	649.73	15438.91	1041.76	0.00	15195.41	33.80	3.67	0.944

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Init. Storage in	Final Storage in	Pcnt. Error
BF-1	BF-1	8818.03	960.16	0.00	341.64	7577.24	0.00	0.00	-0.69
BF-2	BF-2	16442.97	1043.72	0.00	2324.69	13202.79	0.00	0.85	-0.79
BF-3	BF-3	7034.65	954.97	0.00	49.63	6060.38	0.00	0.00	-0.43

BF-4	BF-4	14251.21	1026.33	0.00	521.52	12817.28	0.00	0.83	-0.81
BF-5	BF-5	15916.34	1049.56	0.00	1108.92	13920.92	0.00	0.85	-1.03
BF-6	BF-6	19295.12	1058.56	0.00	2187.98	16242.03	0.00	0.85	-1.01
BF-7	BF-7	16088.64	1042.09	0.00	922.45	14277.78	0.00	0.85	-0.96

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min
POC-1	OUTFALL	0.00	0.00	0.00	0 00:00
BF3-DIV	DIVIDER	0.00	0.00	0.00	0 00:00
BF4-DIV	DIVIDER	0.00	0.00	0.00	0 00:00
BF5-DIV	DIVIDER	0.00	0.00	0.00	0 00:00
BF6-DIV	DIVIDER	0.00	0.00	0.00	0 00:00
BF7-DIV	DIVIDER	0.00	0.00	0.00	0 00:00
BASIN3	STORAGE	0.00	0.59	0.59	16880 21:22
BASIN4	STORAGE	0.00	2.34	2.34	16880 21:18
BASIN5	STORAGE	0.00	0.45	0.45	19902 17:03
BASIN6	STORAGE	0.00	0.64	0.64	19902 17:15
BASIN7	STORAGE	0.00	0.56	0.56	19902 17:15

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal
POC-1	OUTFALL	3.16	16.64	16880	21:14	27.150	199.877
BF3-DIV	DIVIDER	0.78	0.78	16880	21:00	8.988	8.988
BF4-DIV	DIVIDER	6.88	6.88	19902	17:15	64.221	64.221
BF5-DIV	DIVIDER	1.98	1.98	19902	17:00	15.852	15.852
BF6-DIV	DIVIDER	5.32	5.32	19902	17:15	49.938	49.938
BF7-DIV	DIVIDER	3.67	3.67	19902	17:15	33.797	33.797
BASIN3	STORAGE	0.00	0.75	16880	21:00	0.000	0.072
BASIN4	STORAGE	0.00	6.60	19902	17:15	0.000	2.642
BASIN5	STORAGE	0.00	1.76	19902	17:00	0.000	0.814
BASIN6	STORAGE	0.00	5.06	19902	17:15	0.000	5.466
BASIN7	STORAGE	0.00	3.46	19902	17:15	0.000	1.836

****
Node Surcharge Summary
****

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

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
BF3-DIV	DIVIDER	499391.02	0.000	0.000
BF4-DIV	DIVIDER	499391.02	0.000	0.000
BF5-DIV	DIVIDER	499391.02	0.000	0.000
BF6-DIV	DIVIDER	499391.02	0.000	0.000
BF7-DIV	DIVIDER	499391.02	0.000	0.000
BASIN3	STORAGE	499391.02	0.587	2.163
BASIN4	STORAGE	499391.02	2.336	0.914
BASIN5	STORAGE	499391.02	0.451	1.049
BASIN6	STORAGE	499391.02	0.642	0.988
BASIN7	STORAGE	499391.02	0.556	1.569

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
BASIN3	0.000	0	1	1.387	21	16880 21:21	0.58
BASIN4	0.002	0	1	19.942	70	16880 21:17	5.10
BASIN5	0.000	0	0	0.788	28	19902 17:02	1.76
BASIN6	0.001	0	0	3.223	33	19902 17:15	5.04
BASIN7	0.001	0	0	2.045	24	19902 17:15	3.46

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
POC-1	5.46	0.27	16.64	199.877
System	5.46	0.27	16.64	199.877

****
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
UDRAIN3	DUMMY	0.04	6246 03:16			
UDRAIN4	DUMMY	0.28	10671 15:11			
UDRAIN5	DUMMY	0.22	1186 11:52			
UDRAIN6	DUMMY	0.26	1186 11:35			
UDRAIN7	DUMMY	0.21	10671 15:00			
BYPASS3	DUMMY	0.75	16880 21:00			
BYPASS4	DUMMY	6.60	19902 17:15			
BYPASS5	DUMMY	1.76	19902 17:00			
BYPASS6	DUMMY	5.06	19902 17:15			
BYPASS7	DUMMY	3.46	19902 17:15			
ORIFICE3	DUMMY	0.58	16880 21:22			
ORIFICE4	DUMMY	5.10	16880 21:18			
ORIFICE5	DUMMY	1.76	19902 17:03			
ORIFICE6	DUMMY	5.04	19902 17:15			
ORIFICE7	DUMMY	3.46	19902 17:15			

****
Conduit Surcharge Summary
****

	Hours Full		Hours Above Full	Hours Capacity

Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
UDRAIN3	0.01	0.01	0.01	499391.02	0.01
UDRAIN4	0.01	0.01	0.01	499391.02	0.01
UDRAIN5	0.01	0.01	0.01	499391.02	0.01
UDRAIN6	0.01	0.01	0.01	499391.02	0.01
UDRAIN7	0.01	0.01	0.01	499391.02	0.01
BYPASS3	0.01	0.01	0.01	499391.02	0.01
BYPASS4	0.01	0.01	0.01	499391.02	0.01
BYPASS5	0.01	0.01	0.01	499391.02	0.01
BYPASS6	0.01	0.01	0.01	499391.02	0.01
BYPASS7	0.01	0.01	0.01	499391.02	0.01

Analysis begun on: Mon Mar 04 13:00:00 2019
Analysis ended on: Mon Mar 04 13:01:37 2019
Total elapsed time: 00:01:37

HYDROMODIFICATION SCREENING

FOR

RANCHO COSTERA

(ROBERTSON RANCH PLANNING AREAS 1-11, 13, & 23A-C)

AND

EL CAMINO REAL WIDENING

June 19, 2013

Wayne W. Chang, MS, PE 46548

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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APPENDICES

A. SCCWRP Initial Desktop Analysis

B. SCCWRP Field Screening Data

MAP POCKET

Study Area Exhibit
Rancho Costera Drainage Study – Proposed Condition Work Map

Plan) and the adjacent El Camino Real widening project. Both projects are being designed by O'Day Consultants, Inc. (O'Day). Rancho Costera is located south of Calavera Hills Unit 1 (CT 76-12), west of Tamarack Avenue, and north of El Camino Real (see the Vicinity Map and the Study Area Exhibit in the map pocket). The El Camino Real widening is along the south side of Rancho Costera and will extend from Tamarack Avenue on the west to Cannon Road on the east.

The Rancho Costera site is currently undeveloped and supports agricultural uses. The proposed site development varies by planning area (PA): PA 1 and 23A-C are designated as open space; PA 2 is a community facility site; PA 3, 5, 6, 9 and 10 are single-family residential developments; PA 4 is for community recreation, PA 7 and 8 are multi-family residential; and PA 11 is designated village center/commercial. Both projects are subject to hydromodification requirements because they are priority development projects. A variety of best management practices (bioretention basins, bioswales, etc.) will be incorporated throughout the projects to treat runoff from the development areas.

Under pre-project conditions, storm runoff from the Rancho Costera site generally flows towards the south and occurs as sheet flow over the natural ground or as surface flow within natural drainage courses. The majority of this runoff is conveyed to an existing double 8-foot by 4-foot reinforced concrete box culvert (RCB) under El Camino Real east of Kelly Drive or to an existing 8-foot by 8-foot RCB under El Camino Real west of Cannon Road. Some of the runoff will also flow onto El Camino Real where it will be collected by public storm drain systems along with the roadway runoff. The runoff from all of these areas is ultimately conveyed to Agua Hedionda Creek, which outlets into the Agua Hedionda Lagoon and then the Pacific Ocean.

Under post-project conditions, proposed storm drain systems will be constructed to serve Rancho Costera and the existing El Camino Real storm drain system will be altered to accommodate the widening. However, the storm runoff will continue to be conveyed to Agua Hedionda Creek/Lagoon and the Pacific Ocean.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a natural downstream receiving channel to erosion. In this case, there are multiple natural downstream receiving channels near the easterly portion of the site and one natural receiving channel along the westerly portion of the site (see the Study Area Exhibit in the map pocket). The easterly natural channels confluence then flow to Agua Hedionda Creek, while the westerly natural channel flows into the Kelly Drive concrete-lined trapezoidal channel, which discharges to Agua Hedionda Creek. 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 points of compliance, which are at each of the storm drain outlets into the natural channels.

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 should 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 for a study area is determined by assessing and comparing the four bullet items above. As discussed in the Introduction, the project has a point of compliance (POC) at each of the storm drain outlets into a natural channel. In this case, there are natural channels along the easterly and westerly portions of the site. Therefore, a downstream domain of analysis location will be selected below the downstream-most POC in both the easterly and the westerly channels.

The Study Area Exhibit shows several proposed storm drain outfalls into natural channels along the easterly portion of the site. These channels ultimately confluence upstream of El Camino Real and flow to Agua Hedionda Creek south of El Camino Real. Some of the outfalls discharge at essentially the same location along a natural channel, so these form a single POC. The total number of POCs into the easterly channels is twelve (labeled A through L on the Study Area Exhibit). The downstream-most POC within the easterly channels is POC L.

The Study Area Exhibit shows four POCs (labeled M through P) within the natural channel along the westerly portion of the site. The downstream-most POC along this channel is POC P. Therefore, downstream domain of analysis locations will be determined below POC L to the east and POC P to the west, and were assessed as follows.

Per the first bullet item, the first permanent grade control point was located below POC L and POC P through a site investigation and review of aerial photographs. The waterbodies below POC L are Agua Hedionda Creek, Agua Hedionda Lagoon, and the Pacific Ocean. There are no permanent grade controls within these waterbodies below POL L, so this first criteria does not apply for POC L.

For POC P, the natural receiving watercourse continues for over 1,000 feet, where it becomes the concrete-lined Kelly Drive trapezoidal channel. The Kelly Drive channel was recently repaired by the City of Carlsbad. Chang Consultants was under contract with Clayton Dobbs and Sherri Howard at the City and assisted in obtaining the resource agency permits for the repairs. Since the channel is concrete and a primary public drainage facility, it is considered a permanent grade control. Therefore, the upper end of the Kelly Drive channel is the first permanent grade control below POC P.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. The nearest significant tidal backwater or lentic waterbody is for POC L and P is Agua Hedionda Lagoon. From Google Earth, the upstream extent of the lagoon is over 4,500 feet downstream of POC P. For POC L, the lagoon is downstream of the Kelly Drive channel permanent grade control, so the lagoon will not govern for establishing the downstream domain of analysis location.

The final two bullet items are based on 50 and 100 percent tributary drainage areas (in this case, the channels are in urban areas, so the 100 percent criteria will be used). The natural channel below POC L confluences with Agua Hedionda Creek approximately 220 feet below POC L. The overall area tributary to POC L covers approximately 5.11 square miles according to a 2008 *Letter of Map Revision Request for Robertson's Ranch* by Chang Consultants. In comparison, FEMA's May 16, 2012, *Flood Insurance Study* indicates that the Agua Hedionda Creek watershed covers 23.8 square miles at El Camino Real (see Appendix A for excerpts from both reports). This information shows that the Aqua Hedionda Creek tributary drainage area is much greater than 100 percent of the POC L drainage area. In addition, for POC P, a 100 percent larger drainage area occurs where the Kelly Drive channel confluences with Agua Hedionda Creek. Therefore, for both POCs the tributary area criteria is met where their downstream channels confluence with Agua Hedionda Creek.

Based on the above information, the downstream domain of analysis below POC L occurs at the confluence with Agua Hedionda Creek, which is approximately 220 feet downstream of POC L. There is no permanent grade control associated with POC L and the tidal backwater is several thousand feet further downstream of the confluence.

The downstream domain of analysis for the natural channel tributary to POC P is at the permanent grade control created at the upper end of the Kelly Drive concrete-lined channel. The tidal backwater and 100 percent tributary area are further downstream of the Kelly Drive channel. Per the first bullet item, the downstream domain of analysis is one reach below the grade control point. As outlined above, a reach is not to exceed 200 meters (656 feet). The concrete-lined channel is longer than 656 feet, so the reach will be within the non-erodible

channel. Therefore, the downstream domain of analysis for the study reach associated with POC P occurs at the upper end of the Kelly Drive channel.

Upstream Domain of Analysis

The upstream domain of analysis must be established for the easterly and westerly natural channels. Along the easterly side, there are three upstream-most POCs: POC A, POC B, and POC H (see the Study Area Exhibit). The outlet of each of these is essentially at the upstream end of the receiving natural channel. Since the area upstream of these three POCs is not an erodible channel, each POC establishes an upstream domain of analysis location.

Along the westerly side, the upstream-most POC is POC M, and the watercourse above POC M begins at the southerly edge of Tamarack Avenue approximately 290 feet above POC M. Therefore, the upstream domain of analysis location for the westerly natural channel is at the southerly edge of Tamarack Avenue.

Study Reaches within Domain of Analysis

The total domain of analysis (or overall study reach) within the easterly area extends from the three upstream POCs to Agua Hedionda Creek south of El Camino Real. The total domain of analysis for the various natural channels within the westerly area covers approximately 6,241 feet (1,902 meters). The domain of analysis was subdivided into eight natural study reaches with similar characteristics (see the Study Area Exhibit). Reach E1 extends 2,700 feet (823 meters) from the upstream domain of analysis location at POC A down to POC F, which is at a channel confluence. Reach E2 extends 1,253 feet (382 meters) from the upstream domain of analysis location at POC B to POC C. Reach E3 extends 244 feet (74 meters) from POC C to POC D. POC D and E are at the upstream and downstream ends of the proposed Street E culvert crossing of the channel. Reach E4 extends 687 feet (209 meters) from POC E to the channel confluence at POC F. Reach E5 extends 250 feet (76 meters) from POC F to an existing concrete-lined access road crossing the natural channel. Reach E6 extends 284 feet (87 meters) from the access road to POC G, which is located at the upstream end of the existing 8-foot by 8-foot RCBs under El Camino Real. Reach E7 extends 603 feet (184 meters) from the upstream domain of analysis location at POC H to POC G. Reach E8 extends 220 feet (67 meters) from POC L at the downstream end of the 8-foot by 8-foot RCBs under El Camino Real to the downstream domain of analysis location at the confluence with Agua Hedionda Creek.

The total domain of analysis for the westerly area covers approximately 2,546 feet (776 meters). Reach W1 begins at the upstream domain of analysis location on the south side of Tamarack Avenue and extends 290 feet (88 meters) to the upstream end of the proposed Street J access road from Tamarack Avenue. Street J crosses the stream channel and will contain a culvert to convey the stream flow through the roadway embankment. Reach W2 extends 309 feet (94 meters) from POC M at the lower end of the proposed Street J culvert to POC N. Reach W3 extends 940 feet (287 meters) from POC N to POC O, which is located at the upstream end of the existing double 8-foot by 4-foot RCBs under El Camino Real. POC P is at the downstream end of the existing double 8-foot by 4-foot RCBs under El Camino Real. Reach W4 extends 1,007 feet (307 meters) from POC P to the downstream domain of analysis location at the upper end of the concrete-lined Kelly Drive channel.

Several of the study reaches are longer than the 656 feet (200 meters) maximum reach length specified by SCCWRP. Review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and longitudinal slope), vegetative, hydraulic, and soil conditions within each of the reaches are relatively uniform. Subdividing the reaches into smaller subreaches of less than 656 feet will not yield significantly varying results within a reach. Although the screening tool was applied across the entire length of each study reach, the results will be similar for shorter subreaches within each reach.

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 area, valley slope, and valley width. The NED data is similar to USGS mapping. For this report, O'Day's proposed condition hydrology data was used, where available, to identify the drainage areas, which is more accurate than using NED data. The relevant pages from O'Day's hydrology analyses are included in Appendix A and their workmap is included in the map pocket. O'Day's analyses do not provide drainage areas for Reach E7, E8, or W4, so these were obtained as follows. Chang Consultants prepared a 2008 *Letter of Map Revision Request for Robertson's Ranch* that delineated the tributary drainage areas to Reach E7 and E8, so the LOMR data was used (see Appendix A for excerpts). For Reach W4, O'Day's analyses determined the tributary area at the upper end of the reach. The additional area tributary to the lower end of Reach W4 was delineated from the project's topographic mapping to determine the total drainage area tributary to Reach W4. The delineation is included on the Study Area Exhibit.

The mean annual precipitation is provided by the County of San Diego's BMP Sizing Calculator (see Appendix A) and is 13.3 inches.

The valley slopes of each study reach were determined from the 2-foot contour interval mapping prepared for the project, where available, and the City's 2-foot contour interval topographic mapping for a small area at the east. 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 reach by the flow path. The 2-foot contour mapping sources were used because they will provide more precise results than NED data.

The valley width is the bottom width of the main creek channel. The average valley width within each reach was estimated from the 2-foot contour interval topographic mapping, field observations, and review of aerial photographs. The valley slope and valley width for each reach are summarized in Table 1.

These 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.

Reach	Tributary Area, sq. mi.	Valley Slope, m/m	Valley Width, m
E1	0.2400	0.0289	6.1
E2	0.0731	0.0551	1.5
E3	0.0732	0.0369	1.5
E4	0.1272	0.0247	8.5
E5	0.3963	0.0092	11.0
E6	0.3964	0.0088	4.6
E7	4.6800	0.0060	16.8
E8	5.1100	0.0091	25.9
W1	0.0054	0.0448	2.4
W2	0.8078	0.0191	6.1
W3	1.1157	0.0127	17.7
W4	1.2688	0.0183	4.9

Table 1. Summary of Valley Slope and Valley Width

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.

Visual observation reveals that most of the study reaches contain a moderate to densely vegetated channel (see the figures following the report text). The vegetative density extends relatively uniformly across the channel bottom and sides. Due to the vegetative cover, riprap energy dissipaters at each POC, and lack of significant erosion noted during the site investigation, the vertical and lateral stability was anticipated to have a limited susceptibility to erosion.

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 30. 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).

Channel bed resistance is a function of the bed material and vegetation. The figures after this report text contain photographs of the natural channels in each study reach. A site investigation and the figures indicate that the vegetative cover throughout each natural channel within Reaches E1 through E4, E8, and W1 through W4 is mature, dense, and fairly uniform (see Figures 1 through 10 and 17 through 26). The vegetation in some areas is so dense that the channel was either difficult to access or not possible to access at all unless the vegetation is trimmed. The vegetation consists of a variety of mature grasses, reeds, shrubs, and trees. Vegetation prevents bed incision because its root structure binds soil and because the aboveground vegetative growth reduces flow velocities. Table 5-13 from the County of San Diego's *Drainage Design Manual* outlines maximum permissible velocities for various channel linings (see Table 5-13 in Appendix B). Maximum permissible velocity is defined in the manual as the velocity below which a channel section will remain stable, i.e., not erode. Table 5-13 indicates that a fully-lined channel with unreinforced vegetation has a maximum permissible velocity of 5 feet per second (fps). Due to the dense cover and mature vegetation, the permissible velocity when erosion can initiate is likely greater than 5 fps in most of the natural channel areas. Table 5-13 indicates that 5 fps is equivalent to an unvegetated channel containing cobbles (grain size from 64 to 256 mm) and shingles (rounded cobbles). In comparison, coarse gravel (19 to 75 mm) has a maximum permissible velocity of 4 fps. Based on this information, the uniformly vegetated natural canyons in Reaches E1 through E4, E8, and W1 through W4 has an equivalent grain size of at least 64 mm, which is comparable to a transitional/intermediate bed.

Figures 11 through 16 show that Reaches E5 through E7 contain sparser vegetation than the other reaches. Therefore, a relationship between vegetative cover and grain size is not applicable, and pebble count must be performed. Figures 15 through 17 contain photographs of the typical bed material within these three study reaches. A gravelometer is included in the photographs for reference. Each square on the gravelometer indicates grain size in millimeters (the squares range from 2 mm to 180 mm). A pebble count was performed (see results in Appendix A) that determined the median (d_{50}) bed material size to be 11 millimeters (mm) in Reaches E5, E6, and E7.

In addition to the material size, 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 for each study reach.

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 twelve reaches is within category B, which represents intermediate bed material within unknown armoring potential due to a surface veneer and dense vegetation. The soil was probed and penetration was relatively difficult through the underlying layer of each reach. Due to the dense vegetative growth in some reaches, the armoring potential could have been rated higher in those reaches, but Category B was conservatively (i.e., more potential for channel incision) chosen.

Checklist 2 determines grade control characteristics of the channel bed. SCCWRP states that grade controls can be natural. Examples are vegetation or confluences with a larger waterbody. As indicated above and verified with photographs, Reaches E1 through E4, E8, and W1 through W4 contain dense vegetation (see the figures). The plant roots and tree trunks serve as a natural grade control. The spacing of these is much closer than the 50 meters or $2/S_v$ values identified in

the checklist. Further evidence of the effectiveness of the natural grade controls is the absence of headcutting and mass wasting (large vertical erosion of a channel bank). Based on this information, Reaches E1 through E4, E8, and W1 through W4 are within Category A on Checklist 2.

Reaches E5 through E7 do not contain dense vegetation. However, each of these reaches has a grade control at their downstream end. For Reach E5, the existing concrete-lined access road crossing of the natural channel (see Figure 13) is a permanent grade control. For Reaches E6 and E7, the existing 8-foot by 8-foot RCB under El Camino Real is a permanent grade control (see Study Area Exhibit). Table 2 summarizes the length, $2/S_v$, and $4/S_v$ values for each of these reaches. Table 2 shows that for each reach, the reach length is less than the $2/S_v$ value (and naturally also less than $4/S_v$). Therefore, the grade control spacing in each of the three reaches is less than $2/S_v$ and each reach is within Category A on Checklist 2.

Study Reach	Reach Length, ft	$2/S_v$, ft	$4/S_v$, ft
E5	250	713	1,426
E6	284	745	1,491
E7	603	1,099	2,198

Table 2. Grade Control Spacing Data

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 determined in the initial desktop analysis (see Appendix A). d_{50} is derived from field conditions. As discussed above, the equivalent grain size for the densely-vegetated channels in Reaches E1 through E4, E8, and W1 through W4 is at least 64 mm. The Screening Index Threshold diagram shows that the 50 percent probability of incising or braiding for a d_{50} of 64 mm has an index of at least 0.101 (in red rectangle on diagram). The Screening Index for these nine reaches calculated in Appendix A varies from 0.009 to 0.039. Since each reach's Screening Index value is less than the 50 percent value, Reaches E1 through E4, E8, and W1 through W4 fall within Category A.

For Reaches E5 through E7, their D_{50} value was entered onto the Screening Index Threshold graph. As mentioned above, a pebble count determined that the D_{50} for each of these reaches is 11 mm. Plotting 11 mm on the graph corresponds to a 50 percent Screening Index value of 0.038. The Screening Index calculated in Appendix A for the three reaches varies from 0.011 to 0.023. Since each reach's Screening Index value is less than the 50 percent value, Reaches E5, E6, and E7 fall 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 for each of the twelve reaches is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$
$$= [(6 \times 3)^{1/2} \times 3]^{1/2} \quad \text{(Note: each of the twelve reaches has similar values)}$$
$$= 3.6$$

Since the vertical rating is less than 4.5, each reach has a low vertical susceptibility to erosion.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 31) 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 any of the reaches during a field investigation. The banks are intact in the photographs included in the figures. Due to the dense vegetation in most areas, photographs representative of the banks were difficult to take. Nonetheless, the dense vegetation supports the absence of large lateral adjustments.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the banks were difficult to penetrate with a probe. In addition, the banks showed limited evidence of crumbling and were composed of 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. The 2-foot contour interval topographic mapping indicates that the average natural bank angle is no greater than 2 to 1 (horizontal to vertical) or 26.6 degrees in any of the reaches. 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 all 12 study reaches, 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 the VWI for each reach is less than 2.

From the above steps, the lateral susceptibility rating is low for each of the twelve study reaches (red circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree in Appendix B showing the decision path). A review of aerial photographs confirms a lack of braiding or lateral migration throughout the natural channels.

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for the Rancho Costera and associated El Camino Real Widening projects being designed by O'Day Consultants, Inc. The project runoff will ultimately be collected by a series of proposed and/or existing storm drain systems that outlet into unnamed natural channels at various locations along the easterly and westerly portions of the developments. Each outlet is a point of compliance. Based on the points of compliance, the unnamed natural channels were assessed from the upstream-most POCs to either the confluence with Agua Hedionda Creek or the concrete-lined Kelly Drive trapezoidal channel (domain of analysis). The assessment was performed based on office analyses and field work. The results indicate a low susceptibility for vertical and lateral channel erosion for the entire study area.

The HMP requires that these results be compared with the critical stress calculator results incorporated in the County of San Diego's BMP Sizing Calculator. The BMP Sizing Calculator critical stress results are included in Appendix B for all twelve reaches. Based on these values, the critical stress results returned a low susceptibility to erosion. Therefore, the SCCWRP analyses and critical stress calculator demonstrate that the project can be designed assuming a low susceptibility, i.e., $0.5Q_2$.

The SCCWRP results are consistent with the physical condition of the natural channel within the domain of analysis, which is moderately to densely-vegetated throughout. None of the twelve study reaches exhibit signs of extensive, ongoing erosion.

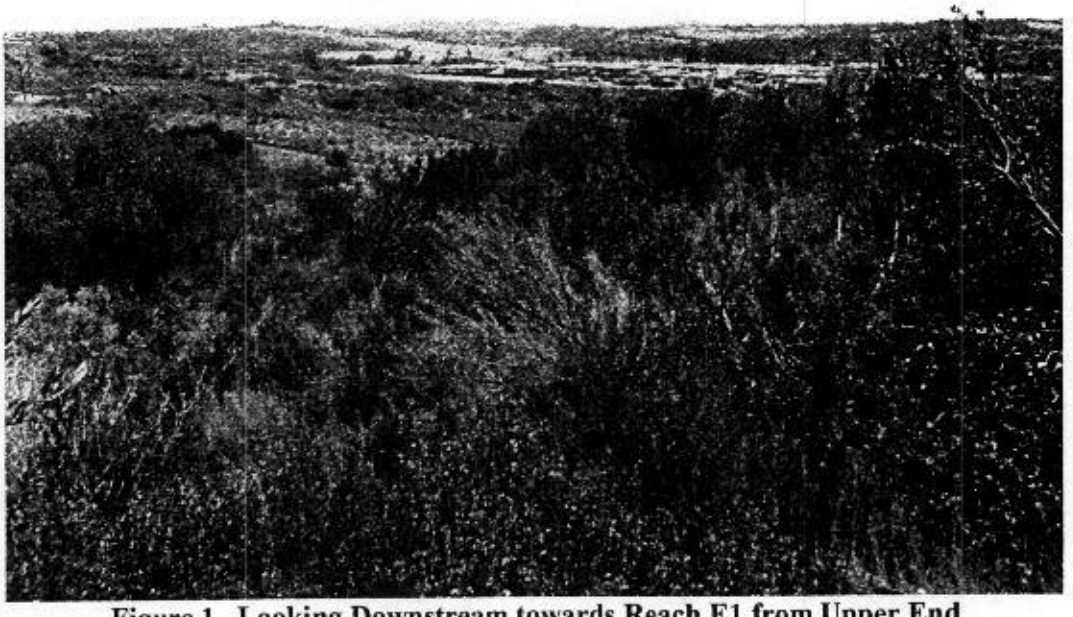


Figure 1. Looking Downstream towards Reach E1 from Upper End

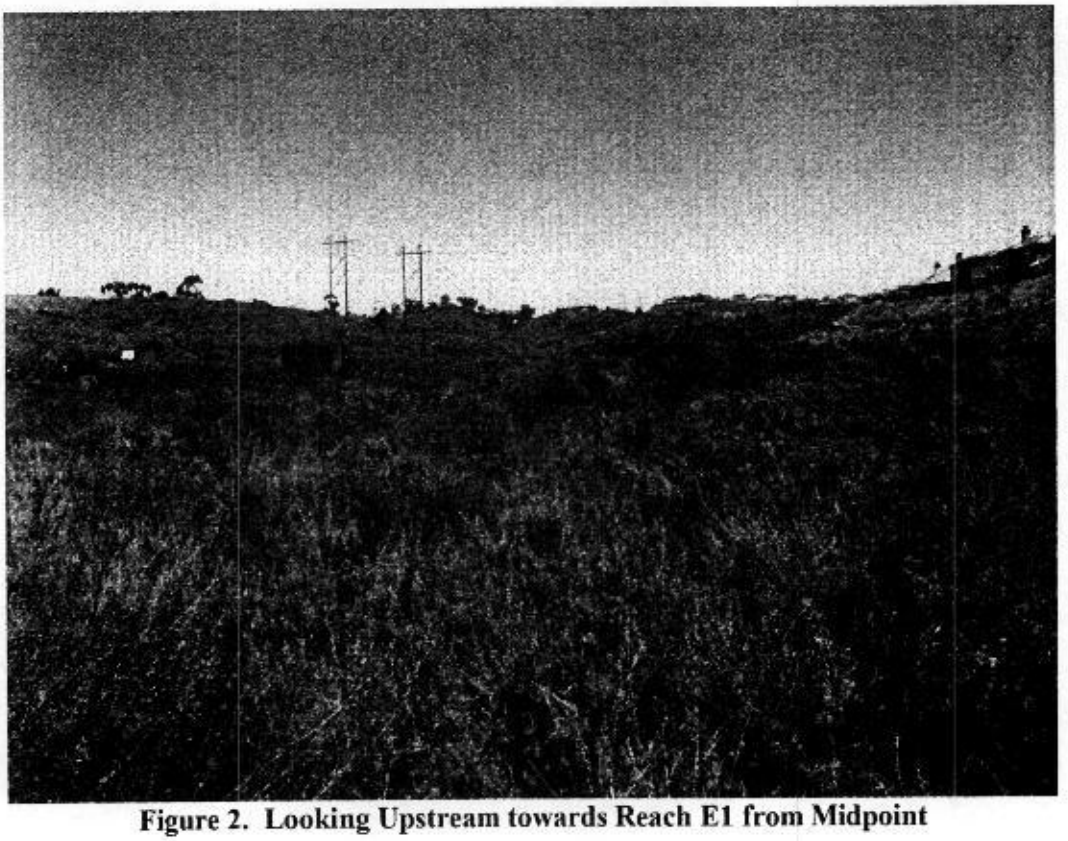


Figure 2. Looking Upstream towards Reach E1 from Midpoint

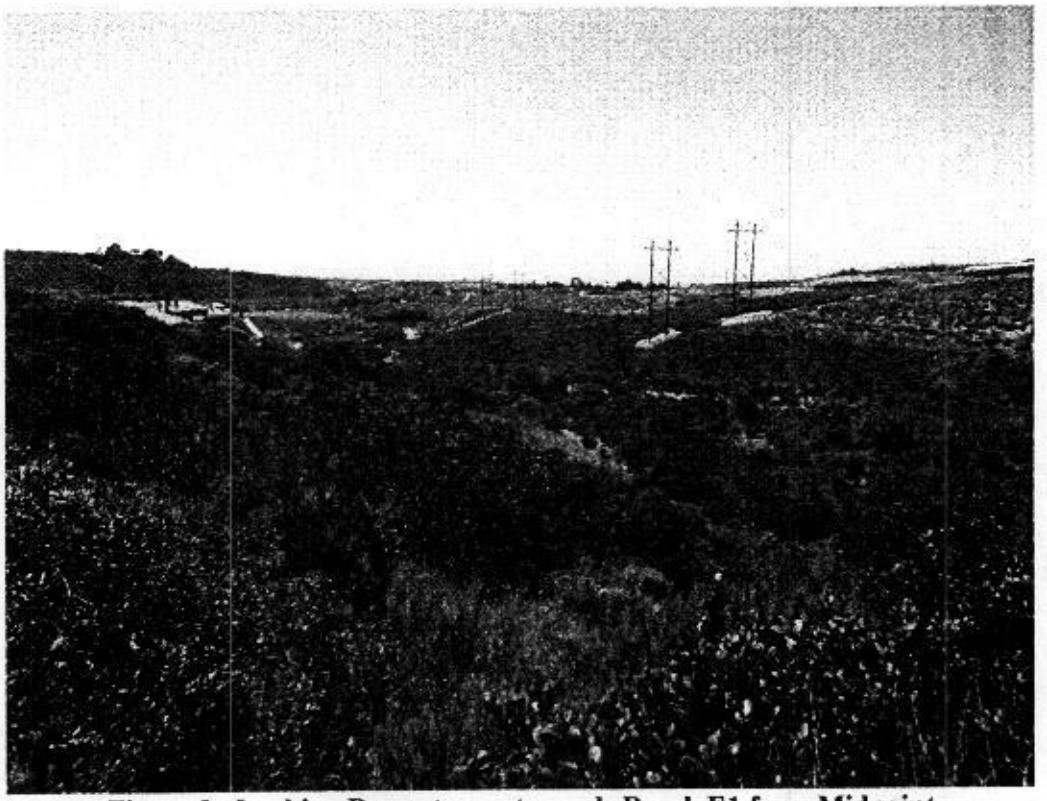


Figure 3. Looking Downstream towards Reach E1 from Midpoint

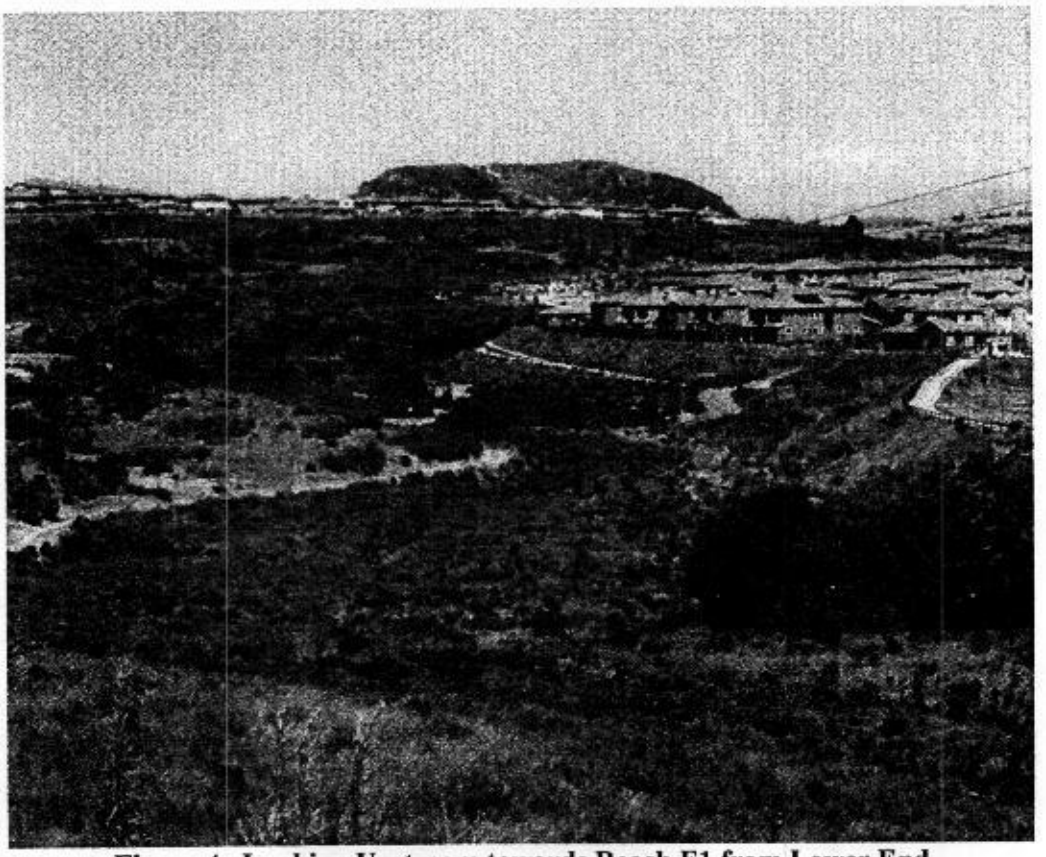


Figure 4. Looking Upstream towards Reach E1 from Lower End

Figure 5. Looking Downstream towards Reach E2 from Upper End

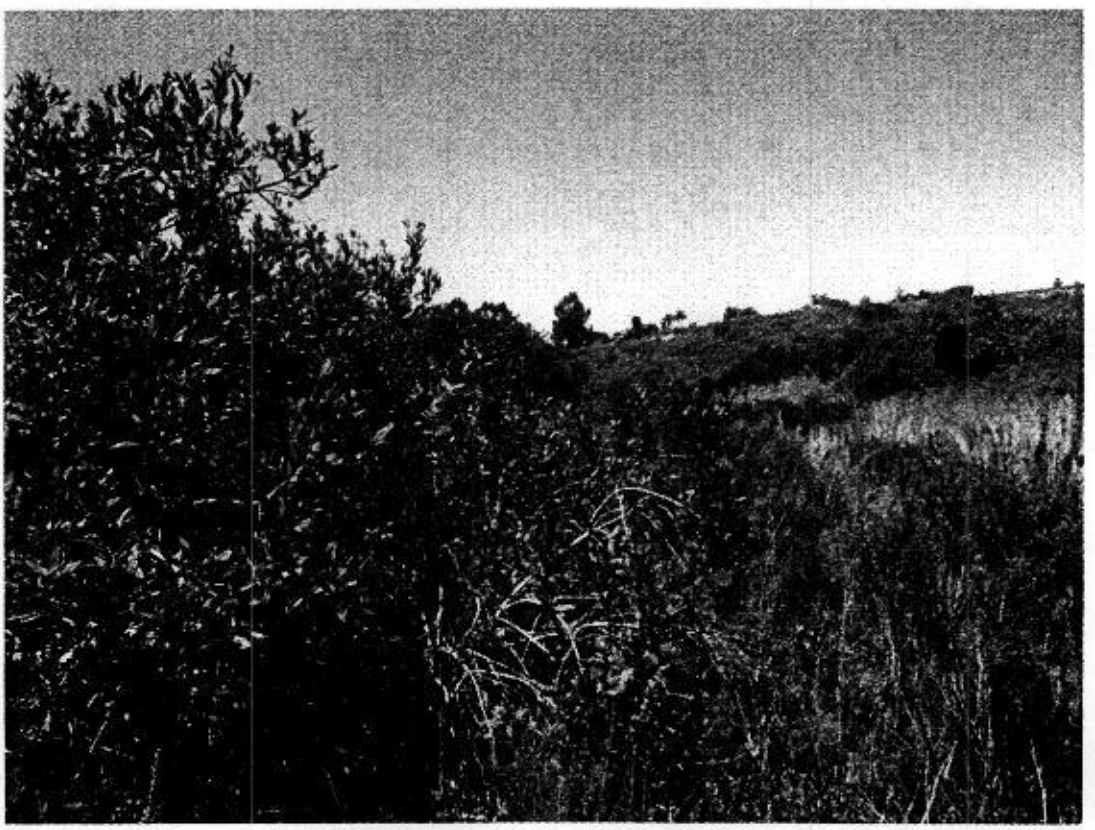


Figure 6. Looking Upstream towards Reach E2 from Midpoint

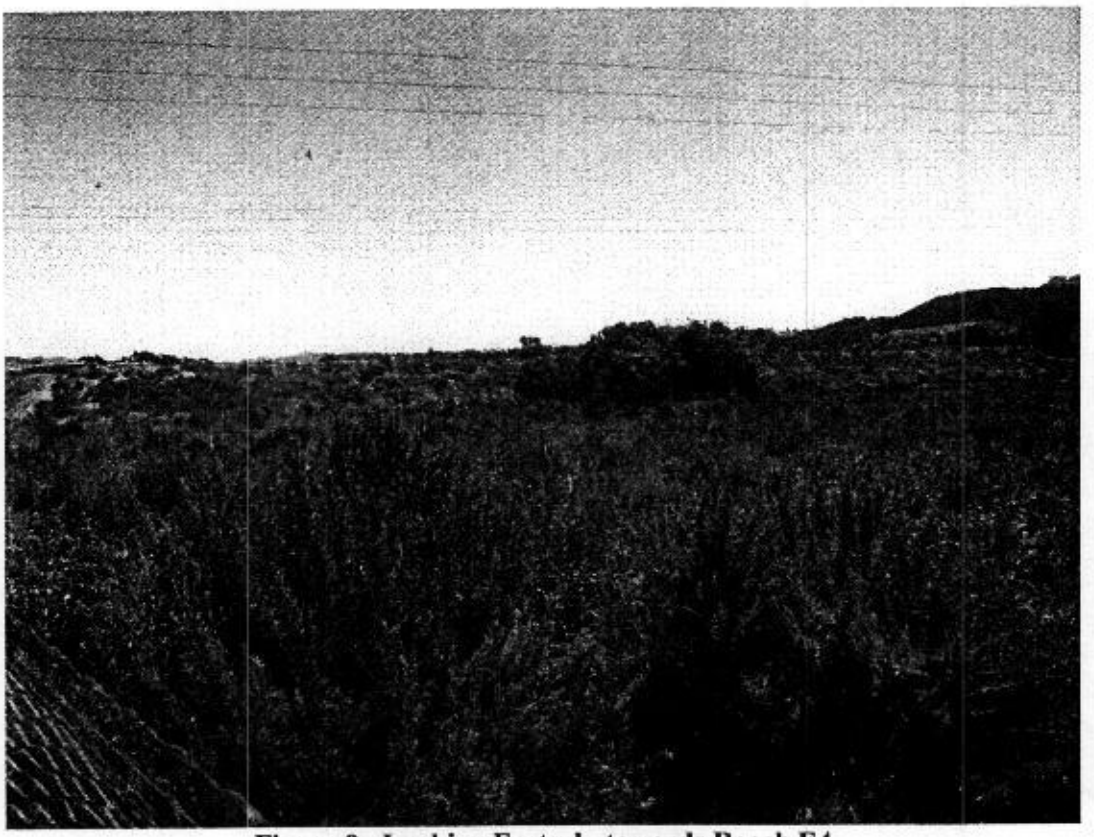


Figure 9. Looking Easterly towards Reach E4

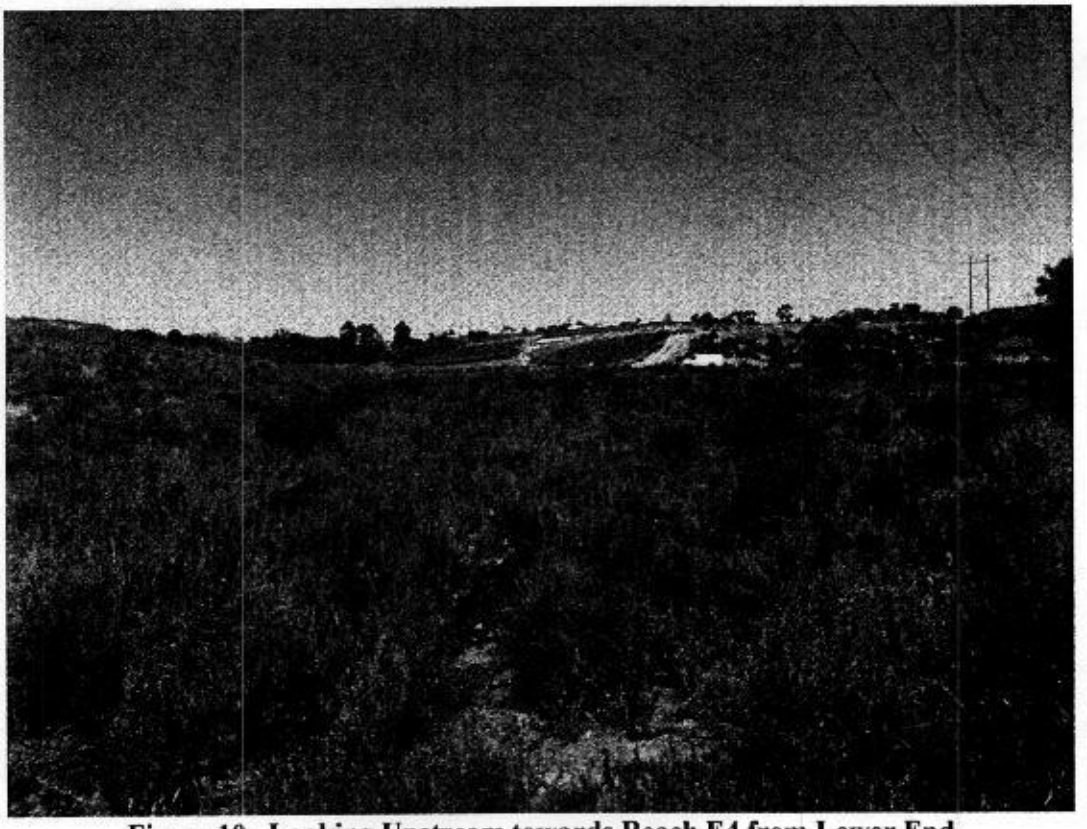


Figure 10. Looking Upstream towards Reach E4 from Lower End

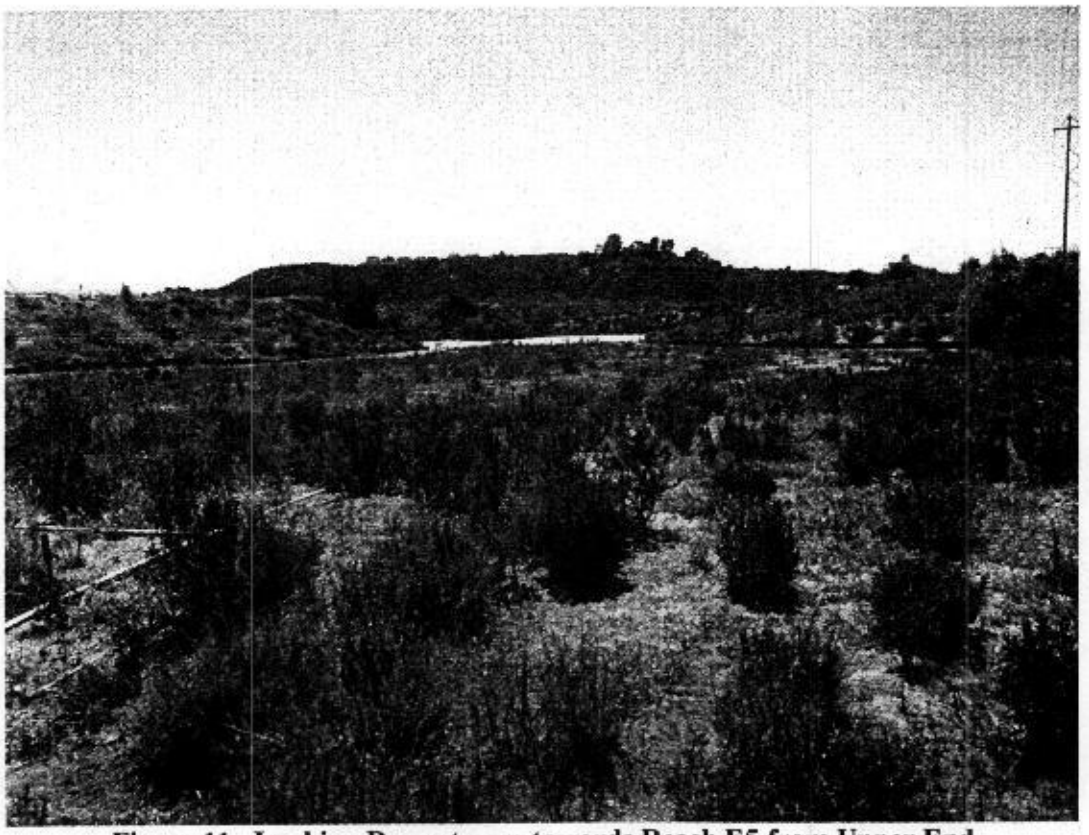


Figure 11. Looking Downstream towards Reach E5 from Upper End

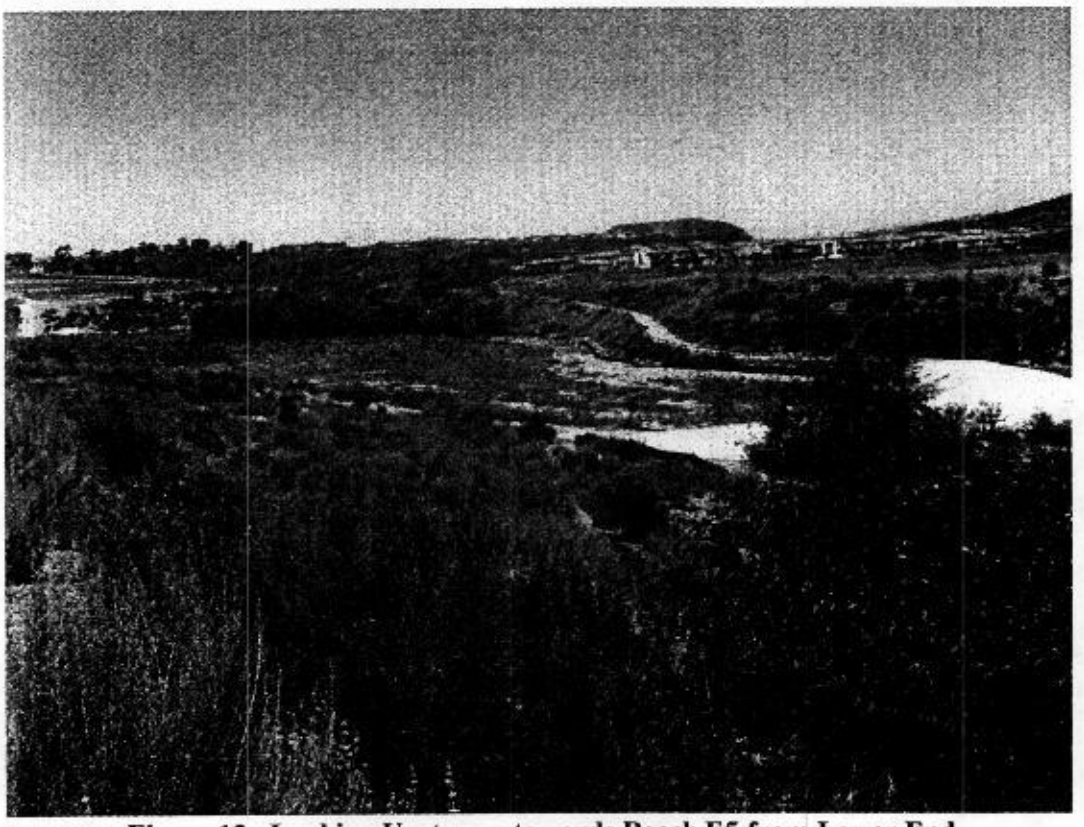


Figure 12. Looking Upstream towards Reach E5 from Lower End

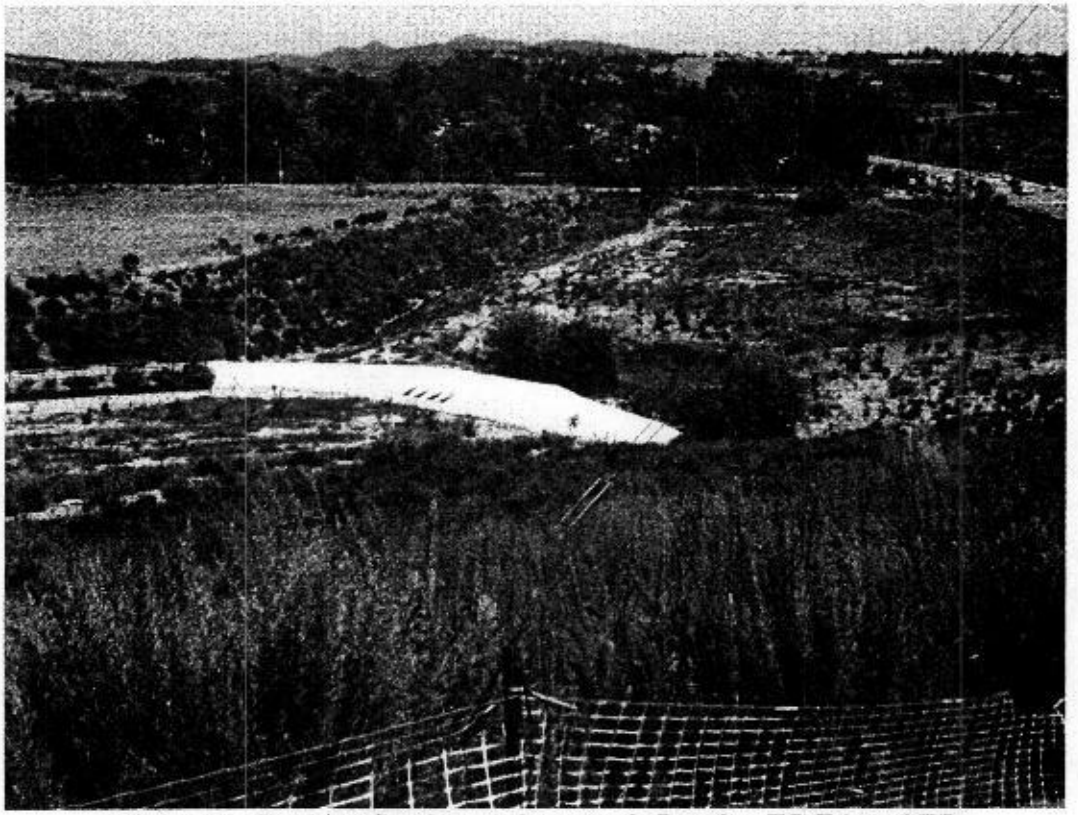


Figure 13. Looking Southeasterly towards Reaches E5, E6, and E7

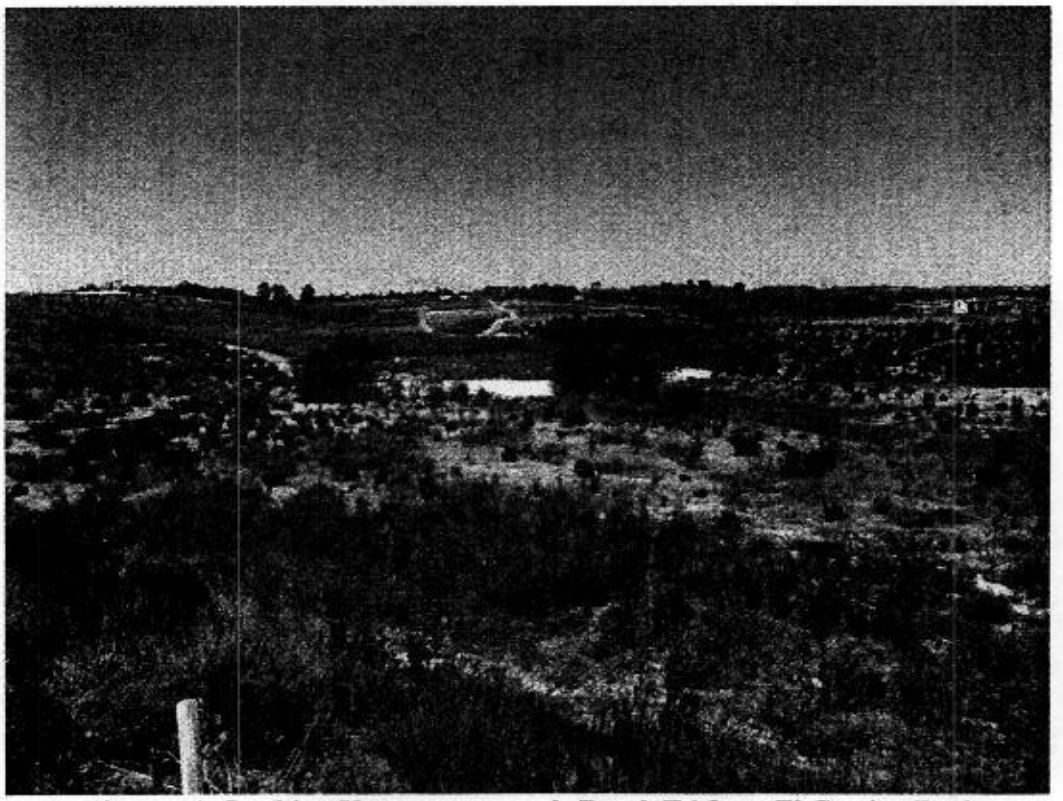


Figure 14. Looking Upstream towards Reach E6 from El Camino Real

Figure 15. Looking Downstream towards Reach E7 from Upper End

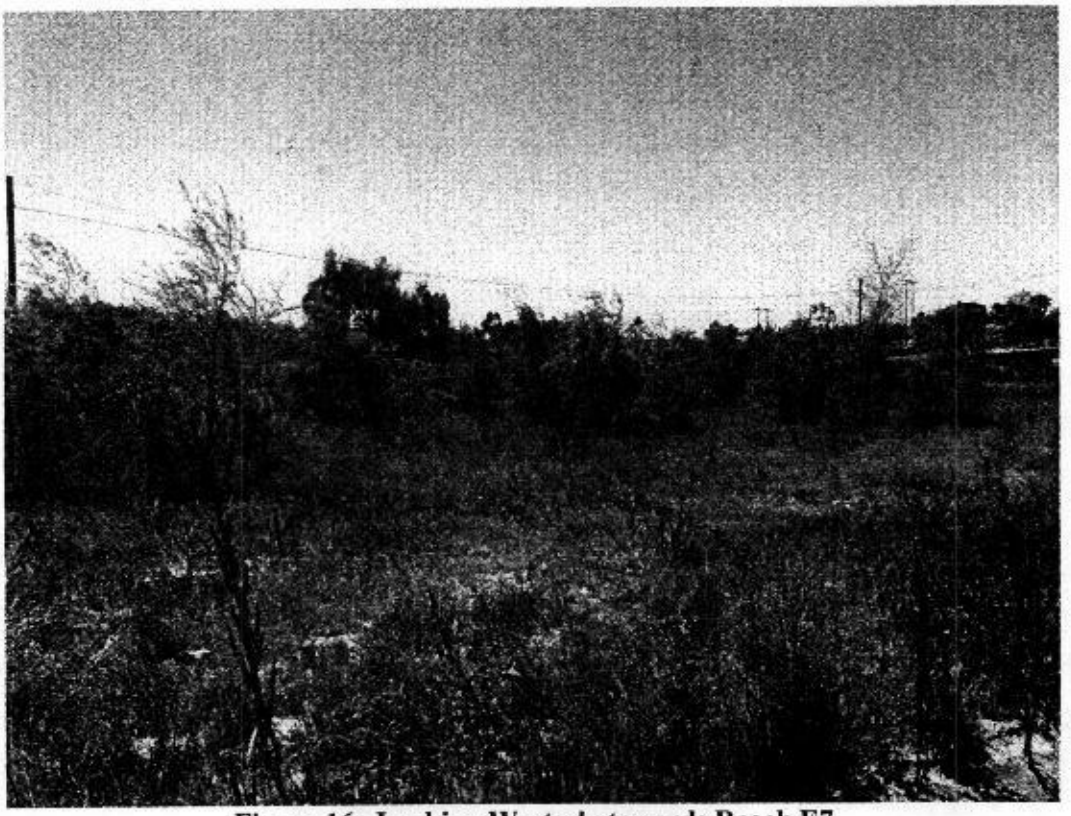


Figure 16. Looking Westerly towards Reach E7

Figure 17. Looking Southeasterly towards Reach E8 and Agua Hedionda Creek

Figure 18. Looking Downstream towards Reach W1 from Upper End

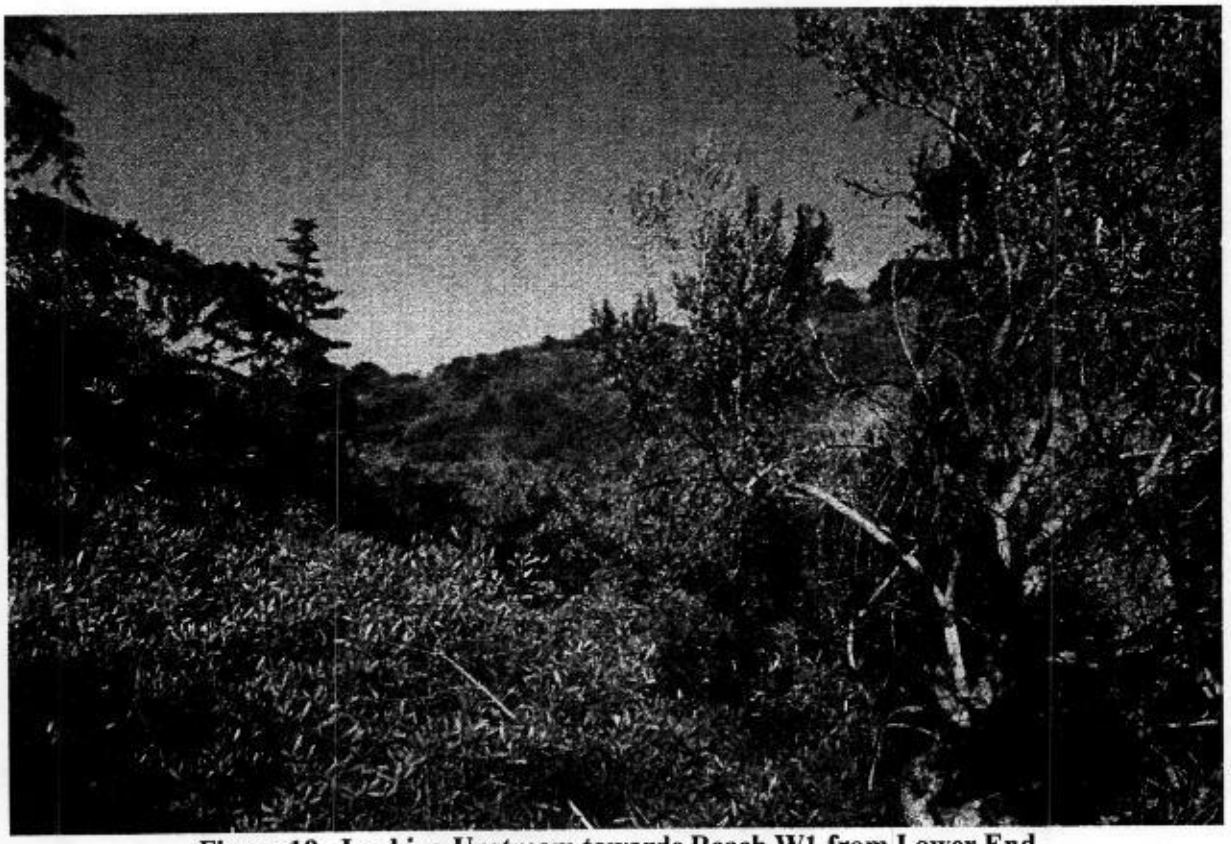


Figure 19. Looking Upstream towards Reach W1 from Lower End

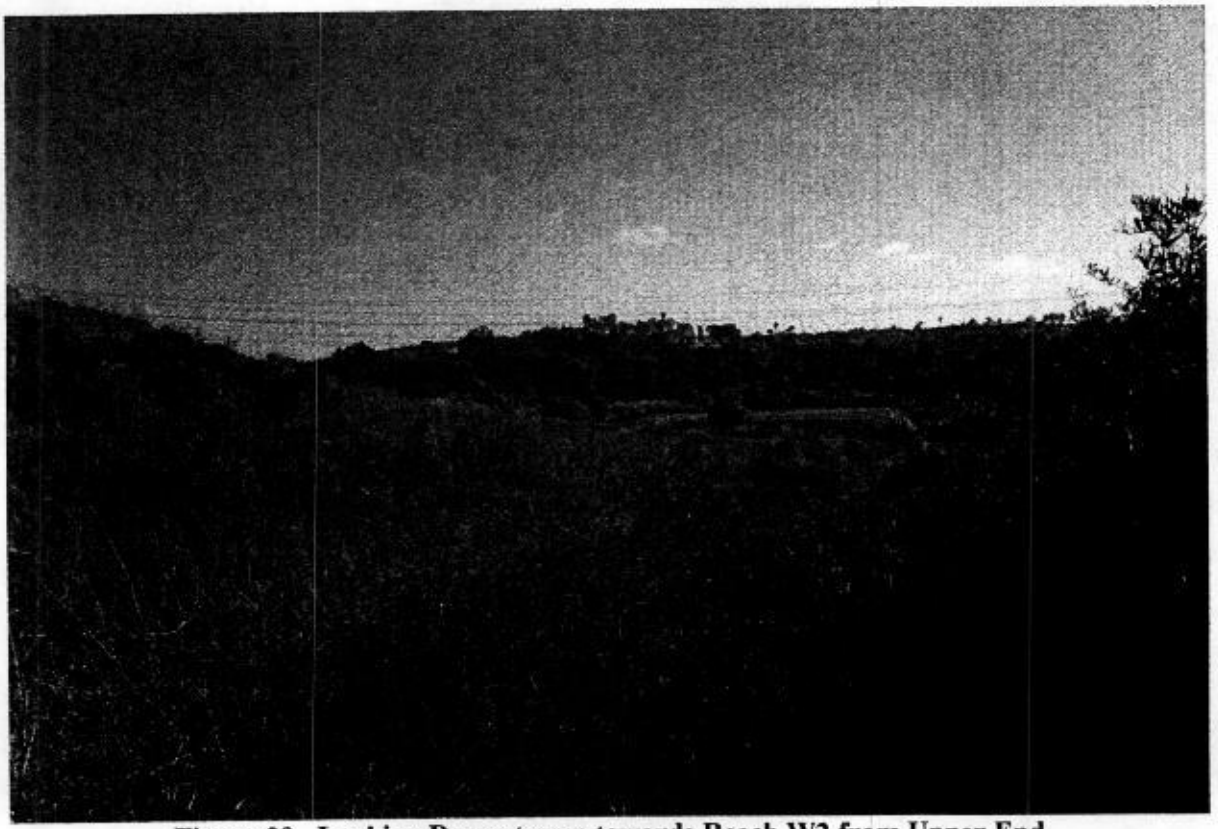


Figure 20. Looking Downstream towards Reach W2 from Upper End

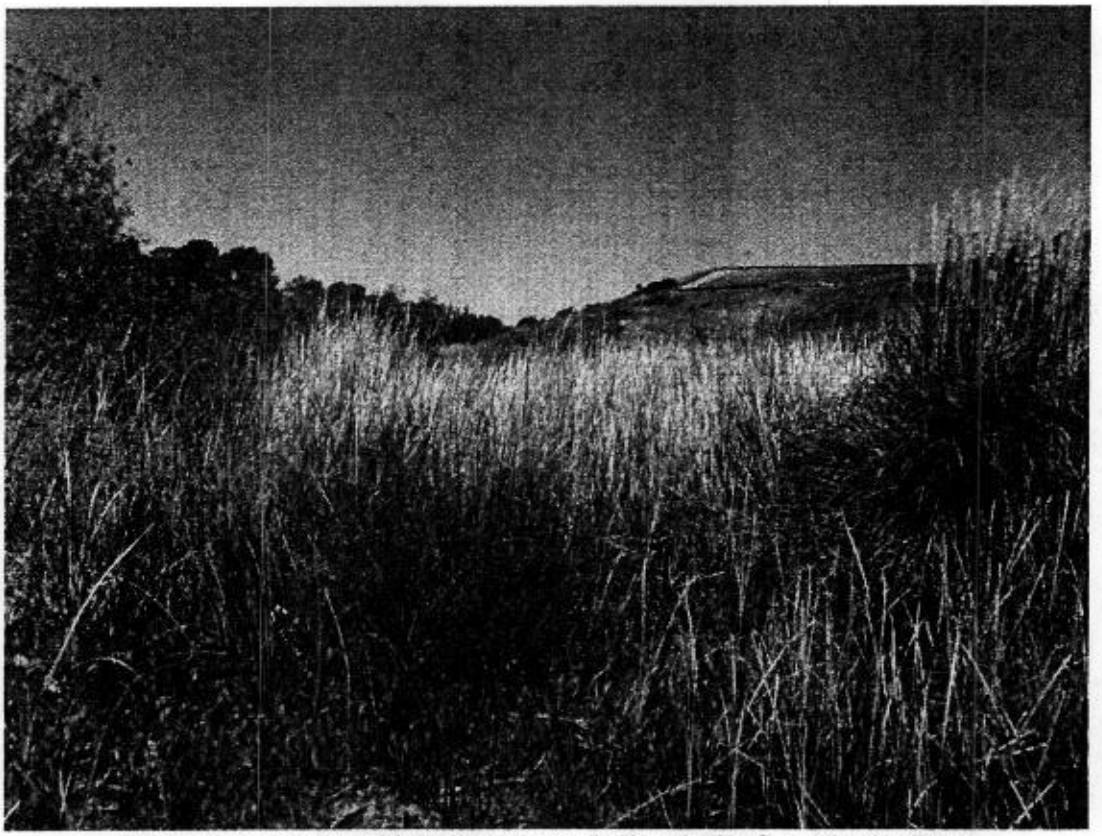


Figure 21. Looking Upstream towards Reach W2 from Lower End

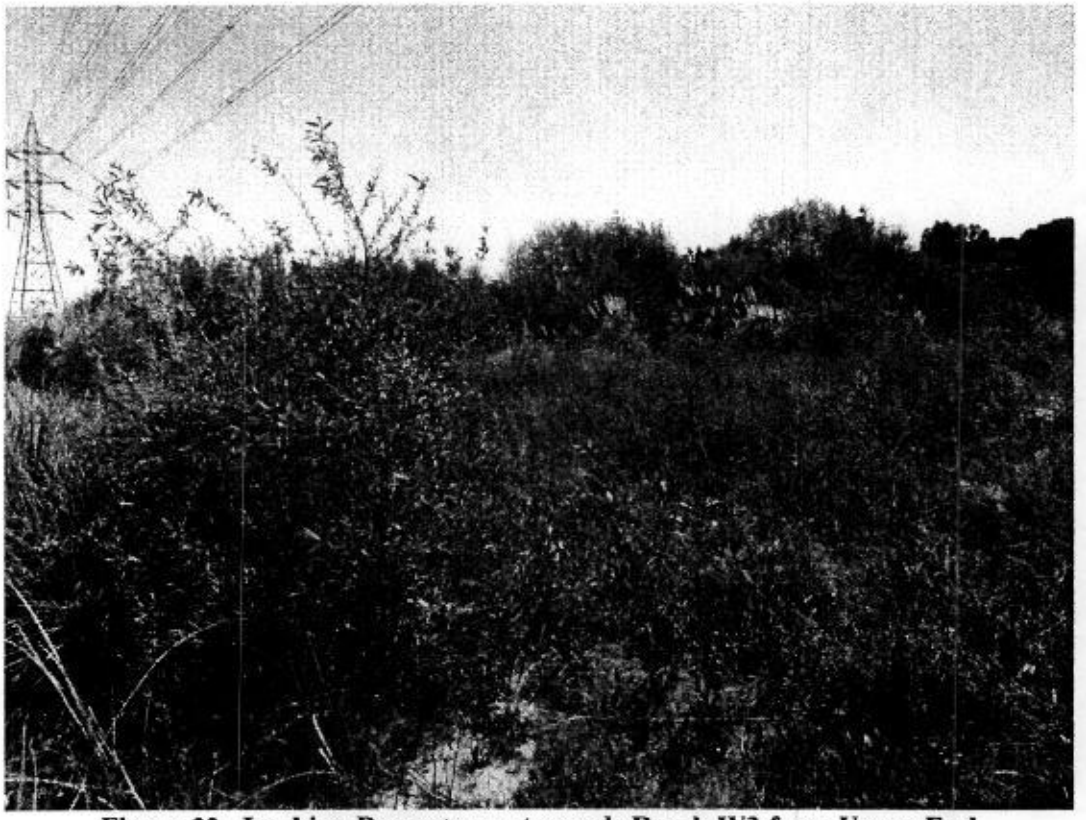


Figure 22. Looking Downstream towards Reach W3 from Upper End

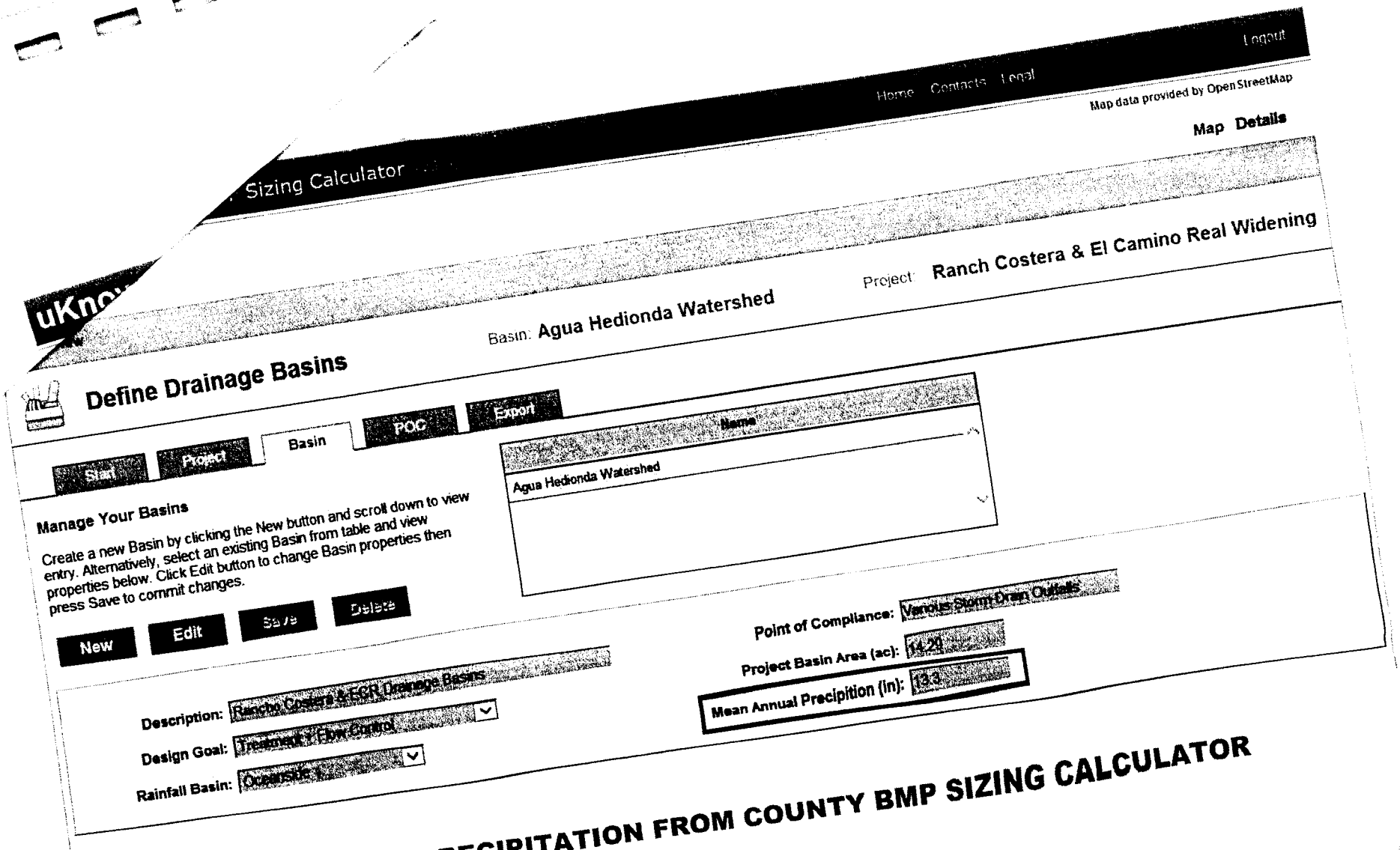
APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS

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
E1	0.2400	13.3	0.0289	6.1	39	1.1
E2	0.0731	13.3	0.0551	1.5	14	0.4
E3	0.0732	13.3	0.0369	1.5	14	0.4
E4	0.1272	13.3	0.0247	8.5	22	0.6
E5	0.3963	13.3	0.0092	11.0	60	1.7
E6	0.3964	13.3	0.0088	4.6	60	1.7
E7	4.6800	13.3	0.0060	16.8	511	14.5
E8	5.1100	13.3	0.0091	25.9	552	15.6
W1	0.0054	13.3	0.0448	2.4	1	0.04
W2	0.8078	13.3	0.0191	6.1	111	3.1
W3	1.1157	13.3	0.0127	17.7	147	4.2
W4	1.2688	13.3	0.0183	4.9	164	4.6

Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
E1	0.030	7.3	0.84
E2	0.034	4.6	0.33
E3	0.023	4.6	0.33
E4	0.020	5.7	1.50
E5	0.012	8.8	1.25
E6	0.011	8.8	0.52
E7	0.023	22.5	0.74
E8	0.036	23.3	1.11
W1	0.009	1.7	1.42
W2	0.034	11.5	0.53
W3	0.026	13.0	1.36
W4	0.039	13.7	0.36



MEAN ANNUAL PRECIPITATION FROM COUNTY BMP SIZING CALCULATOR

Figure 25. Dense Vegetation within Middle of Reach W4

Figure 26. Looking Upstream towards Reach W4 from Lower End at Concrete-Lined Kelly Dr. Channel

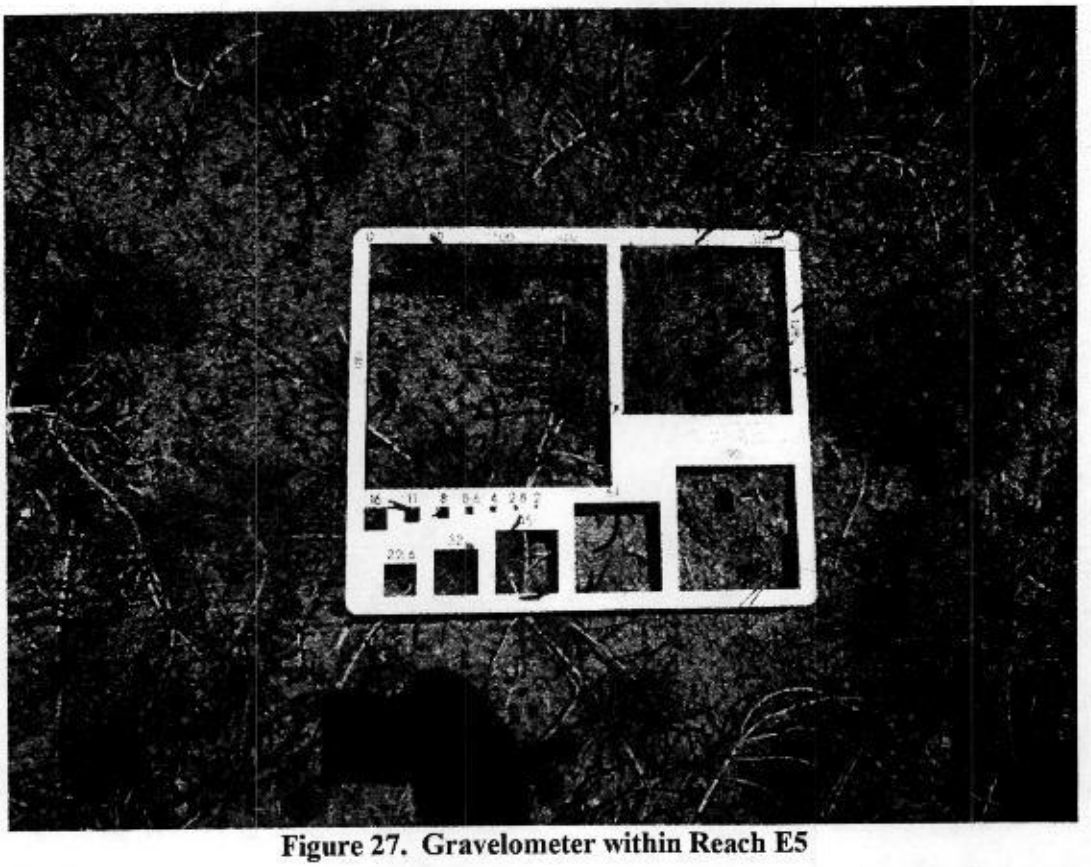


Figure 27. Gravelometer within Reach E5

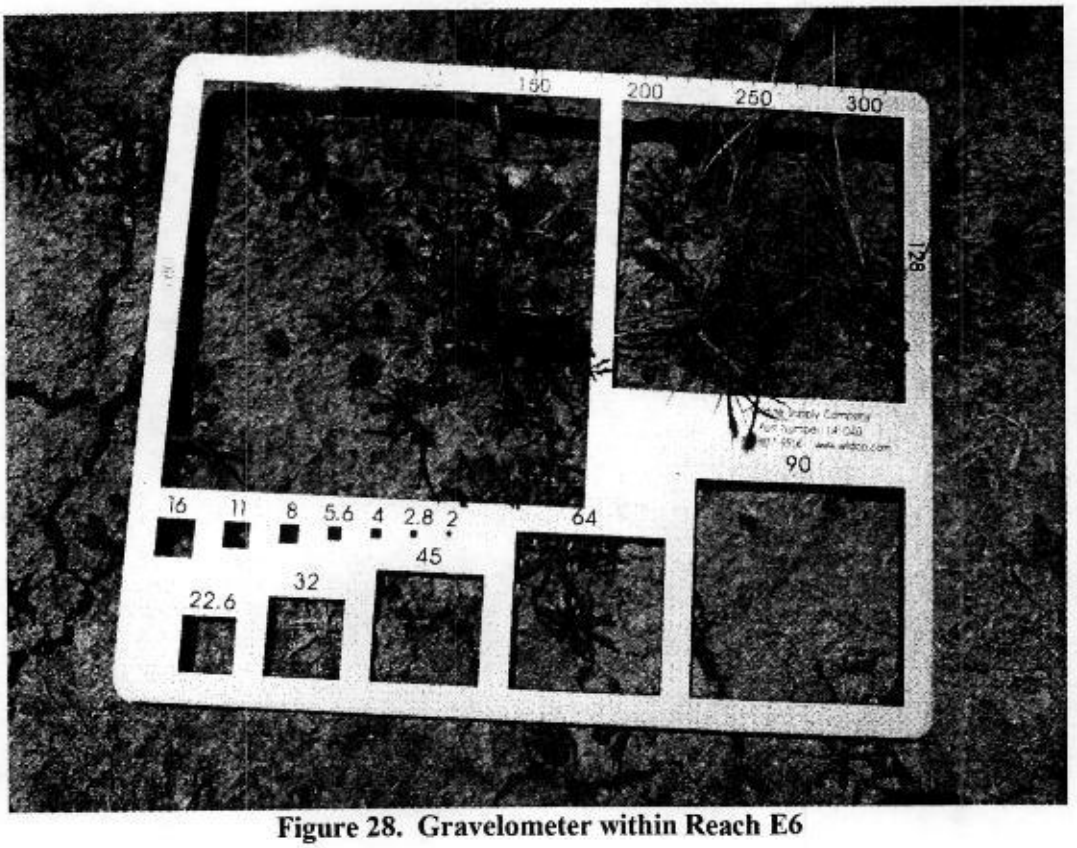


Figure 28. Gravelometer within Reach E6

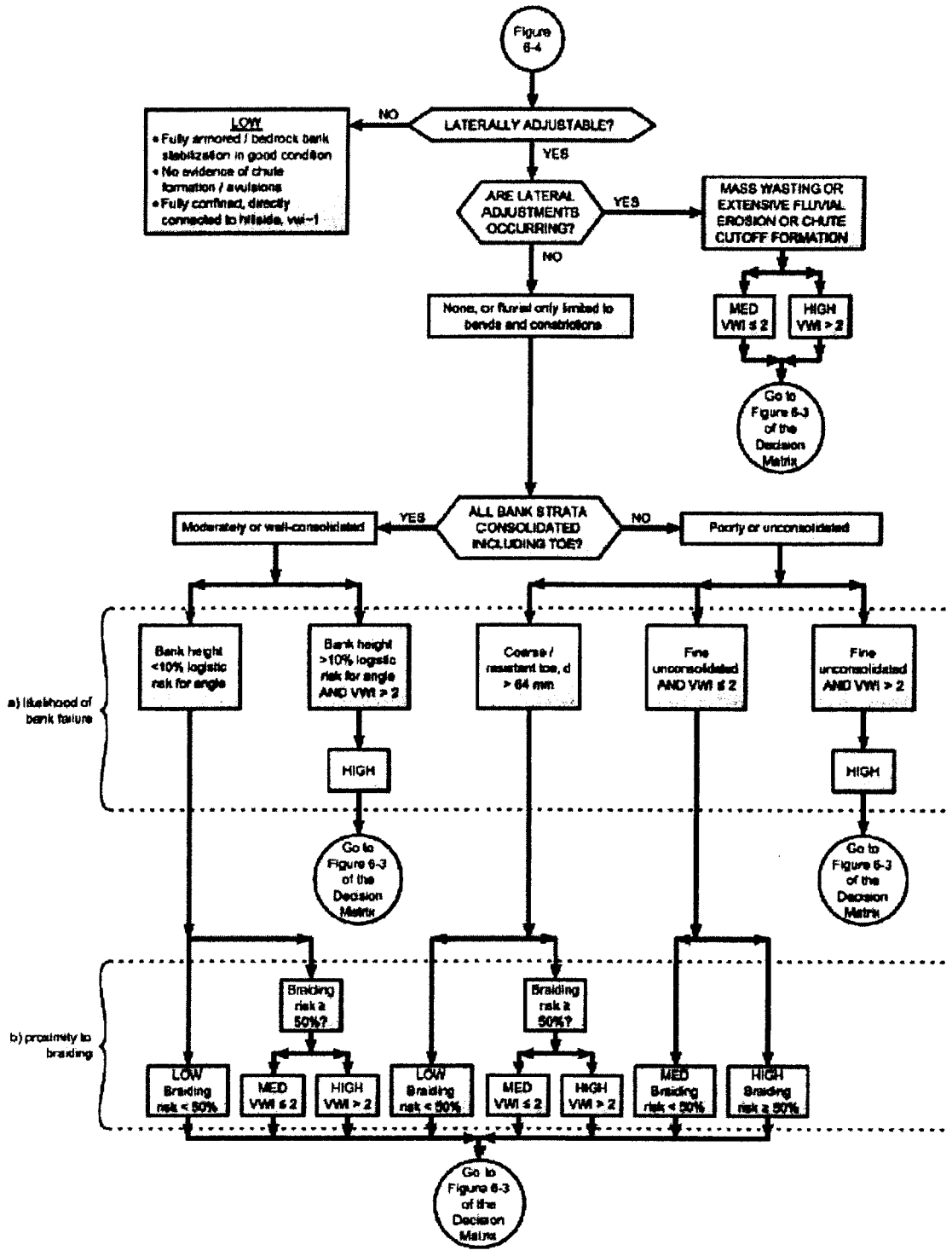


Figure 6-5. Lateral Channel Susceptibility

Figure 31. 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: 33.154 Longitude: -117.3040

Description (river name, crossing streets, etc.): Rancho Costera (north of El Camino Real between Tamarack Ave. and Cannon Rd.) and El Camino Real widening.

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 Table 2. Simplified peak flow, 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

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E6	0.011	8.8	0.52
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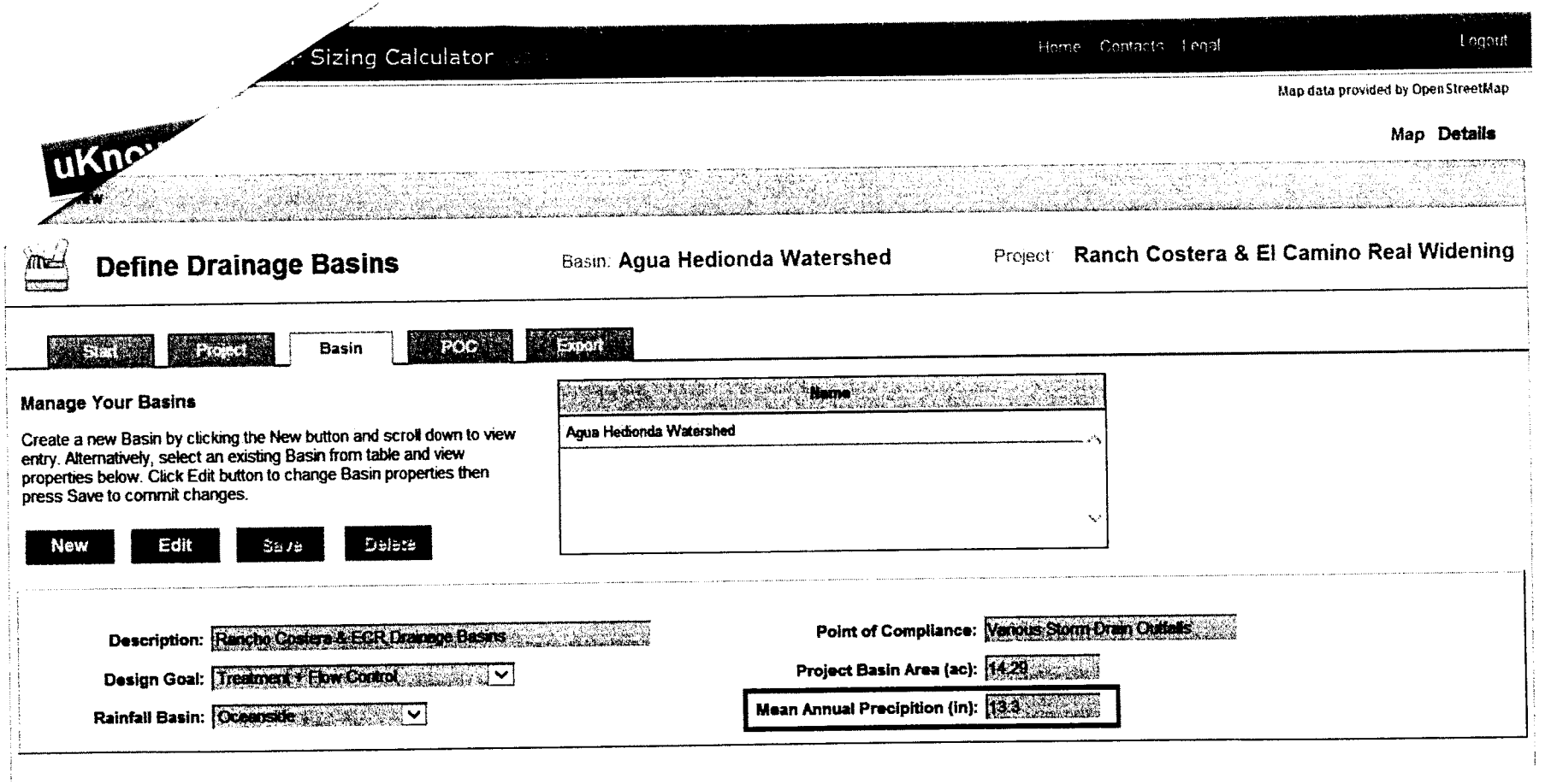
W3	0.026	13.0	1.36
W4	0.039	13.7	0.36



MEAN ANNUAL PRECIPITATION FROM COUNTY BMP SIZING CALCULATOR

PEBBLE COUNT

#	Reach E5 Diameter, mm	Reach E6 Diameter, mm	Reach E7 Diameter, mm
1	2	2	2
2	2	2	2
3	2	2	2
4	2	2	2
5	2	2	2
6	2.8	2	2
7	2.8	2	2
8	2.8	2	2
9	2.8	2	2.8
10	2.8	2.8	2.8
11	4	2.8	2.8
12	4	2.8	2.8
13	4	2.8	2.8
14	4	2.8	2.8
15	4	2.8	2.8
16	4	2.8	2.8
17	4	2.8	4
18	4	2.8	4
19	4	4	4
20	4	4	4
21	4	4	4
22	4	4	4
23	4	4	4
24	5.6	4	4
25	5.6	4	4
26	5.6	4	4
27	5.6	4	4
28	5.6	4	4
29	5.6	5.6	5.6
30	5.6	5.6	5.6
31	5.6	5.6	5.6
32	5.6	5.6	5.6
33	5.6	5.6	5.6
34	5.6	5.6	5.6
35	8	5.6	5.6
36	8	5.6	8
37	8	5.6	8
38	8	5.6	8
39	8	5.6	8
40	8	5.6	8
41	8	5.6	8
42	8	5.6	8
43	8	8	8
44	8	8	8

#	Reach E5 Diameter, mm	Reach E6 Diameter, mm	Reach E7 Diameter, mm
45	8	8	11
46	8	8	11
47	8	8	11
48	11	8	11
49	11	11	11
50	11	11	11
51	11	11	11
52	11	11	11
53	11	11	11
54	11	11	11
55	11	11	11
56	11	11	11
57	11	11	16
58	11	11	16
59	11	11	16
60	11	11	16
61	11	11	16
62	11	11	16
63	11	11	16
64	11	11	16
65	11	16	16
66	11	16	16
67	16	16	16
68	16	16	16
69	16	16	16
70	16	16	16
71	16	16	16
72	16	16	16
73	16	16	16
74	16	16	16
75	16	16	16
76	16	16	16
77	16	16	16
78	16	16	16
79	16	16	16
80	16	16	16
81	16	16	16
82	16	16	16
83	16	16	16
84	16	16	16
85	16	16	22.6
86	16	16	22.6
87	16	16	22.6
88	16	16	22.6
89	16	22.6	22.6
90	16	22.6	22.6

#	Reach E5 Diameter, mm	Reach E6 Diameter, mm	Reach E7 Diameter, mm
91	22.6	22.6	22.6
92	22.6	22.6	22.6
93	22.6	22.6	22.6
94	22.6	22.6	22.6
95	22.6	22.6	32
96	22.6	22.6	32
97	22.6	22.6	32
98	22.6	32	32
99	32	32	32
100	32	32	64

EXCERPT FROM FEMA' MAY 16, 2012, "FLOOD INSURANCE STUDY, SAN DIEGO, COUNTY"
SHOWING AGUA HEDIONDA CREEK DRAINAGE AREA

TABLE 8: SUMMARY OF PEAK DISCHARGES

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cubic feet per second) 10% Annual-Chance	2% Annual-Chance	1% Annual-Chance	0.2% Annual-Chance
Adobe Creek					
2,200 Feet Upstream of Peet Lane	0.67	375	485	560	710
Agua Hedionda Creek					
At Confluence with Buena Creek	6.3	1,600	4,800	7,000	15,500
2,200 Feet Upstream of Rancho Carlsbad Drive	16.5	--	--	7,810	--
Upstream of Calavera Creek	17.3	--	--	8,080	--
At El Camino Real	23.8	--	--	9,850	--
Alvarado Creek					
At Lake Shore Drive	4.6	1,200	2,000	2,300	3,000
At Interstate 8, Near Trailer Park	5.3	1,300	2,200	2,500	3,200
At Interstate 8, Near Murray Boulevard	5.7	1,400	2,400	2,700	3,500
Upstream of Murray Creek	6.3	1,600	2,600	3,000	3,800
Downstream of Murray Creek	10.1	1,700	2,900	3,300	4,200
At Downstream Side of College Avenue	11.4	2,100	3,400	3,900	5,000
Upstream of Tributary Channel	12.1	2,300	3,700	4,300	5,400
Downstream of Tributary Channel	13.4	2,600	4,300	4,800	6,100

-- Data Not Available

EXCERPTS FROM O'DAY CONSULTANTS'
"RANCHO COSTERA DRAINAGE STUDY".
SEE MAP POCKET FOR WORK MAP.

APPENDIX 6

100 Yr. Proposed Hydrologic Calculations

Basin 'H'

(See Exhibit 'K')

```
Maximum flow rates at confluence using above data:
       37.976        22.996        40.432        49.662
Area of streams before confluence:
        5.550         1.210         2.000        26.600
Results of confluence:
Total flow rate =      49.662(CFS)
Time of concentration =     20.000 min.
Effective stream area after confluence =      35.360(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      214.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      53.019(CFS)
Depth of flow =   1.519(Ft.), Average velocity =   7.657(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate      'Y' coordinate
      1               0.00              10.00
      2              30.00               0.00
      3              60.00              10.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------
Sub-Channel flow  =      53.019(CFS)
   '      '    flow top width =       9.115(Ft.)
   '      '     velocity=     7.657(Ft/s)
   '      '    area =       6.924(Sq.Ft)
   '      '    Froude number =      1.548

Upstream point elevation =   142.000(Ft.)
Downstream point elevation =    70.000(Ft.)
Flow length =  1430.000(Ft.)
Travel time  =    3.11 min.
Time of concentration =   23.11 min.
Depth of flow =   1.519(Ft.)
Average velocity =   7.657(Ft/s)
Total irregular channel flow =    53.019(CFS)
Irregular channel normal depth above invert elev. =   1.519(Ft.)
Average velocity of channel(s) =   7.657(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.552(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      2.552(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.471  CA =     22.060
```

```
Subarea runoff =      6.634(CFS) for     11.500(Ac.)
Total runoff =     56.296(CFS)    Total area =      46.860(Ac.)
Depth of flow =   1.554(Ft.), Average velocity =   7.773(Ft/s)
```

Reach E3

Note: Reach E2 = 46.86 - 0.1 = 46.76 Acres

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      214.000 to Point/Station      216.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =    70.000(Ft.)
Downstream point/station elevation =    60.000(Ft.)
Pipe length  =   250.00(Ft.) Slope =   0.0400  Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    56.296(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    56.296(CFS)
Normal flow depth in pipe =   20.16(In.)
Flow top width inside pipe =   28.17(In.)
Critical Depth =   28.38(In.)
Pipe flow velocity =     16.06(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =    23.37 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      214.000 to Point/Station      216.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     46.860(Ac.)
Runoff from this stream =     56.296(CFS)
Time of concentration =   23.37 min.
Rainfall intensity =     2.534(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      218.000 to Point/Station      222.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less       )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  130.500(Ft.)
Lowest elevation =  128.700(Ft.)
Elevation difference =    1.800(Ft.) Slope =  1.800 %
Top of Initial Area Slope adjusted by User to  0.740 %
Bottom of Initial Area Slope adjusted by User to  0.740 %
```

```
'      '    area =      30.066(Sq.Ft)
'      '    Froude number =      1.057

Upstream point elevation =     60.000(Ft.)
Downstream point elevation =     42.000(Ft.)
Flow length =    600.000(Ft.)
Travel time  =     3.07 min.
Time of concentration =    26.44 min.
Depth of flow =    0.298(Ft.)
Average velocity =    3.260(Ft/s)
Total irregular channel flow =     97.999(CFS)
Irregular channel normal depth above invert elev. =    0.298(Ft.)
Average velocity of channel(s) =    3.260(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      216.000 to Point/Station      2009.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Rainfall intensity (I) =      2.340(In/Hr) for a    100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
The area added to the existing stream causes a
a lower flow rate of Q =     93.650(CFS)
therefore the upstream flow rate of Q =     97.999(CFS) is being used
Time of concentration =    26.44 min.
Rainfall intensity =      2.340(In/Hr) for a    100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.492  CA =     40.024
Subarea runoff =      0.000(CFS) for      4.850(Ac.)
Total runoff =     97.999(CFS)     Total area =      81.430(Ac.)
```

Reach E4

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      216.000 to Point/Station      2009.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     81.430(Ac.)
Runoff from this stream =     97.999(CFS)
Time of concentration =    26.44 min.
Rainfall intensity =     2.340(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      254.000 to Point/Station      254.000
```

```
Area of streams before confluence:
      114.250       19.180
Results of confluence:
Total flow rate =     163.679(CFS)
Time of concentration =     20.880 min.
Effective stream area after confluence =     133.430(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      272.000 to Point/Station     2009.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     163.727(CFS)
Depth of flow =   0.727(Ft.), Average velocity =   4.344(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             30.00               0.00
      3             80.00               0.00
      4            100.00              10.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------------------
Sub-Channel flow  =     163.728(CFS)
   '      '    flow top width =      53.637(Ft.)
   '      '     velocity=     4.344(Ft/s)
   '      '    area =      37.692(Sq.Ft)
   '      '    Froude number =      0.913

Upstream point elevation =     69.000(Ft.)
Downstream point elevation =     42.000(Ft.)
Flow length =  1600.000(Ft.)
Travel time  =     6.14 min.
Time of concentration =    27.02 min.
Depth of flow =   0.727(Ft.)
Average velocity =   4.344(Ft/s)
Total irregular channel flow =   163.727(CFS)
Irregular channel normal depth above invert elev. =   0.727(Ft.)
Average velocity of channel(s) =   4.344(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.307(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
The area added to the existing stream causes a
a lower flow rate of Q =     151.902(CFS)
therefore the upstream flow rate of Q =     163.679(CFS) is being used
Rainfall intensity =      2.307(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.429  CA =     65.833
Subarea runoff =       0.000(CFS) for     20.180(Ac.)
Total runoff =     163.679(CFS)    Total area =     153.610(Ac.)
Depth of flow =    0.727(Ft.), Average velocity =   4.343(Ft/s)
```

Reach E1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      272.000 to Point/Station     2009.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     153.610(Ac.)
Runoff from this stream =     163.679(CFS)
Time of concentration =    27.02 min.
Rainfall intensity =      2.307(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
 No.        (CFS)        (min)                 (In/Hr)


1        97.999      26.44              2.340
2       163.679      27.02              2.307
Qmax(1) =
          1.000 *     1.000 *     97.999) +
          1.000 *     0.979 *    163.679) + =      258.167
Qmax(2) =
          0.986 *     1.000 *     97.999) +
          1.000 *     1.000 *    163.679) + =      260.317

Total of 2 main streams to confluence:
Flow rates before confluence point:
      97.999      163.679
Maximum flow rates at confluence using above data:
      258.167      260.317
Area of streams before confluence:
       81.430      153.610


Results of confluence:
Total flow rate =     260.317(CFS)
Time of concentration =     27.019 min.
Effective stream area after confluence  =     235.040(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      2009.000 to Point/Station     2010.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     260.342(CFS)
Depth of flow =    0.680(Ft.), Average velocity =    3.738(Ft/s)
      ******* Irregular Channel Data ***********
```

```
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    24.726(CFS)
Normal flow depth in pipe =   13.66(In.)
Flow top width inside pipe =   20.02(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.92(Ft/s)
Travel time through pipe =    0.78 min.
Time of concentration (TC) =    25.51 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2013.000 to Point/Station     2010.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     12.650(Ac.)
Runoff from this stream =     24.726(CFS)
Time of concentration =   25.51 min.
Rainfall intensity =     2.394(In/Hr)
Summary of stream data:

Stream    Flow rate       TC             Rainfall Intensity
 No.        (CFS)        (min)                   (In/Hr)


1       260.317      29.25              2.192
2        24.726      25.51              2.394
Qmax(1) =
          1.000 *     1.000 *   260.317) +
          0.916 *     1.000 *    24.726) + =     282.955
Qmax(2) =
          1.000 *     0.872 *   260.317) +
          1.000 *     1.000 *    24.726) + =     251.779

Total of 2 streams to confluence:
Flow rates before confluence point:
     260.317       24.726
Maximum flow rates at confluence using above data:
      282.955       251.779
Area of streams before confluence:
      240.950        12.650
Results of confluence:
Total flow rate =    282.955(CFS)
Time of concentration =    29.249 min.
Effective stream area after confluence =    253.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2010.000 to Point/Station     2015.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =    35.300(Ft.)
Downstream point/station elevation =    34.500(Ft.)
Pipe length  =    40.00(Ft.) Slope =   0.0200  Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =   282.955(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
    95.622(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =     19.029(Ft.)
 Minor friction loss =     77.393(Ft.)  K-factor =   1.50
Critical depth could not be calculated.
Pipe flow velocity =     57.64(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    29.26 min.
End of computations, total study area =         253.600 (Ac.)
```

Reach E5

Note: Reach E6 = 253.6 + 0.1 = 253.7 Acres

APPENDIX 4

100 Yr. Proposed Hydrologic Calculations

Basin 'E-F'

(See Exhibit 'K')

```
Process from Point/Station     5000.000 to Point/Station     5000.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     509.400(Ac.)
Runoff from this stream =     512.740(CFS)
Time of concentration =   31.46 min.
Rainfall intensity =     2.092(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5002.000 to Point/Station     5004.000
**** INITIAL AREA EVALUATION ****
--------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  180.000(Ft.)
Lowest elevation =  130.000(Ft.)
Elevation difference =   50.000(Ft.) Slope = 50.000 %
Top of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.34 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  30.000^(1/3)]=   4.34
Calculated TC of    4.345 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      6.850(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.240(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5004.000 to Point/Station     5006.000
**** IMPROVED CHANNEL TRAVEL TIME ****
--------------------------------------------------------------------------
Upstream point elevation =   130.000(Ft.)
Downstream point elevation =    63.000(Ft.)
Channel length thru subarea  =   700.000(Ft.)
Channel base width     =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
```

```
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      3.659(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      3.659(CFS)
Depth of flow =   0.391(Ft.), Average velocity =   5.259(Ft/s)
Channel flow top width =    2.563(Ft.)
Flow Velocity =    5.26(Ft/s)
Travel time  =    2.22 min.
Time of concentration =    6.56 min.
Critical depth =      0.531(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.748(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.748(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      1.214
Subarea runoff =      6.741(CFS) for      3.370(Ac.)
Total runoff =      6.981(CFS)    Total area =      3.470(Ac.)
Depth of flow =   0.538(Ft.), Average velocity =   6.247(Ft/s)
Critical depth =      0.734(Ft.)
```

Reach W1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5006.000 to Point/Station     5008.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =    63.000(Ft.)
Downstream point/station elevation =    61.800(Ft.)
Pipe length  =    68.00(Ft.) Slope =   0.0176  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.981(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.981(CFS)
Normal flow depth in pipe =    9.00(In.)
Flow top width inside pipe =   18.00(In.)
Critical Depth =   12.28(In.)
Pipe flow velocity =      7.90(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     6.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5008.000 to Point/Station     5000.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =    61.800(Ft.)
Downstream point elevation =    57.000(Ft.)
```

```
Depth of flow =   0.299(Ft.), Average velocity =   1.911(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.129(Ft.)
Flow velocity =   1.91(Ft/s)
Travel time =    3.14 min.     TC =    9.39  min.
 Adding area flow to street
Rainfall intensity (I) =      4.562(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                    ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Rainfall intensity =      4.562(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.570  CA =      1.180
Subarea runoff =      5.044(CFS) for      1.970(Ac.)
Total runoff =      5.382(CFS)    Total area =       2.070(Ac.)
Street flow at end of street =      5.382(CFS)
Half street flow at end of street =      2.691(CFS)
Depth of flow =   0.348(Ft.), Average velocity =   2.200(Ft/s)
Flow width (from curb towards crown)=  10.586(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5017.000 to Point/Station     5014.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   135.500(Ft.)
Downstream point/station elevation =    79.050(Ft.)
Pipe length  =   510.00(Ft.) Slope =   0.1107  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.382(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.382(CFS)
Normal flow depth in pipe =    4.78(In.)
Flow top width inside pipe =   15.89(In.)
Critical Depth =   10.73(In.)
Pipe flow velocity =     14.33(Ft/s)
Travel time through pipe =    0.59 min.
Time of concentration (TC) =     9.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5017.000 to Point/Station     5014.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      2.070(Ac.)
Runoff from this stream =      5.382(CFS)
Time of concentration =    9.98 min.
Rainfall intensity =     4.385(In/Hr)
Summary of stream data:
```

```
Stream    Flow rate      TC              Rainfall Intensity
 No.       (CFS)        (min)                 (In/Hr)


1         4.498       5.73               6.276
2         5.382       9.98               4.385
Qmax(1) =
          1.000 *     1.000 *     4.498) +
          1.000 *     0.574 *     5.382) + =       7.586
Qmax(2) =
          0.699 *     1.000 *     4.498) +
          1.000 *     1.000 *     5.382) + =       8.526

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.498       5.382
Maximum flow rates at confluence using above data:
       7.586       8.526
Area of streams before confluence:
       2.040       2.070
Results of confluence:
Total flow rate =      8.526(CFS)
Time of concentration =     9.984 min.
Effective stream area after confluence =      4.110(Ac.)
```

Reach W2 (easterly subarea)

Total Area of Reach W2 is northerly + easterly subarea.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5014.000 to Point/Station     5018.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =    79.050(Ft.)
Downstream point/station elevation =    60.000(Ft.)
Pipe length  =    96.00(Ft.) Slope =   0.1984  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.526(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     8.526(CFS)
Normal flow depth in pipe =    5.20(In.)
Flow top width inside pipe =   16.32(In.)
Critical Depth =   13.57(In.)
Pipe flow velocity =     20.14(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    10.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5018.000 to Point/Station     5010.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =    60.000(Ft.)
Downstream point elevation =    51.000(Ft.)
Channel length thru subarea  =   460.000(Ft.)
Channel base width     =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
```

```
------------------------------------------------------------------
Sub-Channel flow  =     22.805(CFS)
  '      '    flow top width =      7.226(Ft.)
  '      '    velocity=    3.494(Ft/s)
  '      '    area =      6.527(Sq.Ft)
  '      '    Froude number =     0.648

Upstream point elevation =    43.620(Ft.)
Downstream point elevation =    42.000(Ft.)
Flow length =   180.000(Ft.)
Travel time  =    0.86 min.
Time of concentration =    9.93 min.
Depth of flow =   1.807(Ft.)
Average velocity =   3.494(Ft/s)
Total irregular channel flow =    22.805(CFS)
Irregular channel normal depth above invert elev. =   1.807(Ft.)
Average velocity of channel(s) =   3.494(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5050.000 to Point/Station     5034.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.610(Ac.)
Runoff from this stream =     22.805(CFS)
Time of concentration =    9.93 min.
Rainfall intensity =     4.402(In/Hr)
Summary of stream data:

Stream    Flow rate       TC              Rainfall Intensity
 No.        (CFS)        (min)                   (In/Hr)


1       719.611      35.74              1.926
2        22.805       9.93              4.402
Qmax(1) =
          1.000 *    1.000 *   719.611) +
          0.438 *    1.000 *    22.805) + =     729.591
Qmax(2) =
          1.000 *    0.278 *   719.611) +
          1.000 *    1.000 *    22.805) + =     222.633

Total of 2 main streams to confluence:
Flow rates before confluence point:
     719.611      22.805
Maximum flow rates at confluence using above data:
      729.591      222.633
Area of streams before confluence:
      707.440        6.610


Results of confluence:
```

```
Total flow rate =    729.591(CFS)
Time of concentration =    35.742 min.
Effective stream area after confluence  =    714.050(Ac.) Reach W3

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5034.000 to Point/Station     5052.000
**** IMPROVED CHANNEL TRAVEL TIME ****   EXISTING DOUBLE 8'X4' RCB
------------------------------------------------------------------------------
Covered channel
Upstream point elevation =    42.000(Ft.)
Downstream point elevation =    40.000(Ft.)
Channel length thru subarea  =   108.000(Ft.)
Channel base width     =   16.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =    729.591(CFS)
Depth of flow =   2.298(Ft.), Average velocity =  19.840(Ft/s)
Channel flow top width =   16.000(Ft.)
Flow Velocity =   19.84(Ft/s)
Travel time  =    0.09 min.
Time of concentration =   35.83 min.
Critical depth =      4.000(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     5034.000 to Point/Station     5052.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    714.050(Ac.)
Runoff from this stream =    729.591(CFS)
Time of concentration =   35.83 min.
Rainfall intensity =    1.923(In/Hr)
Program is now starting with Main Stream No. 2

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     7000.000 to Point/Station     7007.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------------
User specified 'C' value of 0.700 given for subarea
Rainfall intensity (I) =      3.229(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  16.05 min.  Rain intensity =      3.23(In/Hr)
Total area =      72.820(Ac.)  Total runoff =   163.030(CFS)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     7000.000 to Point/Station     7007.000
**** CONFLUENCE OF MAIN STREAMS ****
```

$Q_{100} = 729.59$ cfs
$T_C = 35.83$ min.
$A = 714.05$ Ac.

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      72.820(Ac.)
Runoff from this stream =    163.030(CFS)
Time of concentration =   16.05 min.
Rainfall intensity =     3.229(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     8003.000 to Point/Station     7007.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------
User specified 'C' value of 0.900 given for subarea
Rainfall intensity (I) =      5.688(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   6.67 min.  Rain intensity =       5.69(In/Hr)
Total area =        2.450(Ac.)  Total runoff =    13.200(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     8003.000 to Point/Station     7007.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.450(Ac.)
Runoff from this stream =     13.200(CFS)
Time of concentration =    6.67 min.
Rainfall intensity =     5.688(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1       729.591      35.83              1.923
2       163.030      16.05              3.229
3        13.200       6.67              5.688
Qmax(1) =
          1.000 *    1.000 *   729.591) +
          0.596 *    1.000 *   163.030) +
          0.338 *    1.000 *    13.200) + =     831.169
Qmax(2) =
          1.000 *    0.448 *   729.591) +
          1.000 *    1.000 *   163.030) +
          0.568 *    1.000 *    13.200) + =     497.314
Qmax(3) =
          1.000 *    0.186 *   729.591) +
          1.000 *    0.416 *   163.030) +
          1.000 *    1.000 *    13.200) + =     216.759

Total of 3 main streams to confluence:
```

```
Flow rates before confluence point:
     729.591      163.030      13.200
Maximum flow rates at confluence using above data:
      831.169      497.314      216.759
Area of streams before confluence:
      714.050       72.820       2.450


Results of confluence:
Total flow rate =    831.169(CFS)
Time of concentration =    35.833 min.
Effective stream area after confluence  =    789.320(Ac.)
End of computations, total study area =         789.320 (Ac.)
```

This is the area into the upper end of Reach W4. The total area tributary to Reach W4 is 789.32 acres plus the tributary area downstream of El Camino Real, which was delineated from the topographic mapping on the Study Area Exhibit and is 22.70 acres.

EXCERPTS FROM CHANG CONSULTANTS' "LOMR REQUEST FOR ROBERTSON'S RANCH" SHOWING DRAINAGE AREA TRIBUTARY TO REACH E7 (4.68 ACRES) AND E8 (5.11 ACRES)

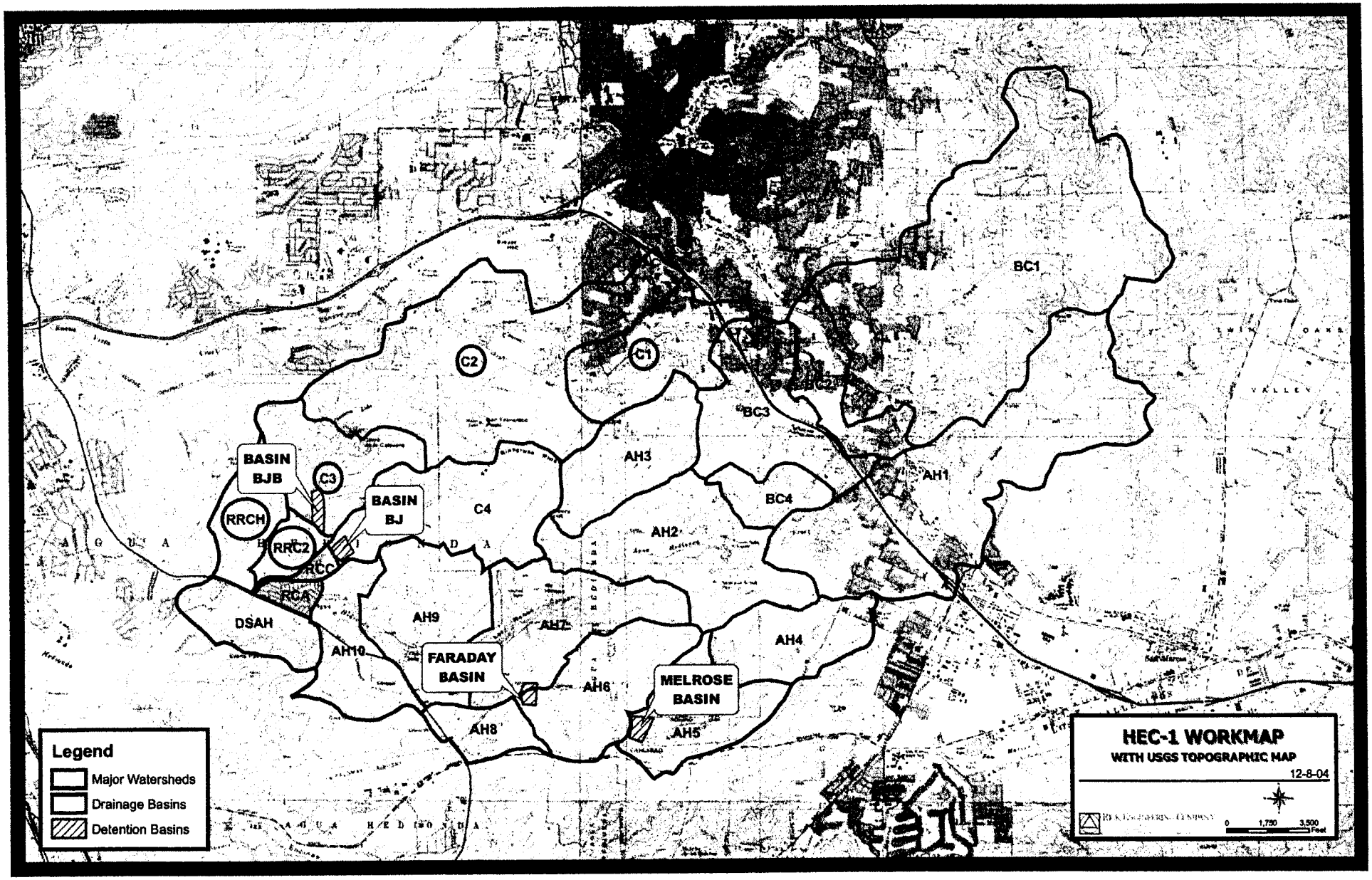
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	C1	505.	10.25	249.	102.	98.	.87		
+	ROUTED TO	CCDETMEL	504.	10.25	249.	102.	98.	.87		
+									335.64	10.25
+	ROUTED TO	C1-C2	361.	11.00	235.	98.	95.	.87		
+									240.99	11.00
+	HYDROGRAPH AT	C2	1519.	10.33	760.	311.	299.	2.72		
+	2 COMBINED AT	COMBINE	1831.	10.42	988.	409.	394.	3.59		
+	ROUTED TO	DETCALA	1348.	11.17	745.	291.	280.	3.59		
+									218.76	11.17
+	ROUTED TO	C2-C3	1325.	11.33	743.	290.	279.	3.59		
+									100.24	11.33
+	HYDROGRAPH AT	C3	475.	10.08	224.	91.	88.	.88		
+	2 COMBINED AT	COMBINE	1501.	11.17	879.	381.	367.	4.47		
+	ROUTED TO	DETNBJB	971.	12.58	832.	381.	367.	4.47		
+									76.38	12.58
+	DIVERSION TO	DIVNORTH	473.	12.58	421.	181.	174.	4.47		
+	HYDROGRAPH AT	DIVCC	498.	12.58	411.	200.	193.	4.47		
+	HYDROGRAPH AT	C4	629.	10.42	314.	128.	123.	1.24		
+	2 COMBINED AT	COMBINE	907.	10.67	681.	328.	316.	5.71		
+	ROUTED TO	C3&-RCC	896.	10.83	680.	326.	314.	5.71		
+									46.10	10.83
+	HYDROGRAPH AT	RCC	26.	10.00	12.	5.	5.	.05		
+	2 COMBINED AT	CCTOTAL	909.	10.75	691.	331.	319.	5.76		
+	HYDROGRAPH AT	RETDIV	473.	12.58	421.	181.	174.	.00		
+	ROUTED TO	RINOR	473.	12.75	421.	179.	173.	.00		

+								40.37	12.75
+	HYDROGRAPH AT	RRC2	99.	10.08	46.	19.	18.	.21	**Reach E7 to here**
+	2 COMBINED AT	BOX	497.	12.17	444.	198.	191.	.21	
+	HYDROGRAPH AT	RRCH	198.	10.00	92.	38.	36.	.43	**Reach E8 to here**
+	2 COMBINED AT	EX_8x8	549.	12.08	504.	236.	227.	.63	
+	ROUTED TO	NURSERY	545.	12.50	503.	236.	227.	.63	
+								35.34	12.50

*** NORMAL END OF HEC-1 ***

DRAINAGE AREA EXHIBIT FROM CHANG CONSULTANTS' LOMR



APPENDIX B

SCCWRP FIELD SCREENING DATA

Table 5-13 Maximum Permissible Velocities for Lined and Unlined Channels

Material or Lining	Maximum Permissible Average Velocity* (ft/sec)
Natural and Improved Unlined Channels	
Fine Sand, Colloidal	1.50
Sandy Loam, Noncolloidal	1.75
Silt Loam, Noncolloidal	2.00
Alluvial Silts, Noncolloidal	2.00
Ordinary Firm Loam	2.50
Volcanic Ash	2.50
Stiff Clay, Very Colloidal	3.75
Alluvial Silts, Colloidal	3.75
Shales And Hardpans	6.00
Fine Gravel	2.50
Graded Loam To Cobbles When Noncolloidal	3.75
Graded Silts To Cobbles When Colloidal	4.00
Coarse Gravel, Noncolloidal	4.00
Cobbles And Shingles	5.00
Sandy Silt	2.00
Silty Clay	2.50
Clay	6.00
Poor Sedimentary Rock	10.0
Fully-Lined Channels	
Unreinforced Vegetation	5.0
Reinforced Turf	10.0
Loose Riprap	per Table 5-2
Grouted Riprap	25.0
Gabions	15.0
Soil Cement	15.0
Concrete	35.0

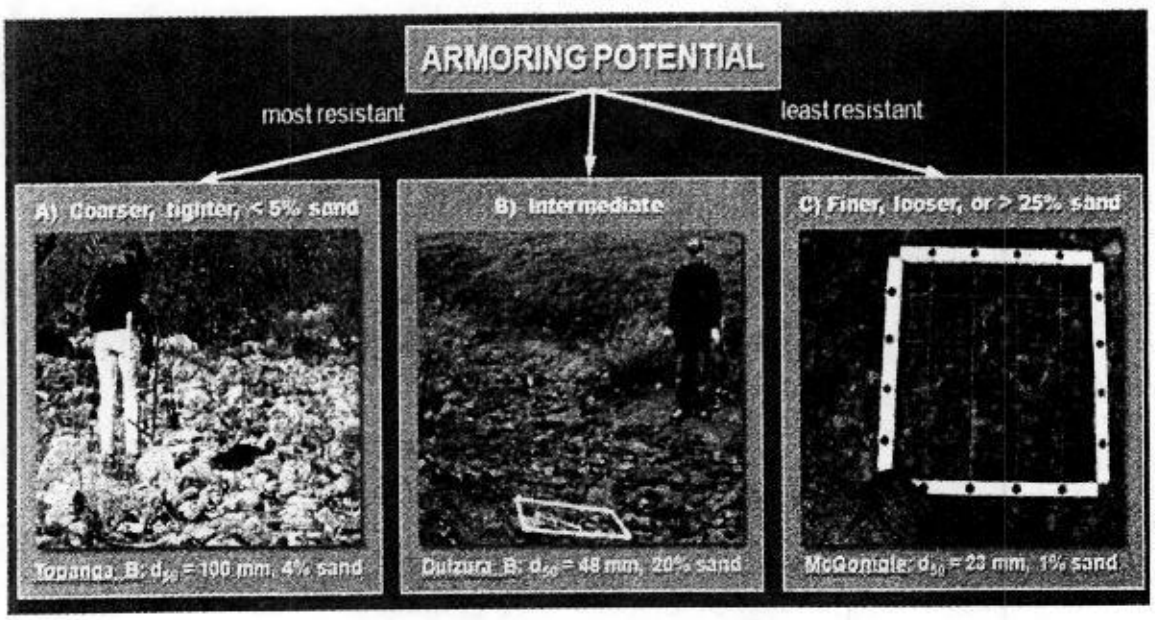
** Maximum permissible velocity listed here is basic guideline; higher design velocities may be used, provided appropriate technical documentation from manufacturer.*

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
X	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

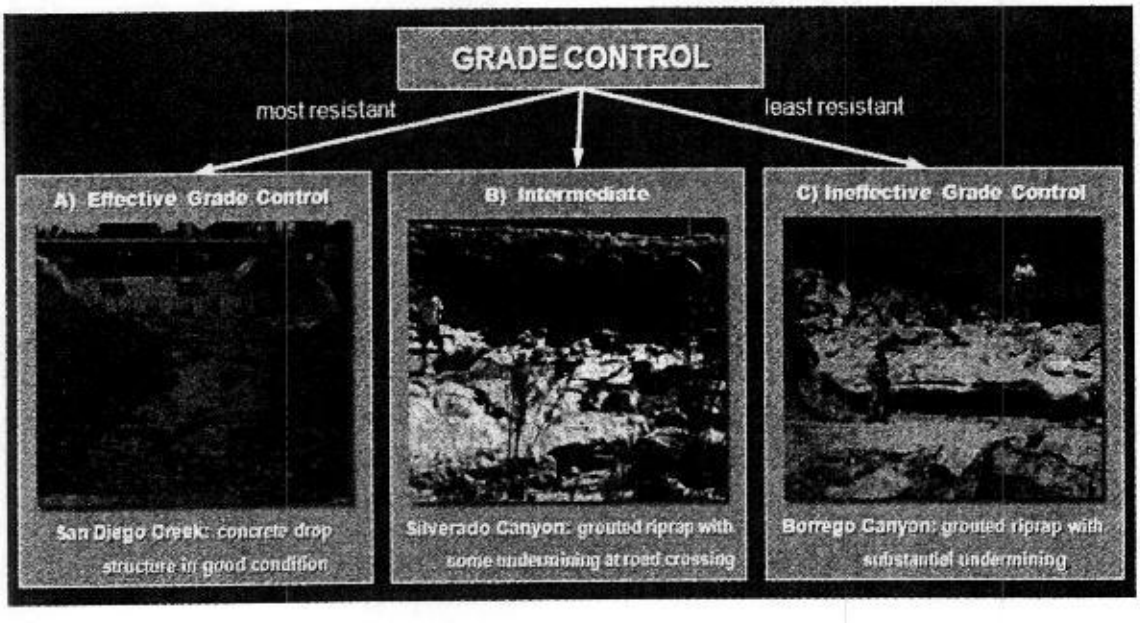


Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in **conjunction with Form 3 Checklist 1.**

RESULT FOR ALL STUDY REACHES

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
☐	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



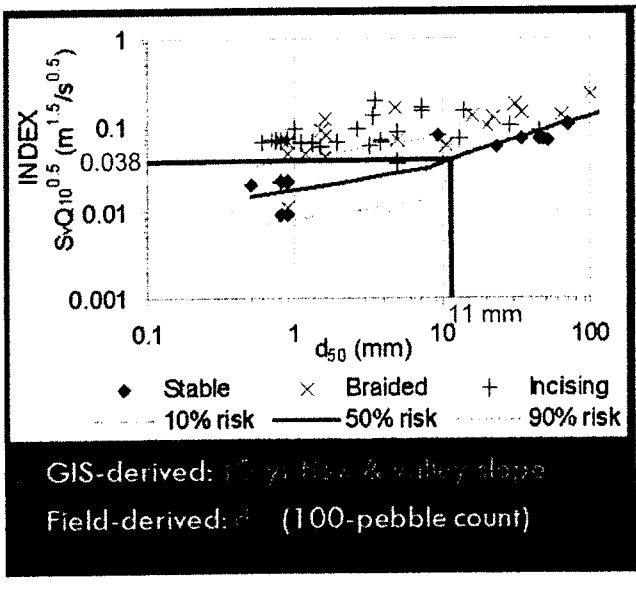
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

RESULT FOR ALL STUDY REACHES

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.

Graphed results apply to Reaches E5, E6, and E7.



Model Type	d_{50} (mm)	50% Risk $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

64mm for dense vegetation in Reaches E1-E4, E8, and W1-W4

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.

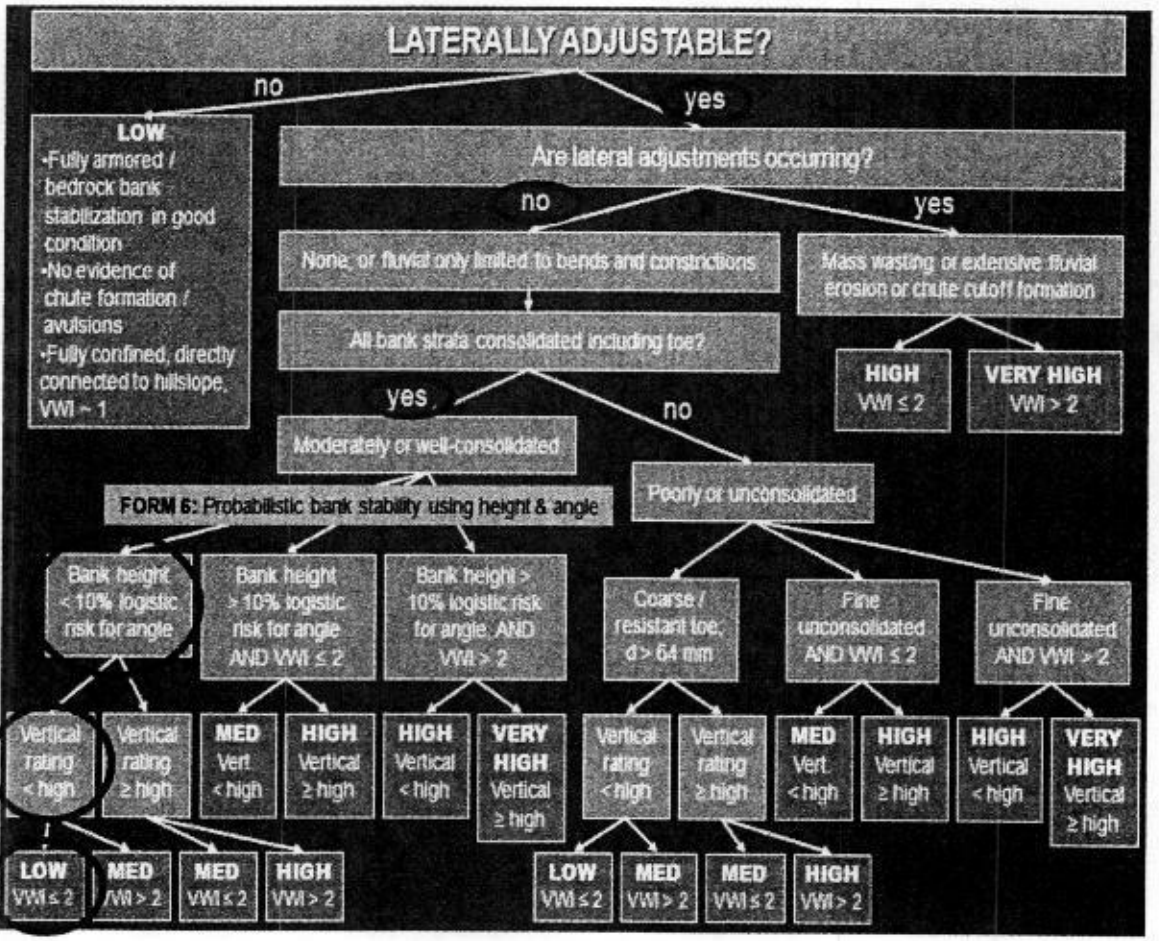
$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

6 x 3 x 3 = 3.6

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

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

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



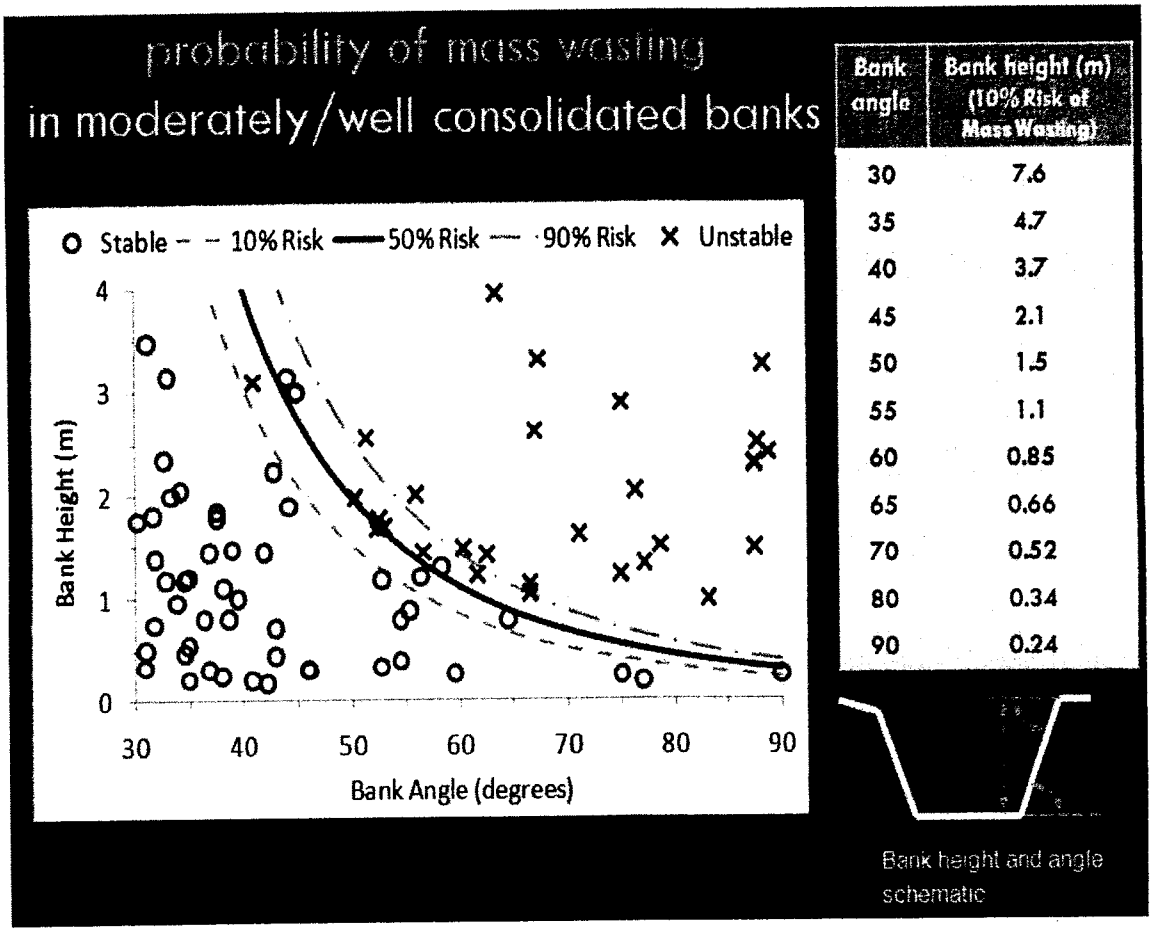
(Sheet 1 of 1)

RESULT FOR ALL STUDY REACHES

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	----	2 m	---	<10%
Right Bank	----	2 m	---	<10%



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

(Sheet 1 of 1)

RESULT FOR ALL STUDY REACHES

uKnow San Diego BMP Sizing Calculator (v3.0)

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Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E1

Define Drainage Basins

Basin: Agua Hedionda Watershed

Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 0.24

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 100.0

Channel Bottom Width (ft): 20.0

Channel Height (ft): 5.0

Channel Slope: 0.0289

Large View

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E2

Define Drainage Basins

Basin: **Agua Hedionda Watershed** Project: **Ranch Costera & El Camino Real Widening**

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 0.0731

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 75.0

Channel Bottom Width (ft): 5.0

Channel Height (ft): 10.0

Channel Slope: 0.0551

Large View

uKnow San Diego BMP Sizing Calculator (v3.0)

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Map data provided by OpenStreetMap

Find

Map Details

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E3

Define Drainage Basins

Basin: Agua Hedionda Watershed

Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel Save Update

Channel Assessed: Yes

Watershed Area (ac): 0.0732

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 45.0

Channel Bottom Width (ft): 5.0

Channel Height (ft): 10.0

Channel Slope: 0.0369

Large View

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Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E4

Define Drainage Basins

Basin: Agua Hedionda Watershed

Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel Save Update

Channel Assessed: Yes

Watershed Area (ac): 0.1272

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 160.0

Channel Bottom Width (ft): 28.0

Channel Height (ft): 5.0

Channel Slope: 0.0247

Large View

uKnow San Diego BMP Sizing Calculator (v3.0) Home Contacts Legal Logout

Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E5

Define Drainage Basins

Basin: Agua Hedionda Watershed Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 0.3963

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 150.0

Channel Bottom Width (ft): 36.0

Channel Height (ft): 5.0

Channel Slope: 0.0092

Large View

uKnow San Diego BMP Sizing Calculator (v3.0) Home Contacts Legal Logout

Find

Map data provided by OpenStreetMap

Map **Details**

Result View **CRITICAL STRESS CALCULATOR RESULTS FOR REACH E6**

Define Drainage Basins

Basin: Agua Hedionda Watershed Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel Save Update

Channel Assessed: Yes

Watershed Area (ac): 0.3964

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 270.0

Channel Bottom Width (ft): 15.0

Channel Height (ft): 4.0

Channel Slope: 0.0088

Large View

uKnow San Diego BMP Sizing Calculator (v3.0)

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Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E7

Define Drainage Basins

Basin: **Agua Hedionda Watershed**

Project: **Ranch Costera & El Camino Real Widening**

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 4.680

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 220.0

Channel Bottom Width (ft): 55.0

Channel Height (ft): 4.0

Channel Slope: 0.0060

Large View

uKnow San Diego BMP Sizing Calculator (v3.0) Home Contacts Legal Logout

Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH E8

Define Drainage Basins

Basin **Agua Hedionda Watershed** Project **Ranch Costera & El Camino Real Widening**

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel Save Update

Channel Assessed: Yes

Watershed Area (ac): 5.110

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 500.0

Channel Bottom Width (ft): 85.0

Channel Height (ft): 2.0

Channel Slope: 0.0091

Large View

Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH W1

Define Drainage Basins

Basin: Agua Hedionda Watershed Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 0.0054

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 80.0

Channel Bottom Width (ft): 8.0

Channel Height (ft): 4.0

Channel Slope: 0.0448

Large View

uKnow San Diego BMP Sizing Calculator (v3.0) Home Contacts Legal Logout

Map data provided by OpenStreetMap

Map **Details**

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH W2

Define Drainage Basins

Basin: Agua Hedionda Watershed Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 0.8078

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

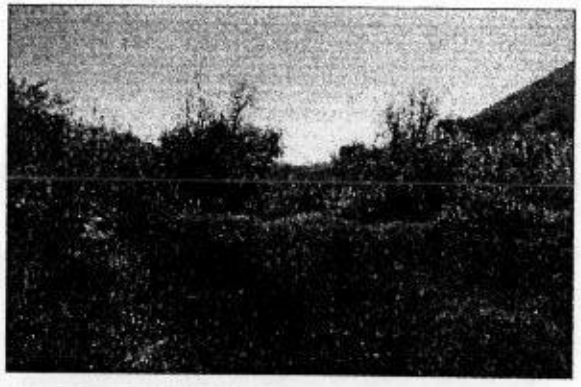
Channel Top Width (ft): 280.0

Channel Bottom Width (ft): 20.0

Channel Height (ft): 4.0

Channel Slope: 0.0191

Large View



Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH W3

Define Drainage Basins

Basin: **Agua Hedionda Watershed** Project: **Ranch Costera & El Camino Real Widening**

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 1.1157

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 150.0

Channel Bottom Width (ft): 58.0

Channel Height (ft): 2.0

Channel Slope: 0.0127

Large View

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH W4

Define Drainage Basins

Basin: Agua Hedionda Watershed Project: Ranch Costera & El Camino Real Widening

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.6Q2

Cancel | Save | Update

Channel Assessed: Yes

Watershed Area (ac): 1.2688

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

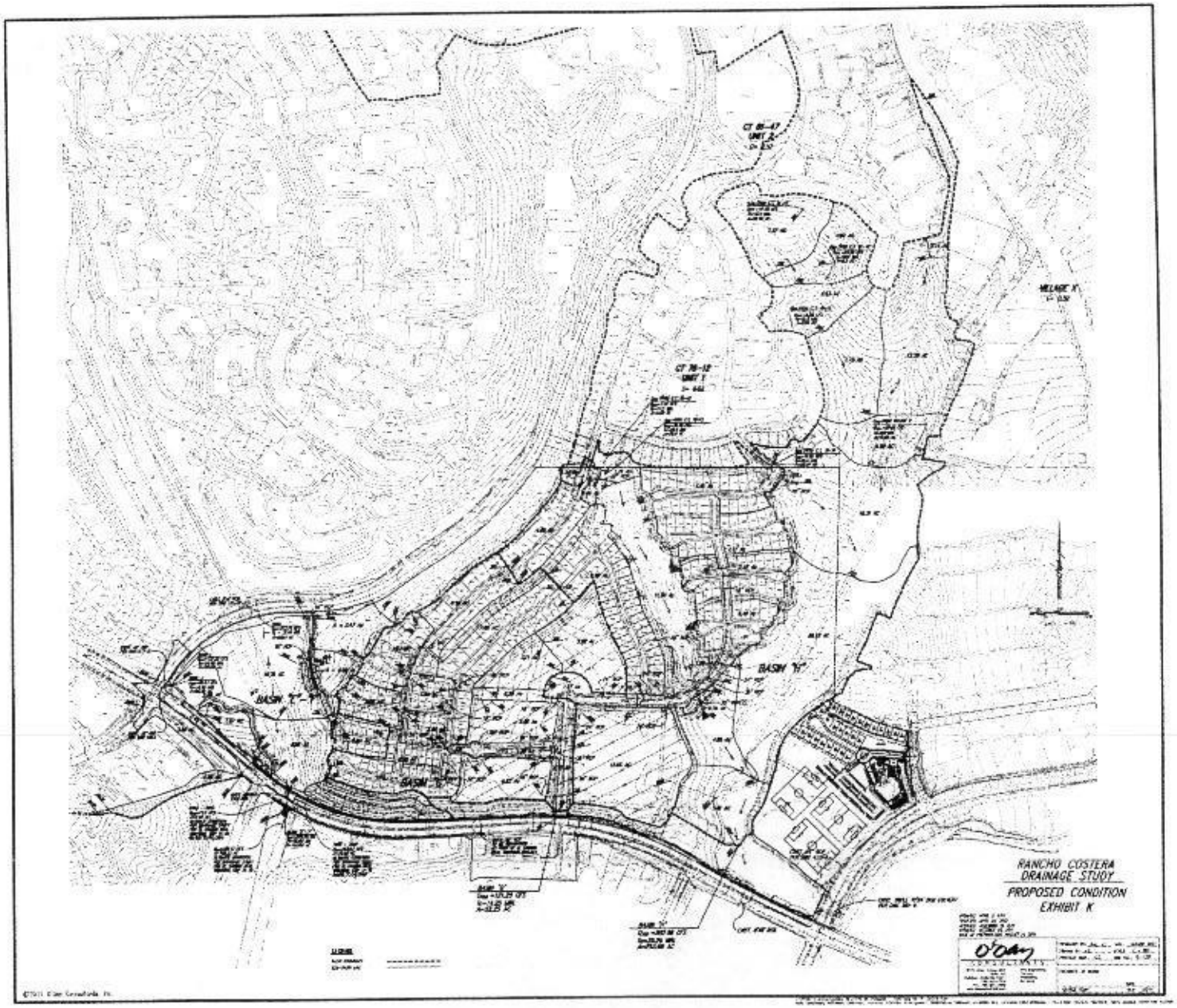
Channel Top Width (ft): 70.0

Channel Bottom Width (ft): 16.0

Channel Height (ft): 4.0

Channel Slope: 0.0183

Large View


RANCHO COSTERA
DRAINAGE STUDY
PROPOSED CONDITION
EXHIBIT K
BASIN 'X'
BASIN 'Y'
BASIN 'Z'
VILLAGE 'K'
O'Day

ATTACHMENT 3

Structural BMP Maintenance Information

ATTACHMENT 3
Structural BMP Maintenance Information

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

Preliminary Design/Planning/CEQA level submittal:

Attachment 3 must identify:

☒ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual

Final Design level submittal:

Attachment 3 must identify:

☒ 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)
☒ How to access the structural BMP(s) to inspect and perform maintenance
☒ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☒ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☒ Maintenance thresholds for BMPs subject to siltation or heavy trash(e.g., silt level posts or other markings shall be included in all BMP components that will trap and store sediment, trash, and/or debris, so that the inspector may determine how full the BMP is, and the maintenance personnel may determine where the bottom of the BMP is . If required, posts or other markings shall be indicated and described on structural BMP plans.)
☒ Recommended equipment to perform maintenance
☒ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3: Structural BMP Maintenance Information

- The table below identifies the specific maintenance indicators and actions for the proposed structural BMPs. (Biofiltration Basins).
- All proposed BMPs shall be access via proposed access road.
- No features proposed to facilitate inspections as all inspections/measurements are based on visual observation.
- For most maintenance actions, a truck is sufficient. A 10-15 cu-yd truck or backhoe may be necessary when removing sediment from BMP.
- No proprietary parts or training necessary to perform activities for proposed BMPs.

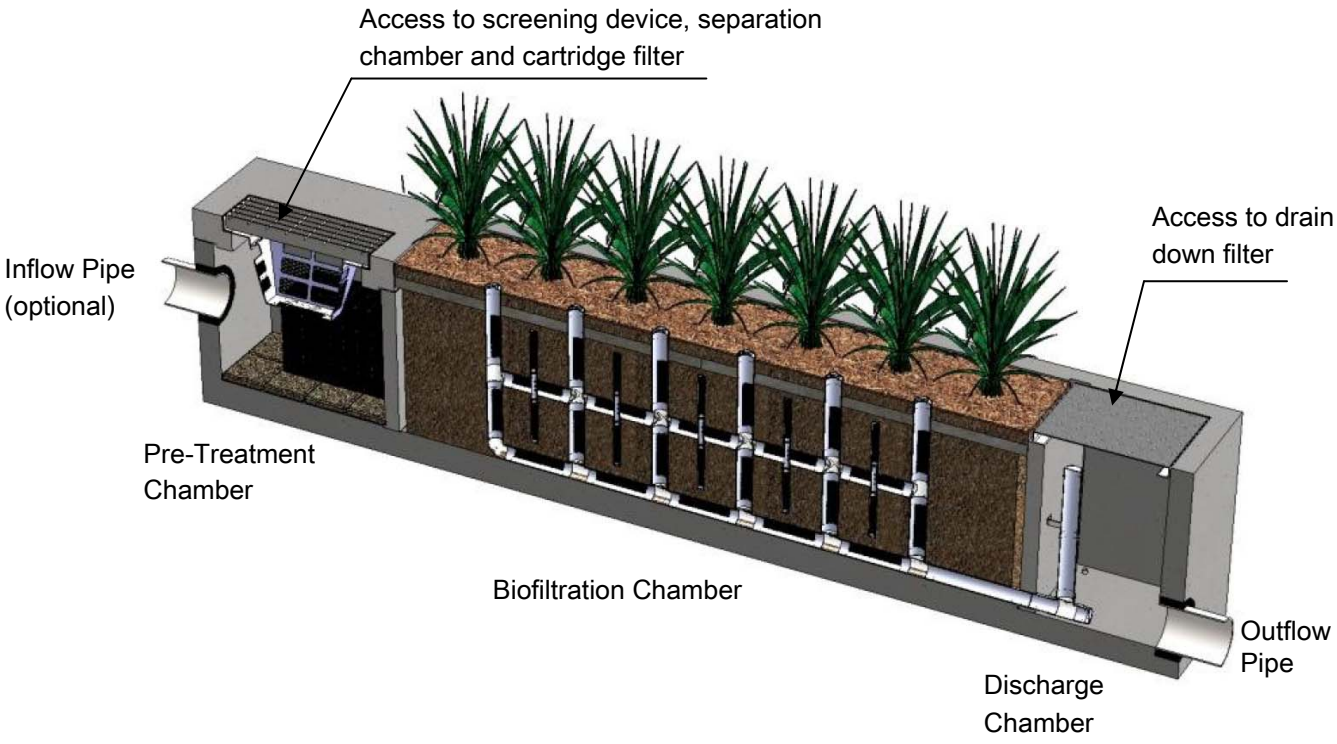
BMP: Biofiltration Basin MAINTENANCE ACTIVITIES					
ROUTINE ACTION	**MAINTENANCE INDICATOR**	**FIELD MEASUREMENT**	**MEASUREMENT FREQUENCY**	**MAINTENANCE ACTIVITY**	**Frequency (# of times per year)**
Vegetation Management for Aesthetics (optional)	Average vegetation height greater than 12-inches, emergence of trees or woody vegetation,	Visual observation and random measurements throughout the side slope area	Annually, prior to start of wet season	Cut vegetation to an average height of 6-inches and remove trimmings. Remove any trees, or woody vegetation.	1.0
Soil Repair	Evidence of erosion	Visual observation	Annually, prior to start of wet season	Reseed/revegetate barren spots prior to wet season	1.0
Standing Water	Standing water for more than 96 hrs	Visual observation	Annually, 96 hours after a target storm (0.60 in) event	Drain facility. Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0
Trash and Debris	Trash and Debris present	Visual observation	Annually, prior to start of wet season	Remove and dispose of trash and debris	1.0
Sediment Management	Sediment depth exceeds 10% of the facility design	Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth	Annually, prior to start of wet season	Remove and properly dispose of sediment. Regrade if necessary. (expected every 2 years)	0.5
Underdrains	Evidence of Clogging	Visual Observation	Annually, prior to start of wet season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, burrows, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Annually, prior to start of wet season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0
Reporting					1.0

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

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

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

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

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

Weather Condition _____ Additional Notes _____

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

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

ATTACHMENT 4
City standard Single Sheet BMP (SSBMP) Exhibit

[Use the City's standard Single Sheet BMP Plan.]

SUMMARY OF RISER DETAILS

BMP	Lower Slot			Middle Slot			Top Riser		Emergency weir
	Width (ft)	Height (ft)	Elevation[1] (ft) B	Width (ft)	Height (ft)	Elevation[1] (ft)	Length[2] (ft)	Elev.[1] (ft)	Length[3] (ft)
BMP 3	1	0.167	1	--	----	-----	12	2.25	
BMP 4	1	0.167	1.5	4	0.167	3.25	12	3.75	8
BMP 5	1.5	0.167	1	8	0.25	1.33	12	1.75	8
BMP 6	1.5	0.167	1	8	0.25	1.33	12	1.75	10
BMP 7	1.5	0.167	1	8	0.25	1.33	12	1.75	8

(1): Basin ground surface elevation assumed to be 0.00 ft elevation.

Notes: (2): Overflow length is the internal perimeter of the riser structure.

(3): Additional Overflow length for peak flow discharges

BMP TABLE

BMP ID	# BMP TYPE	SYMBOL	CASQA NO.	QUANTITY	DRAWING NO.	SHEET NO.(S)	INSPECTION* FREQUENCY	MAINTENANCE* FREQUENCY
TREATMENT CONTROL								
(A)	BIOFILTRATION		TC-32	22,916 SF.	TBD	TBD	SEMI-ANNUALLY	ANNUALLY
(E)	TREE WELL		SD-1	1	TBD	TBD	SEMI-ANNUALLY	ANNUALLY
(F)	MODULAR WETLAND		–	2	TBD	TBD	SEMI-ANNUALLY	ANNUALLY
HYDROMODIFICATION								
(D)	BIOFILTRATION		TC-32	22,916 SF.	TBD	TBD	SEMI-ANNUALLY	ANNUALLY
SOURCE CONTROL								
(B)	STENCILS	NO DUMPING DRAINS TO OCEAN	SD-13	73 EA	TBD	TBD	SEMI-ANNUALLY	AS NEEDED
(C)	BMP SIGN		PERMANENT WATER QUALITY TREATMENT FACILITY	10 EA	TBD	TBD	SEMI-ANNUALLY	AS NEEDED

PARTY RESPONSIBLE FOR MAINTENANCE:

NAME: TBD

ADDRESS: _____ CONTACT _____

_____

_____

PHONE NO. _____

PLAN PREPARED BY:

NAME MEL LANDY

COMPANY HOWES, WEILER & ASSOC.

ADDRESS 2888 LOKER AVE EAST
SUITE 218
CARLSBAD, CA 92010

PHONE NO. (760) 929-2288 EX. 408

SIGNATURE

BMP NOTES:

CERTIFICATION _____

1. THESE BMPS ARE MANDATORY TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS OR THESE PLANS.
2. NO CHANGES TO THE PROPOSED BMPS ON THIS SHEET WITHOUT PRIOR APPROVAL FROM THE CITY ENGINEER.
3. NO SUBSTITUTIONS TO THE MATERIAL OR TYPES OR PLANTING TYPES WITHOUT PRIOR APPROVAL FROM THE CITY ENGINEER.
4. NO OCCUPANCY WILL BE GRANTED UNTIL THE CITY INSPECTION STAFF HAS INSPECTED THIS PROJECT FOR APPROPRIATE BMP CONSTRUCTION AND INSTALLATION.
5. REFER TO MAINTENANCE AGREEMENT DOCUMENT.
6. SEE PROJECT SWOMP FOR ADDITIONAL INFORMATION.

(P) PROPOSED PIPE

SUMMARY OF POST-DEVELOPED CONDITIONS

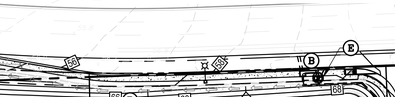
DMA	Tributary Area, A (Ac)	Impervious Percentage, Ip (%)	Drains to
DMA-1D	1.060	46.50	BMP 1
DMA-2D	0.901	72.26	BMP 2
DMA-3D	0.640	78.26	BMP 3
DMA-3C	0.132	50.93	BMP 3
DMA-4D	3.303	63.85	BMP 4
DMA-4C	2.795	65.05	BMP 4
DMA-5D	0.532	77.15	BMP 5
DMA-5C	1.135	47.75	BMP 5
DMA-6D	2.748	66.45	BMP 6
DMA-6C	1.696	66.75	BMP 6
DMA-7D	0.458	75.70	BMP7
DMA-7C	2.748	66.28	BMP7
DMA-8C	0.299	62.81	Modular Wetland
DMA-9C	0.437	48.12	Tree well & Modular Wetland
DMA-10C	0.418	0.00	onsite self-mitigating-excluded from HMP
DMA-11C	0.394	0.00	onsite self-mitigating-excluded from HMP
DMA-11D	0.374	0.00	onsite self-mitigating-excluded from HMP
DMA-12D	0.044	0.00	onsite self-mitigating-**NOT** excluded from HMP
TOTAL	**20.114**	N/A	

NOTE:
DMA TRIBUTARY AREAS EXCLUDES, BMP SQUARE FOOTAGE.

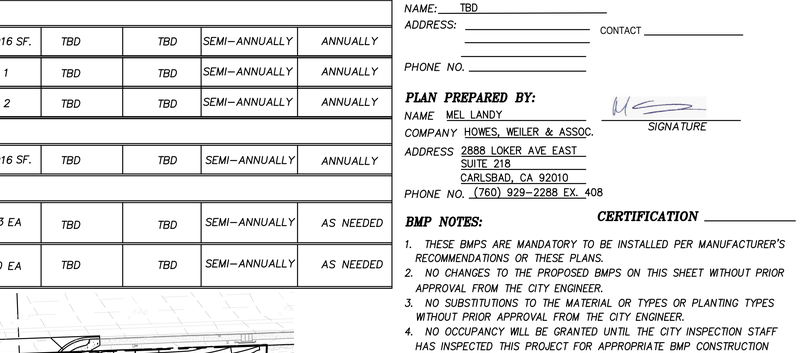
EXIST. BIORETENTION BASIN

EXIST. BIORETENTION BASIN

EXIST. BIORETENTION BASIN



STAINLESS STEEL PLATE / ORIFICE DETAIL
NTS



TYPICAL BIO-FILTRATION BASIN DETAIL
NTS

PERMANENT WATER QUALITY TREATMENT FACILITIES ON THIS SITE

KEEPING OUR WATER CLEAN
MAINTAIN WITH CARE
NO MODIFICATIONS WITHOUT CITY OF CARLSBAD APPROVAL

WATER QUALITY ADVISORY SIGN
NTS

SAMPLE PROHIBITIVE SIGNAGE
NTS

SUMMARY OF DEVELOPED DUAL AND TRIPLE PURPOSE BMPs

BMP	Tributary Area (Ac)[7]	DIMENSIONS					
		BMP Area[1] (ft^2)	Gravel Depth[2] A	Lower Orif. D (in)[3]	Depth Riser Invert (in)[4] C	Weir Perimeter Length[5] (ft)	Total Surface Depth[6] D
BMP 1	1.060	1949	33	0.8	12	12	18
BMP 2	0.901	1098	33	0.9	6	12	12
BMP 3	0.772	2360	36	0.9	27	12	33
BMP 4	6.098	7724	48	2.3	45	12	63
BMP 5	1.66	1692	36	2.2	21	12	30
BMP 6	4.444	4347	36	2.4	21	12	31.5
BMP 7	3.206	3567	48	2	21	12	37.5

Notes:
(1): Area of amended soil equal to area of gravel. 18" thick and in conformance with specifications listed on Fa
(2): Gravel depth needed to comply with hydromodification purposes
(3): Diameter of orifice in gravel layer with invert at bottom of layer; tied with hydromod min threshold ($0.5 Q_2$).
(4): Depth of ponding beneath riser structure's surface spillway.
(5): Overflow length, the internal perimeter of the riser internal dimensions
(6): Total surface depth of BMP from top crest elevation to surface invert.
(7): Tributary area to basin not including area of BMP.

REGISTERED PROFESSIONAL ENGINEER
MELLOR R. LANDY
No. 81085
Exp. 09-30-19
CIVIL
STATE OF CALIFORNIA

HOWES | WEILER | LANDY
PLANNING & ENGINEERING
Tel. 760.929.2288 Fax. 760.929.2287 Email. info@HWL-PE.com
2888 LOKER AVENUE EAST SUITE 217, CARLSBAD, CA 92010 www.HWL-PE.com

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 1 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 1

SINGLE SHEET BMP SITE PLAN

MARJA ACRES

RECORD COPY

INITIAL DATE

PROJECT NO.

DRAWING NO. 509-7A

SPECIFICATIONS

FLOW-BASED

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

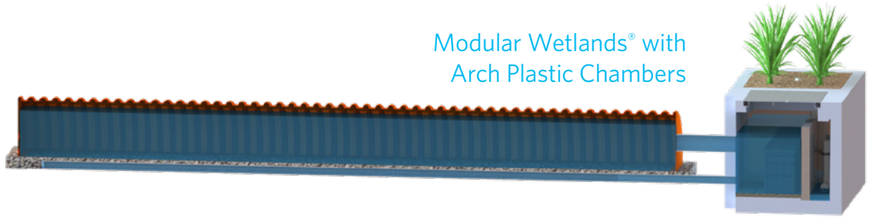
MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq.ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

VOLUME-BASED DESIGN

HORIZONTAL FLOW BIOFILTRATION ADVANTAGE

Modular Wetlands® with
Box Culvert Prestorage

The Modular Wetlands® System Linear offers a unique advantage in the world of biofiltration due to it's exclusive horizontal flow design: Volume-Based Design. No other biofilter has the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The systems horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points. In the example above the Modular Wetlands® is installed downstream of underground box culvert storage. Designed for the water quality volume, the Modular Wetlands® will treat and discharge the required volume within local drain down time requirements.



Modular Wetlands® with
Arch Plastic Chambers

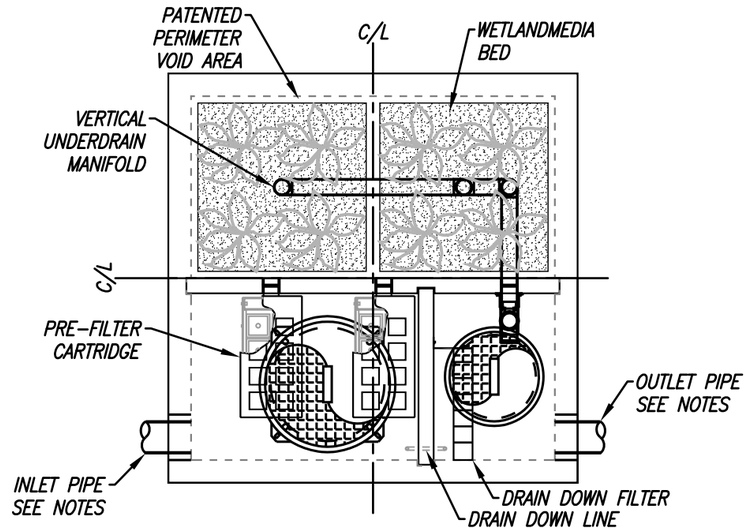
DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the Modular Wetlands®, the only biofilter than can be used downstream of storage BMPs.

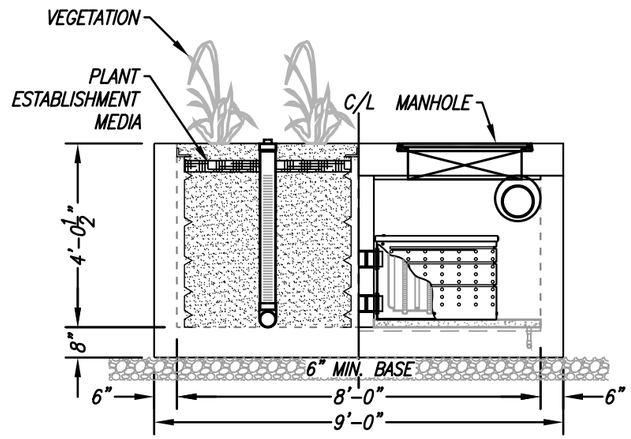
ADVANTAGES

- LOWER COST THAN FLOW BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

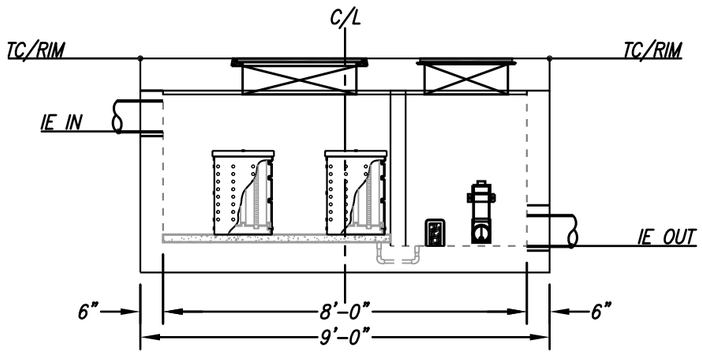
SITE SPECIFIC DATA			
PROJECT NAME		Marja Acres	
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			4.84
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.16"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



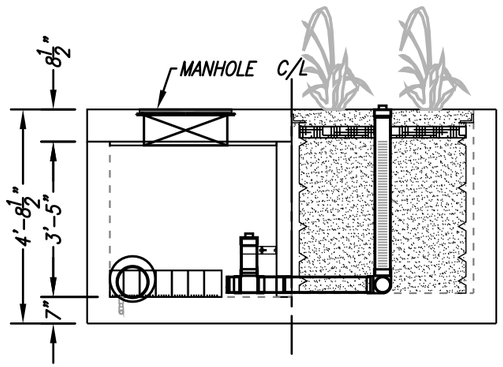
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.230
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

THE PRODUCT DESCRIBED MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

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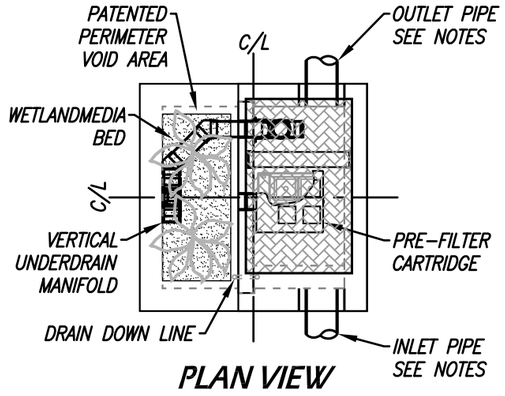
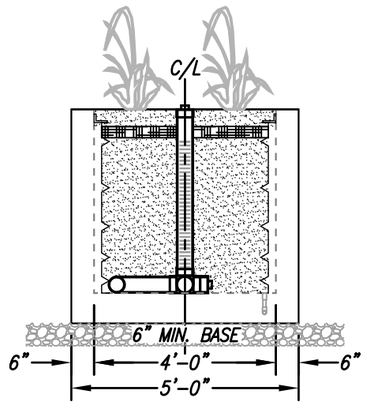
MWS-L-8-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

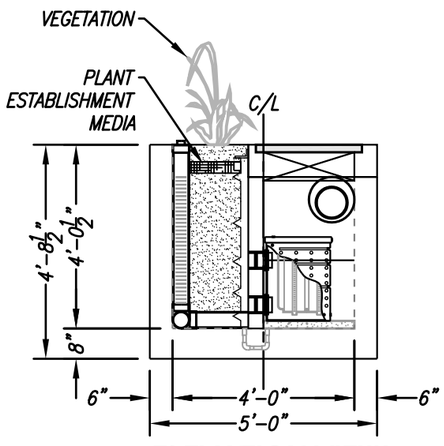
SITE SPECIFIC DATA			
PROJECT NAME		Marja Acres	
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	24" x 42"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			0.83
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.03"
MAXIMUM PICK WEIGHT (LBS)			9000
NOTES:			



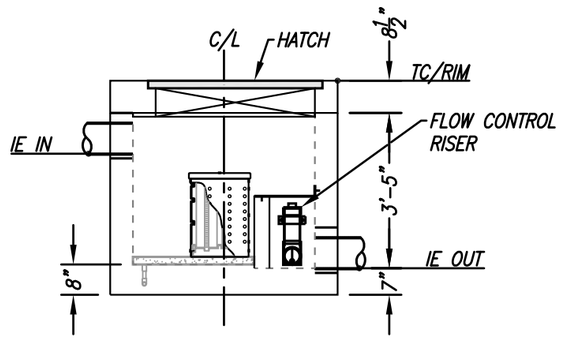
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

INSTALLATION NOTES

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TREATMENT FLOW (CFS)	0.052
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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MWS-L-4-4-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

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