ATTACHMENT G

UDSP EIR 2025 ADDENDUM - APPENDIX G - SWQMP

City of San Marcos
PRIORITY DEVELOPMENT PROJECT (PDP) **STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)** **FOR** **CUBESMART SELF STORAGE** **CUP24-0005** **337 EAST CARMEL STREET** **SAN MARCOS, CA 92078** **ASSESSOR'S PARCEL NUMBER(S):** **220-201-90**
ENGINEER OF WORK: **JOSEPH G. CRESTO, RCE 45601**

REGISTERED PROFESSIONAL ENGINEER
JOSEPH G. CRESTO
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DATE OF SWQMP:
March 14, 2025

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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

PDP SWQMP PREPARER'S CERTIFICATION PAGE

Project Name: CUBESMART SELF STORAGE
Permit Application Number: CUP24-0005

PREPARER'S CERTIFICATION

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

I have read and understand that the [City Engineer] has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the [City Engineer] is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

Engineer of Work's Signature

Joseph G. Cresto, RCE 45601
Print Name

Stevens Cresto Engineers
Company

3/24/25
Date

Engineer's Seal:

PDP SWQMP PROJECT OWNER'S CERTIFICATION PAGE

Project Name: CUBESMART SELF STORAGE
Permit Application Number: CUP24-0005

PROJECT OWNER'S CERTIFICATION

This PDP SWQMP has been prepared for CARMEL ENTERPRISE, LLC by STEVENS CRESTO ENGINEERS. The PDP SWQMP is intended to comply with the PDP requirements of the CITY OF SAN MARCOS BMP Design Manual, which is a design manual for compliance with local CITY OF SAN MARCOS and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

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

_____
Project Owner's Signature

__Gary Levitt, Manager_____
Print Name

__Urban Villages San Marcos, LLC by: Noble Canyon, LLC, its Manager_
Company

__3/14/2025_____
Date

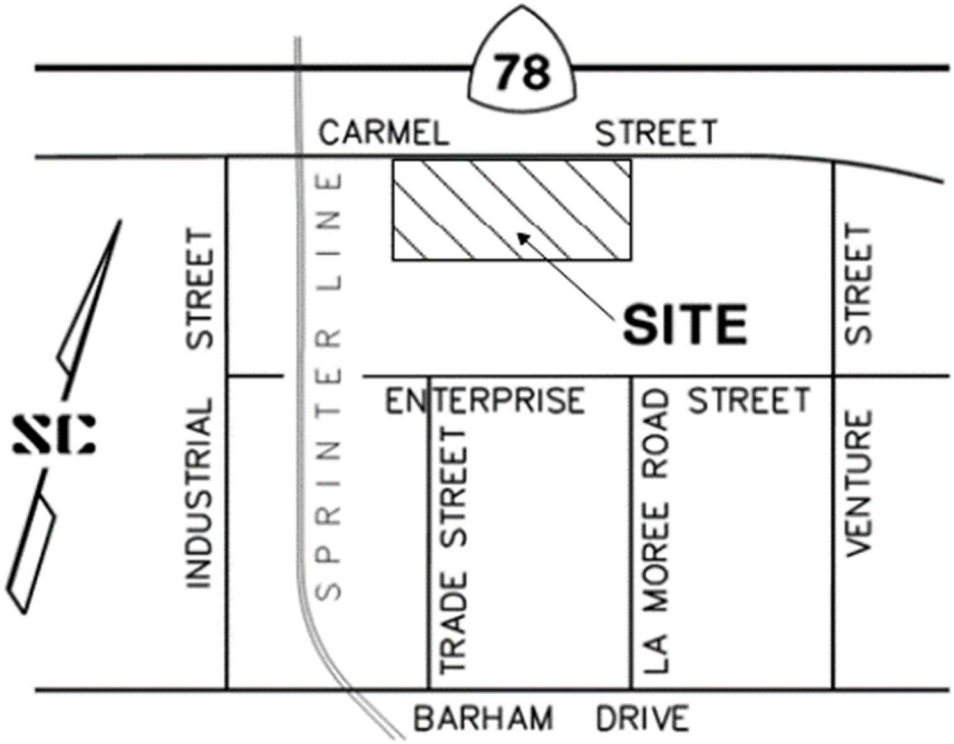
SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1	09/30/2024	■ Preliminary Design / Planning/ CEQA ☐ Final Design	Initial Submittal
2	01/21/2025	■ Preliminary Design / Planning/ CEQA ☐ Final Design	Response to comments
3	03/14/2025	■ Preliminary Design / Planning/ CEQA ☐ Final Design	Response to comments

PROJECT VICINITY MAP

Project Name: CUBESMART SELF STORAGE
Permit Application Number: CUP24-0005



THOMAS BROTHERS COORD:
PAGE 1128; GRID J1

VICINITY MAP

NO SCALE

Applicability of Storm Water Best Management Practices (BMP) Requirements (Storm Water Intake Form for all Development Permit Applications) For detailed information please visit: http://www.san-marcos.net/departments/development-services/stormwater/development-planning	Form I-1 [March 15, 2016]

Project Identification	
Project Name: CUBESMART SELF STORAGE	
Description: Project proposes the development of a commercial self-storage facility.	
Permit Application Number (if applicable): CUP24-0005	Date: 03/14/2025
Project Address: 337 East Carmel Street, San Marcos, CA 92078	

Determination of Requirements

This form is required as part of the City's application process. The purpose of this form is to identify potential land development planning storm water requirements that apply to development projects.

Development projects are defined as construction, rehabilitation, redevelopment, or reconstruction of any public or private projects. In addition, the identification of a development project, as it relates to storm water regulations, would truly apply to development and redevelopment activities that have the potential to contact storm water and contribute a source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

To access the BMP Design Manual, Storm Water Quality Management Plan (SWQMP) templates, and other pertinent information related to this program please refer to:
http://www.san-marcos.net/departments/development-services/stormwater/development-planning

Please answer each of the following steps below, starting with Step 1 and progressing through each step until reaching "Stop".

Step	Answer	Progression
Step 1: Based on the above, Is the project a "development project" (See definition above)? See Section 1.3 of the BMP Design Manual for further guidance if necessary.	■ Yes	Go to Step 2.
	☐ No	Permanent BMP requirements do not apply. No SWQMP will be required. Provide brief discussion below. **STOP.**
Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building):		
Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? **To answer this item, complete Form I-2, Project Type Determination. See Section 1.4 of the BMP Design Manual *in its entirety* for guidance.** **In addition to Section 1.4, please refer to the City's SWQMP Submittal Requirements form.**	☐ Standard Project	Only Standard Project requirements apply, including Standard Project SWQMP. **STOP.**
	■ PDP	Standard and PDP requirements apply, including PDP SWQMP. **Go to Step 3 on the following page.**
	☐ Exception to PDP definitions	Standard Project requirements apply, and any additional requirements specific to the type of project. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP. **STOP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Form I-1 Page 2, Form Date: March 15, 2016		
Step 3 (PDPs only). Please answer the list of questions in this section to determine if hydromodification requirements reply to the proposed PDP. Does the project:		
Step 3a. Discharge storm water runoff directly to the Pacific Ocean?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	■ No	Continue to Step 3b.
Step 3b. Discharge storm water runoff directly to an enclosed embayment, not within protected areas?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	■ No	Continue to Step 3c.
Step 3c. Discharge storm water runoff directly to a water storage reservoir or lake, below spillway or normal operating level?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	■ No	Continue to Step 3d.
Step 3d. Discharge storm water runoff directly to an area identified in WMAA?	☐ Yes	**STOP**. Hydromodification requirements do not apply.
	■ No	Hydromodification requirements apply to the project. Go to Step 4.
Discussion / justification if hydromodification control requirements do <u>not</u> apply:		
Step 4 (PDPs subject to hydromodification control requirements only). Does protection of critical coarse sediment yield areas apply based on review of WMAA Potential Critical Coarse Sediment Yield Area Map? See Section 6.2 of the BMP Design Manual for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	■ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.

Project Type Determination Checklist				Form I-2 [March 15, 2016]
Project Information				
Project Name/Description: CUBESMART SELF STORAGE				
Permit Application Number (if applicable): CUP24-0005				Date: 03/14/2025
Project Address: 337 East Carmel Street, San Marcos, CA 92078				
Project Type Determination: Standard Project or Priority Development Project (PDP)				
The project is (select one): ■ New Development ☐ Redevelopment				
The total proposed newly created or replaced impervious area is: 90,430 ft^2 (2.08) acres				
Is the project in any of the following categories, (a) through (f)?				
Yes ■	No ☐	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	
Yes ☐	No ■	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	
Yes ■	No ☐	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.	

Form I-2 Page 2, Form Date: March 15, 2016			
Yes ☐	No ■	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
Yes ☐	No ■	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
Yes ☐	No ■	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See BMP Design Manual Section 1.4.2 for additional guidance.*

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

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

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

The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: _____ ft^2 (A)

The total proposed newly created or replaced impervious area is _____ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: _____%

The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%) – only new impervious areas are considered PDP

OR

☐ greater than fifty percent (50%) – the entire project site is a PDP

Site Information Checklist For PDPs	Form I-3B (PDPs) [March 15, 2016]
Project Summary Information	
Project Name	CUBESMART SELF STORAGE
Project Address	337 EAST CARMEL STREET SAN MARCOS, CA 92078
Assessor's Parcel Number(s) (APN(s))	220-201-90
Permit Application Number	CUP24-0005
Project Hydrologic Unit	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ■ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☐ Otay 910 ☐ Tijuana 911
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Richland 904.52
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	2.71 Acres (117,989 Square Feet)
Area to be Disturbed by the Project (Project Area)	2.90 Acres (126,255 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	2.08 Acres (90,430 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	0.82 Acres (35,825 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

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

☐ Existing development
■ Previously graded but not built out
☐ Demolition completed without new construction
☐ Agricultural or other non-impervious use
☐ Vacant, undeveloped/natural

Description / Additional Information:
The project area is located north of Enterprise Street, east of Industrial Street, and west of Venture Street, and adjacent to Carmel Street. In the existing condition, CubeSmart Self Storage has a rough graded pad per GP21-00004.

Existing Land Cover Includes (select all that apply):

■ Vegetative Cover
☐ Non-Vegetated Pervious Areas
☐ Impervious Areas

Description / Additional Information:
The site is currently a rough graded pad per GP21-00004.

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):

☐ NRCS Type A
☐ NRCS Type B
■ NRCS Type C
☐ NRCS Type D

Type C soil is dominant throughout the site per USDA Web Soil Survey.

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

See Geotechnical Exploration, Inc. “Report of Update Geotechnical Investigation,” for Campus Pointe Affordable Housing Project, San Marcos, CA, dated January 20, 2021 for additional information.

Existing Natural Hydrologic Features (select all that apply):

☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
■ None

Description / Additional Information:

Description of Existing Site Drainage Patterns

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

Describe existing site drainage patterns:

In the existing condition, the site is composed of rough graded pads which drain into sediment basins constructed per GP21-00004. The sediment basins drain into an existing double 6’x5’ box culvert constructed per IP21-00005. Flow continues flowing through existing culverts at Carmel Street and State Route 78.

Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:

CubeSmart Self Storage proposes the development of two new commercial self-storage buildings and improvements associated with development. This development would accommodate the relocation of an existing self-storage facility at 235 E. Carmel Street to 337 E. Carmel Street.

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

Storage unit buildings, walkways and sidewalks, street improvements and driveways.

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

Landscape and self-mitigating (hydroseed) areas.

Does the project include grading and changes to site topography?

■ Yes

☐ No

Description / Additional Information:

The project includes fine grading associated with development.

Description of Proposed Site Drainage Patterns

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

■ Yes

☐ No

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

Describe proposed site drainage patterns:

Runoff generated by the proposed project will be conveyed via a proposed private storm drain system into two proposed private underground detention systems (UD-1 & UD-2). A flow control/bypass structure downstream of each underground detention system will route the required DCV into a corresponding proposed private proprietary biofiltration system (PBF-1 & PBF-2). Runoff will then continue downstream via a proposed private storm drain system into an existing box culvert which flows under East Carmel Street and State Route 78.

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

Description / Additional Information:

Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):

Storm water is collected within a private storm drain system, which conveys flows to an existing private storm drain system on the north side of the site. The existing private storm drain system conveys flows to existing box culvert. The box culvert flows under East Carmel Street and State Route 78 and continues through an existing reinforced concrete pipe which ultimately discharge to San Marcos Creek. San Marcos Creek flows southwest, to Lake San Marcos, and then continues to Batiquitos Lagoon, ultimately discharging 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 and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
San Marcos Creek	DDE, Phosphorous, Selenium, Sediment Toxicity	Est. TMDL: 2019 and 2021
San Marcos Lake	Ammonia as Nitrogen, Nutrients	Est. TMDL: 2019

Identification of Project Site Pollutants*

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

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

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

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 2.b of the SWQMP.

☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit.

Discussion / Additional Information:
See attachment 2b.

Flow Control for Post-Project Runoff*

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

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

The project is tributary to a single POC, an existing outlet at San Marcos Creek, north of Highway 78.

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:
Hydromodification Screening for NC – Enterprise Affordable Housing dated September 14, 2024 prepared by Chang Consultants.

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 local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

The proposed project has existing high tail water condition at discharge points within existing storm drain systems. In final engineering, the use of backwater valves and other design methods will be implemented to prevent impacts in proposed systems.

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.

Source Control BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-4 [March 15, 2016]

Project Identification

Project Name: CUBESMART SELF STORAGE

Permit Application Number: CUP24-0005

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 of the Model BMP Design Manual for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification 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:			
SC-2 Storm Drain Stenciling or Signage	■ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
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:			
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:			

Form I-4 Page 2 of 2, Form Date: March 15, 2016			
Source Control Requirement	**Applied?**		
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:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
■ 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
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Site Design BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-5 [March 15, 2016]

Project Identification

Project Name: CUBESMART SELF STORAGE

Permit Application Number: CUP24-0005

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 of the Model BMP Design Manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification 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: The project site has been previously rough graded per GP21-00004.			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	■ N/A
Discussion / justification if SD-2 not implemented: The project site has been previously rough graded per GP21-00004.			
SD-3 Minimize Impervious Area	■ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
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: Although proposed impervious surfaces will drain to pervious areas, the flow length is not typically 10' min. Biofiltration is the primary treatment method proposed.			

Form I-5 Page 2 of 2, Form Date: March 15, 2016			
Site Design Requirement	**Applied?**		
SD-6 Runoff Collection	■ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	■ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	■ No	☐ N/A
Discussion / justification if SD-8 not implemented: Per the Harvest and Use Feasibility Screening Checklist (Attachment 1c), harvesting and use of precipitation is not feasible.			

Summary of PDP Structural BMPs	Form I-6 (PDPs) [March 15, 2016]

Project Identification

Project Name: CUBESMART SELF STORAGE

Permit Application Number: CUP24-0005

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

After calculating the DCV for each DMA, a feasibility analysis was performed for infiltration potential and “No Infiltration Condition” was selected, which led to the selection of Biofiltration BMPs, per fact sheet B.1-1, for use at the site. The project proposes 2 proprietary biofiltration systems and 2 underground storage systems.

Form I-6 Page 3 of X (Copy as many as needed) Form Date: March 15, 2016
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**
Structural BMP ID No. PBF-1
Construction Plan Sheet No. C4
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2) ■ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ■ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	Joseph G. Cresto Stevens Cresto Engineers 9665 Chesapeake Drive, Suite 200 San Diego, CA 92123 (858) 694-5660
Who will be the final owner of this BMP?	CubeSmart Self Storage
Who will maintain this BMP into perpetuity?	CubeSmart Self Storage
What is the funding mechanism for maintenance?	Private maintenance will be budgeted with other site costs.

Form I-6 Page 3 of X (Copy as many as needed) Form Date: March 15, 2016
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**
Structural BMP ID No. PBF-2
Construction Plan Sheet No. C4
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2) ■ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ■ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	Joseph G. Cresto Stevens Cresto Engineers 9665 Chesapeake Drive, Suite 200 San Diego, CA 92123 (858) 694-5660
Who will be the final owner of this BMP?	CubeSmart Self Storage
Who will maintain this BMP into perpetuity?	CubeSmart Self Storage
What is the funding mechanism for maintenance?	Private maintenance will be budgeted with other site costs.

Form I-6 Page 3 of X (Copy as many as needed) Form Date: March 15, 2016
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**
Structural BMP ID No. UD-1
Construction Plan Sheet No. C4
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2) ☐ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ■ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ☐ Pollutant control only ■ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ■ Other (describe in discussion section below) 100-yr peak flow detention

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	Joseph G. Cresto Stevens Cresto Engineers 9665 Chesapeake Drive, Suite 200 San Diego, CA 92123 (858) 694-5660
Who will be the final owner of this BMP?	CubeSmart Self Storage
Who will maintain this BMP into perpetuity?	CubeSmart Self Storage
What is the funding mechanism for maintenance?	Private maintenance will be budgeted with other site costs.

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

Structural BMP ID No. UD-2

Construction Plan Sheet No. C4

Type of structural BMP:
- ☐ Retention by harvest and use (HU-1)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial retention by biofiltration with partial retention (PR-1)
- ☐ Biofiltration (BF-1)
- ☐ Biofiltration with Nutrient Sensitive Media Design (BF-2)
- ☐ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ■ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below)

Purpose:
- ☐ Pollutant control only
- ■ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment/forebay for another structural BMP
- ■ Other (describe in discussion section below)
  100-yr peak flow detention

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	Joseph G. Cresto Stevens Cresto Engineers 9665 Chesapeake Drive, Suite 200 San Diego, CA 92123 (858) 694-5660
Who will be the final owner of this BMP?	CubeSmart Self Storage
Who will maintain this BMP into perpetuity?	CubeSmart Self Storage
What is the funding mechanism for maintenance?	Private maintenance will be budgeted with other site costs.

ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet.	■ 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 ☐ Not 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.	■ Included ☐ Not included because the entire project will use harvest and use BMPs
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

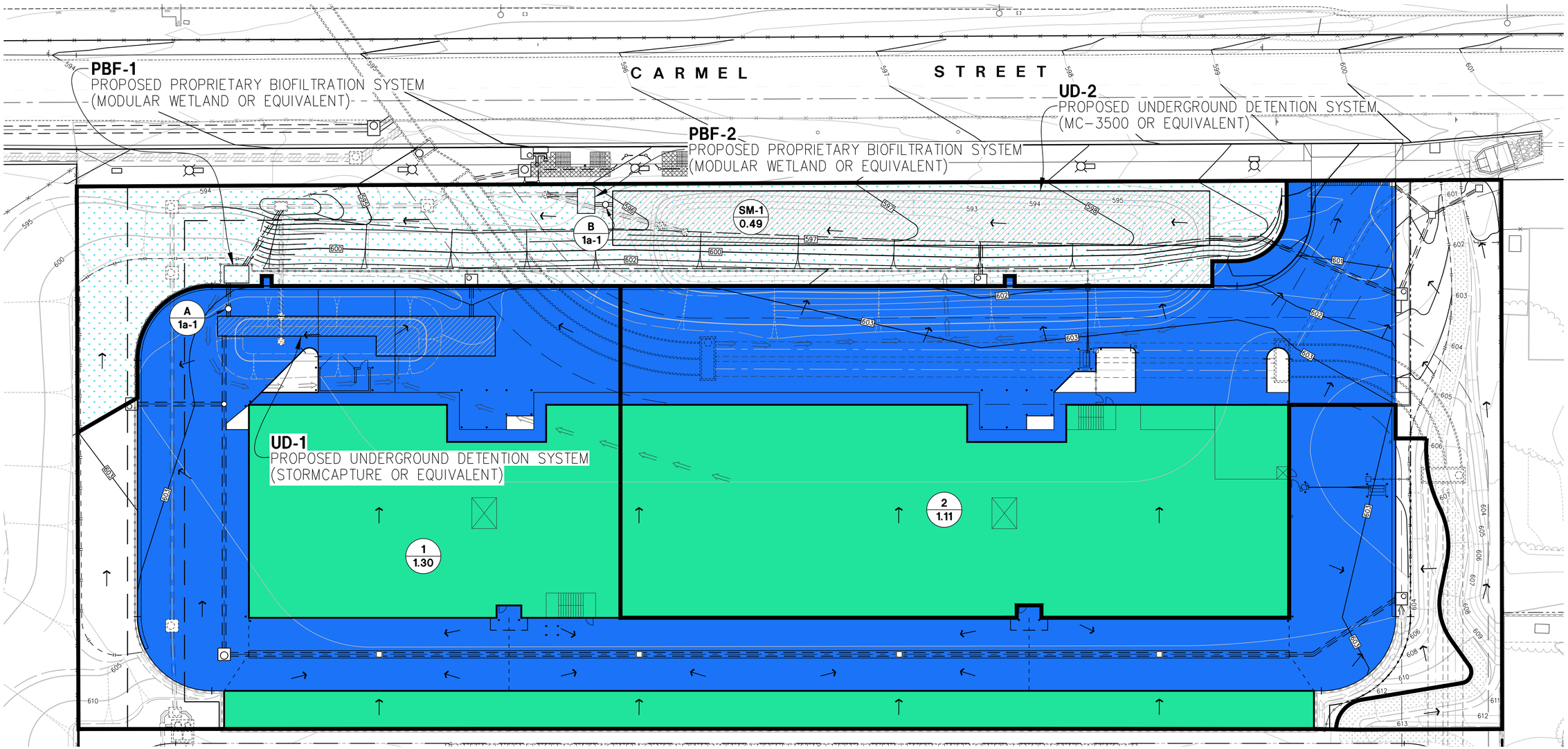
Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

- ■ Underlying hydrologic soil group
- ■ Approximate depth to groundwater
- ■ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☐ Critical coarse sediment yield areas to be protected
- ■ Existing topography and impervious areas
- ■ Existing and proposed site drainage network and connections to drainage offsite
- ■ Proposed demolition
- ■ Proposed grading
- ■ Proposed impervious features
- ■ Proposed design features and surface treatments used to minimize imperviousness
- ■ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- ☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- ■ Structural BMPs (identify location, type of BMP, and size/detail)

Attachment 1a

DMA Exhibit

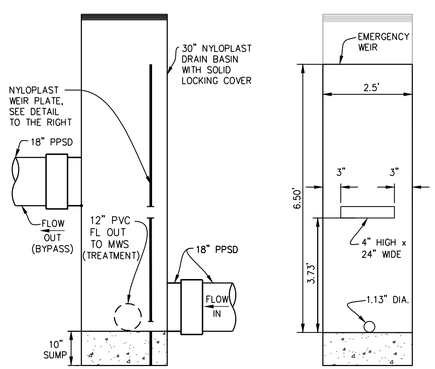


LEGEND

- 1 / 1.30 — DMA DESIGNATION / AREA (ACRES)
- DMA BOUNDARY
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- RUNOFF FLOW DIRECTION
- 600 — EXISTING CONTOUR
- 600 — PROPOSED CONTOUR
- PROPOSED BUILDING (C=0.90)
- PROPOSED IMPERVIOUS (C=0.90)
- SELF-MITIGATING AREA (C=0.30)
- PERVIOUS (C=0.30)

PROPOSED BMPS

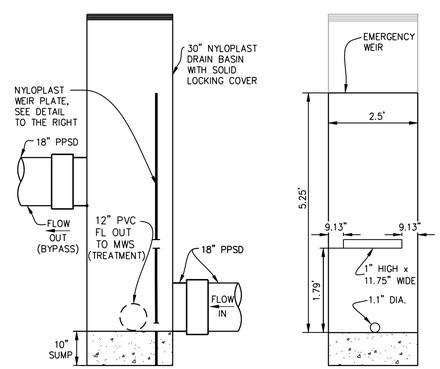
- PROPOSED UNDERGROUND DETENTION SYSTEM (100-YEAR PEAK FLOW & HYDROMODIFICATION MITIGATION) — UD-1
- PROPOSED PROPRIETARY BIOFILTRATION SYSTEM (WATER QUALITY) — PBF-1



ELEVATION VIEW — WEIR PLATE DETAIL

DETENTION SYSTEM UD-1 FLOW CONTROL STRUCTURE (A / 1a-1)

NO SCALE



ELEVATION VIEW — WEIR PLATE DETAIL

DETENTION SYSTEM UD-2 FLOW CONTROL STRUCTURE (B / 1a-1)

NO SCALE

DMA SUMMARY TABLE

DMA ID	AREA (SF)	DESCRIPTION	TYPE
1	56,760	19,000 SF PROPOSED BUILDING 31,685 SF PROPOSED IMPERVIOUS 6,075 SF PROPOSED LANDSCAPE[1]	DRAINS TO PROPOSED BMP UD-1 / PBF-1
2	48,155	22,565 SF PROPOSED BUILDING 17,180 SF PROPOSED IMPERVIOUS 8,410 SF PROPOSED LANDSCAPE[1]	DRAINS TO PROPOSED BMP UD-2 / PBF-2
SM-1	21,340	21,340 SF SELF-MITIGATING	--
TOTAL	126,255	41,565 SF PROPOSED BUILDING 14,485 SF PROPOSED LANDSCAPE[1] 48,865 SF PROPOSED IMPERVIOUS 21,340 SF SELF-MITIGATING	--

[1]SEE LANDSCAPE NOTE.

LANDSCAPE NOTE:
LANDSCAPE TO HAVE AMENDED SOILS PER CITY OF SAN MARCOS BMP DESIGN MANUAL, FACT SHEET E.11.

SOILS/GROUNDWATER

UNDERLYING HYDROLOGIC SOIL GROUP C

APPROXIMATE DEPTH TO GROUNDWATER (GW): 5 FT < GW DEPTH < 10 FT

0 10 20 40 60

SCALE: 1"=20'

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr. Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

CUBESMART SELF STORAGE

SAN MARCOS, CALIFORNIA

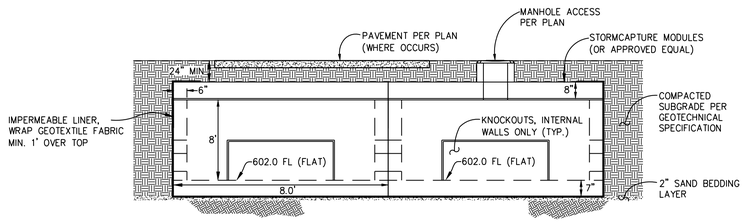
ATTACHMENT 1a-1
DRAINAGE MANAGEMENT AREA EXHIBIT

DATE: 03/20/2025

SCE NO. 13003.85

SHEET 1a-1

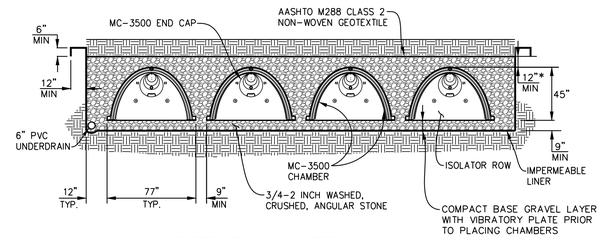
1 OF 2 SHEETS



DETENTION SYSTEM "UD-1"
TYPICAL CROSS SECTION

NO SCALE

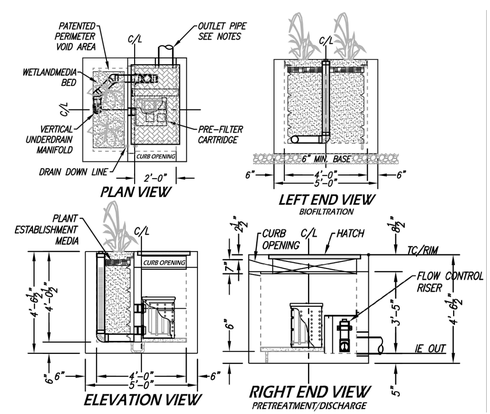
A
1a-2



DETENTION SYSTEM "UD-2"
TYPICAL CROSS SECTION

NO SCALE

B
1a-2



PROPRIETARY BIOFILTRATION, MODULAR
WETLAND SYSTEM, OR APPROVED EQUIVALENT

NO SCALE

C
1a-2

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr. Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

CUBESMART SELF STORAGE
SAN MARCOS, CALIFORNIA

ATTACHMENT 1a-2
DRAINAGE MANAGEMENT AREA EXHIBIT

DATE:	01/20/25
SCE NO.	13003.85
SHEET	1a-2
	2 OF 2 SHEETS

Attachment 1c

Worksheet B.3-1 (Form I-7), Harvest and Use Feasibility Screening Checklist

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.

36-Hour Irrigation demand: 390 gal/AC (Table B.3-3 For Low Water Use).
For total landscape area: 0.333 ac. Irrigation demand: 130 gal, or 17.4 CF.

3. Calculate the DCV using worksheet B-2.1.

DCV = 4,679 (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.

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.

Attachment 1d

Worksheet C.4-1 (Form I-8), Categorization of Infiltration Feasibility

(TO BE PROVIDED AT FINAL ENGINEERING)

Attachment 1e

Pollutant Control BMP Design Worksheets/Calculations

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	PBF-1	PBF-2									unitless
	2	85th Percentile 24-hr Storm Depth	0.68	0.68									inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	50,685	39,745									sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	6,075	8,410									sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No									yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	56,760	48,155	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.81	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.81	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	2,605	2,074	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.81	0.76	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	2,605	2,074	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.81	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	45,976	36,598	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	2,605	2,074	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

2,605 CF X 1.5 = 3,907.5 CF
3,907.5 CF < 10,072 CF PER MANUFACTURER
MWS-L-8-8 PROVIDES ADEQUATE WATER
QUALITY TREATMENT.

2,074 CF X 1.5 = 3,111 CF
3,111 CF < 10,072 CF PER MANUFACTURER
MWS-L-8-8 PROVIDES ADEQUATE WATER
QUALITY TREATMENT.

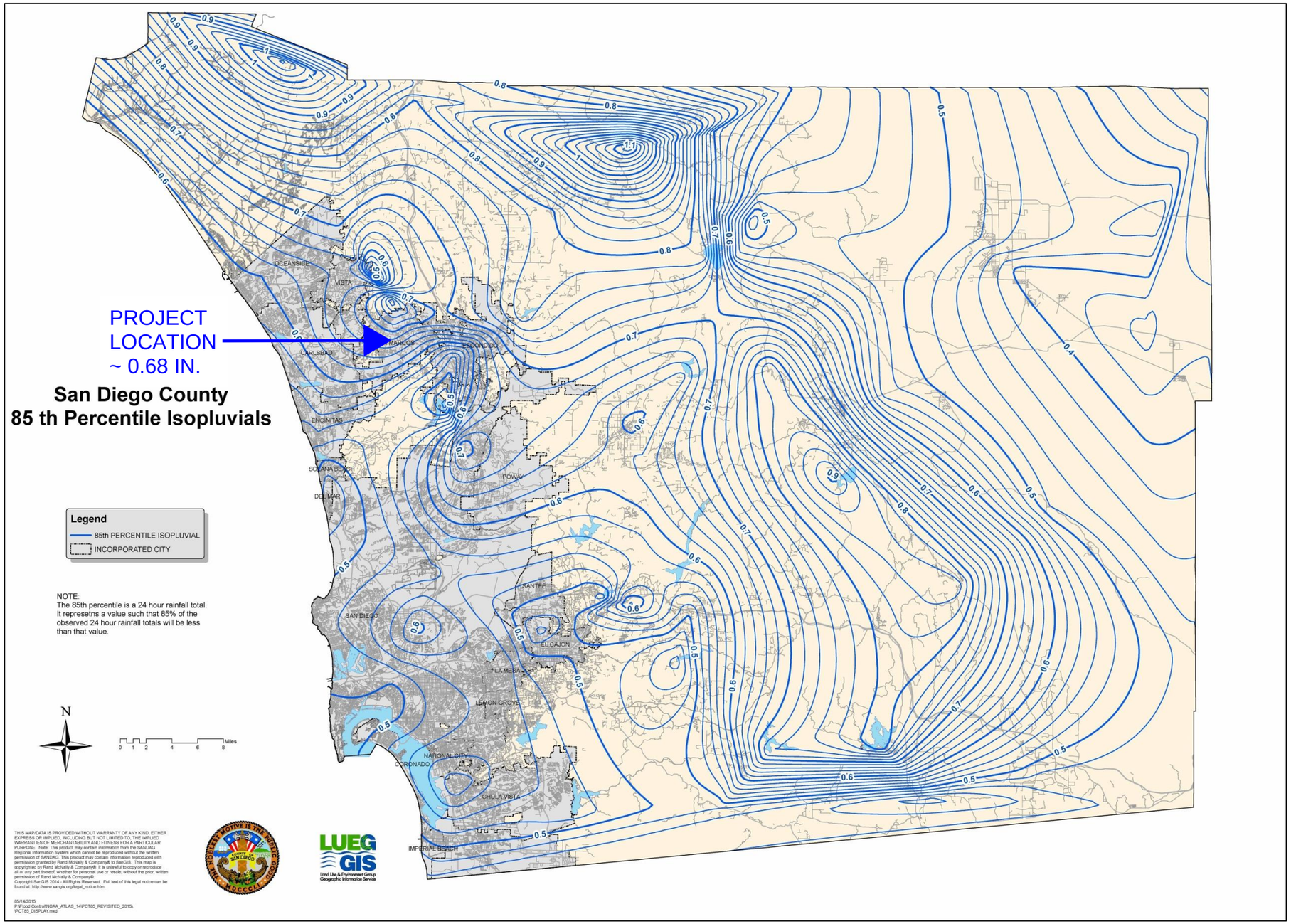
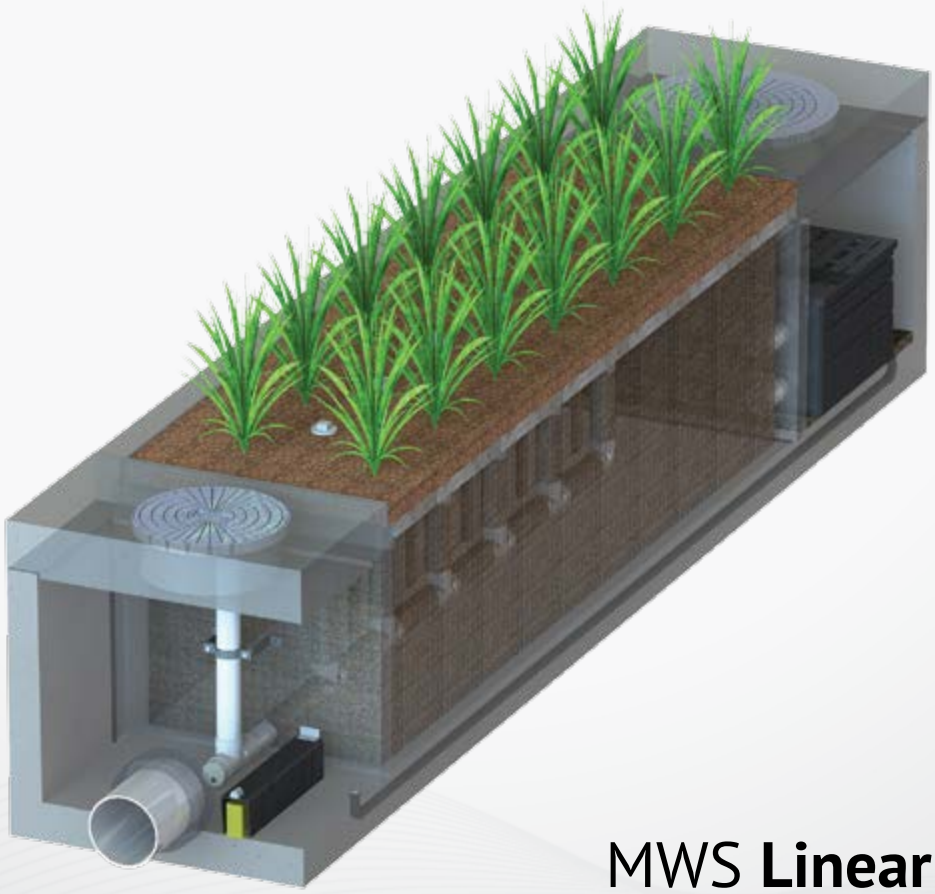


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS **Linear**

Contents

1 Introduction

2 Applications

3 Configurations

4 Advantages

5 Operation

6 Orientations | Bypass

7 Performance | Approvals

8 Sizing

9 Installation | Maintenance | Plants

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS **Linear**

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

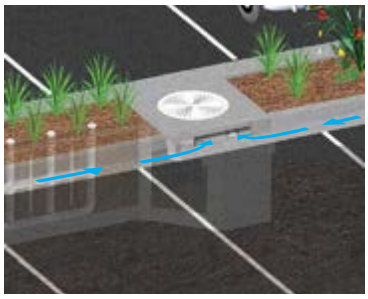
The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

- Agriculture
- Reuse
- Low Impact Development
- Waste Water

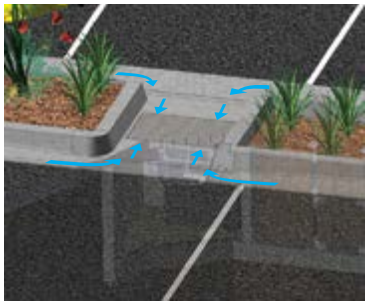
Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.



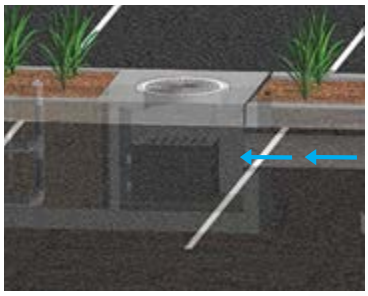
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

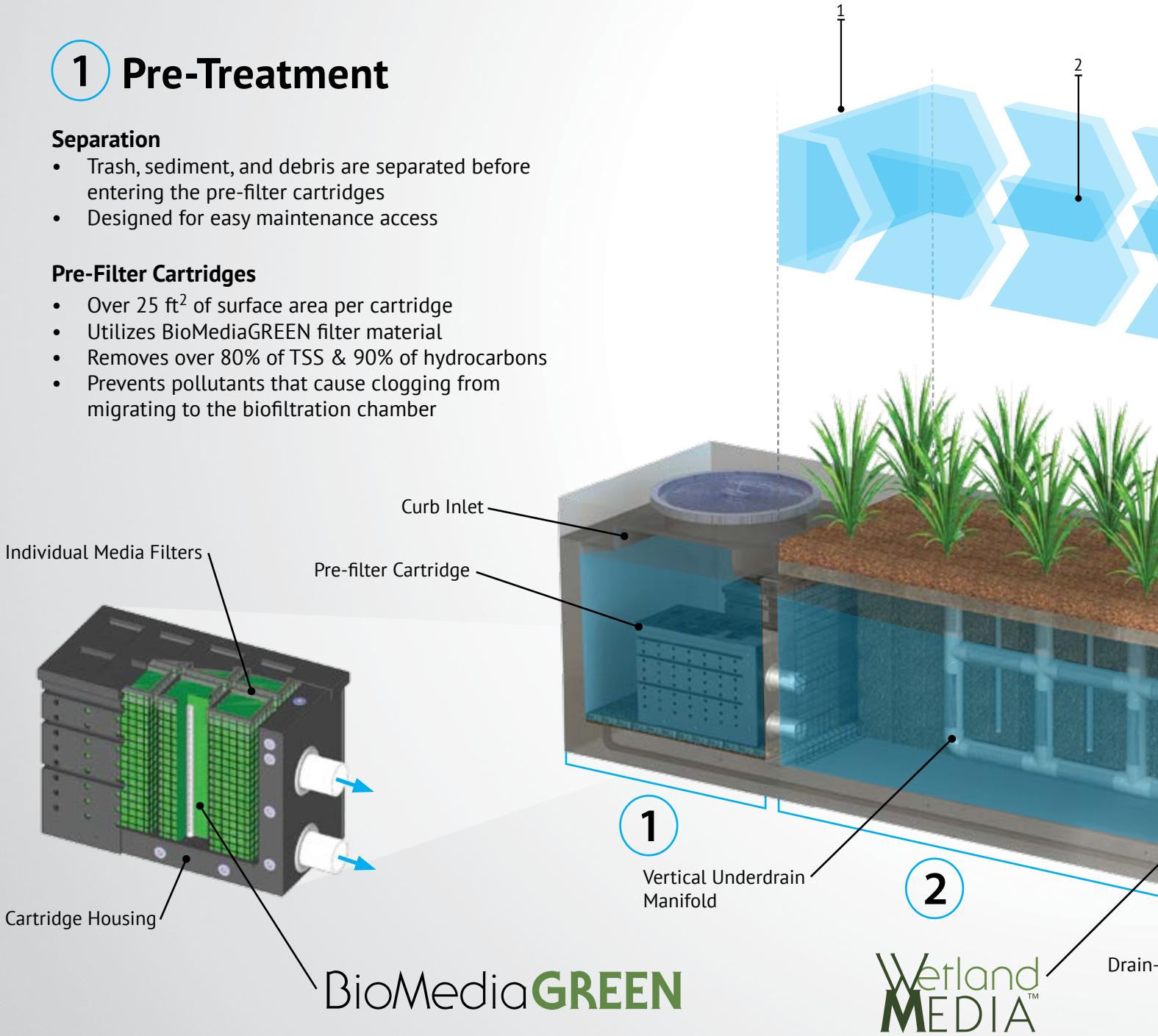
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



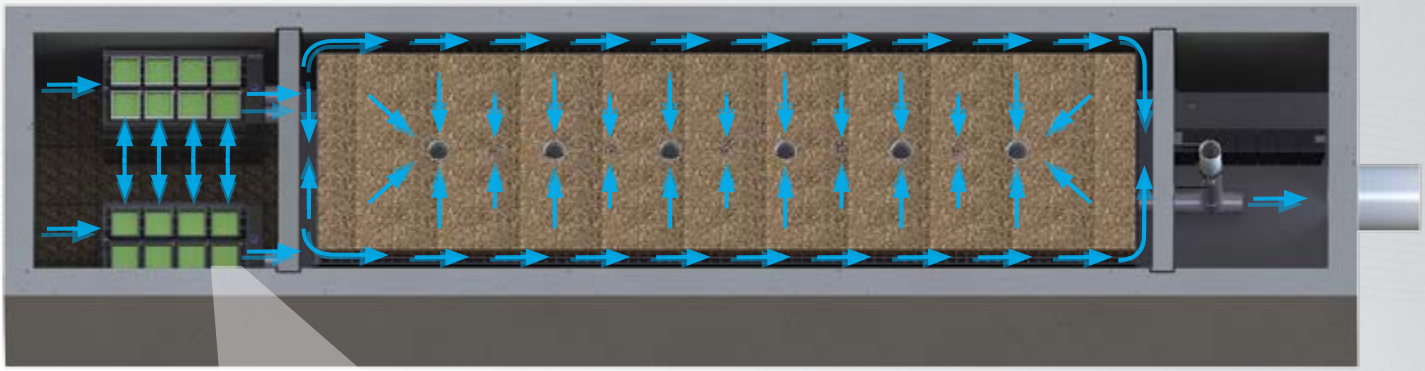


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

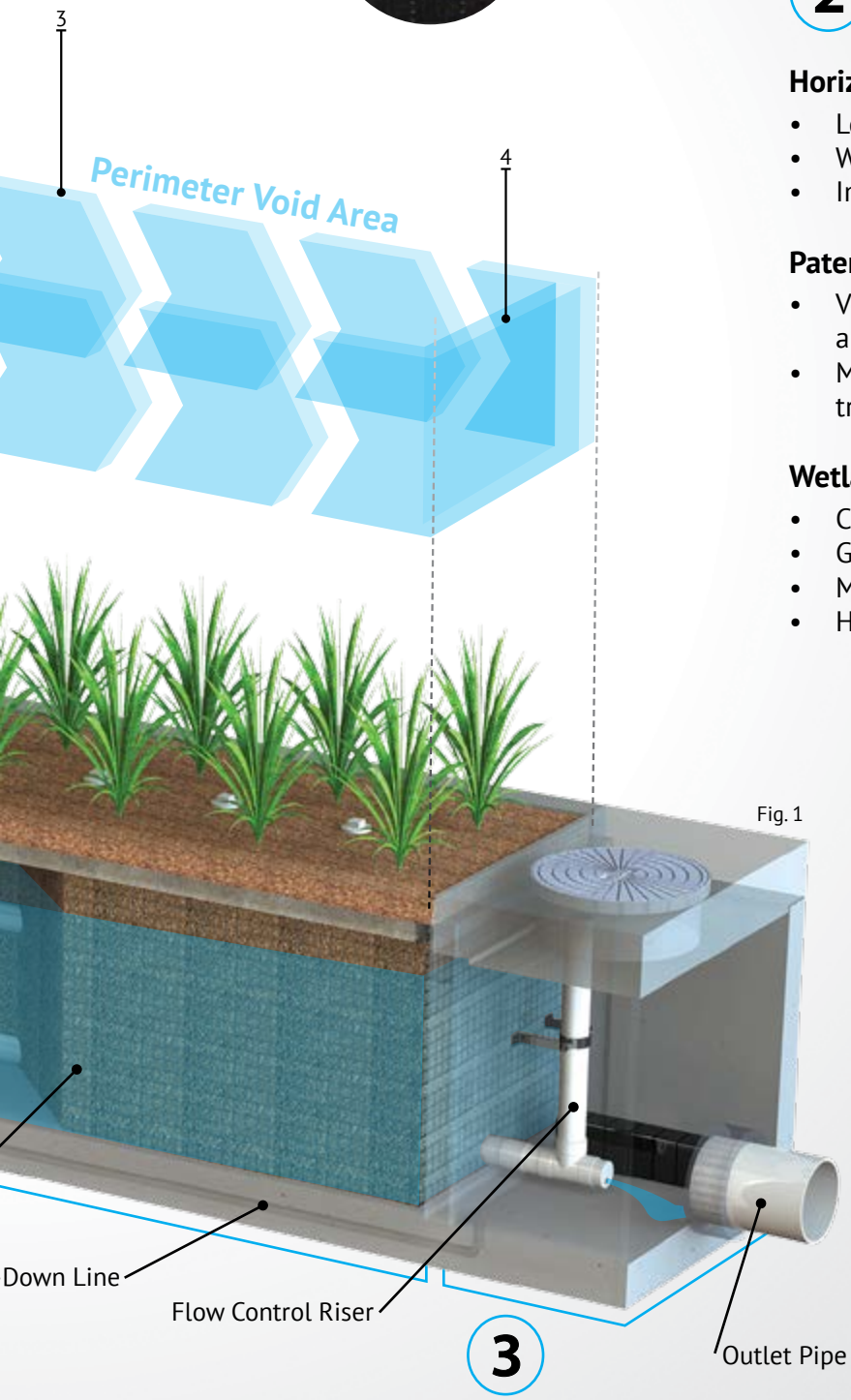


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

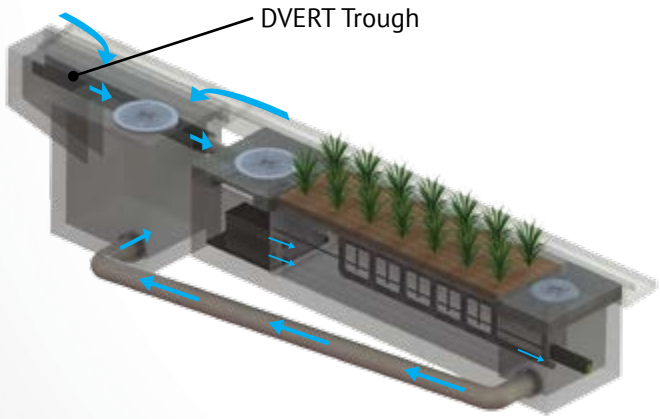
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

Maryland Department Of The Environment Approved

Granted ESD (Environmental Site Design) status for new construction, redevelopment and retrofitting when designed in accordance with the Design Manual.

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus, and 30% Total Nitrogen.

Flow Based Sizing

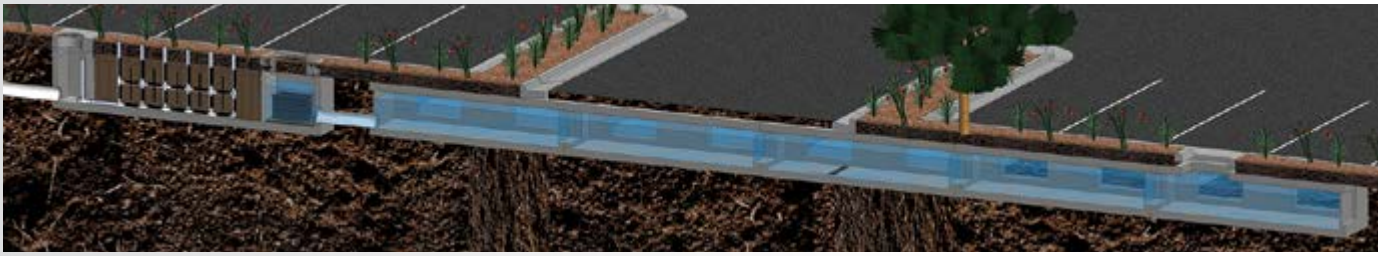
The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072 ← PBF-1 & PBF-2
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit **www.ModularWetlands.com/Plants** for more information and various plant lists.

TECHNICAL REPORT

MODULAR WETLAND SYSTEM LINEAR STORMWATER TREATMENT SYSTEM OVERVIEW

Prepared for
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Office of Water Resources
RI Department of Environmental Management

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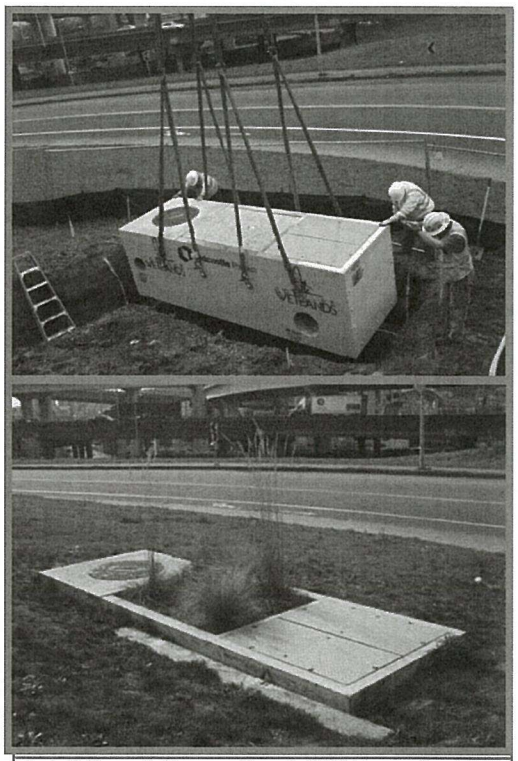
*PROVIDED AS REFERENCE FOR MWS INFILTRATION RATE

EXECUTIVE SUMMARY



Installation of the monitored MWS-Linear for TAPE testing in Portland, Oregon.

Modular Wetland System - Linear filtration system (MWS-Linear) is a water quality treatment system consisting of a pre-treatment chamber, a media cartridge pre-filter, a wetland biofiltration chamber, and an outlet control device. The system is housed in a precast concrete vault and can be designed in numerous configurations including piped, curb or grated inlet structures.

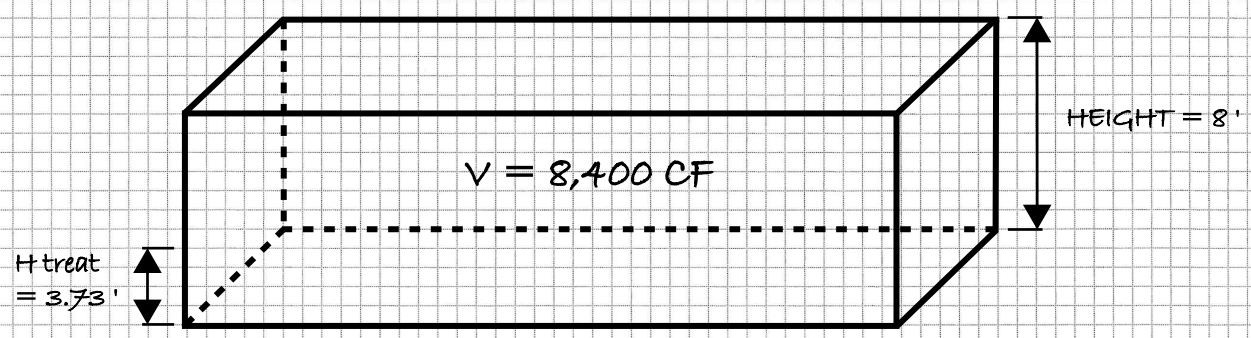
Since 2007, the MWS-Linear has been used throughout the United States and Australia to address stringent stormwater regulations. During this time various third party independent hydrologic and water quality monitoring studies have been performed on the MWS-Linear. In 2010, a system was approved and installed in Portland, Oregon to test under the Washington State TAPE protocol. An approved consultant was hired to conduct this monitoring to obtain performance data to support the issuance of a General Use Level Designation (GULD) for the MWS-Linear by the Washington Department of Ecology (Ecology). Monitoring was performed in accordance with procedures described in *Guidance for Evaluating Emerging Stormwater Treatment Technologies; Technology Assessment Protocol - Ecology (TAPE)* (Ecology 2011).

TAPE field testing was completed in May of 2013. The MWS-Linear met the treatment benchmarks for TSS, phosphorus and dissolved metals. It's the first system to achieve these benchmarks for all three. The system was tested over a two year period. The system was able to meet these benchmarks at loading rates up to 121 inches an hour or 1.21 gallons per minute per square foot surface area. Mean values for TSS removal were 85% The d50 for the TSS was between 8 and 30 microns. Mean values for total phosphorus removal were 64%. Other removal efficiencies from the TAPE testing and other third party independent field tests are discussed in more detail in Appendix A & B. The performance data shows that the MWS-Linear meets the required removal efficiencies set forth in Minimum Standard 3: Water Quality of the Rhode Island Stormwater Design and Installation Standards Manual (December 2010). The manual states the BMP was be able to remove 85% TSS, 60% of pathogens, 30% of total phosphorus, and 30% of total nitrogen.

*PROVIDED AS REFERENCE FOR MWS INFILTRATION RATE

UD-1 VOLUME SIZING CALC

- MODULE SIZE (INTERNAL DIM): 8' H X 7' W X 15' L
- NUMBER OF MODULES: 10
- TOTAL VOLUME (V) = 10 (8' x 7' x 15') = 8,400 CF



- VOLUME PER 1 FT:

$$\frac{8{,}400\ CF = 8\ FT}{V1FT = 1\ FT}$$

$$V1FT = 1{,}050\ CF$$

- TREATMENT VOLUME: DCV * 1.5 = 2,605 CF * 1.5 = 3907.5 CF
- HEIGHT OF TREATMENT VOLUME:

$$\frac{1{,}050\ CF = 1\ FT}{3{,}907.5\ CF = H\ treat}$$

$$\boxed{H\ treat = 3.73'}$$

Vault Drawdown Calculation - UD1

Project Name	**Cubesmart Self Storage**	
Project Number	**13003.85**	
Vault Drawdown	**49.37**	**hrs**

Total Vault Volume (cf)	8400
Total Chamber Height (ft)	8

Note: Drawdown time is calculated assuming initial water surface depth equal to the invert of the lowest surface discharge opening in the basin outlet structure.

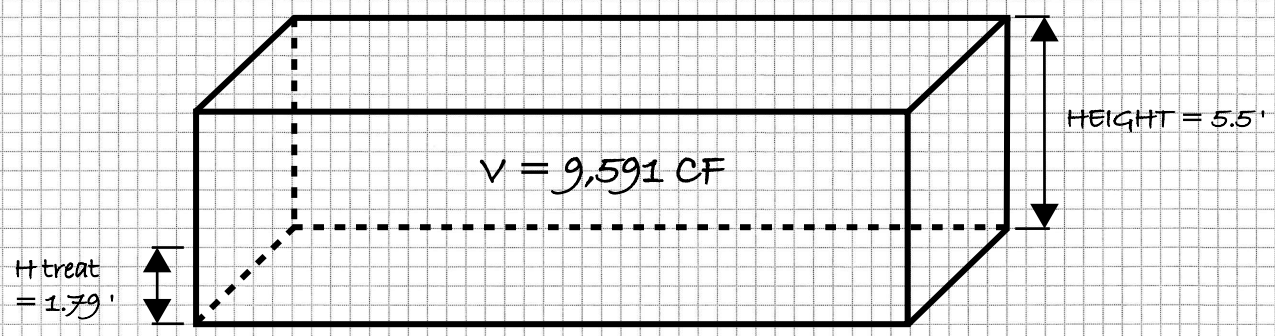
Qorifice=CoAo*[(2gHo)^0.5]

Orifice Diameter:		**1.13**
C:		**0.6**

Surface Depth (ft)	Area (sq. ft)	Volume (cf)	Qorifice (cfs)	T (hrs)	Total Time (hrs)
3.73	1050	3916.5	0.06	0.00	0.00
3.5	1050	3675	0.06	1.08	1.08
3.25	1050	3413	0.06	1.22	2.30
3	1050	3150	0.06	1.27	3.56
2.5	1050	2625	0.05	2.77	6.34
2	1050	2100	0.05	3.10	9.44
1.5	1050	1575	0.04	3.58	13.02
1	1050	1050	0.03	4.39	17.41
0.75	1050	788	0.03	2.53	19.94
0.5	1050	525	0.02	3.10	23.05
0.25	1050	263	0.02	4.39	27.43
0.0	1050	0	0.00	21.94	49.37

UD-2 VOLUME SIZING CALC

- MODULE SIZE (INTERNAL DIM): 5.5' H X 13.67' W X 127.54' L
- TOTAL VOLUME: 9,591 CF



- VOLUME PER 1 FT:

$$\frac{9{,}591 \text{ CF} = 5.5 \text{ FT}}{\text{V1FT} = 1 \text{ FT}}$$

$$\text{V1FT} = 1{,}743.8 \text{ CF}$$

- TREATMENT VOLUME: DCV * 1.5 = 2,074 CF * 1.5 = 3,111 CF
- HEIGHT OF TREATMENT VOLUME:

$$\frac{1{,}743.8 \text{ CF} = 1 \text{ FT}}{3{,}111 \text{ CF} = \text{H treat}}$$

$$\boxed{\text{H treat} = 1.79'}$$

Vault Drawdown Calculation - UD2

Project Name	**Cubesmart Self Storage**	
Project Number	**13003.85**	
Vault Drawdown	**49.25**	**hrs**

Total Vault Volume (cf)	9591
Total Chamber Height (ft)	5.5

Note: Drawdown time is calculated assuming initial water surface depth equal to the invert of the lowest surface discharge opening in the basin outlet structure.

Qorifice=CoAo*[(2gHo)^0.5]

Orifice Diameter:		**1.10**
C:		**0.6**

Surface Depth (ft)	Area (sq. ft)	Volume (cf)	Qorifice (cfs)	T (hrs)	Total Time (hrs)
1.79	1743.8	3121.4	0.04	0.00	0.00
1.75	1743.8	3051.7	0.04	0.46	0.46
1.5	1743.8	2615.7	0.04	3.11	3.57
1.25	1743.8	2179.8	0.04	3.41	6.98
1	1743.8	1743.8	0.03	3.81	10.79
0.75	1743.8	1307.9	0.03	4.40	15.19
0.5	1743.8	871.9	0.02	5.39	20.58
0.4	1743.8	697.5	0.02	2.41	22.99
0.3	1743.8	523.1	0.02	2.78	25.78
0.2	1743.8	348.8	0.01	3.41	29.18
0.1	1743.8	174.4	0.01	4.82	34.00
0.0	1743.8	0.0	0.00	15.24	49.25

Project: CUBESMART SELF STORAGE 13003.85 - UD2

StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	MC-3500	
Units -	**Imperial**	Click Here for Metric
Number of Chambers -	51	
Number of End Caps -	6	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in
Amount of Stone Between Chambers -	6	in
Area of system -	2806	sf Min. Area - 2626 sf min. area

☑ Include Perimeter Stone in Calculations

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Single End Cap *(cubic feet)*	Incremental Chambers *(cubic feet)*	Incremental End Cap *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch, EC and Stone *(cubic feet)*	Cumulative System (cubic feet)	Elevation (feet)
66	0.00	0.00	0.00	0.00	93.53	93.53	9590.96	5.50
65	0.00	0.00	0.00	0.00	93.53	93.53	9497.44	5.42
64	0.00	0.00	0.00	0.00	93.53	93.53	9403.91	5.33
63	0.00	0.00	0.00	0.00	93.53	93.53	9310.38	5.25
62	0.00	0.00	0.00	0.00	93.53	93.53	9216.86	5.17
61	0.00	0.00	0.00	0.00	93.53	93.53	9123.33	5.08
60	0.00	0.00	0.00	0.00	93.53	93.53	9029.81	5.00
59	0.00	0.00	0.00	0.00	93.53	93.53	8936.28	4.92
58	0.00	0.00	0.00	0.00	93.53	93.53	8842.75	4.83
57	0.00	0.00	0.00	0.00	93.53	93.53	8749.23	4.75
56	0.00	0.00	0.00	0.00	93.53	93.53	8655.70	4.67
55	0.00	0.00	0.00	0.00	93.53	93.53	8562.17	4.58
54	0.06	0.00	2.96	0.00	92.34	95.30	8468.65	4.50
53	0.19	0.02	9.90	0.14	89.51	99.55	8373.34	4.42
52	0.29	0.04	14.99	0.23	87.44	102.66	8273.79	4.33
51	0.40	0.05	20.59	0.31	85.17	106.06	8171.13	4.25
50	0.69	0.07	35.05	0.41	79.35	114.80	8065.07	4.17
49	1.03	0.09	52.44	0.53	72.34	125.31	7950.27	4.08
48	1.25	0.11	63.73	0.64	67.78	132.15	7824.96	4.00
47	1.42	0.13	72.53	0.76	64.21	137.50	7692.82	3.92
46	1.57	0.14	80.23	0.87	61.09	142.18	7555.32	3.83
45	1.71	0.16	87.06	0.98	58.31	146.35	7413.13	3.75
44	1.83	0.18	93.25	1.09	55.79	150.13	7266.78	3.67
43	1.94	0.20	98.83	1.20	53.51	153.54	7116.65	3.58
42	2.04	0.22	104.08	1.31	51.37	156.76	6963.10	3.50
41	2.13	0.23	108.87	1.41	49.41	159.69	6806.34	3.42
40	2.22	0.25	113.44	1.50	47.55	162.49	6646.65	3.33
39	2.31	0.27	117.65	1.59	45.83	165.07	6484.16	3.25
38	2.38	0.28	121.62	1.68	44.21	167.51	6319.09	3.17
37	2.46	0.29	125.41	1.76	42.66	169.83	6151.58	3.08
36	2.53	0.31	128.94	1.85	41.21	172.00	5981.75	3.00
35	2.59	0.32	132.28	1.93	39.84	174.05	5809.75	2.92
34	2.66	0.33	135.46	2.01	38.54	176.01	5635.70	2.83
33	2.72	0.35	138.47	2.08	37.31	177.86	5459.69	2.75
32	2.77	0.36	141.34	2.16	36.13	179.62	5281.84	2.67
31	2.82	0.37	144.06	2.23	35.01	181.30	5102.21	2.58
30	2.88	0.38	146.65	2.31	33.94	182.90	4920.91	2.50
29	2.92	0.40	149.13	2.38	32.92	184.43	4738.01	2.42
28	2.97	0.41	151.46	2.45	31.96	185.87	4553.58	2.33
27	3.01	0.42	153.63	2.51	31.07	187.21	4367.71	2.25
26	3.05	0.43	155.72	2.58	30.21	188.50	4180.50	2.17
25	3.09	0.44	157.81	2.64	29.35	189.80	3991.99	2.08
24	3.13	0.45	159.66	2.70	28.58	190.94	3802.20	2.00
23	3.17	0.46	161.45	2.77	27.84	192.05	3611.25	1.92
22	3.20	0.47	163.17	2.82	27.13	193.12	3419.20	1.83
21	3.23	0.48	164.79	2.88	26.46	194.13	3226.07	1.75
20	3.26	0.49	166.33	2.94	25.82	195.09	3031.95	1.67
19	3.29	0.50	167.80	2.99	25.21	196.00	2836.86	1.58
18	3.32	0.51	169.22	3.04	24.62	196.88	2640.86	1.50
17	3.34	0.51	170.55	3.09	24.07	197.71	2443.98	1.42
16	3.37	0.52	171.80	3.13	23.55	198.49	2246.27	1.33
15	3.39	0.53	173.02	3.18	23.05	199.24	2047.78	1.25
14	3.41	0.54	174.14	3.22	22.58	199.94	1848.54	1.17
13	3.44	0.54	175.29	3.26	22.11	200.65	1648.60	1.08
12	3.46	0.55	176.34	3.30	21.67	201.31	1447.94	1.00
11	3.48	0.56	177.41	3.33	21.23	201.97	1246.63	0.92
10	3.51	0.59	178.76	3.57	20.59	202.92	1044.66	0.83
9	0.00	0.00	0.00	0.00	93.53	93.53	841.74	0.75
8	0.00	0.00	0.00	0.00	93.53	93.53	748.21	0.67
7	0.00	0.00	0.00	0.00	93.53	93.53	654.68	0.58
6	0.00	0.00	0.00	0.00	93.53	93.53	561.16	0.50
5	0.00	0.00	0.00	0.00	93.53	93.53	467.63	0.42
4	0.00	0.00	0.00	0.00	93.53	93.53	374.11	0.33
3	0.00	0.00	0.00	0.00	93.53	93.53	280.58	0.25
2	0.00	0.00	0.00	0.00	93.53	93.53	187.05	0.17
1	0.00	0.00	0.00	0.00	93.53	93.53	93.53	0.08

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

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

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 2a	Hydromodification Management Exhibit (Required)	☐ Included ■ **N/A – WILL BE PROVIDED AT FINAL ENGINEERING** See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	■ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐ Not performed ■ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary (Required) See Chapter 6 and Appendix G of the BMP Design Manual	☐ Included ☐ Submitted as separate stand-alone document ■ **N/A – WILL BE PROVIDED AT FINAL ENGINEERING**
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ■ Not required because BMPs will drain in less than 96 hours

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

N/A – WILL BE PROVIDED AT FINAL ENGINEERING

The Hydromodification Management Exhibit must identify:

- ☐ Underlying hydrologic soil group
- ☐ Approximate depth to groundwater
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☐ Critical coarse sediment yield areas to be protected
- ☐ Existing topography
- ☐ Existing and proposed site drainage network and connections to drainage offsite
- ☐ Proposed grading
- ☐ Proposed impervious features
- ☐ Proposed design features and surface treatments used to minimize imperviousness
- ☐ Point(s) of Compliance (POC) for Hydromodification Management
- ☐ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
- ☐ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

Attachment 2a

Hydromodification Management Exhibit

N/A WILL BE PROVIDED AT FINAL ENGINEERING

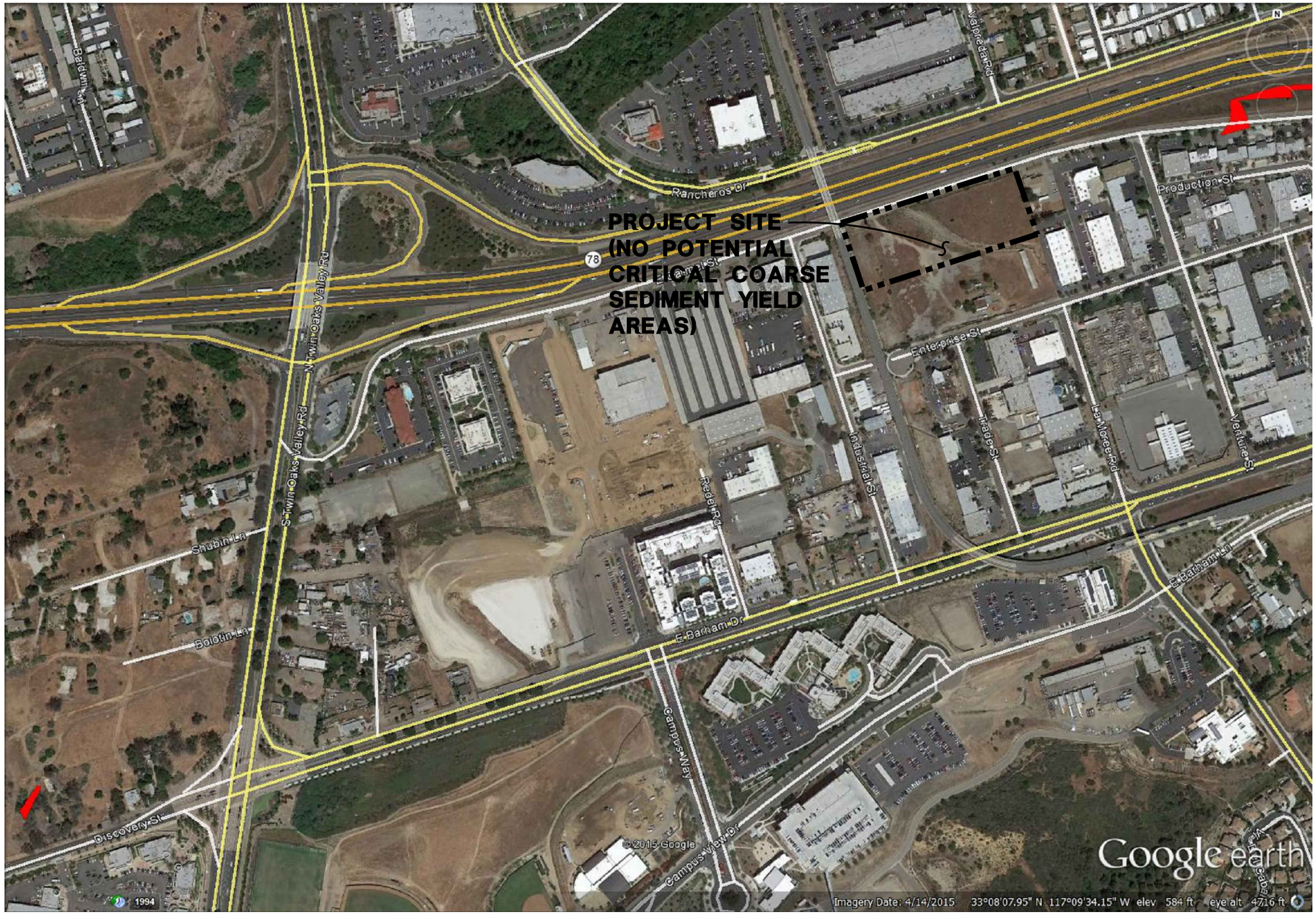
Attachment 2b

Management of Critical Coarse Sediment Yield Areas

LEGEND

PROJECT BOUNDARY

POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS (SEE NOTE BELOW)



NTS

THE GOOGLE EARTH OVERLAY SHOWN IDENTIFIES POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS, AS DETERMINED IN THE SAN DIEGO COUNTY REGIONAL WMAA (SOURCE: PROJECTCLEANWATER.ORG)

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

NC - CARMEL ENTERPRISE - HOUSING
SAN MARCOS, CALIFORNIA

ATTACHMENT 2b
POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS MAP

DATE: 01/13/25

SCE NO. 13003.85

SHEET **2b**

Attachment 2c

Geomorphic Assessment of Receiving Channels

HYDROMODIFICATION SCREENING

FOR

NC – ENTERPRISE AFFORDABLE HOUSING

September 14, 2024

Will sign and stamp upon approval

Wayne W. Chang, MS, PE 46548

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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Rancho Santa Fe, CA 92067
(858) 692-0760

FOR REVIEW ONLY

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APPENDICES

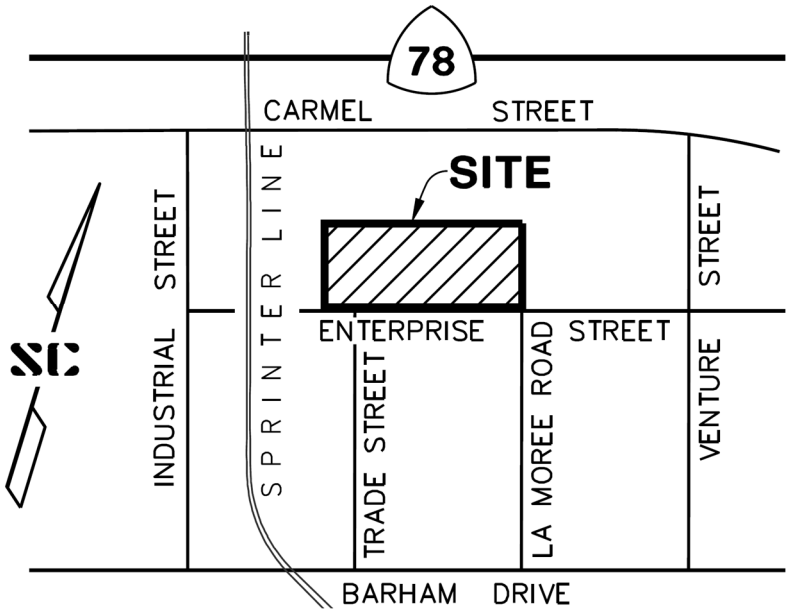
A. SCCWRP Initial Desktop Analysis

B. SCCWRP Field Screening Data

FOR REVIEW ONLY

INTRODUCTION

The County of San Diego's March 2011, *Final Hydromodification Management Plan;* January 8, 2011, *Standard Urban Stormwater Mitigation Plan* (SUSMP); and City of San Marcos' February 2016, *BMP Design Manual,* outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility,* developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress results from the County of San Diego's Critical Flow Calculator spreadsheet to establish the appropriate erosion susceptibility threshold of low, medium, or high.



Vicinity Map

This report provides a hydromodification screening analysis for the proposed NC - Enterprise Affordable Housing redevelopment project located along the north side of Enterprise Street east of the North County Transit District's Sprinter light rail line in the city of San Marcos (see the Vicinity Map). The project is being designed by Stevens Cresto Engineers. Under existing conditions, the project area has been rough graded and contains sediment basins per GP21-00004. Off-site runoff enters the southeasterly portion of the site from a 6-foot by 3.5-foot box culvert. Off-site runoff is also directed westerly towards the site from an earthen ditch along the

south side of East Carmel Street. The sediment basin flows and off-site runoff enter a 6-foot by 5-foot reinforced concrete box culvert near the northwest corner of the site that continues north across State Route 78. The box culvert becomes an 84-inch reinforced concrete pipe (RCP) that outlets into San Marcos Creek along the Sprinter rail line (see the Study Area Exhibit in Appendix A). San Marcos Creek is a natural watercourse at the outlet. San Marcos Creek flows over 6 miles west to Batiquitos Lagoon.

The project proposes a multi-family affordable residential building and right-of-way improvements. The project runoff will be primarily collected and conveyed by a private drainage system. The project runoff will enter proposed biofiltration BMPs, underground detention, and tree wells. The off-site runoff will be conveyed through the site. The treated project runoff and bypassed off-site runoff will enter the 6-foot by 5-foot box culvert and then 84-inch RCP similar to existing conditions. The runoff will then continue to be directed to San Marcos Creek.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for the project's point of compliance, which is at the discharge point from the 84-inch RCP into San Marcos Creek (see Figure 6 and the Study Area Exhibit).

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

DOMAIN OF ANALYSIS

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

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

The upstream limit is defined as:

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

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

Downstream Domain of Analysis

The downstream domain of analysis for the study area has been determined by assessing and comparing the four bullet items above. As discussed above, the project's storm runoff be conveyed in hardened, non-erodible drainage facilities to San Marcos Creek near the Sprinter rail line. The discharge point into San Marcos Creek is the point of compliance (POC) for hydromodification purposes (see the Study Area Exhibit included in Appendix A). The POC is the point below which a drainage course is natural and susceptible to erosion. The downstream domain of analysis location is selected below this POC.

Per the first bullet item, the first permanent grade control below the POC was identified during a site visit. The first grade control occurs where San Marcos Creek contains a large concrete transition structure approximately 1,200 feet downstream of the POC (see Figure 12 and the Study Area Exhibit). The concrete transition structure lines the creek bed and banks and directs the creek flow into quintuple box culverts that continue under North Twin Oaks Valley Road. The concrete transition structure is a permanent facility that acts as a grade control for the upstream channel bed. i.e., it will prevent erosion of the upstream channel bed.

The second bullet item criteria is based on the lentic waterbody. The nearest lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody is Lake San Marcos. The Lake San Marcos lentic waterbody is further downstream from the POC than the permanent grade control, so the second bullet item will not govern over the first bullet item in establishing the downstream domain of analysis location.

The third bullet item is met when the natural watercourse below a POC confluences with a stream with an equal order or larger tributary area. San Marcos Creek does not confluence with another stream before the grade control, so the third bullet item will govern over the first in establishing the downstream domain of analysis location.

The fourth bullet item is met when the natural stream below a POC accumulates 50 or 100 percent drainage area for natural or urban drainage systems, respectively. San Marcos Creek at the POC is a natural drainage system, so 50 percent applies. The San Marcos Creek watershed area at the POC covers approximately 7 square miles (see the Streamstats discussion in the Initial Desktop Analysis section below). Fifty percent additional drainage area (approximately 3.5 square miles) will not be accumulated along San Marcos Creek between the POC and permanent grade control. Therefore, the fourth bullet item will not govern over the first bullet item.

Based on the above information, the downstream domain of analysis location is established by the permanent grade control criteria (bullet item 1) and occurs at the upstream edge of the concrete transition structure in San Marcos Creek.

Upstream Domain of Analysis
San Marcos Creek extends upstream of the POC, so the upstream domain of analysis location must be determined. The upstream domain of analysis location is established by the closer of 20 channel top widths or the first upstream grade control. The top of San Marcos Creek is approximately 250 feet wide at the POC, so 20 channel top widths is 5,000 feet. A site visit revealed riprap across the creek bed and banks under the Inland Rail Trail bridge approximately 1,500 feet upstream of the POC (see Figure 1). This is the first upstream grade control point and establishes the upstream domain of analysis location for the POC.

Study Reaches within Domain of Analysis
From the above information, the downstream domain of analysis location for the POC is based on the grade control criteria. Of the four bullet criteria, this is the first point reached below the POCs. The grade control criteria requires the downstream domain of analysis location to extend one reach (656 feet) below the first grade control. One reach below the first grade control (located at the upstream edge of the concrete transition structure) will be within the Twin Oaks Valley Road box culverts. Since the reach below the grade control is non-erodible, the downstream domain of analysis location is set at the grade control.

After the upstream and downstream domain of analysis locations are established for the POC, the study reach is identified (see the Study Area Exhibit). The entire domain of analysis extends along San Marcos Creek from the upstream domain of analysis location at the riprap under the Inland Rail Trail bridge to the downstream domain of analysis location at the upstream edge of the concrete transition structure. San Marcos Creek has two geometries along the entire domain of analysis. The upper portion is a relatively narrow trapezoidal channel, while the lower portion is a much wider trapezoidal channel. As a result, the domain of analysis was divided into an upper reach, Reach 1, which is 1,103 feet long and a lower reach, Reach 2, which is 1,637 feet long.

Review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and slope), vegetative, hydraulic, and soil conditions within each reach are relatively uniform. Subdividing Reach 1 and 2 into subreaches of less than 656 feet will not yield varying conclusions. Although the screening tool was applied across the entire length of the domain of analysis, the results will be identical for shorter subreaches within Reach 1 and 2.

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. NED is similar to USGS quadrangle mapping. The USGS Streamstats program was used to determine the watershed areas tributary to Reach 1 and 2 (see Appendix A). Streamstats is based on the USGS' Digital Elevation Model and a digital representation of the stream network that is equivalent to NED data. The watershed areas are 6.7390 and 7.0066 square miles, respectively.

The mean annual precipitation was obtained from the rain gages closest to the site. These are the Western Regional Climate Center's Escondido and Escondido 2 gages (see Appendix A). The average annual rainfall measured at the Escondido gage for the period of record from 1893 to 1979 is 16.22 inches. The average annual rainfall measured at the Escondido 2 gage for the period of record from 1979 to 2013 is 14.93 inches. The time-weighted average rainfall from these two gages is 15.85 inches.

Two-foot contour interval SANGIS topographic mapping was used for the valley slope and valley width. The SANGIS mapping is more detailed than NED mapping, so will yield more accurate results. The valley slopes of Reach 1 and 2 were determined from the SANGIS topographic mapping. 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 Reach 1 and 2 by their lengths.

Reach	Tributary Drainage Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	6.7390	0.00453	4.6
2	7.0066	0.00611	53.3

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

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

FIELD SCREENING

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

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

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 14. The first step is to assess the channel bed resistance. There are three categories defined as follows:

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

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

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

Based on the channel photographs in the figures and site investigation, the bed material and resistance (associated with moderate to dense vegetation) are generally within the transitional/intermediate bed category. Some bed areas contained smaller grain sizes typically found in a labile bed. However, Reach 1 and 2 do not meet the criteria of containing loosely-packed material. The material is moderately-packed with dense vegetation binding the soil, which is a characteristic of a transitional/intermediate bed.

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

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

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Screening 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 natural channel bed along Reach 1 and 2 are assigned to Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential due to a surface veneer such as vegetation. The soil in both reaches was probed and penetration was relatively difficult through the underlying layer.

Checklist 2 determines grade control characteristics of the channel bed. This is reliant on the spacing of the grade controls. The categories for Checklist 2 are related to a grade control spacing of $2/S_v$ and $4/S_v$, where S_v is the valley slope from Appendix A. The $2/S_v$ and $4/S_v$ results are in meters, so a factor is applied to convert to feet. A reach is in Category A if it has a maximum grade control spacing of less than $2/S_v$. A reach is in Category B if it has a maximum spacing between $2/S_v$ and $4/S_v$. Finally, a reach is in Category C if it has a maximum spacing greater than $4/S_v$. Table 2 summarizes the S_v, $2/S_v$, and $4/S_v$ values for Reach 1 and 2 along with the maximum grade control spacing within each study reach. The Reach 1 maximum grade control spacing is equal to the length of Reach 1 (1,103 feet) plus Reach 2 (1,637 feet). The Reach 2 maximum grade control spacing is the length of Reach 2 (1,637 feet). The associated category is also included in Table 2.

Reach	S_v, feet/feet	$2/S_v$, feet	$4/S_v$, feet	Max. Grade Control Spacing, feet	Category
1	0.00453	1,448	2,895	2,740	B
2	0.00611	1,074	2,148	1,637	B

Table 2. Checklist 2 Values based on Grade Control Spacing

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle

diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the screening index (INDEX) value determined in the initial desktop analysis (see Appendix A). The Form 1 results in Appendix A determined an INDEX of 0.0216 for Reach 1 and 0.0296 for Reach 2. SCCWRP specifies use of a US SAH-97 half-phi template gravelometer to determine d_{50} in a natural channel. This gravelometer allows a minimum d_{50} measurement of 2 millimeters. The Screening Index Threshold diagram shows that the probability of incising or braiding is less than 50 percent for a d_{50} of 2 millimeters if the INDEX value is 0.0220 or less. Since the Reach 1 Screening Index values is less than the 50 percent value, Reach 1 is within Category A.

For Reach 2, d_{50} had to be determined to assess the Screening Index Threshold since its INDEX value is greater than the smallest 50 percent risk value. d_{50} can be derived from a pebble count in which a minimum of 100 particles are obtained along transects at the site. SCCRWP states that if fines less than ½-inch thick are at a sample point, it is appropriate to sample the coarser buried substrate. A gravelometer along Reach 2 is included in Figure 13 for reference. The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The pebble count result for Reach 2 is included in Appendix B and show a d_{50} of 11 millimeters. The screening index for Reach 2 from Appendix A is 0.0296. Plotting the d_{50} and screening index values on the Mobility Index Threshold diagram shows that Reach 2 has a less than 50 percent probability of incising or braiding, so falls within Category A.

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

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

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

$$\begin{aligned}\text{Vertical Rating} &= [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2} \\ &= [(6 \times 6)^{1/2} \times 3]^{1/2} \\ &= 4.2 \text{ for Reach 1 and 2}\end{aligned}$$

Since the vertical rating is less than 4.5, Reach 1 and 2 have a low threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 15) 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 avulsions such as chute cutoffs 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 are 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 Reach 1 or 2 during a field investigation as evidenced by the figures.

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 in Reach 1 and 2. This determination was made because the ground surface was difficult to penetrate with a probe. In addition, the banks showed no evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the site investigation and SANGIS' 2-foot contour interval topographic mapping, the bank angles in Reach 1 and 2 average 1.5:1 (33.7 degrees) or flatter – most banks are 2:1. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 33.7 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For Reach 1 and 2 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 calculation in the spreadsheet in Appendix A shows that the VWI for Reach 1 (VWI=0.17) and 2 (VWI=1.91) are less than 2.

From the above steps, the lateral susceptibility rating is low for both reaches (red circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for the NC - Enterprise Affordable Housing redevelopment project being designed by Stevens Cresto Engineers. The project runoff will be treated and then collected and conveyed north in hardened, non-erodible drainage facilities (culvert and RCP) to San Marcos Creek. An assessment was performed for San Marcos Creek based on office analyses and field work. The results indicate a low threshold for vertical and lateral susceptibilities for Reach 1 and 2

The HMP requires that these results be compared with the critical stress calculator results outlined in the County of San Diego HMP. The critical stress results are included in Appendix B for the Reach 1 and 2 using the spreadsheet provided by the County. The channel dimensions were estimated from topographic mapping and Google Earth. Based on these values, the critical stress results returned a low threshold for Reach 1 and 2 consistent with the SCCWRP channel screening results. Therefore, the SCCWRP analyses and critical stress calculator demonstrate that a low overall threshold is applicable to the overall study reach (i.e., $0.5Q_2$).

Figure 1. Riprap under Inland Rail Trail – Upstream End of Reach 1

Figure 2. Looking Downstream at Reach 1 from Upper End

Figure 3. Looking Upstream at Middle of Reach 1

Figure 4. Looking Downstream at Middle of Reach 1

Figure 5. Looking Upstream at Lower End of Reach 1 / Upper End of Reach 2 from Sprinter Rail

Figure 6. Reach 2 at Sprinter Rail Crossing - 84" RCP Outlet (POC) at Bottom of Figure

Figure 7. Looking Downstream at Reach 2 from Sprinter Rail Crossing

Figure 8. Middle of Reach 2

Figure 9. Looking Upstream at Reach 2 from Rancheros Drive

Figure 10. Looking Downstream at Reach 2 from Rancheros Drive

Figure 11. Looking Upstream at Reach 2 from Lower End at Concrete Transition Structure

Figure 12. Concrete Transition Structure and Box Culverts below Reach 2

Figure 13. Gravelometer in Reach 2

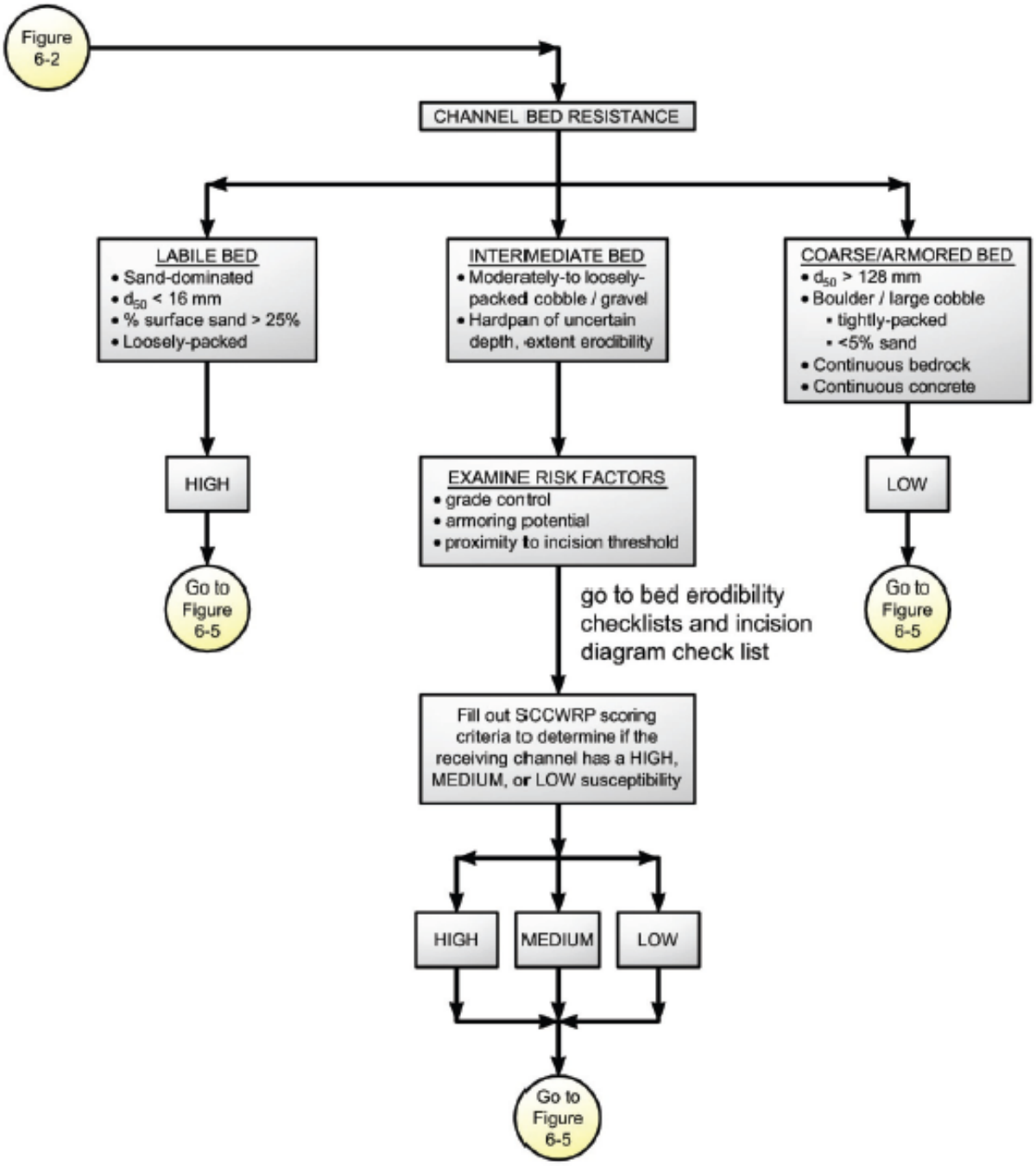


Figure 6-4. SCCWRP Vertical Susceptibility

Figure 14. SCCWRP Vertical Channel Susceptibility Matrix

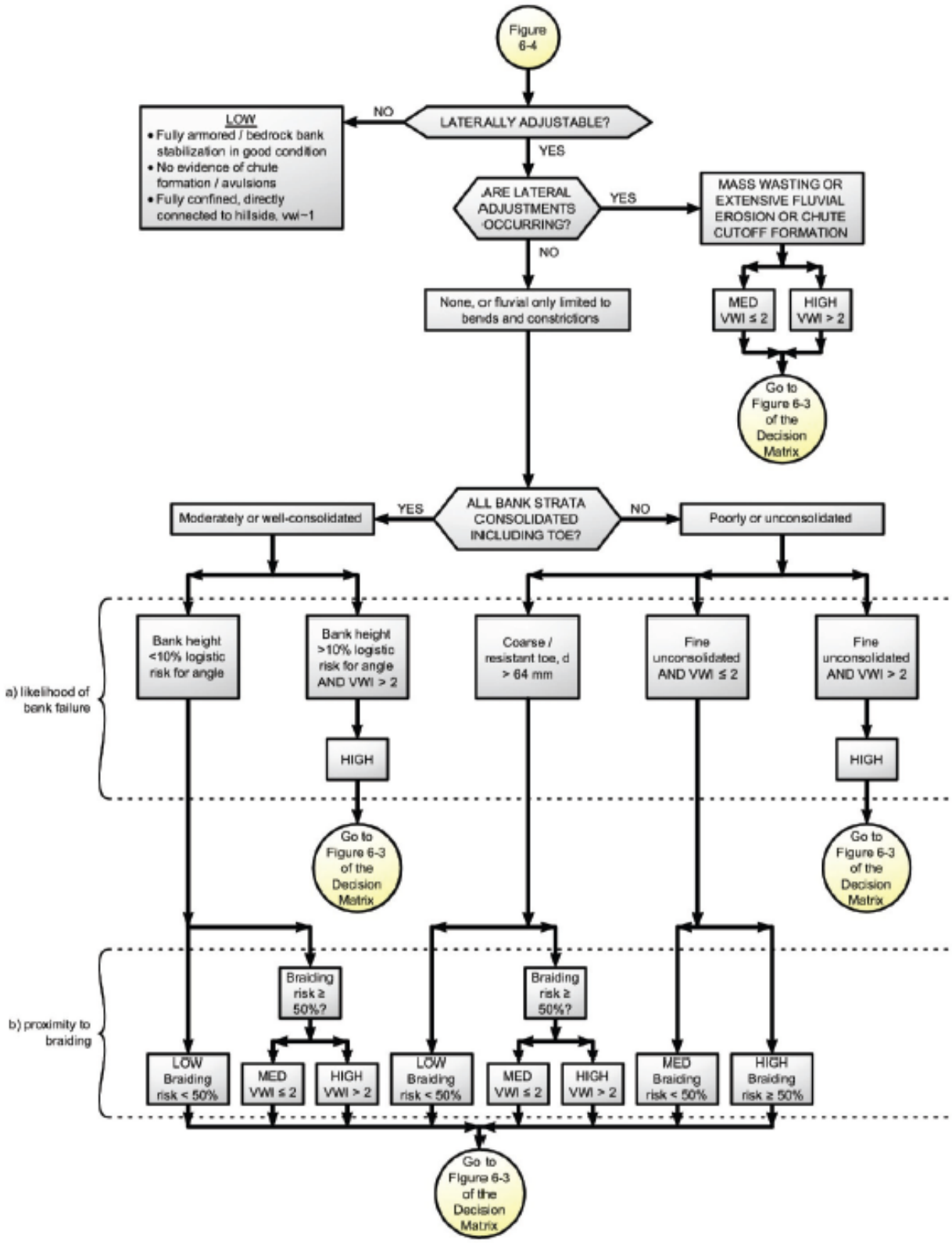


Figure 6-5. Lateral Channel Susceptibility

Figure 15. 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: 33.140727° Longitude: -117.158380°

Description (river name, crossing streets, etc.): San Marcos Creek from Inland Rail Trail to upstream of North Twin Oaks Valley Road.

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.

Note: Lat/Long obtained from Google Earth near middle of study reach.

Form 1 Table 1. Initial desktop analysis in GIS.

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

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

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

(Sheet 1 of 1)

SCCWRP FORM 1 ANALYSES

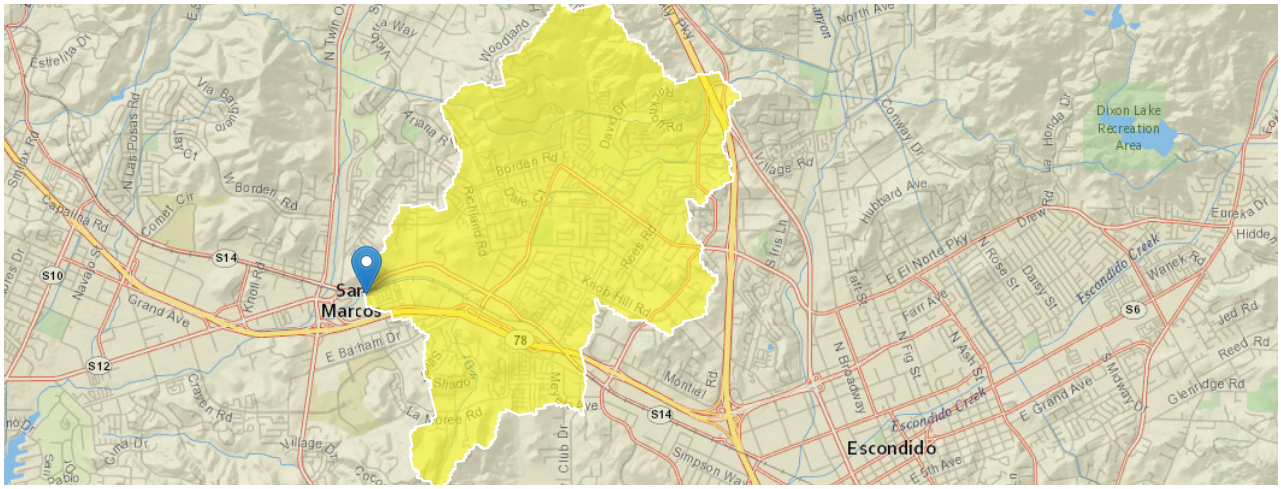
Reach	Area A, sq. mi.	Mean Annual Precip. P, inches	Valley Slope Sv, m/m	Valley Width Wv, m	10-Year Flow Q10cfs, cfs	10-Year Flow Q10, cms
1	6.7390	15.85	0.00453	4.6	804	22.7
2	7.0066	15.85	0.00611	53.3	831	23.5

Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
1	0.0216	27.5	0.17
2	0.0296	27.9	1.91

StreamStats Report

Reach 1

Region ID: CA
Workspace ID: CA20240915023902654000
Clicked Point (Latitude, Longitude): 33.14147, -117.15679
Time: 2024-09-14 19:39:24 -0700



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	6.7390	square miles

General Disclaimers

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

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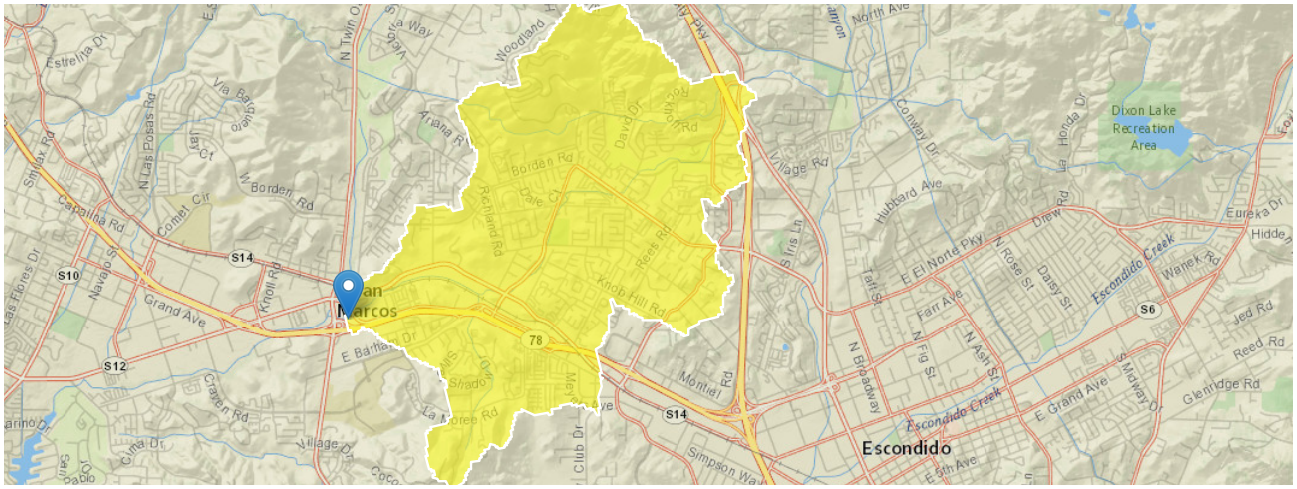
Application Version: 4.24.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

Reach 2

StreamStats Report

Region ID: CA
Workspace ID: CA20240915020704703000
Clicked Point (Latitude, Longitude): 33.13864, -117.16169
Time: 2024-09-14 19:07:27 -0700



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	7.0066	square miles

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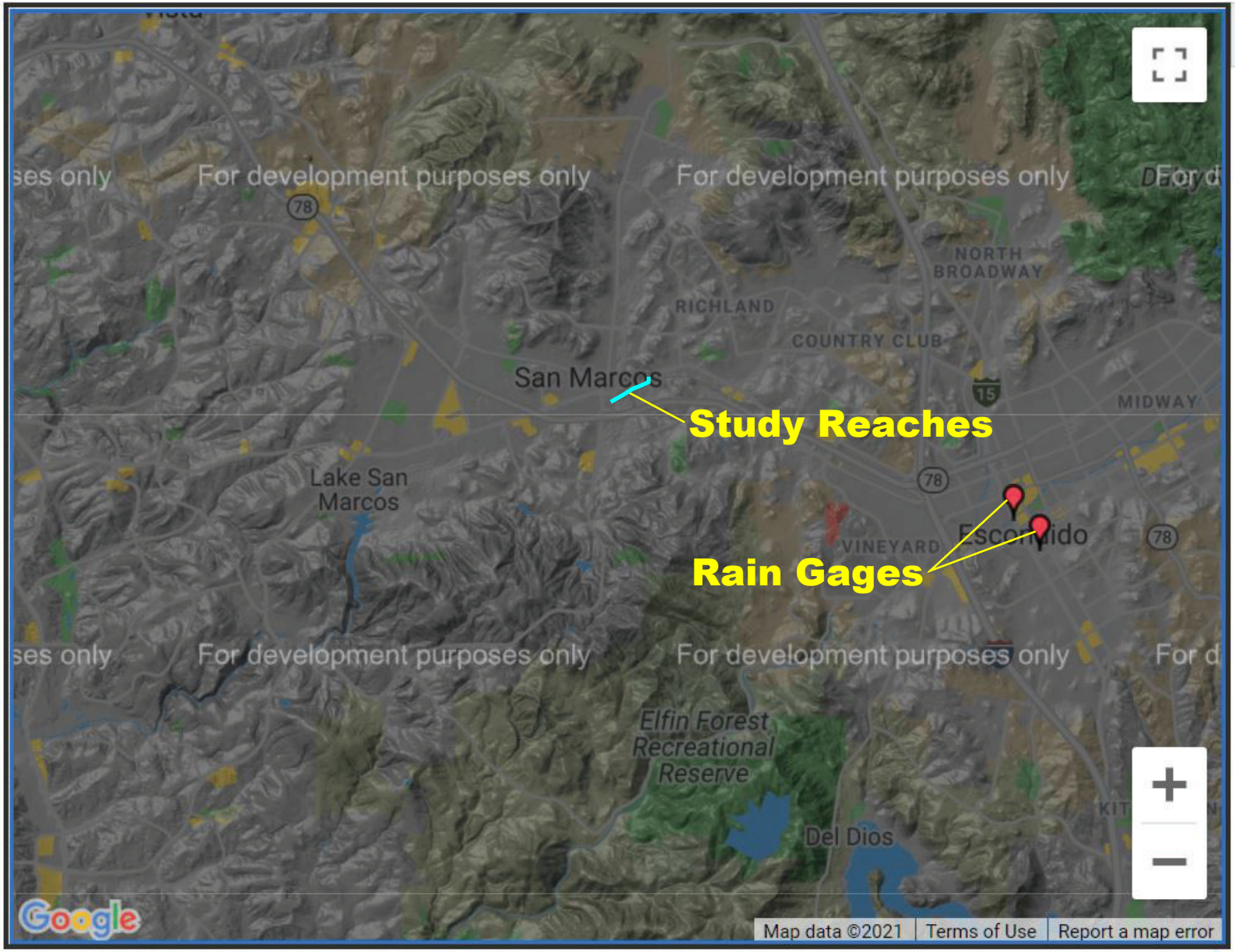
Application Version: 4.24.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

US COOP Station Map



Rain Gages

ESCONDIDO, CALIFORNIA (042862)

Period of Record Monthly Climate Summary

Period of Record : 12/01/1893 to 03/31/1979

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	64.9	66.3	68.8	72.2	76.1	82.0	88.2	88.2	85.7	79.0	72.9	66.5	75.9
Average Min. Temperature (F)	37.1	39.7	42.4	46.0	50.5	54.0	58.0	58.6	55.1	48.7	41.2	37.4	47.4
Average Total Precipitation (in.)	3.24	3.11	2.68	1.32	0.47	0.09	0.03	0.13	0.23	0.70	1.54	2.67	16.22
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)						No	Data						

Percent of possible observations for period of record.
Max. Temp.: 99.7% Min. Temp.: 99.7% Precipitation: 99.7% Snowfall: 63.6% Snow Depth: 63.5%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

ESCONDIDO 2, CALIFORNIA (042863)

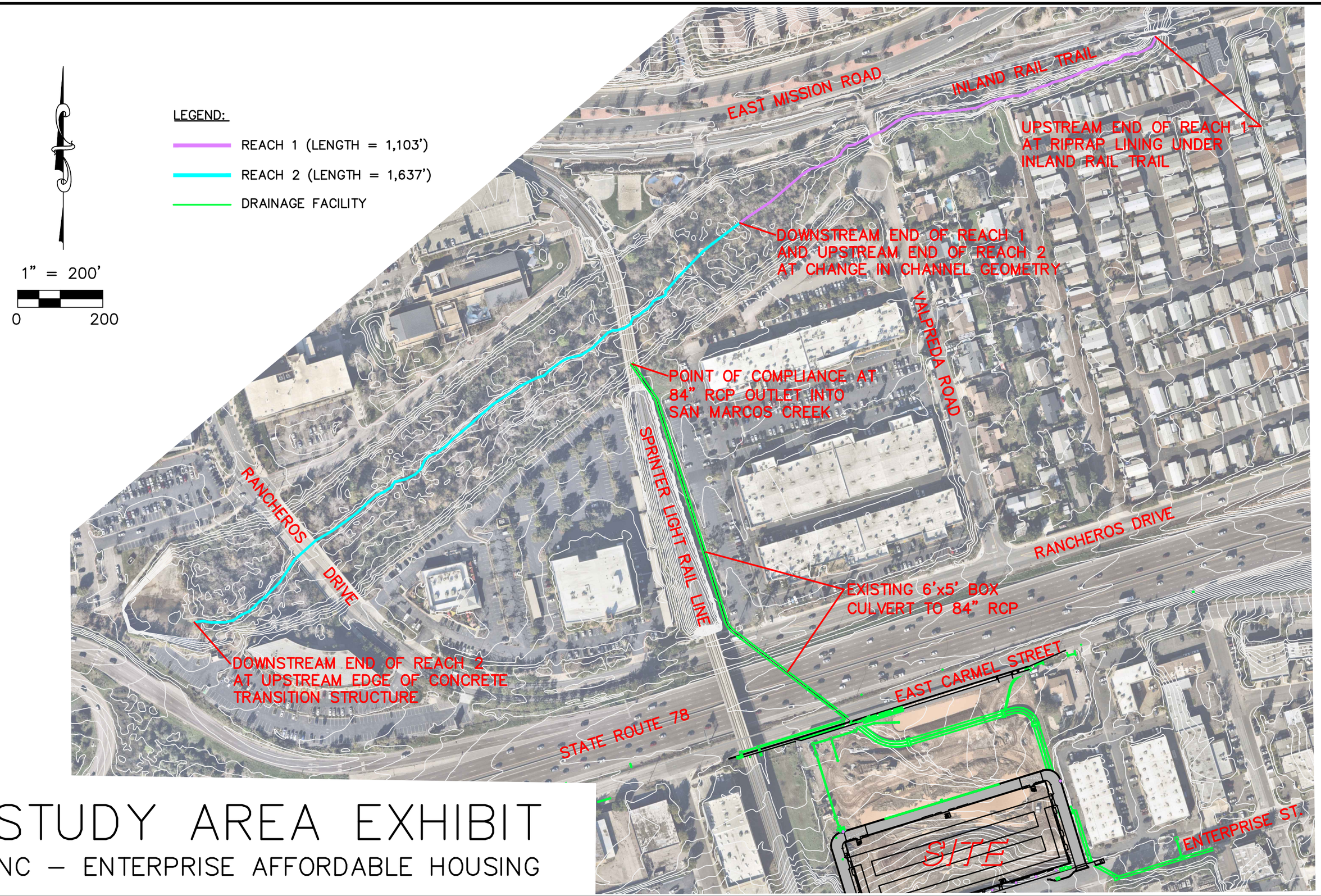
Period of Record Monthly Climate Summary

Period of Record : 5/ 1/1979 to 3/27/2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	69.0	69.0	70.3	74.5	76.6	82.0	87.2	88.6	86.6	79.9	73.3	68.9	77.2
Average Min. Temperature (F)	43.1	44.4	47.1	50.4	54.6	58.1	62.1	63.3	61.4	55.2	46.6	41.8	52.3
Average Total Precipitation (in.)	3.00	3.46	2.71	1.14	0.26	0.12	0.08	0.08	0.20	0.74	1.33	1.82	14.93
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 97.6% Min. Temp.: 97.1% Precipitation: 97.7% Snowfall: 98.1% Snow Depth: 98.1%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu



STUDY AREA EXHIBIT

NC – ENTERPRISE AFFORDABLE HOUSING

APPENDIX B

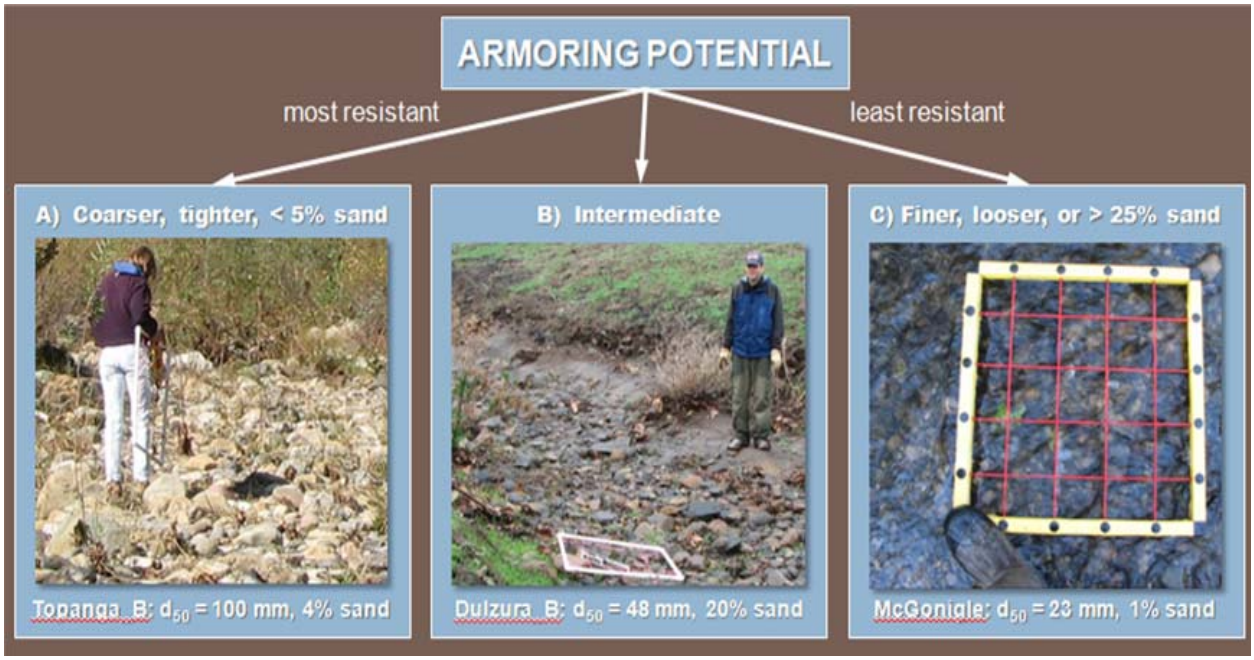
SCCWRP FIELD SCREENING DATA

Form 3 Support Materials

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

Form 3 Checklist 1: Armoring Potential

□	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
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



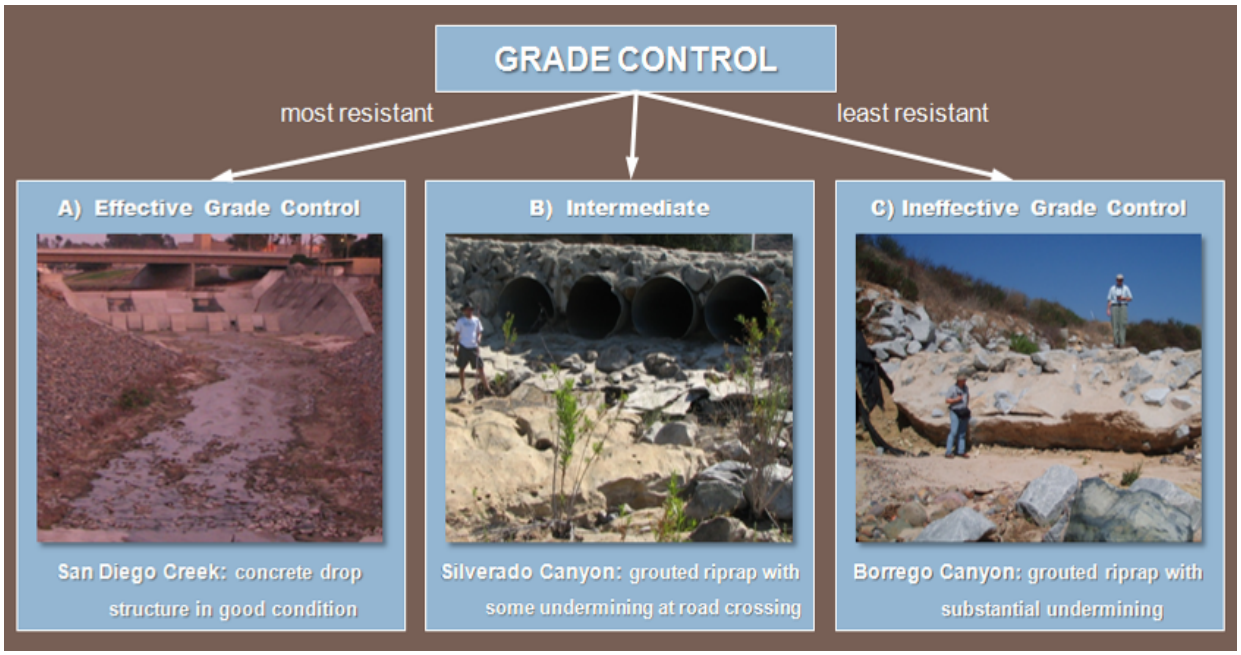
Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used i**n conjunction with Form 3 Checklist 1.**

(Sheet 2 of 4)

REACH 1 AND 2 RESULTS

Form 3 Checklist 2: Grade Control

□	A	Grade control is present with spacing <50 m or $2/S_v$ m • No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined • Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout • If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder
x	B	Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance
□	C	Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



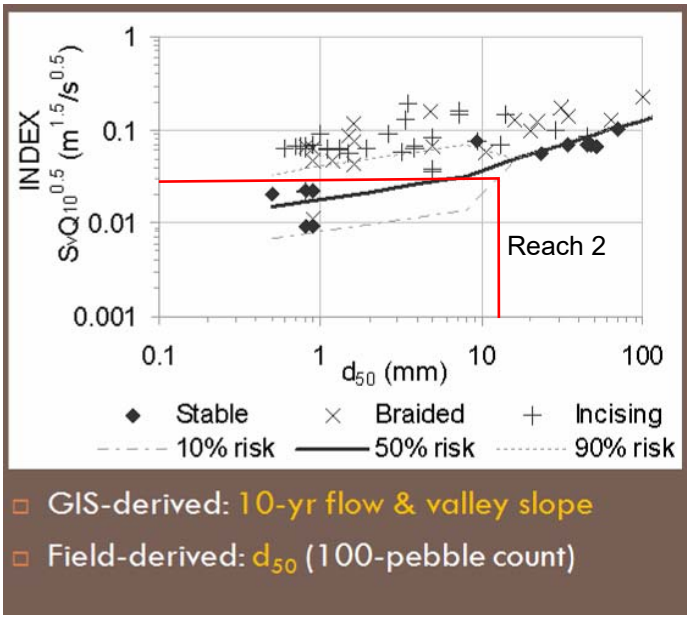
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

(Sheet 3 of 4)

REACH 1 AND 2 RESULTS

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.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
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

Reach 1 = 0.216

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 6 x 3 = 4.2

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

(Sheet 4 of 4)

REACH 1 AND 2 RESULTS

PEBBLE COUNT REACH 2

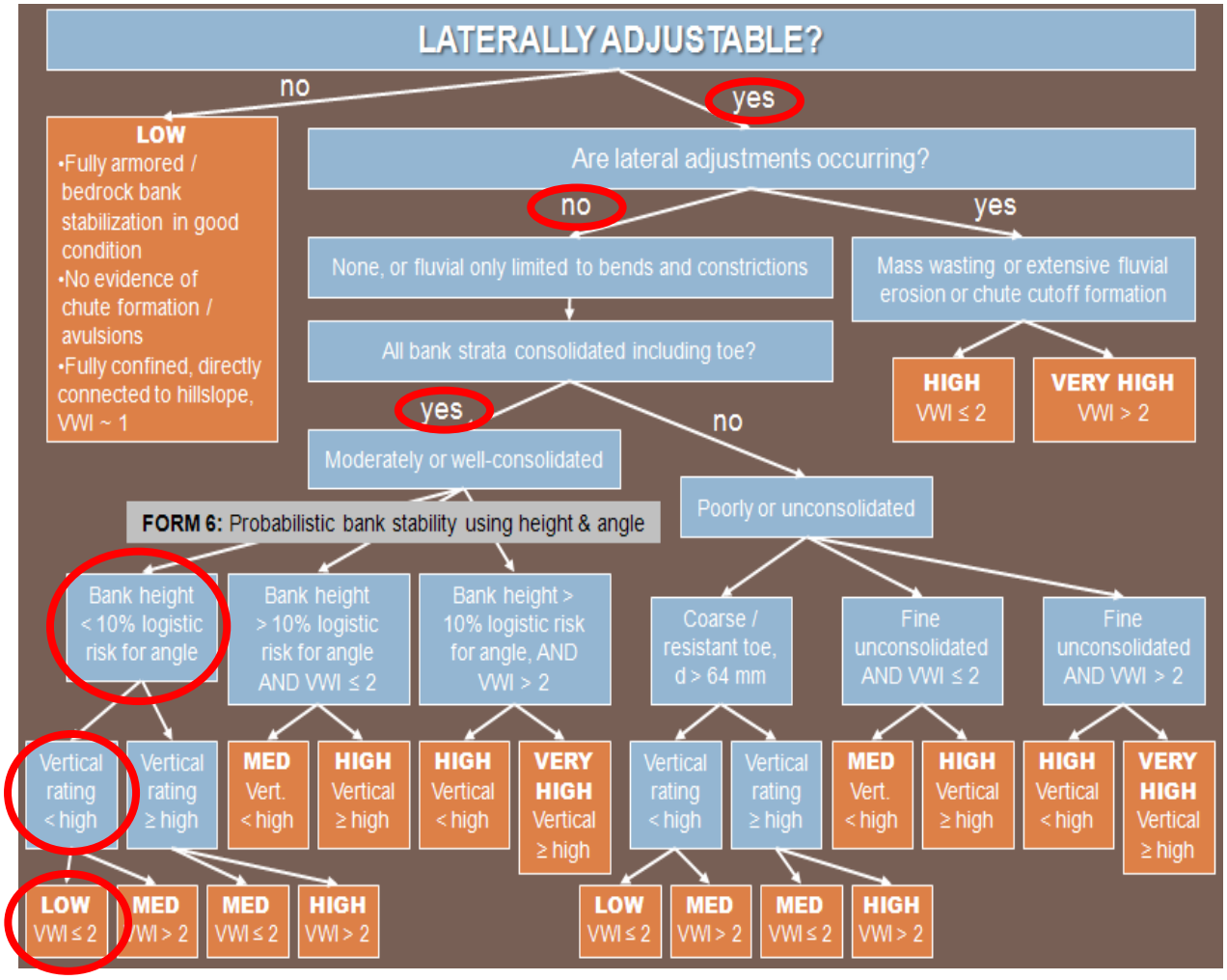
#	Reach 2 Diameter, mm
1	2
2	2
3	2
4	2
5	2
6	2
7	2
8	2
9	2
10	2.8
11	2.8
12	2.8
13	2.8
14	2.8
15	2.8
16	2.8
17	2.8
18	2.8
19	4
20	4
21	4
22	4
23	4
24	4
25	4
26	4
27	4
28	4
29	4
30	4
31	4
32	4
33	5.6
34	5.6
35	5.6
36	5.6
37	5.6
38	5.6
39	5.6
40	5.6
41	5.6
42	5.6
43	8
44	8

#	Reach 2 Diameter, mm	
45	8	
46	8	
47	8	
48	8	
49	11	
50	11	D50
51	11	
52	11	
53	11	
54	11	
55	11	
56	11	
57	11	
58	11	
59	11	
60	11	
61	11	
62	11	
63	16	
64	16	
65	16	
66	16	
67	16	
68	16	
69	16	
70	16	
71	16	
72	16	
73	16	
74	16	
75	16	
76	16	
77	16	
78	16	
79	16	
80	16	
81	16	
82	16	
83	16	
84	16	
85	22.6	
86	22.6	
87	22.6	
88	22.6	
89	22.6	
90	22.6	

#	Reach 2 Diameter, mm
91	22.6
92	22.6
93	22.6
94	22.6
95	32
96	32
97	32
98	32
99	32
100	32

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

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



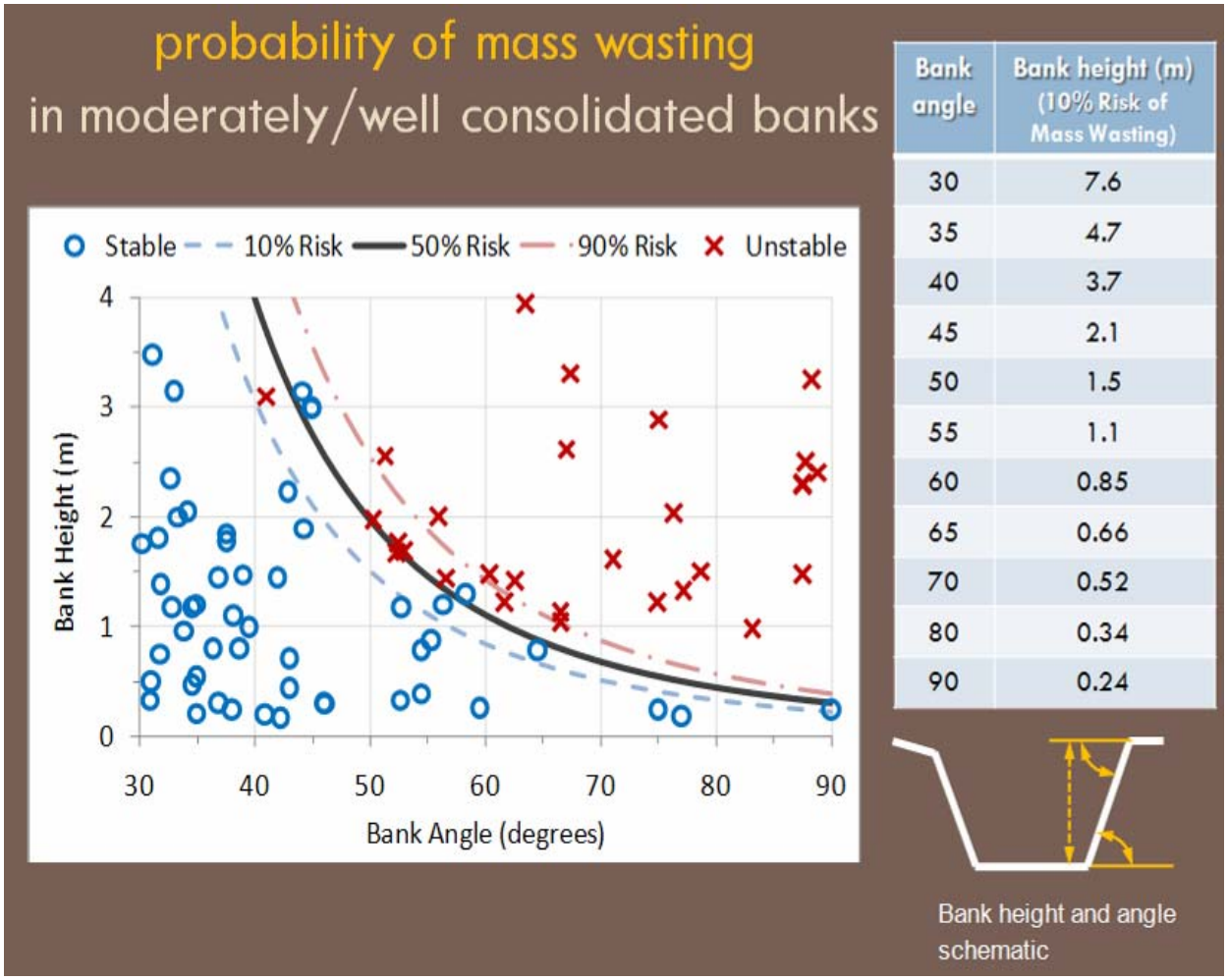
(Sheet 1 of 1)

REACH 1 AND 2 RESULTS

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

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

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	33.7 degrees (1.5:1)	---	---	<10%
Right Bank	33.7 degrees (1.5:1)	---	---	<10%



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

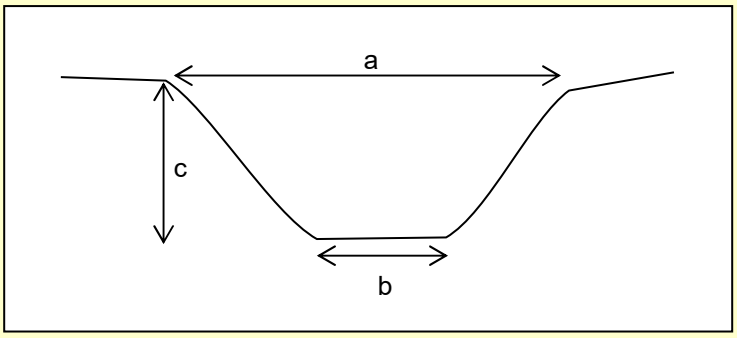
(Sheet 1 of 1)

REACH 1 AND 2 RESULTS

Critical Flow Calculator

Reach 1

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	50.0
b) Channel width at bed (ft)	15.0
c) Bank height at top of bank (ft)	10.0
Channel gradient (ft/ft)	0.00453
Receiving channel roughness	Very weedy, or dense timber and underbrush n= 0.10

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

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

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	15.85	Receiving water watershed area at PoC (sq mi)	6.7390
Project watershed annual precipitation (inches)	15.85	Project watershed area draining to PoC (sq mi)	6.7390

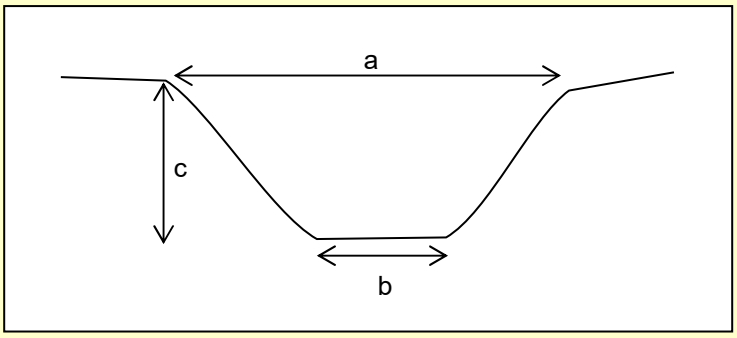
Outputs - Flow control range

Receiving water Q2	48.6	**Point of Compliance low flow rate (cfs)**	**24.3**
Project site Q2	48.6	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Critical Flow Calculator

Reach 2

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	250.0
b) Channel width at bed (ft)	175.0
c) Bank height at top of bank (ft)	10.0
Channel gradient (ft/ft)	0.00611
Receiving channel roughness	Very weedy, or dense timber and underbrush n= 0.10

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

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

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	15.85	Receiving water watershed area at PoC (sq mi)	7.0066
Project watershed annual precipitation (inches)	15.85	Project watershed area draining to PoC (sq mi)	7.0066

Outputs - Flow control range

Receiving water Q2	50.0	**Point of Compliance low flow rate (cfs)**	**25.0**
Project site Q2	50.0	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Attachment 2d

Flow Control Facility Design and Structural BMP Drawdown Calculations

N/A WILL BE PROVIDED AT FINAL ENGINEERING

ATTACHMENT 3
Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	■ Included
Attachment 3b	Draft Maintenance Agreement (when applicable)	☐ Included ■ N/A – WILL BE PROVIDED AT FINAL ENGINEERING

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 3a must identify:

■ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual

Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

□ **Final Design level submittal:**

Attachment 3a 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 specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
□ Recommended equipment to perform maintenance
□ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3b: For private entity operation and maintenance, Attachment 3b shall include a draft maintenance agreement in the local jurisdiction's standard format (PDP applicant to contact the [City Engineer] to obtain the current maintenance agreement forms).

ATTACHMENT 3A

TREATMENT CONTROL BMP
OPERATION & MAINTENANCE REQUIREMENTS

BMP DESIGNATION	PROPRIETARY BIOFILTRATION	DETENTION FACILITY
CITY BMP ID NO.	TBD (PBF-1, MWS-L-8-8)	TBD (UD-1)
BMP TYPE	PROPRIETARY BIOFILTRATION (TC-32)	UNDERGROUND DETENTION (MP-50)
MANUFACTURER	CONTECH	OLDCASTLE
MANUFACTURER'S TELEPHONE NUMBER	(760) 433-7640	(619) 240-8000
MODEL NUMBER	TBD	TBD
FINANCIALLY RESPONSIBLE PARTY	CARMEL ENTERPRISE, LLC	
MAINTENANCE ASSURANCE	MAINTENANCE AGREEMENT THAT RUNS WITH THE LAND	
MAINTENANCE INDICATOR	TRASH ACCUMULATION/ SEDIMENT ACCUMULATION IN INLET CHAMBER, DEAD VEGETATION, STANDING WATER, WEEDS.	ACCUMULATION OF SEDIMENT
MINIMUM MAINTENANCE FREQUENCY	TWICE A YEAR, WITH ONE OCCURRENCE PRIOR TO OCT. 1ST (START OF RAINY SEASON)	TWICE A YEAR, WITH ONE OCCURRENCE PRIOR TO OCT. 1ST (START OF RAINY SEASON), QUARTERLY FOR THE FIRST 12 MONTHS IN ADDITION TO EVENT BASED INSPECTIONS.
MAINTENANCE ACTIVITIES	REMOVE TRASH AND DEBRIS[1] FROM INLET CHAMBER, NORMAL LANDSCAPE MAINTENANCE (PRUNING, WEEDING, PLANT REPLACEMENT, ETC.) CONSULT MANUFACTURER IF STANDING WATER IS PRESENT FOR MORE THAN 48 HOURS AFTER A RAIN EVENT, REPLACE CARTRIDGE FILTER MEDIA ONCE A YEAR	INSPECT MODULES AND SYSTEM COMPONENTS, REMOVE TRASH/DEBRIS[1] FROM INLET STRUCTURES. CLEAN DRY SYSTEM WHEN SEDIMENT REACHES 10-15% OF STORAGE VOLUME. CLEAN WET SYSTEM WHEN SEDIMENT REACHES 30% OF STORAGE VOLUME.

1. ALL COLLECTED DEBRIS, TRASH, ORGANICS, AND SEDIMENTS SHALL BE TRANSPORTED AND DISPOSED OF AT AN APPROVED FACILITY FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATIONS.

CUBESMART SELF STORAGE

*NOTE: EXHIBITS ARE PRELIMINARY. FINAL EXHIBITS WILL BE PROVIDED AT FINAL ENGINEERING

ATTACHMENT 3A

TREATMENT CONTROL BMP
OPERATION & MAINTENANCE REQUIREMENTS

BMP DESIGNATION	PROPRIETARY BIOFILTRATION	DETENTION FACILITY
CITY BMP ID NO.	TBD (PBF-2, MWS-L-8-8)	TBD (UD-2)
BMP TYPE	PROPRIETARY BIOFILTRATION (TC-32)	UNDERGROUND DETENTION (MP-50)
MANUFACTURER	CONTECH	ADS STORMTECH
MANUFACTURER'S TELEPHONE NUMBER	(760) 433-7640	(866) 407-2222
MODEL NUMBER	TBD	MC-3500
FINANCIALLY RESPONSIBLE PARTY	CARMEL ENTERPRISE, LLC	
MAINTENANCE ASSURANCE	MAINTENANCE AGREEMENT THAT RUNS WITH THE LAND	
MAINTENANCE INDICATOR	TRASH ACCUMULATION/ SEDIMENT ACCUMULATION IN INLET CHAMBER, DEAD VEGETATION, STANDING WATER, WEEDS.	ACCUMULATION OF SEDIMENT
MINIMUM MAINTENANCE FREQUENCY	TWICE A YEAR, WITH ONE OCCURRENCE PRIOR TO OCT. 1ST (START OF RAINY SEASON)	TWICE A YEAR, WITH ONE OCCURRENCE PRIOR TO OCT. 1ST (START OF RAINY SEASON), QUARTERLY FOR THE FIRST 12 MONTHS IN ADDITION TO EVENT BASED INSPECTIONS.
MAINTENANCE ACTIVITIES	REMOVE TRASH AND DEBRIS[1] FROM INLET CHAMBER, NORMAL LANDSCAPE MAINTENANCE (PRUNING, WEEDING, PLANT REPLACEMENT, ETC.) CONSULT MANUFACTURER IF STANDING WATER IS PRESENT FOR MORE THAN 48 HOURS AFTER A RAIN EVENT, REPLACE CARTRIDGE FILTER MEDIA ONCE A YEAR	INSPECT MODULES AND SYSTEM COMPONENTS, REMOVE TRASH/DEBRIS[1] FROM INLET STRUCTURES. CLEAN DRY SYSTEM WHEN SEDIMENT REACHES 10-15% OF STORAGE VOLUME. CLEAN WET SYSTEM WHEN SEDIMENT REACHES 30% OF STORAGE VOLUME.

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CUBESMART SELF STORAGE

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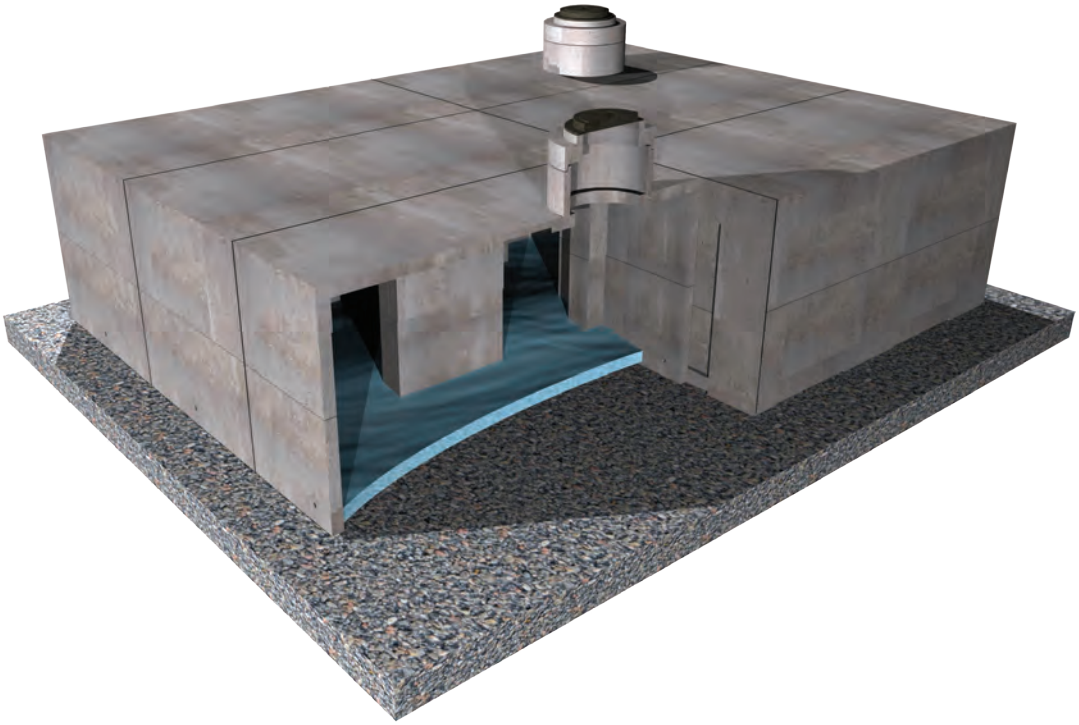
Oldcastle Infrastructure™
A CRH COMPANY

STORMCAPTURE®

Inspection and Maintenance Guide



Water

Description

The StormCapture® system is an underground, modular, structural precast concrete storage system for stormwater detention, retention, infiltration, harvesting and reuse, and water quality volume storage. The system's modular design utilizes multiple standard precast concrete units with inside dimensions of 7 feet by 15 feet (outside dimensions of 8 feet by 16 feet) to form an underground storage system. The inside height of the StormCapture system can range from 2 feet to 14 feet. This modular design provides limitless configuration options for site-specific layouts.

StormCapture components can be provided as either open-bottom modules to promote infiltration or closed-bottom modules for detention. In some cases, StormCapture modules can be placed in a checkerboard configuration for an even more efficient design. A Link Slab, with a footprint of 9 feet by 17 feet, is then used to bridge each space without a module.

The standard StormCapture design incorporates lateral and longitudinal passageways between modules to accommodate internal stormwater conveyance throughout the system. These passageways may be classified as either a "window configuration" with standard 12-inch tall sediment baffles extending up from the floor of the module to the bottom of the window, or a "doorway configuration" without the sediment baffles. The function and drainage rate of a StormCapture system depends on site-specific conditions and requirements.

Stormwater typically enters the StormCapture system through an inlet pipe. Grated inlets can also be used for direct discharge into the system. The StormCapture system is rated for H-20 traffic loading with limited cover. Higher load requirements can also be accommodated. In addition, StormCapture systems are typically equipped with a limited number of maintenance modules that provide access to the system for ongoing inspection and maintenance.

Function

The StormCapture system is primarily used to manage water quantity by temporarily storing stormwater runoff from impervious surfaces to prevent flooding, slow down the rate at which stormwater leaves the site, and reduce receiving stream erosion. In addition, the StormCapture system can be used to capture stormwater runoff for water quality treatment. Regardless of how the StormCapture system is used, some sedimentation may occur in the modules during the time water is stored.

Configurations

The configuration of the StormCapture systems may vary, depending on the water quality and/or quantity requirements of the site. StormCapture configurations for detention, retention/infiltration, and retention/harvesting are described below.

Detention

StormCapture Detention systems are designed with a closed bottom to detain stormwater runoff for controlled discharge from the site. This design may incorporate a dead storage sump and a permanent pool of water if the outlet pipe is higher than the floor elevation. Discharge from the system is typically controlled by an outlet orifice and/or outlet weir to regulate the rate of stormwater leaving the system. StormCapture Detention systems are typically designed with silt-tight joints, however when conditions exist that require a StormCapture system to be watertight, the system may be wrapped in a continuous, impermeable geomembrane liner. If the StormCapture Detention system includes Link Slabs, a liner must be used to detain water since the chambers under each Link Slab have no floor slab. In this case, care must be taken by maintenance personnel not to damage the exposed liner beneath each Link Slab.

Retention/Infiltration

StormCapture Retention/Infiltration systems are designed with an open bottom to allow for the retention of stormwater onsite through infiltration into the base rock and surrounding soils. For infiltration systems, the configuration of the base of the StormCapture system may vary, depending on the needs of the site and the height of the system. Some systems may use modules that have fully open bottoms with no concrete floor, while other systems may use modules that incorporate floor openings in the base of each module. These are typically 24-inch by 24-inch openings. For open-bottom systems, concrete splash pads may be installed below inlet grate openings and pipe inlets to prevent erosion of base rock. A StormCapture Infiltration system may have an elevated discharge pipe for peak overflow.

Retention/Harvesting

StormCapture Retention/Harvesting systems are similar to detention systems using closed-bottom modules, but stormwater is typically retained onsite for an extended period of time and later reused for non-potable applications or irrigation. For rainwater harvesting systems, an impermeable geomembrane liner is typically installed around the modules to provide a water-tight system.

Inspection and Maintenance Overview

State and local regulations typically require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Inspections should be used to evaluate the conditions of the system. Based on these inspections, maintenance needs can be determined. Maintenance needs vary by site and system. Using this Inspection & Maintenance Guide, qualified maintenance personnel should be able to provide a recommendation for maintenance needs. Requirements may range from minor activities such as removing trash, debris or pipe blockages to more substantial activities such as vacuuming and removal of sediment and/or non-draining water. Long-term maintenance is important to the operation of the system since it prevents excessive pollutant buildup that may limit system performance by reducing the operating capacity and increasing the potential for scouring of pollutants during periods of high flow.

Only authorized personnel shall inspect and/or enter a StormCapture system. Personnel must be properly trained and equipped before entering any underground or confined space structure. Training includes familiarity with and adherence to any and all local, state and federal regulations governing confined space access and the operation, inspection, and maintenance of underground structures.

Inspection and Maintenance Frequency

The StormCapture system should be inspected on a regular basis, typically twice per year, and maintained as required. The maintenance frequency will be driven by the amount of runoff and pollutant loading encountered by a given system. Local jurisdictions may also dictate inspection and maintenance frequencies.

Inspection Equipment

The following equipment is helpful when conducting StormCapture inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Measuring stick or sludge sampler
- Long-handled net (optional)

Inspection Procedures

A typical StormCapture system provides strategically placed access points that may be used for inspection. StormCapture inspections are usually conducted visually from the ground surface, without entering the unit. This typically limits inspection to the assessment of sediment depth, water drain down, and general condition of the modules and components, but a more detailed assessment of structural condition may be conducted during a maintenance event.

To complete an inspection, safety measures including traffic control should be deployed before the access covers are removed. Once the covers have been removed, the following items should be inspected and recorded (see form provided at the end of this document) to determine whether maintenance is required:

- Observe inlet and outlet pipe penetrations for blockage or obstruction.
- If possible, observe internal components like baffles, flow control weirs or orifices, and steps or ladders to determine whether they are broken, missing, or possibly obstructed.
- Observe, quantify, and record the sediment depths within the modules.
- Retrieve as much floating trash as possible with a long-handled net. If a significant amount of trash remains, make a note in the Inspection & Maintenance Log.
- For infiltration systems, local regulations may require monitoring of the system to ensure drain down is occurring within the required permit time period (typically 24 to 72 hours). If this is the case, refer to local regulations for proper inspection procedure.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during the inspection:

- Inlet or outlet piping is blocked or obstructed.
- Internal components are broken, missing, or obstructed.
- Accumulation of more than six inches of sediment on the system floor or in the sump, if applicable.
- Significant accumulation of floating trash and debris that cannot be retrieved with a net.
- The system has not drained completely after it hasn't rained for one to three days, or the drain down does not meet permit requirements.
- Any hazardous material is observed or reported.

Maintenance Equipment

The following equipment is helpful when conducting StormCapture maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- Vacuum truck

Maintenance Procedures

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is usually required to maintain the StormCapture. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Once safety measures such as traffic control have been deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove trash and debris using an extension on the end of the boom hose of the vacuum truck. Continue using the vacuum truck to completely remove accumulated sediment. Some jetting may be necessary to fully evacuate sediment from the system floor or sump. Jetting is acceptable in systems with solid concrete floors or base slabs (referred to as closed-bottom systems). However, jetting is not recommended for open-bottom systems with a gravel foundation since it may cause bedding displacement, undermining of the foundation, or internal disturbance.
- All material removed from the system during maintenance must be disposed of in accordance with local regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.
- Inspect inlet and outlet pipe penetrations for cracking and other signs of movement that may cause leakage.
- Inspect the concrete splash pads (applicable for open-bottom systems only) for proper function and placement.
- Inspect the system for movement of modules. There should be less than 3/4-inch spacing between modules.
- Inspect the general interior condition of modules for concrete cracking or deterioration. If the system consists of horizontal joints as part of the modules, inspect those joints for leakage, displacement or deterioration.

Be sure to securely replace all access covers, as appropriate, following inspection and/or maintenance. If the StormCapture modules or any of the system components show significant signs of cracking, spalling, or deterioration or if there is evidence of excessive differential settlement between modules, contact Oldcastle Infrastructure at **800-579-8819.**

StormCapture
Inspection & Maintenance Log

Refer to as-built records for details about system size and location onsite

Location _____

System Configuration: Inspection Date _____

☐ Detention ☐ Infiltration ☐ Retention/Harvesting

Inlet or Outlet Blockage or Obstruction **Notes:**

☐ Yes ☐ No

Condition of Internal Components **Notes:**

☐ Good ☐ Damaged ☐ Missing

Sediment Depth Observed **Notes:**

☐ Inches of Sediment: _____

Trash and Debris Accumulation **Notes:**

☐ Significant ☐ Not Significant

Drain Down Observations **Notes:**

☐ Appropriate Time Frame ☐ Inappropriate Time Frame

Maintenance Requirements

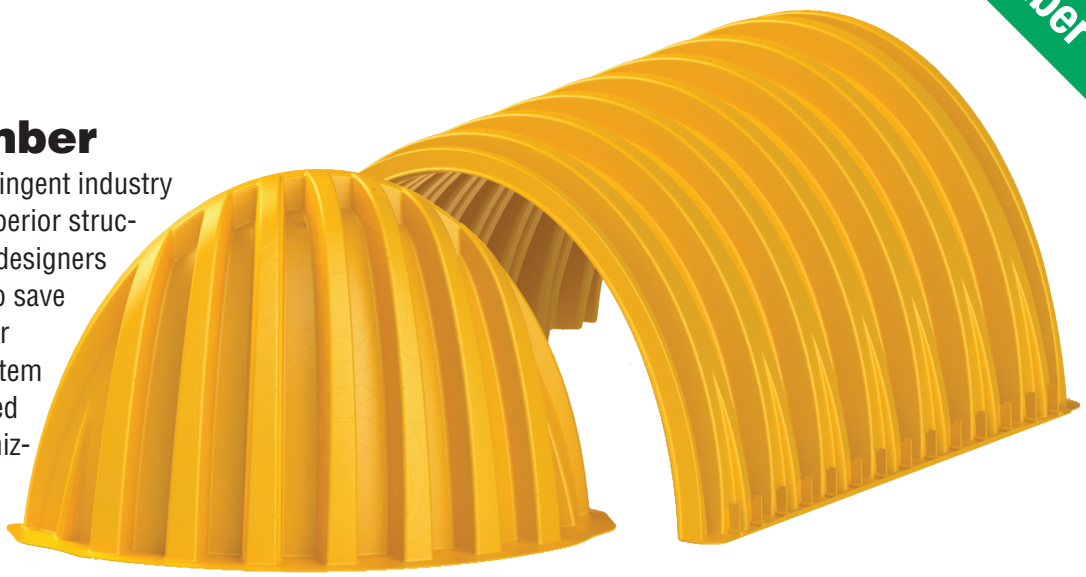
☐ **Yes - Schedule Maintenance** ☐ **No - Inspect Again in _____ Months**

StormTech®
Detention • Retention • Water Quality

MC-3500 Chamber

StormTech MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	178.9 ft³ (5.06 m³)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (305 mm) of stone above, 9" (229 mm) of stone below chambers, 9" (229 mm) of row spacing, and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	25.7" (653 mm) x 75" (1905 mm) x 45" (1143 mm)
End Cap Storage	14.9 ft³ (0.42 m³)
Min. Installed Storage*	46.0 ft³ (1.30 m³)
Weight	49 lbs (22.2 kg)

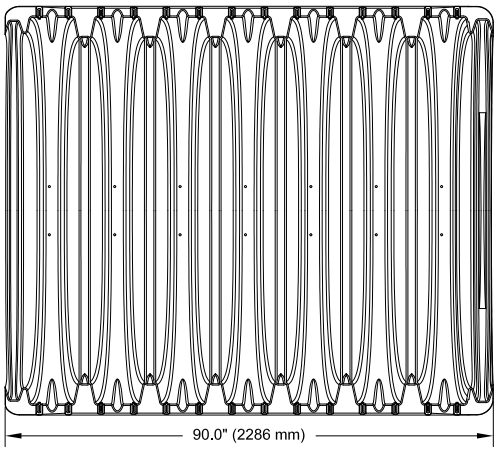
* This assumes a minimum of 12" (305mm) of stone above, 9" (229 mm) of stone below, 9" (229 mm) row spacing, 6" (152 mm) of stone perimeter, and 40% stone porosity.

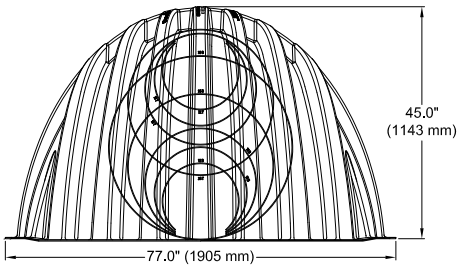
Shipping

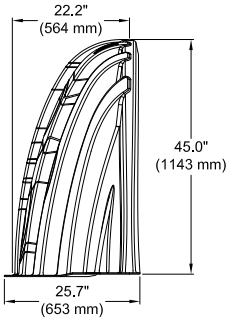
15 chambers/pallet

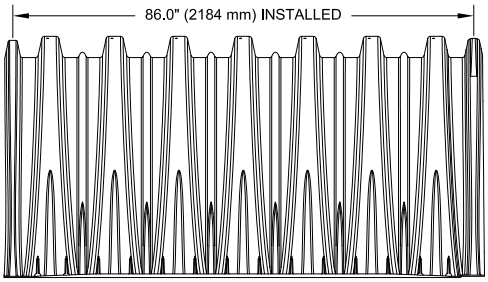
7 end caps/pallet

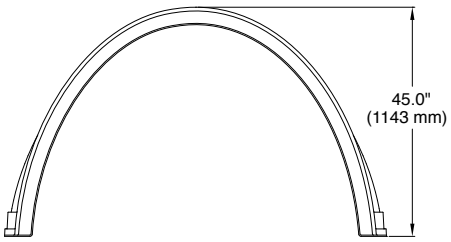
7 pallets/truck











Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
	ft³ (m³)	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (0.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

NOTE: Assumes 40% porosity for the stone plus the chamber/end cap volume. End Cap volume assumes 6" (152mm) stone perimeter.

Volume of Excavation Per Chamber/End Cap in yd³ (m³)

	Stone Foundation Depth in. (mm)			
	9 (229)	12 (305)	15 (381)	18 (457)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.2 (3.2)	4.4 (3.3)	4.5 (3.5)

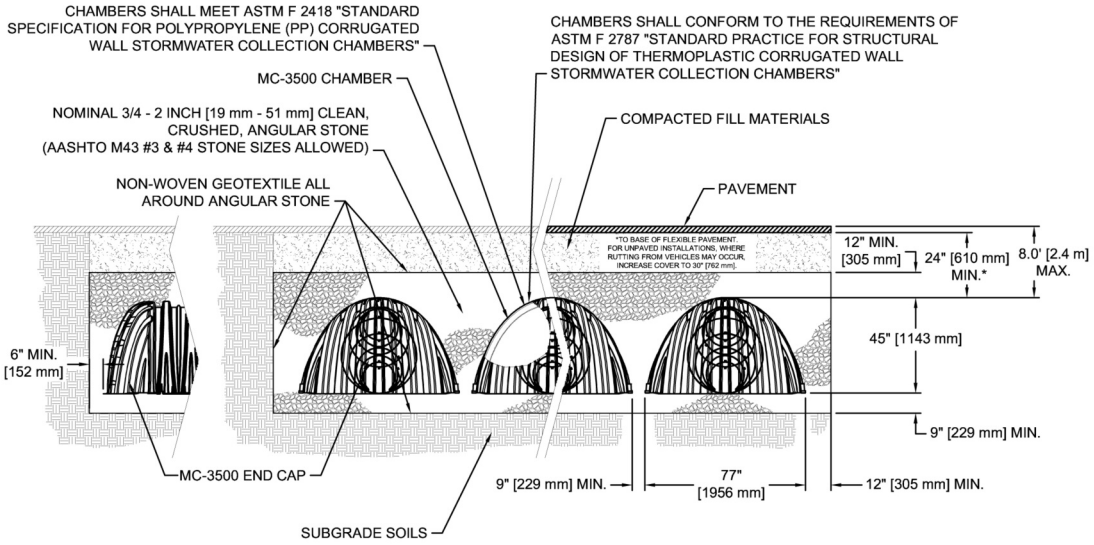
NOTE: Assumes 9" (229 mm) of separation between chamber rows, 6" (152 mm) of perimeter in front of end caps, and 24" (610 mm) of cover. The volume of excavation will vary as depth of cover increases.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9 in.	12 in.	15 in.	18 in.
MC-3500	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
End Cap	4.1 (2.9)	4.3 (3.0)	4.5 (3.2)	4.7 (3.3)
METRIC kg (m³)	**229 mm**	**305 mm**	**381 mm**	**457 mm**
MC-3500	8220 (4.9)	8831 (5.3)	9443 (5.6)	10054 (6.0)
End Cap	3699 (2.2)	3900 (2.3)	4100 (2.4)	4301 (2.6)

NOTE: Assumes 12" (305 mm) of stone above, and 9" (229 mm) row spacing, and 6" (152mm) of perimeter stone in front of end caps.

General Cross Section



NOTES:

1. THIS CROSS SECTION PROVIDES GENERAL INFORMATION FOR THE MC-3500 CHAMBER. STORMTECH MC-3500 CHAMBERS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE MC-3500 DESIGN MANUAL AND MC-3500 CONSTRUCTION GUIDE.
2. PROPERLY INSTALLED MC-3500 CHAMBERS PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR EARTH AND LIVE LOADS WITH CONSIDERATION FOR IMPACT AND MULTIPLE PRESENCES.
3. PERIMETER STONE MUST ALWAYS BE BROUGHT UP EVENLY WITH BACKFILL OF BED. PERIMETER STONE MUST EXTEND HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH STRAIGHT OR SLOPED SIDEWALLS.

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S150909 03/2014

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9.0 Inspection and Maintenance

9.1 Isolator Row Plus Inspection

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row Plus. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a con- fined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3” (76 mm), cleanout is required.

A StormTech Isolator Row Plus should initially be inspected immediately after completion of the site’s construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site’s owner. Once in normal service, a StormTech Isolator Row Plus should be inspected bi-annually until an understanding of the sites characteristics is developed. The site’s maintenance manager can then revise the inspection schedule based on experience or local requirements.

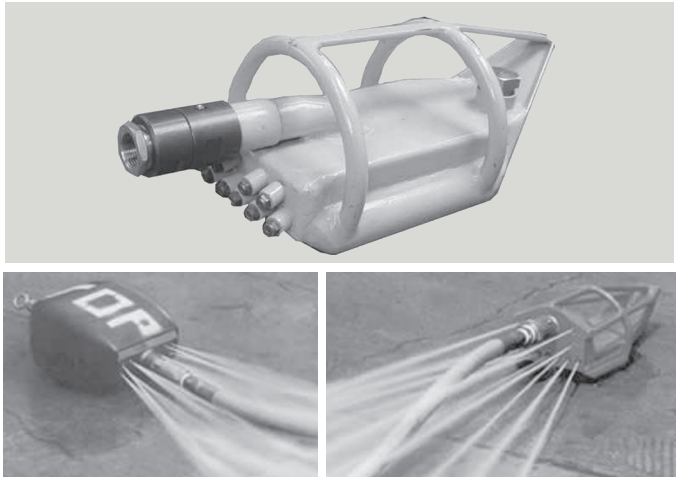
9.2 Isolator Row Plus Maintenance

JetVac maintenance is recommended if sediment has been collected to an average depth of 3” (76 mm) inside the Isolator Row Plus. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row Plus. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combi- nation vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” (1143 mm) are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. The JetVac process shall only be performed on StormTech Rows that have ADS Plus fabric over the foundation stone.

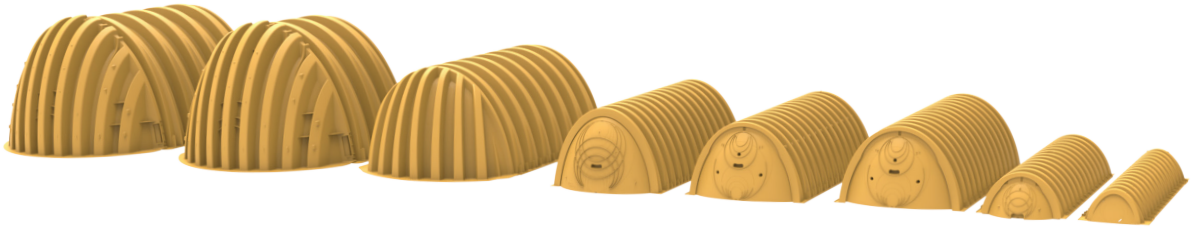
A Flamp (flared end ramp) is attached to the inlet pipe on the inside of the chamber end cap to provide a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning, and to guide cleaning and inspection equipment back into the inlet pipe when complete.

Flamp (Flared End Ramp)

A typical JetVac truck (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row Plus maintenance. (These are not StormTech products).



A Family of Products and Services for the Stormwater Industry:

MC-3500, MC-4500 and MC-7200 Chambers and End Caps

SC-160LP, SC-310, SC-740 & SC-800 Chambers & End Caps

DC-780 Chambers and End Caps

Fabricated End Caps

Fabricated Manifold Fittings

Patented Isolator Row PLUS for Maintenance and Water Quality

Chamber Separation Spacers

In-House System Layout Assistance

On-Site Educational Seminars

Worldwide Technical Sales Group

Centralized Product Applications Department

Research and Development Team

Technical Literature, O&M Manuals and Detailed CAD drawings all downloadable via our Website

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Modular Wetlands® Linear Operatons & Maintenance Manual

MODULAR WETLANDS

MODULAR WETLANDS LINEAR
OPERATION & MAINTENANCE MANUAL

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OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.

WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.

Safety Boots

Gloves

Hard Hat

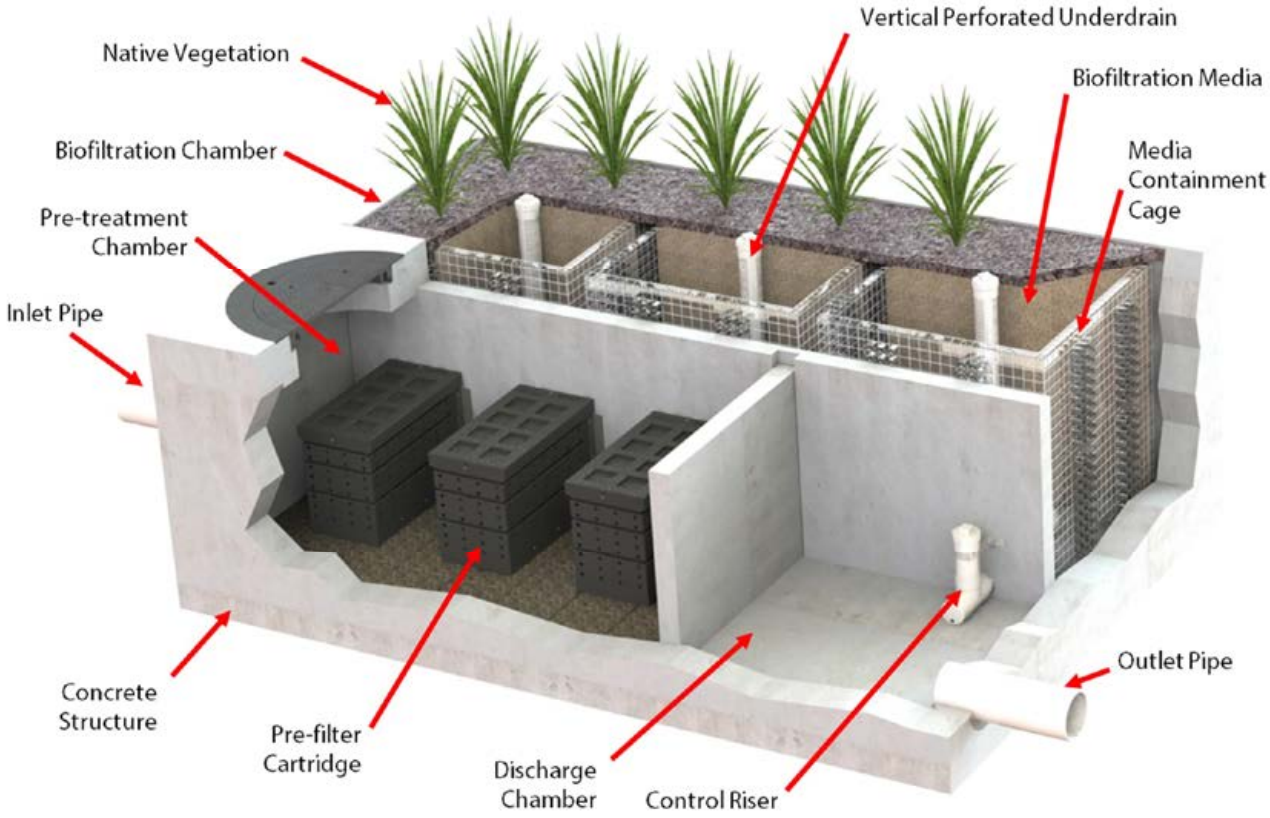
Eye Protection

Maintenance and Protection of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:

Modular Wetlands Linear Inspection Form

Flashlight

Tape Measure

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that 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 not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.

7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
    - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:

Modular Wetlands Linear Maintenance Form

Flashlight

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

Vacuum Assisted Truck with Pressure Washer

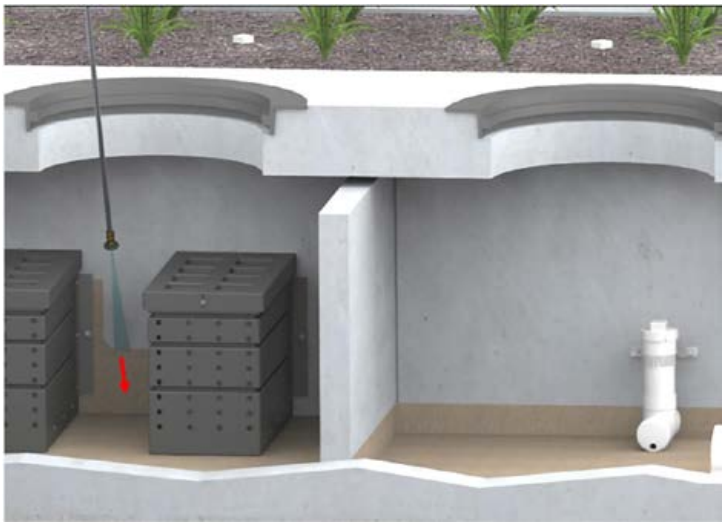
Replacement
BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at https://www.conteches.com/maintenance)

MAINTENANCE INSTRUCTIONS

1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).

3. VACUUM SYSTEM CHAMBERS

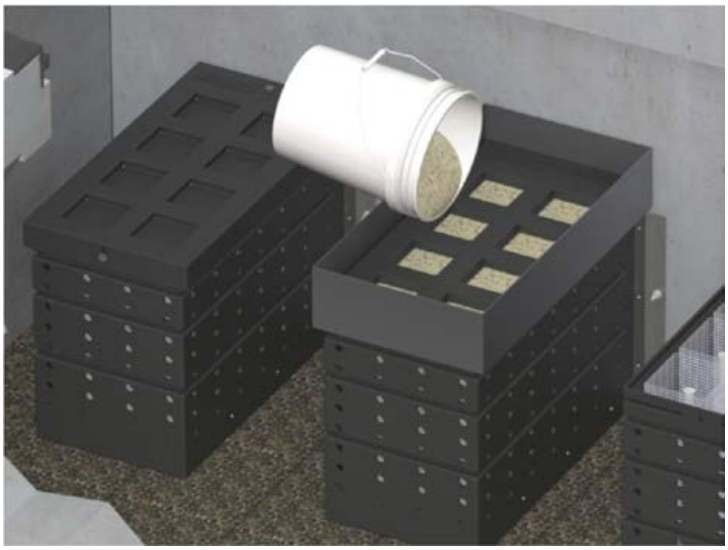
Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.

4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)

5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.

7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

8. INSPECT UNDERDRAIN SYSTEM

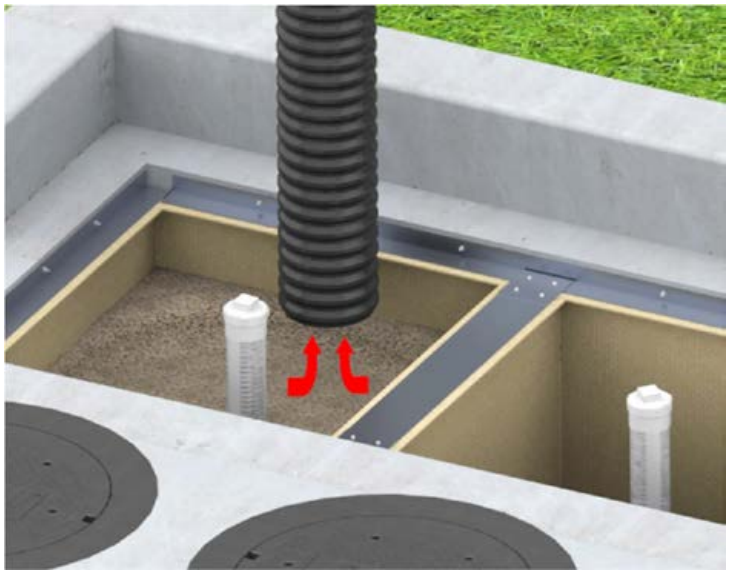
Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.

9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.

2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

3. REPLANT VEGETATION

Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.

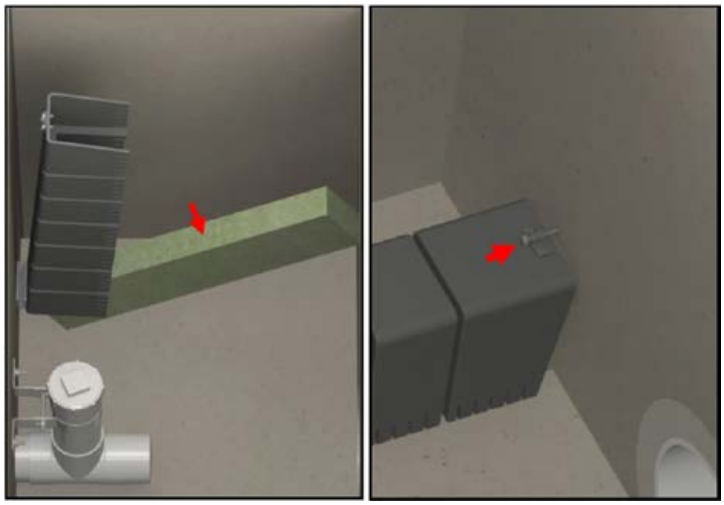
REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

NOTE: The drain down filter is only found on units installed in California prior to 2023

If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new media.

1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

NOTES

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Inspection Report
Modular Wetlands Linear

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.

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: _____

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Cleaning and Maintenance Report
Modular Wetlands Linear

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:

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SUPPORT

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ModWetLinear OM Manual 03/24

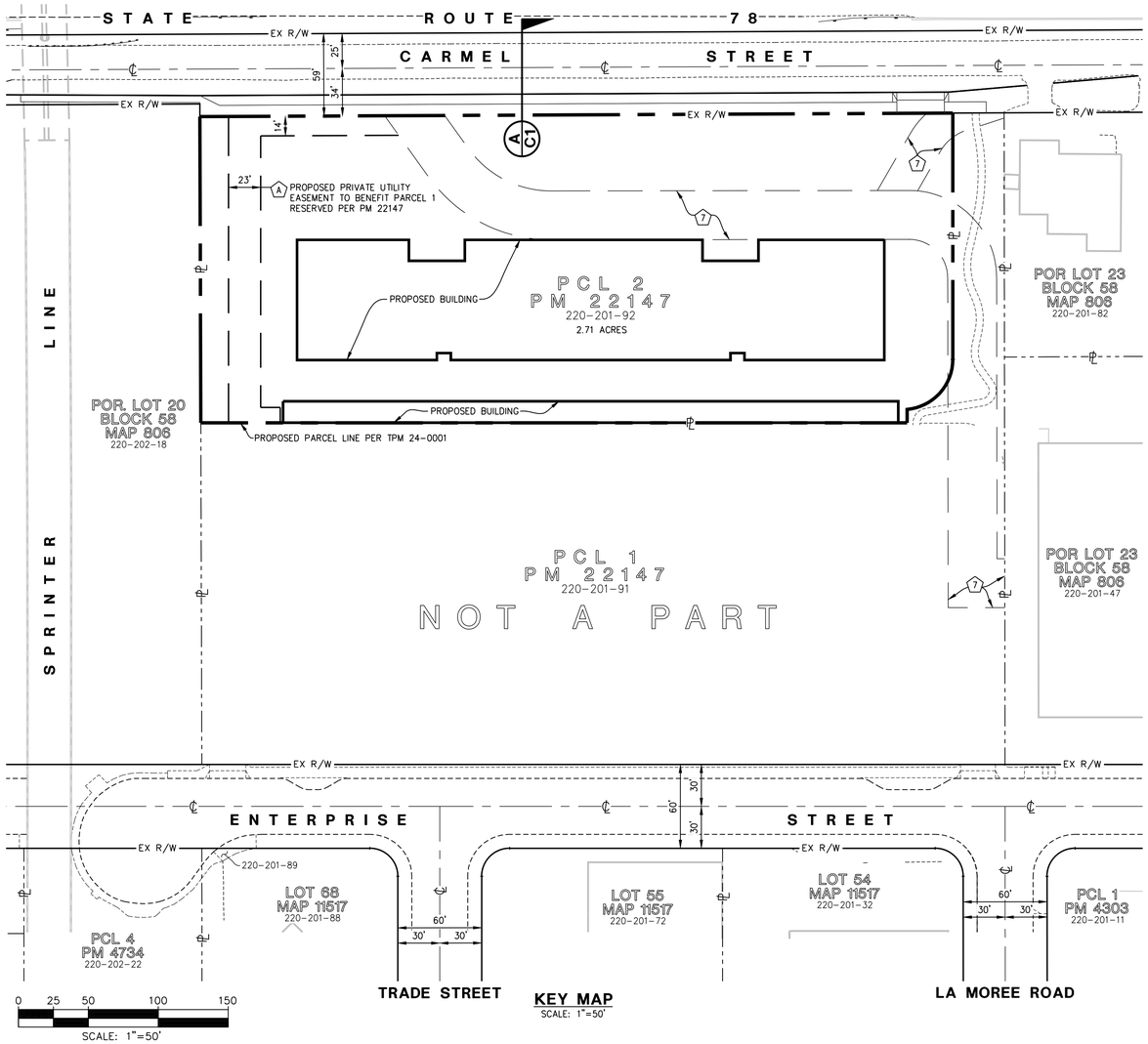
ATTACHMENT 4
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

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

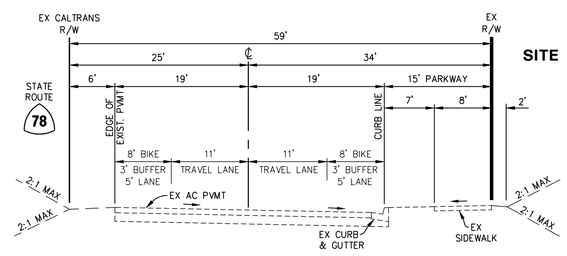
The plans must identify:

- ■ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- ■ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- ■ Details and specifications for construction of structural BMP(s)
- ☐ Signage indicating the location and boundary of structural BMP(s) as required by the [City Engineer]
- ■ How to access the structural BMP(s) to inspect and perform maintenance
- ■ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ■ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- ■ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- ■ All BMPs must be fully dimensioned on the plans
- ■ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number shall be provided. Photocopies of general brochures are not acceptable.



KEY MAP
SCALE: 1"=50'

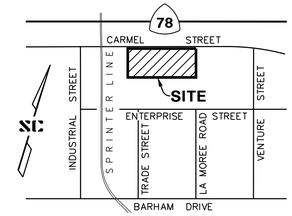
SCALE 1"=50'



PROPOSED STREET AND PARKWAY IMPROVEMENTS PER IP24-00013

CARMEL STREET
NO SCALE

A C1



THOMAS BROTHERS COORD:
PAGE 1128; GRID J1

VICINITY MAP
NO SCALE

SHEET INDEX

NO.	DESCRIPTION
C1	TITLE SHEET/KEY MAP/SECTIONS
C2	EXISTING CONDITIONS
C3	CONCEPT GRADING & UTILITY PLAN
C4	CONCEPT STORM WATER BMP PLAN
C5	CONCEPT FIRE TRUCK ACCESS PLAN

ABBREVIATIONS

ACP	ASBESTOS CEMENT PIPE
ASPH	ASPHALT
APN	ASSESSOR PARCEL NUMBER
CI	CURB INLET
COMM	COMMUNICATION
CONC	CONCRETE
CSUSM	CAL STATE UNIVERSITY SAN MARCOS
DBL	DOUBLE
DG	DECOMPOSED GRANITE
DWG	DRAWING
DWY	DRIVEWAY
E	ELECTRIC
EOP	EDGE OF PAVEMENT
EX	EXISTING
FH	FIRE HYDRANT
FL	FLOW LINE
FS	FINISH SURFACE
G	GAS
GTR	GUTTER
HP	HIGH POINT
JT	JOINT TRENCH - DRY UTILITY
LP	LOW POINT
PA	PLANTER AREA
PM	PARCEL MAP
PPSD	POLYPROPYLENE STORM DRAIN
P/L	PROPERTY LINE
PVC	POLYVINYL CHLORIDE
PVT	PRIVATE
RCB	REINFORCED CONCRETE BOX
RCP	REINFORCED CONCRETE PIPE
R/W	RIGHT OF WAY
SFL	SWALE FLOW LINE
SD	STORM DRAIN
SMH	SEWER MANHOLE
S, SWR	SEWER
TC	TOP OF CURB
TYP	TYPICAL
UGE	UNDERGROUND ELECTRIC
VCP	VITRIFIED CLAY PIPE
VWD	VALLECITOS WATER DISTRICT
WM	WATER METER/IRRIGATION METER
W, WTR	WATER

EXISTING EASEMENTS

(7) EXISTING DRAINAGE EASEMENT TO THE CITY OF SAN MARCOS PER DOC. NO. 2022-0202965 REC. MAY 11, 2022

PROPOSED EASEMENTS

(A) PROPOSED PRIVATE UTILITY EASEMENT RESERVATION PER PARCEL MAP DOC. NO. 2024-7000616 REC. DECEMBER 16, 2024

REFERENCE DWGS.

CITY OF SAN MARCOS:
IP21-00005, GP21-00004, GP24-00021, IP24-00013

VALLICITOS WATER DISTRICT:
1266-01, 1429-10, 1867-1

LEGEND

PROJECT BOUNDARY
EXISTING PROPERTY LINE
EXISTING RIGHTS-OF-WAY — EX R/W
EXISTING EASEMENT LINE
SPOT ELEVATION — 610.25
DIRECTION OF SURFACE FLOW
P.C.C. CURB
ASPHALT PAVEMENT
PAVEMENT RESTORATION (PER SECTION 14.12.340 STREET EXCAVATION ORDINANCE NO. 2003-1196)
PCC PAVEMENT
CONCRETE SIDEWALK
PROPOSED CONTOUR — 510
PROPOSED SLOPE — 2:1
DAYLIGHT LINE
RETAINING WALL
BUILDING WALL
CURB AND GUTTER
CURB
RESIDENTIAL DRIVEWAY
DOMESTIC WATER SERVICE — W
IRRIGATION SERVICE — IR
FIRE SERVICE — FS
FIRE SERVICE (SIZE TO BE DETERMINED) — FS
FIRE SERVICE RPDA
FIRE HYDRANT
STORM DRAIN — SD
STORM DRAIN CLEANOUT/CURB INLET
STORM DRAIN CATCH BASIN — OR.
STORM DRAIN NYLOPLAST DRAINAGE BASIN
MODULAR WETLAND SYSTEM
UNDERGROUND HYDROMODIFICATION DETENTION SYSTEM
SEWER MAIN — S
SEWER LATERAL — S
EXISTING SLOPE
EXISTING CONTOUR — 510
EXISTING CURB AND GUTTER
EXISTING AC BERM
EXISTING STREET LIGHT
EXISTING STORM DRAIN — SD
EXISTING WATER MAIN — W
EXISTING FIRE HYDRANT
EXISTING SEWER MAIN/LATERAL — S
EXISTING SEWER MANHOLE — S
EXISTING JOINT UTILITY TRENCH (ELECT, GAS, TELCO, CATV) — G JT

LEGAL DESCRIPTION

A PORTION OF PARCEL 2 OF PARCEL MAP NO. 22147, IN THE CITY OF SAN MARCOS, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA AS PER MAP RECORDED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY ON DECEMBER 16, 2024 AS FILE NO. 2024-7000616 OFFICIAL RECORDS.

ASSESSOR'S PARCEL NUMBER

220-201-90

BENCH MARK

DESCRIPTION: FOUND MONUMENT NUMBER 17, CP-017
LOCATION: S'LY SWK 128'± EAST OF INTERSECTION OF TWIN OAKS VALLEY ROAD AND EAST CARMEL STREET. ACROSS FROM 76 (SHELL) GAS STATION.
RECORD FROM: RECORD OF SURVEY 2373I
ELEV.: 573.53 DATUM: NAVD '88

SOURCE OF TOPOGRAPHY

SOURCE OF TOPOGRAPHY SHOWN WAS COMPILED USING PHOTOGRAMMETRIC METHODS BY PHOTO GEODETIC, INC. DATE OF PHOTOGRAPHY: JUNE 7, 2024 AND SUPPLEMENTED BY DATA FROM CITY OF SAN MARCOS ROUGH GRADING PLAN GP21-00004 AND GROUND SURVEY DATA BY STEVENS CRESTO ENGINEERS, INC.

EARTHWORK QUANTITIES

CUT: 2,100 C.Y.
FILL: 5,300 C.Y.
EXPORT: 3,200 C.Y. (IMPORT)

NOTE: VOLUMES REPORTED ARE RAW VOLUMES. BULK AND SHRINK HAVE NOT BEEN FACTORED IN.

OWNER/PERMITEE

CARMEL ENTERPRISE, L.L.C. A DELAWARE LIMITED LIABILITY COMPANY
5550 CARMEL MOUNTAIN ROAD #204
SAN DIEGO, CA 92130
(858) 631-8555
ATTN: GARY LEVITT, MANAGER.

ENGINEER OF WORK

STEVENS CRESTO ENGINEERS
9665 CHESAPEAKE DRIVE, STE. 200
SAN DIEGO, CA 92123
TEL. (858) 694-5660

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

REGISTERED PROFESSIONAL ENGINEER JOSEPH G. CRESTO C 45601 CIVIL STATE OF CALIFORNIA

NOT FOR CONSTRUCTION

SHEET: C1							
CONDITIONAL USE PERMIT #: CUP 24-0005							
OWNER: CARMEL ENTERPRISE, LLC				PHONE: (858) 342-2441			
ADDRESS: 5550 CARMEL MOUNTAIN RD. SUITE 204 SAN DIEGO, CA 92130							
ARCHITECT, ENGINEER DESIGNER: ARIEL VALLI - VALLI ARCHITECTURAL GROUP				PHONE: (949) 813-4191			
ADDRESS: 924-D N. ART VILLAGE WAY, IVINS UT 84738				LOCATION: 337 E. CARMEL ST. SAN MARCOS CA 92069			
TYPE OF DEVELOPMENT: SELF STORAGE							
ZONE: OFFICE/COMMERCIAL (UNIVERSITY DISTRICT SPECIFIC PLAN)				ASSESSOR'S PARCEL NUMBER(S): 220-201-92			
SITE DATA							
AREA (sq.ft)			COVERAGE %				
LOT:		117,989	100%				
BUILDING:		41,000	34.75%				
PARKING:		2,088	1.77%				
LOADING/DRIVEWAYS:		47,143	39.95%				
LANDSCAPING:		27,758	23.53%				
PARKING				DRIVEWAY (SIZE AND SLOPE)	SETBACKS		
GARAGE:	0	LOADING 4		ONE WAY	FRONT: 89'-2"	REAR: 0	
COVERED:	0	HANDICAP 1		TWO WAY	LEFT SIDE: 49'-0" BLDG. A / 6'-4" BLDG. B		
OPEN:	7	TOTAL 12		SLOPE	RIGHT SIDE: 69'-1" BLDG. A / 58'-9" BLDG. B		

CUBESMART SELF STORAGE
SAN MARCOS, CA

TITLE SHEET

05.28.2025

C1

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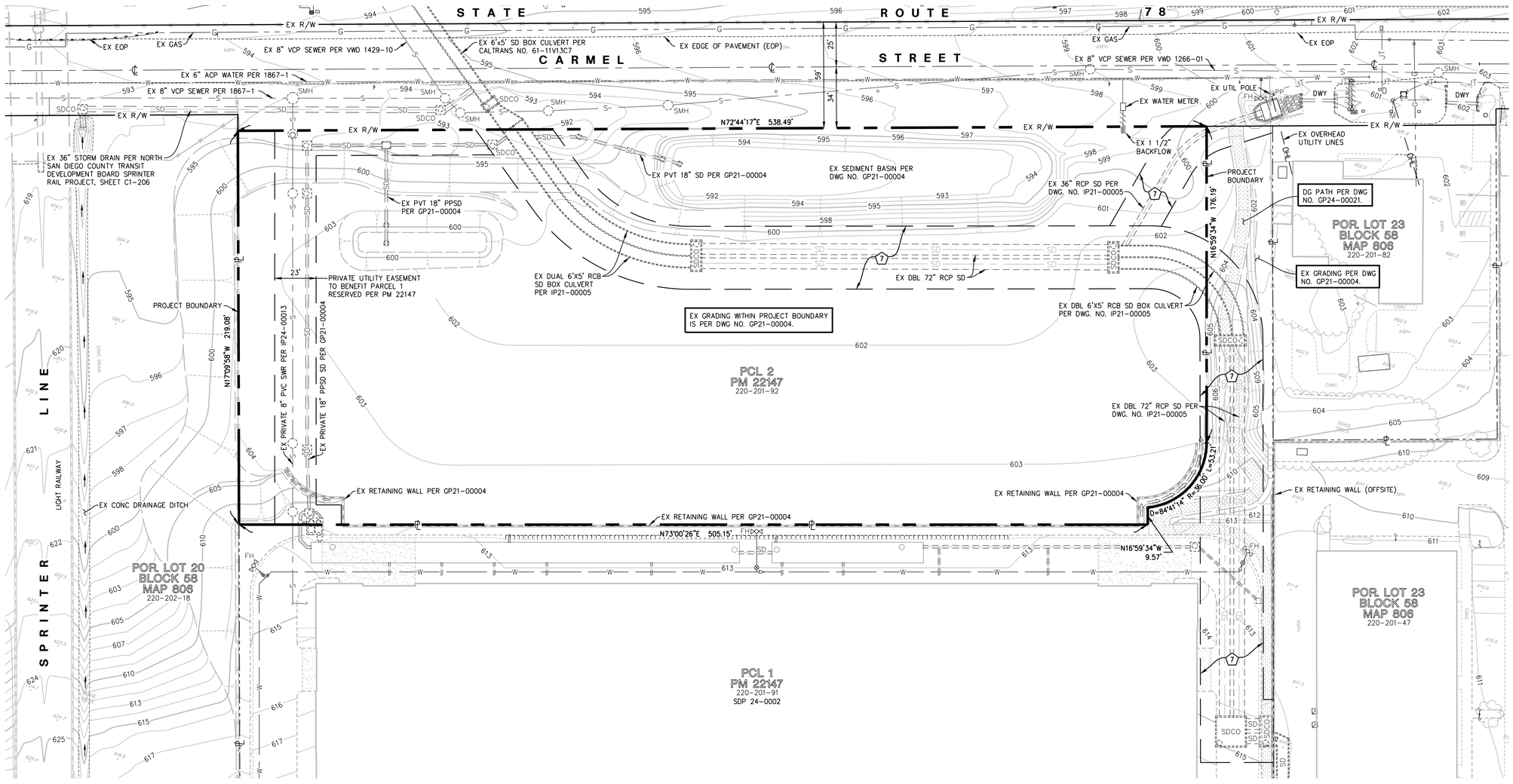

LEGEND

DESCRIPTION	SYMBOL
BOUNDARY	
EXISTING RIGHT-OF-WAY	
EXISTING PROPERTY LINE	
EXISTING EASEMENT	
EXISTING CURB	
EXISTING STORM DRAIN	SD
EXISTING CONTOUR	500
EXISTING FIRE HYDRANT	
EXISTING STREET LIGHT	
EXISTING STORM DRAIN RISER INLET	SD
EXISTING STORM DRAIN CLEANOUT/CURB INLET	
EXISTING WATER	W
EXISTING SEWER	S
EXISTING SEWER MANHOLE	S
EXISTING HP GAS	G
EXISTING JT UTILITIES (ELEC, G, TELCO)	JT

EXISTING EASEMENTS

(7) EASEMENT FOR DRAINAGE PURPOSES TO THE CITY OF SAN MARCOS DOC NO. 2022-0202965, O.R. REC. MAY 11, 2022

0 15 30 60 90

SCALE: 1"=30'

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

REGISTERED PROFESSIONAL ENGINEER JOSEPH G. CRESTO 45507 CIVIL STATE OF CALIFORNIA

NOT FOR CONSTRUCTION

SHEET: C2							
CONDITIONAL USE PERMIT #: CUP 24-0005							
OWNER: CARMEL ENTERPRISE, LLC				PHONE: (858) 342-2441			
ADDRESS: 5550 CARMEL MOUNTAIN RD, SUITE 204 SAN DIEGO, CA 92130							
ARCHITECT, ENGINEER DESIGNER: ARIEL VALLI - VALLI ARCHITECTURAL GROUP				PHONE: (949) 813-4191			
ADDRESS: 924-D N. ART VILLAGE WAY, IVINS UT 84738				LOCATION: 337 E. CARMEL ST. SAN MARCOS CA 92069			
TYPE OF DEVELOPMENT: SELF STORAGE							
ZONE: OFFICE/COMMERCIAL (UNIVERSITY DISTRICT SPECIFIC PLAN)				ASSESSOR'S PARCEL NUMBER(S): 220-201-92			
SITE DATA							
AREA (sq.ft)		COVERAGE %					
LOT:	117,989	100%					
BUILDING:	41,000	34.75%					
PARKING:	2,088	1.77%					
LOADING/DRIVEWAYS:	47,143	39.95%					
LANDSCAPING:	27,758	23.53%					
PARKING				DRIVEWAY (SIZE AND SLOPE)	SETBACKS		
GARAGE:	0	LOADING	4	ONE WAY	FRONT:	89'-2"	REAR: 0
COVERED:	0	HANDICAP	1	TWO WAY	LEFT SIDE:	49'-0" BLDG. A / 6'-4" BLDG. B	
OPEN:	7	TOTAL	12	SLOPE	RIGHT SIDE:	69'-1" BLDG. A / 58'-9" BLDG. B	

CUBESMART SELF STORAGE

SAN MARCOS, CA

EXISTING CONDITIONS

05.28.2025

C2

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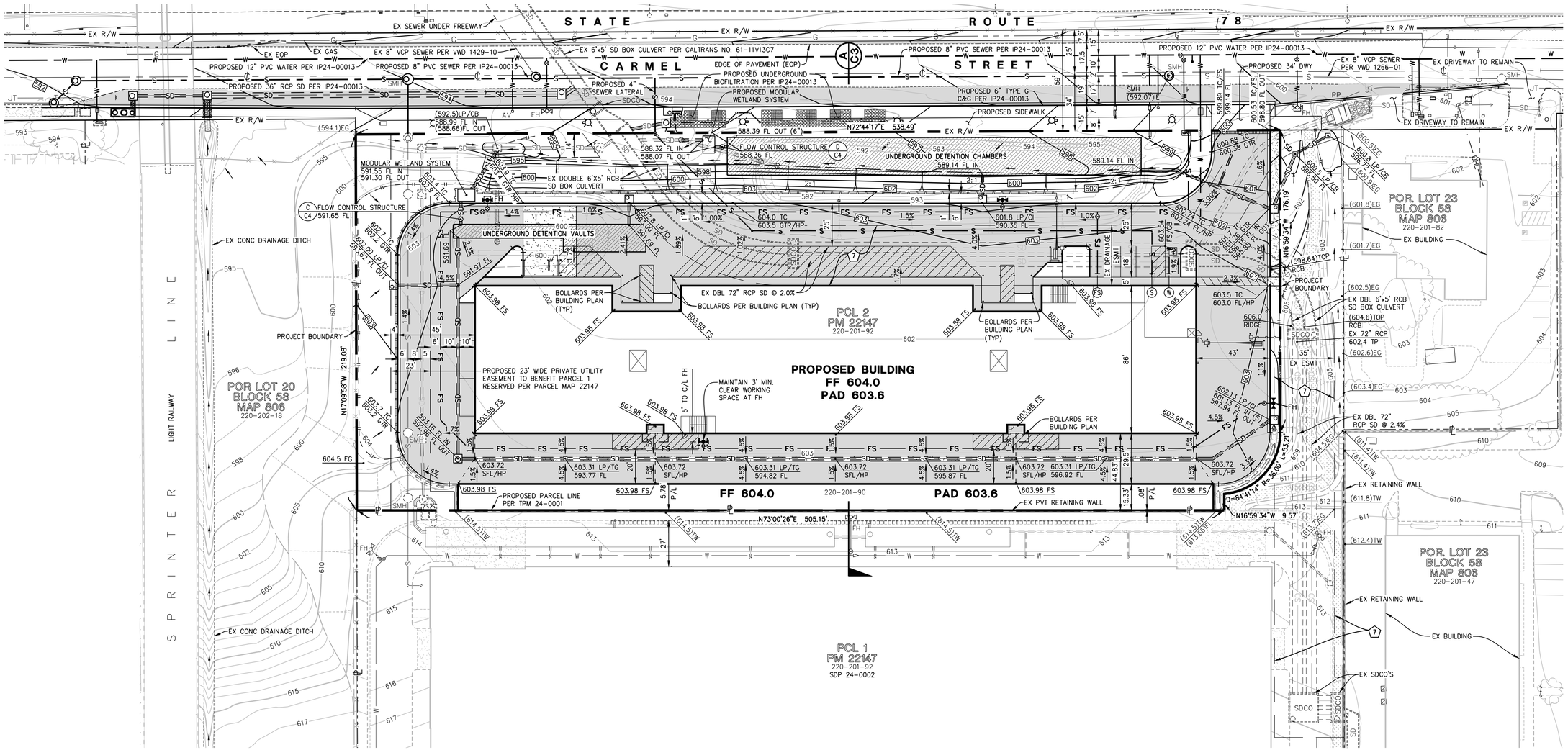
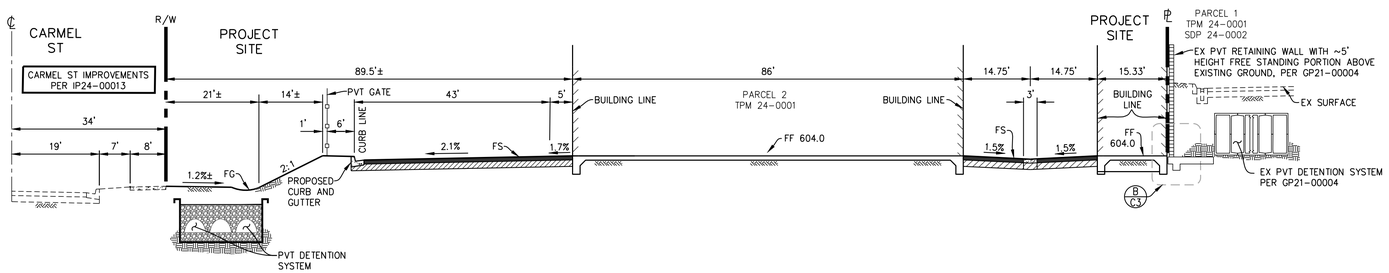


EXISTING EASEMENTS

(7) EASEMENT FOR DRAINAGE PURPOSES TO THE CITY OF SAN MARCOS DOC NO. 2022-0202965, O.R. REC. MAY 11, 2022



SECTION (A / C3)

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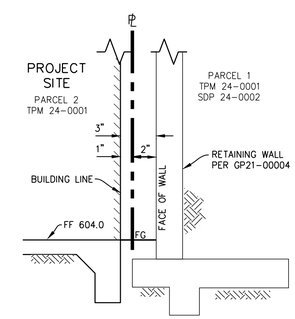

SOUTH WALL EDGE CONDITION (B / C3)

NO SCALE

SCALE: 1"=30'

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

NOT FOR CONSTRUCTION

SHEET: C3							
CONDITIONAL USE PERMIT #: CUP 24-0005							
OWNER: CARMEL ENTERPRISE, LLC				PHONE: (858) 342-2441			
ADDRESS: 5550 CARMEL MOUNTAIN RD. SUITE 204 SAN DIEGO, CA 92130							
ARCHITECT, ENGINEER DESIGNER: ARIEL VALLI - VALLI ARCHITECTURAL GROUP				PHONE: (949) 813-4191			
ADDRESS: 924-D N. ART VILLAGE WAY, IVINS UT 84738				LOCATION: 337 E. CARMEL ST. SAN MARCOS CA 92069			
TYPE OF DEVELOPMENT: SELF STORAGE							
ZONE: OFFICE/COMMERCIAL (UNIVERSITY DISTRICT SPECIFIC PLAN)				ASSESSOR'S PARCEL NUMBER(S): 220-201-92			
SITE DATA							
AREA (sq.ft)		COVERAGE %					
LOT:	117,989	100%					
BUILDING:	41,000	34.75%					
PARKING:	2,088	1.77%					
LOADING/DRIVEWAYS:	47,143	39.95%					
LANDSCAPING:	27,758	23.53%					
PARKING				DRIVEWAY (SIZE AND SLOPE)	SETBACKS		
GARAGE: 0	LOADING 4			ONE WAY	FRONT: 89'-2"	REAR: 0	
COVERED: 0	HANDICAP 1			TWO WAY	LEFT SIDE: 49'-0" BLDG. A / 6'-4" BLDG. B		
OPEN: 7	TOTAL 12			SLOPE	RIGHT SIDE: 69'-1" BLDG. A / 58'-9" BLDG. B		

CUBESMART SELF STORAGE — CONCEPT GRADING & UTILITY PLAN

05.28.2025

C3

SAN MARCOS, CA

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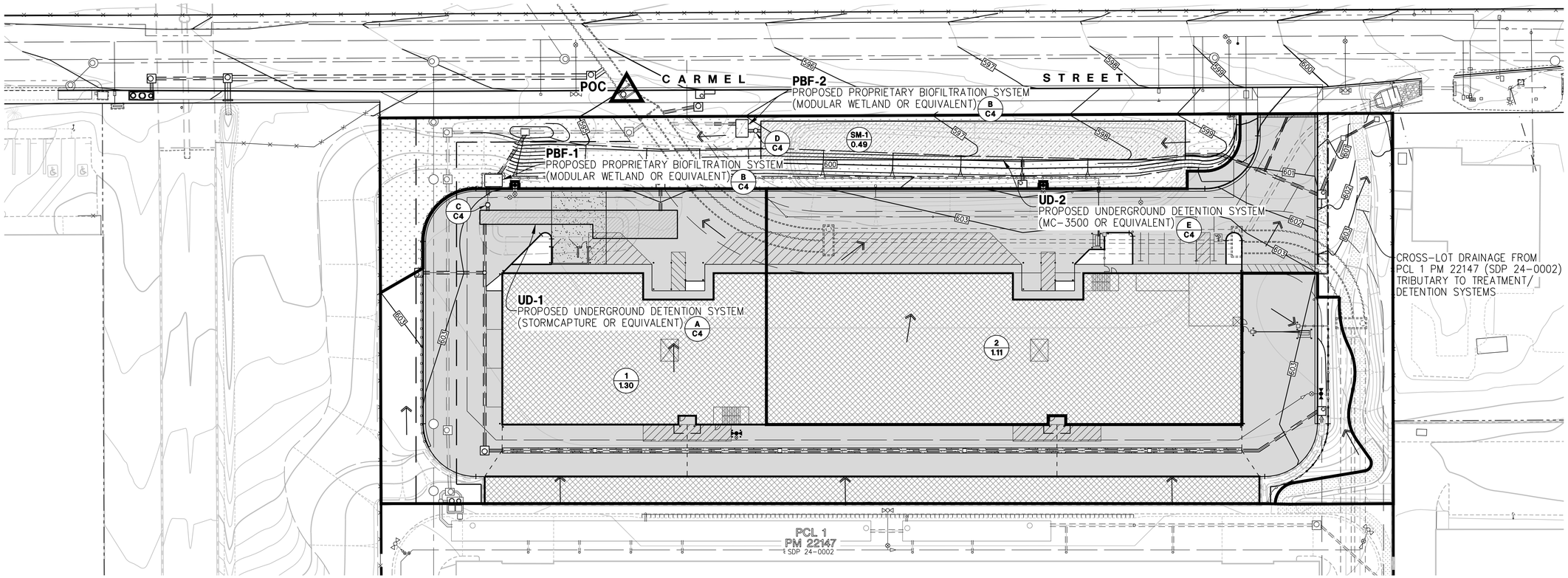


LEGEND

- 1 / 1.30 — DMA DESIGNATION / AREA (ACRES)
- DMA BOUNDARY
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- RUNOFF FLOW DIRECTION
- PERVIOUS
- PROPOSED BUILDING
- PROPOSED IMPERVIOUS
- SELF-MITIGATING AREA
- POC (POINT OF COMPLIANCE)

PROPOSED BMPS

PROPOSED UNDERGROUND DETENTION SYSTEM (100-YEAR PEAK FLOW & HYDROMODIFICATION MITIGATION) — UD-1

PROPOSED PROPRIETARY BIOFILTRATION (POLLUTANT CONTROL ONLY). — PBF-1

DMA SUMMARY TABLE

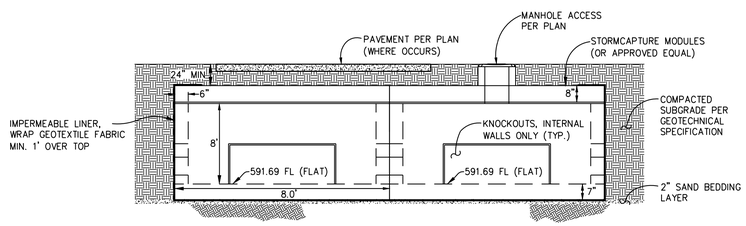
DMA ID	AREA (SF)	DESCRIPTION	TYPE
1	56,760	19,000 SF PROPOSED BUILDING 31,685 SF PROPOSED IMPERVIOUS 6,075 SF PROPOSED LANDSCAPE[1]	DRAINS TO PROPOSED BMP UD-1 / PBF-1
2	48,155	22,565 SF PROPOSED BUILDING 17,180 SF PROPOSED IMPERVIOUS 8,410 SF PROPOSED LANDSCAPE[1]	DRAINS TO PROPOSED BMP UD-2 / PBF-2
SM-1	21,340	21,340 SF SELF-MITIGATING	--
TOTAL	126,255	41,565 SF PROPOSED BUILDING 14,485 SF PROPOSED LANDSCAPE[1] 48,865 SF PROPOSED IMPERVIOUS 21,340 SF SELF-MITIGATING	--

[1] SEE LANDSCAPE NOTE.

LANDSCAPE NOTE:
LANDSCAPE TO HAVE AMENDED SOILS PER CITY OF SAN MARCOS BMP DESIGN MANUAL, FACT SHEET E.11.

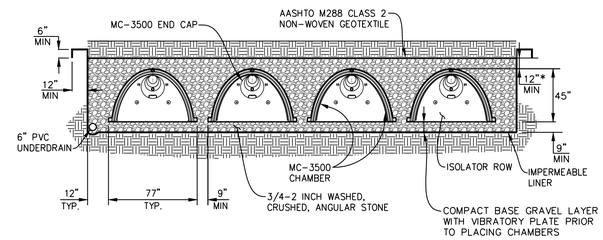
SOILS/GROUNDWATER

UNDERLYING HYDROLOGIC SOIL GROUP C
APPROXIMATE DEPTH TO GROUNDWATER (GW): 5 FT < GW DEPTH < 10 FT



DETENTION SYSTEM "UD-1" TYPICAL CROSS SECTION (A / C4)

NO SCALE



DETENTION SYSTEM "UD-2" TYPICAL CROSS SECTION (E / C4)

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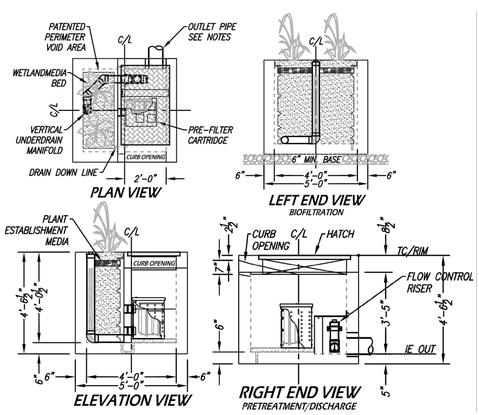
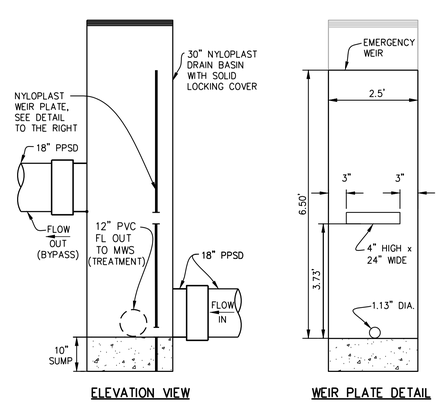


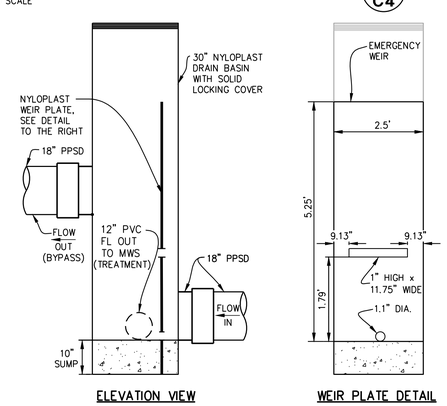
PROPRIETARY BIOFILTRATION, MODULAR WETLAND SYSTEM, OR APPROVED EQUIVALENT (B / C4)

NO SCALE



DETENTION SYSTEM UD-1 FLOW CONTROL STRUCTURE (C / C4)

NO SCALE



DETENTION SYSTEM UD-2 FLOW CONTROL STRUCTURE (D / C4)

NO SCALE

SCALE: 1"=30'

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

REGISTERED PROFESSIONAL ENGINEER — JOSEPH G. CRESTO — C 45501 — CIVIL — STATE OF CALIFORNIA

NOT FOR CONSTRUCTION

SHEET: C4							
CONDITIONAL USE PERMIT #: CUP 24-0005							
OWNER: CARMEL ENTERPRISE, LLC				PHONE: (858) 342-2441			
ADDRESS: 5550 CARMEL MOUNTAIN RD. SUITE 204 SAN DIEGO, CA 92130							
ARCHITECT, ENGINEER DESIGNER: ARIEL VALLI - VALLI ARCHITECTURAL GROUP				PHONE: (949) 813-4191			
ADDRESS: 924-D N. ART VILLAGE WAY, IVINS UT 84738				LOCATION: 337 E. CARMEL ST. SAN MARCOS CA 92069			
TYPE OF DEVELOPMENT: SELF STORAGE							
ZONE: OFFICE/COMMERCIAL (UNIVERSITY DISTRICT SPECIFIC PLAN)				ASSESSOR'S PARCEL NUMBER(S): 220-201-92			
SITE DATA							
AREA (sq.ft)		COVERAGE %					
LOT:	117,989	100%					
BUILDING:	41,000	34.75%					
PARKING:	2,088	1.77%					
LOADING/DRIVEWAYS:	47,143	39.95%					
LANDSCAPING:	27,758	23.53%					
PARKING				DRIVEWAY (SIZE AND SLOPE)	SETBACKS		
GARAGE: 0	LOADING 4			ONE WAY	FRONT: 89'-2"	REAR: 0	
COVERED: 0	HANDICAP 1			TWO WAY	LEFT SIDE: 49'-0" BLDG. A / 6'-4" BLDG. B		
OPEN: 7	TOTAL 12			SLOPE	RIGHT SIDE: 69'-1" BLDG. A / 58'-9" BLDG. B		

CUBESMART SELF STORAGE — CONCEPT STORM WATER BMP PLAN

SAN MARCOS, CA

05.28.2025

C4

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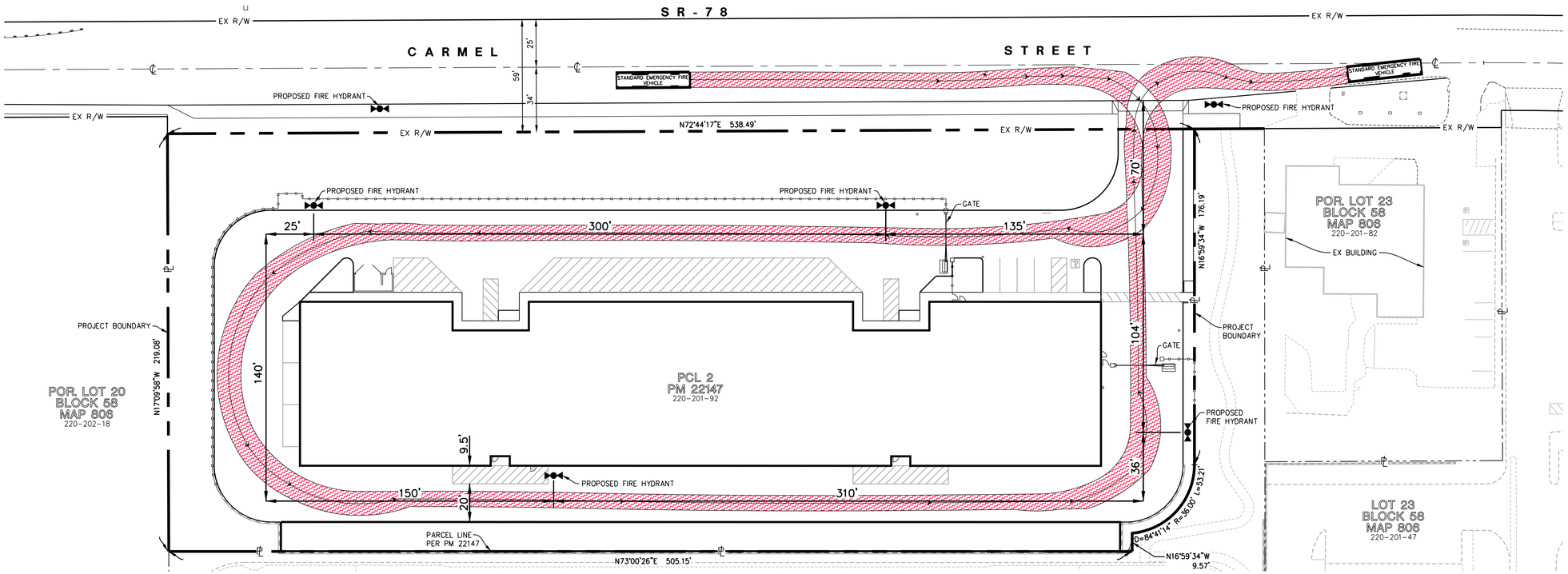
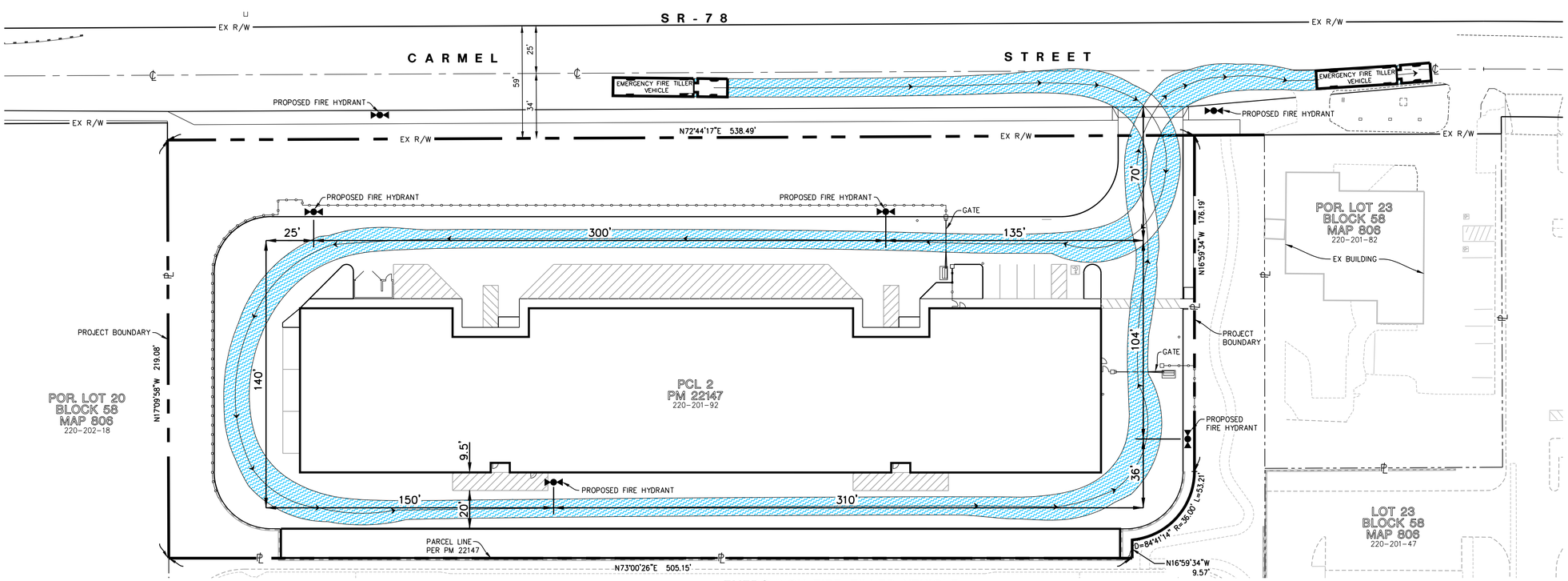


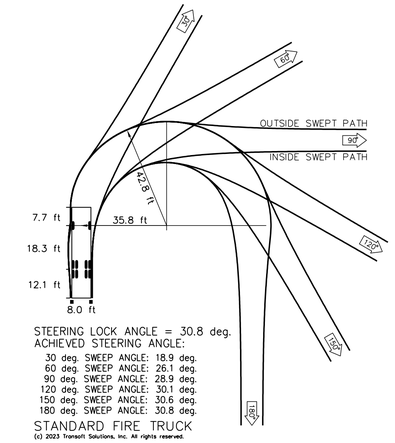
STANDARD FIRE EMERGENCY VEHICLE

SCALE: 1"=30'



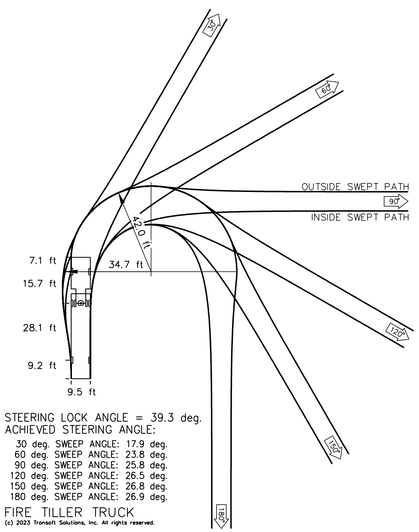
EMERGENCY FIRE TILLER VEHICLE

SCALE: 1"=30'



STANDARD EMERGENCY FIRE VEHICLE

NO SCALE



EMERGENCY FIRE TILLER VEHICLE

NO SCALE

0 15 30 60 90

SCALE: 1"=30'

NOT FOR CONSTRUCTION

STEVENS CRESTO ENGINEERS
9665 Chesapeake Dr, Ste 200
San Diego, CA 92123
858.694.5660 stevenscresto.com

REGISTERED PROFESSIONAL ENGINEER JOSEPH C. CRESTO 45501 CIVIL STATE OF CALIFORNIA

SHEET: C5							
CONDITIONAL USE PERMIT #: CUP 24-0005							
OWNER: CARMEL ENTERPRISE, LLC				PHONE: (858) 342-2441			
ADDRESS: 5550 CARMEL MOUNTAIN RD. SUITE 204 SAN DIEGO, CA 92130							
ARCHITECT, ENGINEER DESIGNER: ARIEL VALLI - VALLI ARCHITECTURAL GROUP				PHONE: (949) 813-4191			
ADDRESS: 924-D N. ART VILLAGE WAY, IVINS UT 84738				LOCATION: 337 E. CARMEL ST. SAN MARCOS CA 92069			
TYPE OF DEVELOPMENT: SELF STORAGE							
ZONE: OFFICE/COMMERCIAL (UNIVERSITY DISTRICT SPECIFIC PLAN)				ASSESSOR'S PARCEL NUMBER(S): 220-201-92			
SITE DATA							
AREA (sq.ft)		COVERAGE %					
LOT:	117,989	100%					
BUILDING:	41,000	34.75%					
PARKING:	2,088	1.77%					
LOADING/DRIVEWAYS:	47,143	39.95%					
LANDSCAPING:	27,758	23.53%					
PARKING				DRIVEWAY (SIZE AND SLOPE)	SETBACKS		
GARAGE: 0	LOADING 4			ONE WAY	FRONT: 89'-2"	REAR: 0	
COVERED: 0	HANDICAP 1			TWO WAY	LEFT SIDE: 49'-0" BLDG. A / 6'-4" BLDG. B		
OPEN: 7	TOTAL 12			SLOPE	RIGHT SIDE: 69'-1" BLDG. A / 58'-9" BLDG. B		

CUBESMART SELF STORAGE CONCEPT FIRE TRUCK ACCESS PLAN

05.28.2025

C5

SAN MARCOS, CA

X:\2013\13003\CAD\PRELIM\CUP\EAST-85\13003.85 CUP C5.DWG DATE: 5/28/2025 9:06 AM USER: CMB