Training

Water Quality Management Plan Training

RIVERSIDE COUNTY
WATERSHED PROTECTION

Prepared for: Santa Margarita Region Copermittees
Presented By: CASC Engineering and Consulting, Inc.
Spring 2024

Outline

- Background/WQMP Applicability
- Training Introduction
- Major Criteria Changes
- WQMP Process Refresher
- Case Studies for Major Changes
- Alternative Compliance Pathways
- Questions and Discussion

Background

- 2010 - South Riverside County MS4 Permit (R9-2010-0016)
  - 2014 Santa Margarita Region Water Quality Management Plan (SMR WQMP)
  - 2014 Santa Margarita Region Hydromodification Management Plan (SMR HMP)
- 2013 – San Diego Regional MS4 Permit (Order R9-2013-0001)
  - Initially covered San Diego County
  - Then South Orange County (2015)
- 2015 – Santa Margarita Region Enrolled in San Diego Regional MS4 Permit (Order R9-2015-0100). Permit required preparation of:
  - Water Quality Improvement Plan (WQIP)
  - Watershed Management Area Analysis (WMAA) - Optional
  - Water Quality Equivalency (WQE) Calculations - Optional
  - BMP Design Manual (Water Quality Management Plan plus Exhibits)

Background: WQMP Applicability

- WQMP requirements apply to development projects subject to the land-use and permitting authority of local jurisdictions
  - Does not include interior projects, roofing projects, retaining walls, signs, etc.
- **All development projects** must implement Source Control BMPs and Low Impact Development (LID) Principles (i.e., "Site Design BMPs")
- **Priority Development Projects** (PDPs) must also prepare project-specific WQMPs, meet pollutant control requirements, and meet hydromodification standards (if applicable)

Background: Site Design and Source Control BMPs for **All Developments**

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Source Control BMPs

- Prevent illicit discharges to the MS4
- Add signage or stenciling to all storm drain catch basins
- Protect outdoor storage areas, work areas, and trash storage areas from rainfall, run-on, runoff, and wind dispersal

Site Design BMPs

- Preserve existing drainage patterns
- Protect existing vegetation and sensitive areas
- Preserve natural infiltration capacity
- Minimize impervious area
- Disperse runoff to adjacent pervious areas
- Utilize native or drought tolerant species in site landscaping
- Implement harvest and use of runoff if applicable and feasible

MS4 Permit: E.3.a.(2) and (3)
WQMP: 3.2 and 3.8

General Criteria – All Projects

- On-site BMPs must be located to remove pollutants as close to the source as possible and always before discharge to receiving waters
- Structural BMPs must not be constructed in waters of the U.S.
- BMPs must be designed to avoid creation of a nuisance or pollution associated with vectors (e.g., mosquitos, rodents)

MS4 Permit: E.3.a.(1)
WQMP: 1.5

Background: PDP Categories

Category	Threshold
New Development Projects	Create 10,000 SF Impervious surface
Redevelopment Projects	Create and/or replace 5,000 SF impervious surface on sites with more than 10,000 SF existing impervious surface
Automotive Repair Shops	Create and/or replace 5,000 SF impervious surface
Restaurants	Create and/or replace 5,000 SF impervious surface
Hillside Developments	Create and/or replace 5,000 SF impervious surface
Environmentally Sensitive Areas	Create and/or replace 2,500 SF Impervious surface
Parking Lots	Create and/or replace 5,000 SF Impervious surface
Streets, Roads, Highways and Freeways	Create and/or replace 5,000 SF Impervious surface
Retail Gasoline Outlets	Create and/or replace 5,000 SF Impervious surface and are > 5,000 SF or Average Daily Traffic >= 100
Pollutant Generating projects disturbing 1 or more acres	1 or more acres disturbed area

MS4 Permit: E.3.b.(1)
WQMP: 1.1

Project Definition

- Must be based on the "whole of the project"
- Individual PDP thresholds apply to distinct uses of the project
- Example 1:
  - New office development project creating 4,000 sq-ft of parking lot and 2,000 sq-ft of building
  - < 5,000 sq-ft parking lot; < 10,000 sq-ft total created impervious surface ➔ Not a PDP
- Example 2:
  - New office development project creating 6,000 sq-ft parking lot, 2,000 sq-ft building.
  - > 5,000 sq-ft parking lot ➔ whole project is a PDP
- Example 3:
  - New restaurant project creating 4,000 sq-ft of parking lot, and 2,000 sq-ft of building
  - > 5,000 sq-ft total impervious area ➔ project is a PDP within categories that have a 5,000 sq-ft threshold

Overview of PDP Requirements

- Meet Stormwater Pollutant Control Requirements
  - Implement LID BMPs (retention or biofiltration) or Alternative Compliance in combination with flow-through BMPs to mitigate for pollutants not retained on site
- Meet Hydromodification Requirements, if applicable
  - Post-development discharge from the site cannot exceed runoff from the pre-development condition by more than 10% the flow range between 10% of Predev Q2 and Predev Q10
  - Analyze using SMRHM, another continuous simulation model, or Hydromod Spreadsheet prepared by Riverside County (Verify with Copermittee)
  - May be met by using LID BMPs, modified LID BMPs, hydrologic control BMPs, or Alternative Compliance
  - Must avoid critical coarse sediment yield areas (CCSYAs) or ensure no net impact
- Complete preliminary and final project-specific WQMPs
- Provide plans and mechanisms for ongoing O&M

Training Introduction

- What's changed in the MS4 permit?
- Why and how was the WQMP updated?
- When does the 2018 SMR WQMP become active?
- How does the WQMP relate to other planning documents?
  - Water Quality Improvement Plan (WQIP) (accepted)
  - Watershed Management Area Analysis (WMAA) (accepted)
  - Water Quality Equivalency (WQE) (published)
  - Hydromodification Management Plan (HMP) (historic)

Overview of significant changes in the MS4 Permit

- Changes to "grandfathering" provisions
- Harvest and use now required on all projects "where feasible and applicable"
- Potential PDP Exemptions added for "Green Streets" and trails and paths
- Additional criteria and a new sizing option added related to design of biofiltration LID BMPs
  - Design to maximize volume and pollutant retention

Overview of significant changes in the MS4 Permit (continued)

- Alternative compliance is now a potential pathway for any PDP, subject to availability and acceptance
- Final hydromodification exemptions are in the accepted WMAA
- There is no alternative compliance for critical coarse sediment yield areas
- WQIP priorities and strategies influence land development BMPs
  - WQIP Accepted by Regional Board

What did not change?

- General WQMP process
- Most source control and site design BMPs for all development projects
- Most PDP categories and thresholds
- Design storm sizes for pollutant treatment BMPs including LID BMPs
- Flow-duration thresholds for PDPs subject to hydromodification requirements
- Most requirements related to critical coarse sediment

Why has the WQMP been updated?

- The regional MS4 permit has been updated and requires updates to Jurisdictional Development Planning Processes:

E 3. Development Planning

Each Copermittee must use their land use and planning authorities to implement a development planning program in accordance with the strategies in the Water Quality Improvement Plan described pursuant to Provision B.3.b.(1) and includes, at a minimum, the following requirements:

d. BMP Design Manual Update

2018 WQMP Now Active

- The 2018 WQMP became effective July 5, 2018
- PDPs with a complete, approved design before July 5, 2018 may continue under 2014 WQMP rules if all of the following are met:
  - The design includes pollutant control and hydromodification management consistent with the 2014 WQMP
  - Prior to July 5, 2018 the local jurisdiction has issued a permit to commence construction
  - Construction has occurred either during the 365 days prior to July 5, 2018 OR within the 180 days after July 5, 2018
  - The approved design is completed within 5 years of July 5, 2018
- Or, PDPs may continue with approved plans if the local jurisdiction lacks the legal authority to require compliance with the 2018 WQMP.

Note: This is paraphrased. See MS4 Permit Section E.3.e.1.a.i and WQMP Section 1.2 for full text of these provisions.

How does the WQMP relate to…?

Program / Document	Relation to WQMP

Water Quality Improvement Plan (WQIP)	• Prioritized water quality conditions that affect BMP selection and implementation at PDPs
	  • Requires "nutrient sensitive" bioretention media in biofiltration BMPs
	  • Establishes priority water quality conditions in addition to 303d list

Watershed Management Area Analysis (WMAA)	• Identifies stream channels exempt from hydromodification (replaced interim exemptions) • Identifies Potential Critical Coarse Sediment Yield Areas via mapping
Water Quality Equivalency Guidance (WQE) (San Diego, Riverside, and Orange County)	• Serves as an approved calculation approach as part of alternative compliance demonstrations
Hydromodification Management Plan (historical)	• All relevant requirements from the 2014 HMP are now included directly into the WQMP

WQIP Implications

- Identified eutrophication and nutrient loading (N and P) in nearly all streams within the SMR in Riverside County as the Highest Priority Water Quality Condition

All PDPs must mitigate for nutrients:

- Nutrient sensitive bioretention soil media
  - **Identified as a strategy in WQIP**
- Select proprietary biofilters and proprietary flow-through treatment control BMPs that have received third-party approvals for nutrients
- Select non-proprietary treatment control BMPs with M or H effectiveness for nutrients
- Nutrient/ fertilizer/ dry weather flow source controls have increased importance

Other Water Quality Concerns

Water Body	Nutrients	Metals	Toxicity	Bacteria and Pathogens	Pesticides and Herbicides	Sulfate	Total Dissolved Solids
De Luz Creek	X	X				X	
Long Canyon Creek		X		X	X		
Murrieta Creek	X	X	X		X		
Redhawk Channel	X	X		X	X		X
Santa Gertudis Creek	X	X		X	X		
Santa Margarita Estuary	X						
Santa Margarita River (Lower)	X			X			
Santa Margarita River (Upper)	X		X				
Temecula Creek	X	X	X		X		X
Warm Springs Creek	X	X		X	X		

If PDP is a potential source of impairment pollutant:

- Bioretention media subject to additional pollutant requirements
- Select proprietary biofilters and flow-through treatment control BMPs that have received third-party approvals for impairment pollutants

Overview of Updated WQMP Requirements

Overview of major changes to the WQMP

- PDP exemptions for "Green Streets" and trails
- Infiltration feasibility process and bioretention and biofiltration BMPs
- Bioretention soil media
- Large-scale bioretention/biofiltration BMPs
- Tree well BMPs
- Full trash capture requirements (Statewide Trash Amendments)
- Areas exempt from hydromodification requirements
- Lack of alternative compliance for Critical Coarse Sediment Yield
- Alternative compliance program and applicability
- Source control and LID principles checklist for other development projects

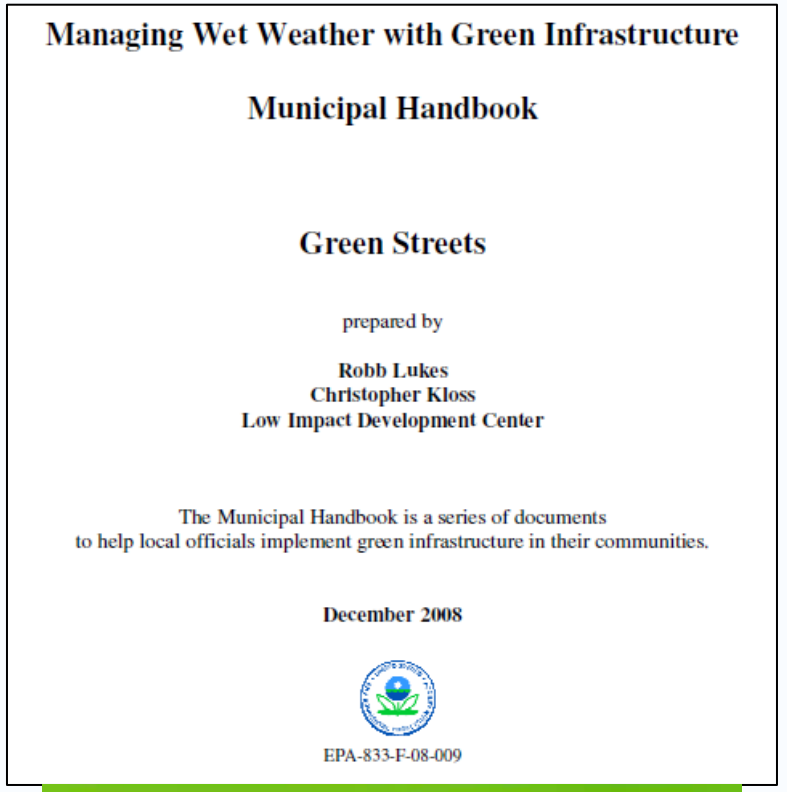
"Green Streets" PDP Exemption

- May be allowed by local jurisdiction for qualifying projects
- Applicable for retrofits or redevelopments to **existing** paved streets, alleys, and roads
  - Can be applied to a portion of a PDP (e.g., turn lane in public right of way associated with private project)
  - The "whole of the project" must still be used to define the PDP
- To qualify, projects need to implement US EPA Green Streets guidance to the MEP
  - Standard is opportunistic and includes wider range of stormwater management options than for PDPs
  - Accounts for typical constraints: limited right-of-way, existing utilities, grade differential between surface and outfall
- See local jurisdiction for documentation requirements

US EPA Green Streets Guidance

Potential BMPs:

- Street trees
- Curb-extension bioretention
- Permeable pavement
- Permeable friction overlays
- Vegetated swales
- Filter strips
- Proprietary biofilters
- Infiltration trenches
- Proprietary flow-through treatment
- Media filter drains



Managing Wet Weather with Green Infrastructure

Municipal Handbook

Green Streets

prepared by

Robb Lukes
Christopher Kloss
Low Impact Development Center

The Municipal Handbook is a series of documents
to help local officials implement green infrastructure in their communities.

December 2008

EPA-833-F-08-009

Sidewalks, bicycle lanes, and trails PDP Exemption

- Applicable for new or retrofit projects that:
  - Divert stormwater runoff to vegetated areas; or,
  - Are hydraulically disconnected from paved streets or roads; or,
  - Are designed with permeable pavements in accordance with US EPA Green Streets guidance

New Infiltration Feasibility Process

Infiltration Rate Feasibility

Determine infiltration rate:

- Onsite testing for most sites
- Soil maps with available data can be used as feasibility screening for small sites[1] (must be supplemented with testing if infiltration is proposed)

Determine factored infiltration rate:

- Using factor of safety for infiltration testing method

Other Feasibility Criteria

Groundwater protection criteria (e.g., depth to groundwater, groundwater contamination, water supply wells)

Geotechnical risks (e.g., slope stability, utilities, liquefaction, fill soils)

Downstream impacts to water rights or beneficial uses

[1] Small Site Size Thresholds

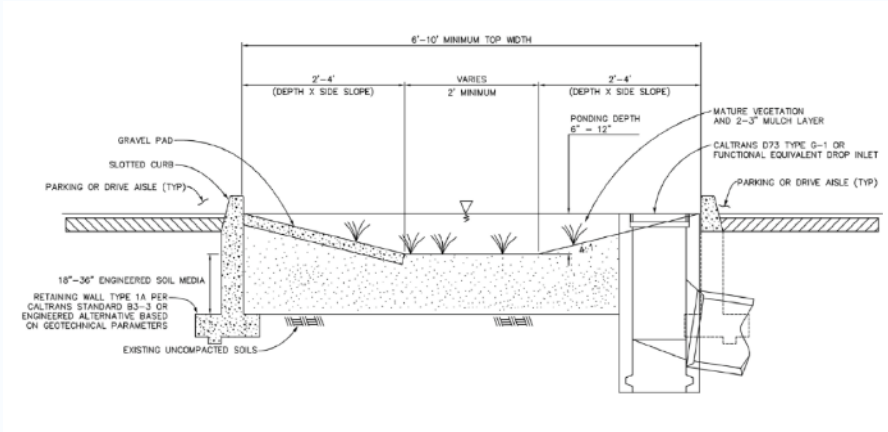
Residential	Commercial, Institutional	Industrial
Less than 10 acres and less than 30 DU	Less than 5 acres and less than 50,000 SF Impervious	Less than 2 acres and less than 20,000 SF Impervious

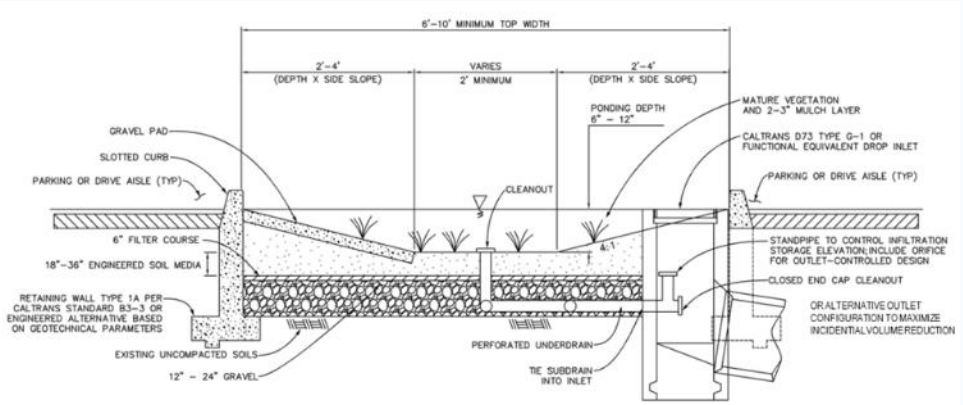
Infiltration Feasibility

Factored Infiltration Rate (in/hour)	Potential LID BMPs	Design Requirements
> 0.8 in/hour **and** site also passes all other feasibility criteria	• Bioretention • Infiltration Basin • Infiltration Trench • Pervious Pavement	Retain the full DCV. Consider designing and permitting the use of a back-up plan if rates are uncertain (capped underdrain).
0.1 – 0.8 in/hour **and** site feasibility analysis supports some amount of infiltration	• Biofiltration with Partial Infiltration • Proprietary Biofiltration with Supplemental Retention	Meet biofiltration sizing requirements and be designed to maximize infiltration
< 0.1 in/hour **or** other feasibility criteria do not permit any infiltration	• Biofiltration with No Infiltration • Proprietary Biofiltration	Meet biofiltration sizing requirements

- Flow-through treatment control BMPs may be used only in conjunction with Alternative Compliance

Bioretention and Biofiltration





Bioretention

- May include capped underdrains as backup if the WQMP provides calculations showing that facility would meet biofiltration sizing
- Uncapping would require a WQMP amendment with supporting basis

Biofiltration

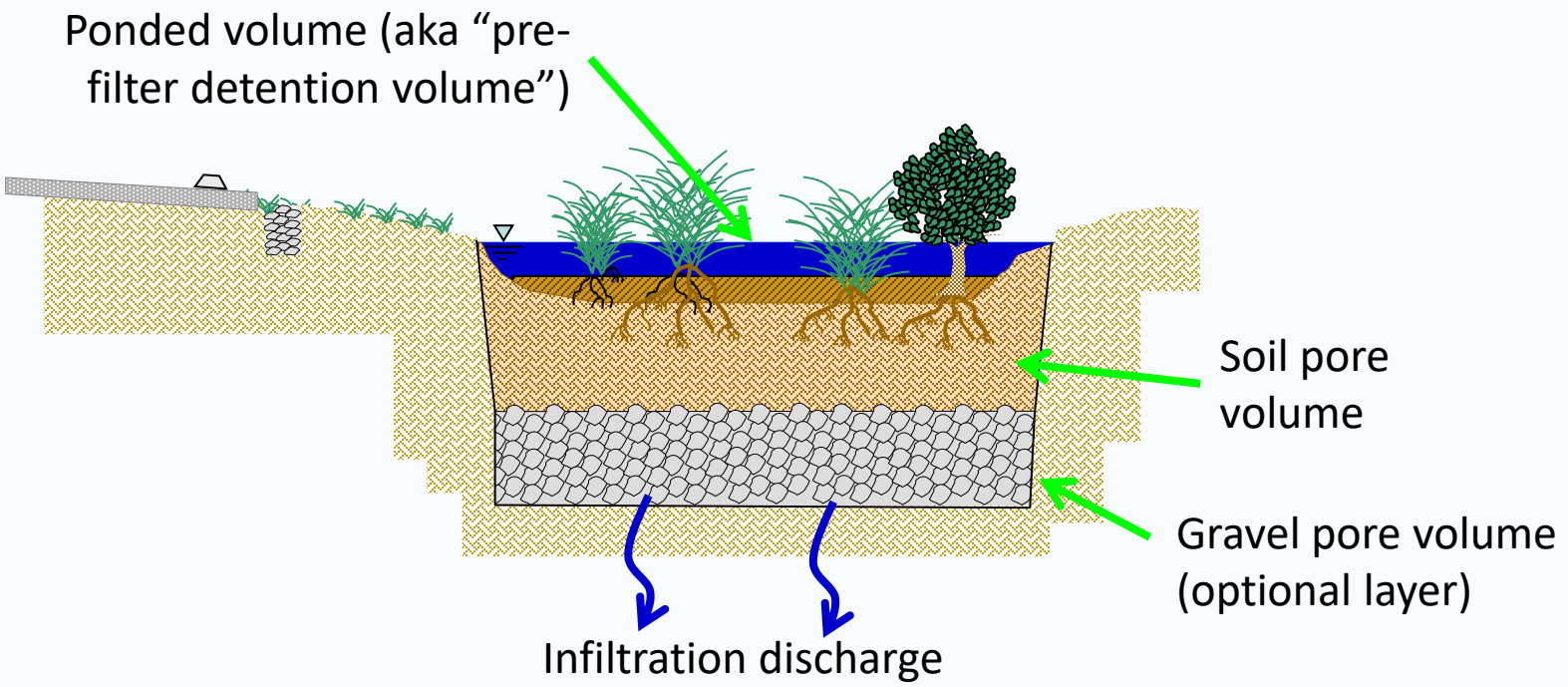
- Partial Infiltration design includes no liner and upturned elbow (or equiv.) to maximize infiltration
- No Infiltration design may include impermeable liner
- Both types may include outlet controls

Bioretention and Biofiltration

Design Element	Bioretention	Biofiltration
Soil Infiltration Rate	> 0.8 in/hour	0.1 – 0.8 in/hour: Partial Infiltration <0.1 in/hour: No Infiltration
Sizing	Retain 100% of DCV	Static volume equal to 75% of DCV **OR** Treat 150% of DCV
Surface Ponding	6 to 12 inches ponding (potentially higher if designed as a large-scale bioretention/biofiltration facility)	
Bioretention Media	18 – 36 inch depth soil according to **Bioretention Soil Media** Fact Sheet	
Gravel	None required unless capped underdrain is included	6 inch filter course and 18 inches minimum drainage gravel
Underdrains	None required	6” minimum diameter perforated

Retention BMP storage volumes

$$\text{BMP Volume} = V_{pond} + V_{soil} + V_{gravel}$$

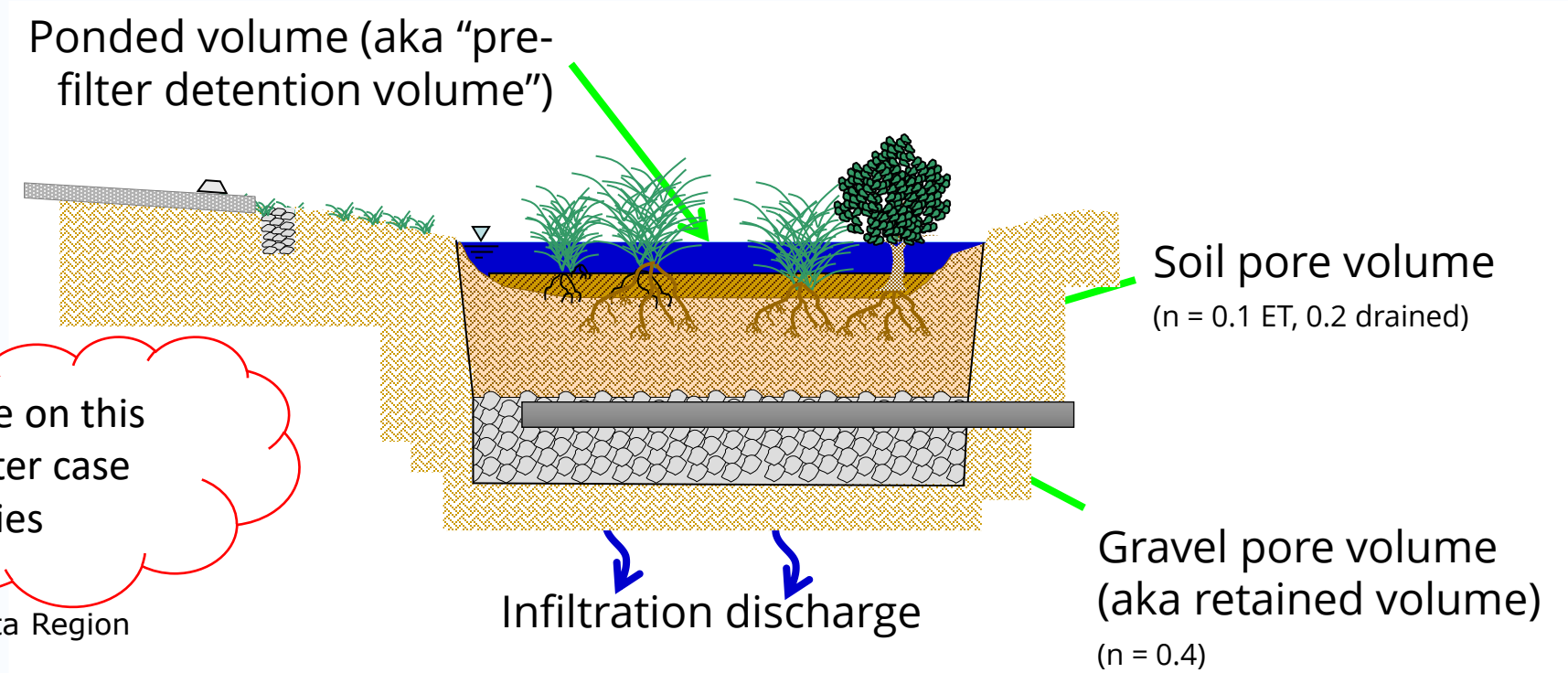


Biofiltration BMP storage volumes

Retention volume = $V_{gravel\ below\ underdrain} + V_{soil\_ET}$

Biofiltration volume (static) = $V_{pond} + V_{soil+drained}$

Biofiltration volume (dynamic) = $V_{pond} + V_{soil+drained} + V_{biofiltered\ during\ event}$



Santa Margarita Region

Regional Bioretention/ Biofiltration

- Fact Sheet added for BMPs that receive runoff from > 5 acres
- Maximum ponding depth increased from 1 to 3 feet
- Additional design requirements specific to bioretention/ biofiltration at larger scale
- Some jurisdictions may not permit such large BMPs
- More on this in later case studies

Bioretention Soil Media

- The entire SMR region drains to nutrient impaired waters (Santa Margarita River and Estuary and others)
  - WQIP established a strategy to improve nutrient performance of bioretention soil media
- Bioretention Soil Media (BSM) specifications have been revised to:
  - Improve pollutant removal
  - Limit potential for nutrient export from BSM
  - Limit potential for hydraulic failure
- More stringent limits on nutrient and contaminant content of media components
- Increased BSM testing requirements for Whole BSM and components (sand, compost, topsoil)

Bioretention Soil Media Whole Blend

Component Type	Bioretention	Biofiltration (Partial and No Infiltration)	
		Flowrate controlled by media layer	Flowrate controlled by outlet device (e.g., orifice)
Sand Type	Washed[1]	Washed[1]	Washed[1]
Sand Fraction, by volume	60%	60-80%	80%
Topsoil Type	Sandy Loam or Loamy Sand	Sandy Loam or Loamy Sand	NA
Topsoil Fraction, by volume	20%	Up to 20%	0%
Organic Type	Nutrient-sensitive compost	Coconut coir pith, peat, or low nutrient compost	Coconut coir pith, peat, or low nutrient compost
Organic Fraction, by volume	20%	20%	20%

[1] Alternate sand is allowed if the full mix meets hydraulic criteria

Bioretention Soil Media Applicable Criteria

Testing Element	Bioretention (full infiltration)	Biofiltration (Partial and No Infiltration)
General Criteria and Composition	Applicable, no testing	Applicable, no testing
Basic Testing of Mixed BSM	Applicable, testing	Applicable, testing
Hydraulic Evaluation of Mixed BSM	Not Applicable	Applicable, testing
Chemical Suitability of Mixed BSM	Not Applicable	Applicable, testing
Sand for BSM	Applicable[1]	Applicable[1]
Topsoil for BSM	Applicable[1]	Applicable[1]
Organic Amendments for BSM	Applicable, testing	Applicable, testing
Mulch for BSM	Applicable, no testing	Applicable, no testing

[1] Testing of these elements can be waived by the local jurisdiction if testing of mixed BSM is acceptable.

BSM Testing Requirements

Testing Element	Applicable BMPs	Typical Testing Cost per Sample	Who Submits Samples?	Can Testing Requirement be Waived?
Basic Testing of Mixed BSM	Bioretention and biofiltration	~$200	Typically contractor	No
Hydraulic Evaluation of Mixed BSM	Biofiltration	~$30	Typically contractor	No
Chemical Suitability of Mixed BSM	Biofiltration	~$30	Typically contractor	No
Sand for component	Bioretention and biofiltration	~$55	Data typically available from supplier	Yes
Topsoil component	Bioretention and biofiltration	~$30	Typically contractor	Yes
Compost component	Bioretention and biofiltration	~$325	Data typically available from supplier	No

$250 to 350 in testing costs for typical project

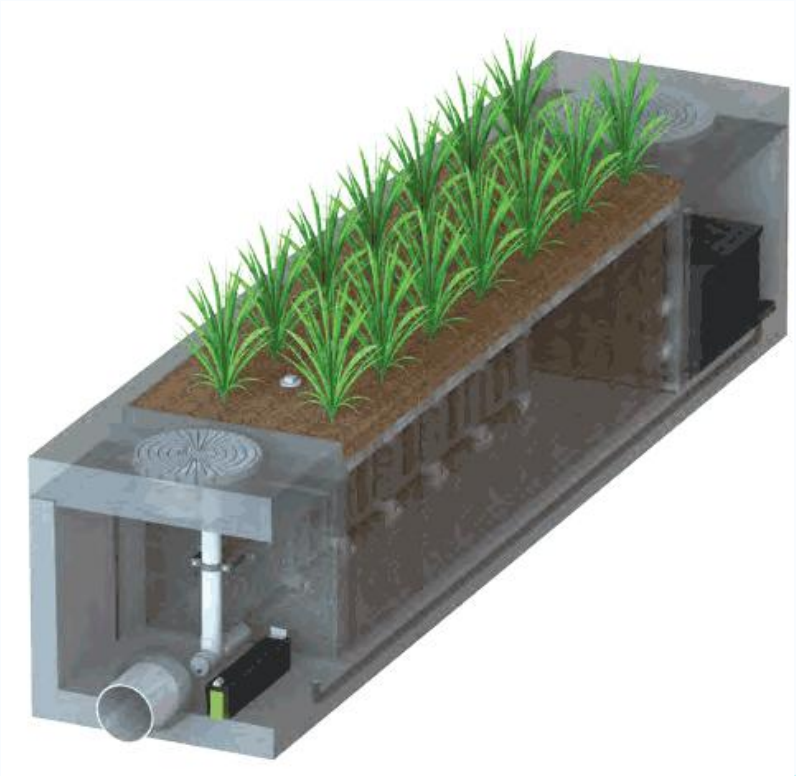
Suppliers will likely begin offering mixes with appropriate documentation

Sourcing Suitable BSM

- Media survey conducted for City of San Diego in 2017 included suppliers from Riverside County and nearby portions of San Diego County that meet updated specifications
- Typical cost for mixed BSM is $40 - $70 per cubic yard
- Most high-quality soil suppliers should be able to meet specifications for all components
- Topsoil specification is for loamy sand or sandy loam
- Sand specification is for washed concrete sand (ASTM C-33)
- Compost specifications should be achievable by producers registered through US Composting Council Seal of Testing Assurance Program[1]: Seven STA Approved composters in Riverside County

[1] compostingcouncil.org/participants/#CA

Proprietary Biofiltration



Proprietary Biofiltration Conditions of Acceptance

- Must include biological features including substrate and vegetation
- Must be sized according to biofiltration requirements:
  - Static volume = 0.75 x DCV, OR Treat 1.5 x DCV (account for routing)
- Must maximize infiltration if in Partial Infiltration feasibility category (factored soil infiltration = 0.1 – 0.8 inches/hour and no other feasibility issues)
  - Upstream options: Dispersion or permeable pavement
  - Downstream options: supplemental infiltration galleries, gravel sumps
- Must have third-party monitoring data documenting effectiveness for removing **primary pollutants of concern**
  - Standard approach is Washington State TAPE Protocol
- Must be used consistent with manufacturer guidelines

Proprietary Biofiltration Pollutant Removal Effectiveness

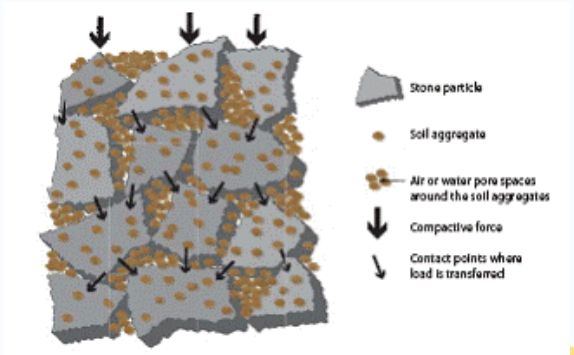
- Must be Approved through Washington State TAPE **GULD** for category corresponding to Primary Pollutants of Concern:

Primary Pollutants of Concern	Acceptable Washington TAPE GULD Treatment Category
Trash	Pretreatment, Basic Treatment, Phosphorus Treatment, or Enhanced Treatment
Sediments	Basic Treatment, Phosphorus Treatment, or Enhanced Treatment
Oil and Grease	Basic Treatment, Oil Treatment, Phosphorus Treatment, or Enhanced Treatment
Nutrients (N and P)	Phosphorus Treatment (no TAPE category for N)
Metals	Enhanced Treatment
Pesticides and Herbicides	Basic Treatment, Phosphorus Treatment, or Enhanced Treatment
Other Organics	Basic Treatment, Phosphorus Treatment, or Enhanced Treatment
Bacteria and Viruses	Basic Treatment, Phosphorus Treatment, or Enhanced Treatment

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

New Tree Well BMP

- Tree Wells support healthy trees and retain stormwater runoff via evapotranspiration and infiltration
- Can be implemented as **Self-Retaining Areas** to retain runoff from up to **10 parts impervious area to each unit surface area of tree well soil**
- Three general types of tree wells:
  - Open Top: no pavement above soil, but may use grate
  - Structural Soil: specially-formulated structural soil with pavement overlying
  - Suspended Pavement: Silva Cells or similar systems



Tree Well Design Guidelines

Design Element	Design Requirement	Rationale
Inlet	Sufficient to permit runoff during the 85th percentile 24-hour storm from the entire self-retaining area	Runoff must freely enter tree well
Inlet ponding area	At least 10% of the tree well soil area and at least 4 inches deep	Permits easy entry and distribution of runoff
Distribution layer	Covering at least 80% of the total tree well area. At least 12 inches thick if gravel. At least 4 inches thick of void space.	Permit rapid distribution of runoff across the entire tree well soil area
Soil thickness	At least 36 inches deep	Promote healthy trees
Soil texture	Loamy sand, sandy loam, loam, or structural soil	Promote healthy trees

- Optional design elements include root barriers, surface grates, and underdrains

Full Trash Capture

- To comply with Statewide Trash Capture Amendments and San Diego Regional Board Order R9-2017-0077, MS4 Permittees must implement full trash capture in high priority land uses (or equivalent):
  - High density residential: 10+ DU/acre
  - Industrial
  - Commercial
  - Mixed urban
  - Public transportation facilities
- The 2015 MS4 Permit does not require full trash capture at applicable PDPs but jurisdictions may require full trash capture

Full Trash Capture BMPs

- Full trash capture BMPs must be designed to:
  - remove all particles larger than 5 mm
  - from all flows not less than the 1-year 1-hour event or for the maximum flow rate of the corresponding storm drain
- Potential BMPs for Full Trash Capture:
  - Catch-basin screens
  - High flow trash capture devices: hydrodynamic or screens
  - LID BMPs with trash screens or upstream diversions
- Trash capture requirements and approved BMPs are evolving. The most up to date requirements can be found at:
  - https://www.waterboards.ca.gov/water_issues/programs/stormwater/trash_implementation.html

Full Trash Capture Hydrology

$$Q_{TRASH} = C \cdot i \cdot A_{TRIB}$$

City	1-year 1-hour Precipitation Depth (in/hr)
Murrieta	0.47
Temecula	0.50
Wildomar	0.37

From NOAA Atlas 14: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

- Full trash capture flow rates are greater than flow-through treatment control BMP Design Flow Rate (V_{BMP})
  - V_{BMP} intensity value (i) = 0.2 inches/hour

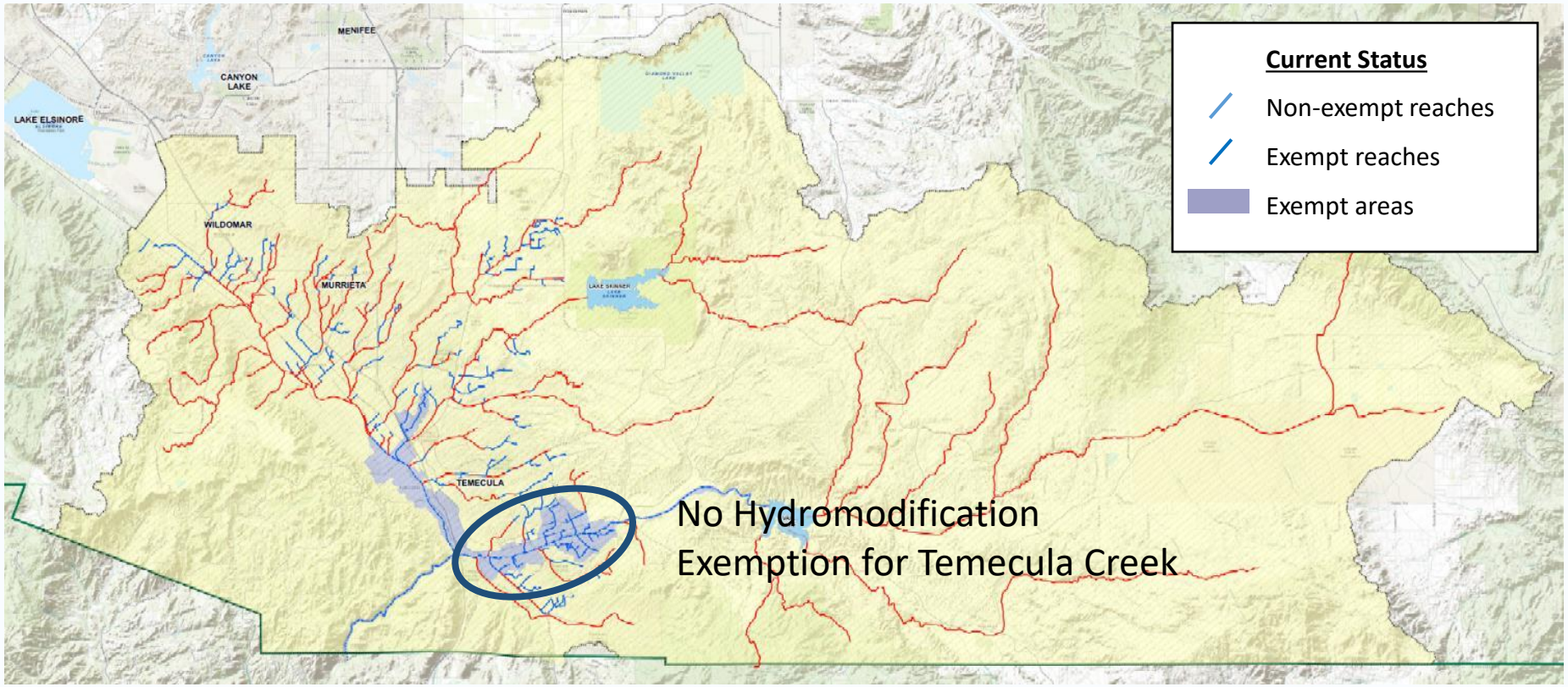
Hydromodification Requirements

- The **Hydrologic Performance Standard** requires that BMPs be implemented such that the post-project runoff flow rates do not exceed pre-development runoff flow rates by more than 10% within the flow range from 10% of the 2-year return interval runoff event to the 10-year return interval runoff event
- The **Sediment Supply Standard** requires that PDPs must avoid development of Critical Coarse Sediment Yield Areas, or implement measures such that there is no net impact to the receiving water

Hydromodification Exemptions

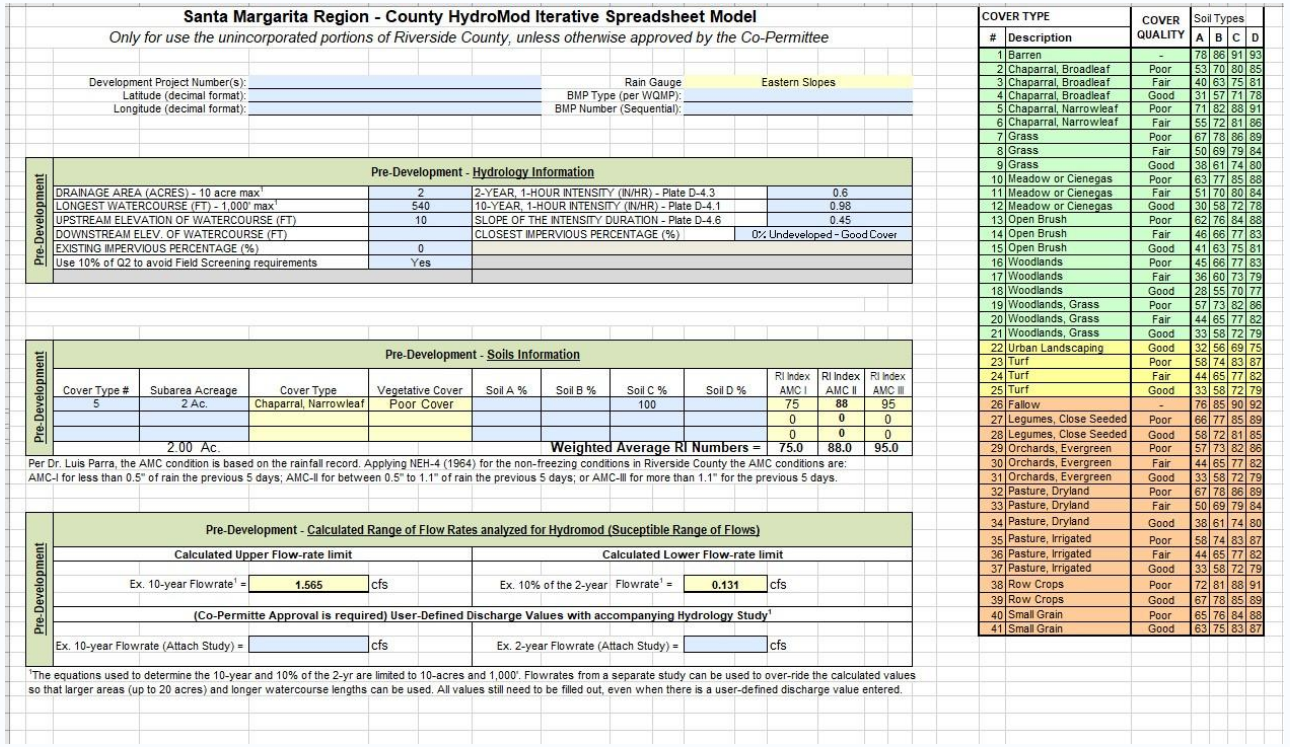
- Areas that drain directly to certain waterbodies are exempt from hydromodification requirements because those waterbodies are not susceptible to hydroamidation. Examples include lakes, reservoirs, the Pacific Ocean, large rivers, and armored channels.
- Interim exemptions expire when the BMP Manual is effective (July 5, 2018)
- The Watershed Management Area Analysis (WMAA) includes a chapter designed to identify and provide technical support for new or renewed exemptions
- Murrieta Creek and Santa Margarita River are exempt streams
  - WMAA as part of accepted WQIP (November 2018)
  - Temecula Creek not exempt per accepted WQIP

Hydromodification Exempt Areas



Riverside County Hydromodification Spreadsheet

- Developed by Riverside County Transportation Department
- Pre/post hydrology and basin routing
- Instantaneous results (flow and duration)
- Consistent with local hydrology methods
- Permit compliant



Santa Margarita Region - County HydroMod Iterative Spreadsheet Model

Only for use the unincorporated portions of Riverside County, unless otherwise approved by the Co-Permittee

Development Project Number(s):
Latitude (decimal format):
Longitude (decimal format):
Rain Gauge: Eastern Slopes
BMP Type (per WQMP):
BMP Number (Sequential):

Pre-Development - Hydrology Information

DRAINAGE AREA (ACRES) - 10 acre max[1]	2	2-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.3	0.6
LONGEST WATERCOURSE (FT) - 1,000' max[1]	540	10-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.1	0.98
UPSTREAM ELEVATION OF WATERCOURSE (FT)	10	SLOPE OF THE INTENSITY DURATION - Plate D-4.6	0.45
DOWNSTREAM ELEV. OF WATERCOURSE (FT)		CLOSEST IMPERVIOUS PERCENTAGE (%)	0% Undeveloped - Good Cover
EXISTING IMPERVIOUS PERCENTAGE (%)	0		
Use 10% of Q2 to avoid Field Screening requirements	Yes		

Pre-Development - Soils Information

Cover Type #	Subarea Acreage	Cover Type	Vegetative Cover	Soil A %	Soil B %	Soil C %	Soil D %	RI Index AMC I	RI Index AMC II	RI Index AMC III
5	2 Ac.	Chaparral, Narrowleaf	Poor Cover			100		75	88	95
								0	0	0
								0	0	0
	2.00 Ac.						Weighted Average RI Numbers =	75.0	88.0	95.0

Per Dr. Luis Parra, the AMC condition is based on the rainfall record. Applying NEH-4 (1964) for the non-freezing conditions in Riverside County the AMC conditions are: AMC-I for less than 0.5" of rain the previous 5 days; AMC-II for between 0.5" to 1.1" of rain the previous 5 days; or AMC-III for more than 1.1" for the previous 5 days.

Pre-Development - Calculated Range of Flow Rates analyzed for Hydromod (Suceptible Range of Flows)

Calculated Upper Flow-rate limit		Calculated Lower Flow-rate limit	
Ex. 10-year Flowrate[1] =	1.565 cfs	Ex. 10% of the 2-year Flowrate[1] =	0.131 cfs

(Co-Permitte Approval is required) User-Defined Discharge Values with accompanying Hydrology Study[1]

Ex. 10-year Flowrate (Attach Study) =	cfs	Ex. 2-year Flowrate (Attach Study) =	cfs

[1]The equations used to determine the 10-year and 10% of the 2-yr are limited to 10-acres and 1,000'. Flowrates from a separate study can be used to over-ride the calculated values so that larger areas (up to 20 acres) and longer watercourse lengths can be used. All values still need to be filled out, even when there is a user-defined discharge value entered.

COVER TYPE #	COVER TYPE Description	COVER QUALITY	Soil Types A	B	C	D
1	Barren	-	78	86	91	93
2	Chaparral, Broadleaf	Poor	53	70	80	85
3	Chaparral, Broadleaf	Fair	40	63	75	81
4	Chaparral, Broadleaf	Good	31	57	71	78
5	Chaparral, Narrowleaf	Poor	71	82	88	91
6	Chaparral, Narrowleaf	Fair	55	72	81	86
7	Grass	Poor	67	78	86	89
8	Grass	Fair	50	69	79	84
9	Grass	Good	38	61	74	80
10	Meadow or Cienegas	Poor	63	77	85	88
11	Meadow or Cienegas	Fair	51	70	80	84
12	Meadow or Cienegas	Good	30	58	72	78
13	Open Brush	Poor	62	76	84	88
14	Open Brush	Fair	46	66	77	83
15	Open Brush	Good	41	63	75	81
16	Woodlands	Poor	45	66	77	83
17	Woodlands	Fair	36	60	73	79
18	Woodlands	Good	28	55	70	77
19	Woodlands, Grass	Poor	57	73	82	86
20	Woodlands, Grass	Fair	44	65	77	82
21	Woodlands, Grass	Good	33	58	72	79
22	Urban Landscaping	Good	32	56	69	75
23	Turf	Poor	58	74	83	87
24	Turf	Fair	44	65	77	82
25	Turf	Good	33	58	72	79
26	Fallow	-	76	85	90	92
27	Legumes, Close Seeded	Poor	66	77	85	89
28	Legumes, Close Seeded	Good	58	72	81	85
29	Orchards, Evergreen	Poor	57	73	82	86
30	Orchards, Evergreen	Fair	44	65	77	82
31	Orchards, Evergreen	Good	33	58	72	79
32	Pasture, Dryland	Poor	67	78	86	89
33	Pasture, Dryland	Fair	50	69	79	84
34	Pasture, Dryland	Good	38	61	74	80
35	Pasture, Irrigated	Poor	58	74	83	87
36	Pasture, Irrigated	Fair	44	65	77	82
37	Pasture, Irrigated	Good	33	58	72	79
38	Row Crops	Poor	72	81	88	91
39	Row Crops	Good	67	78	85	89
40	Small Grain	Poor	65	76	84	88
41	Small Grain	Good	63	75	83	87

Critical Coarse Sediment Yield

- Bed sediment supply to receiving waters plays an important role in the stability of channels
- Because development of natural lands can cause a change in the supply of bed sediment to channels, PDPs must either:
  - Avoid development of areas that have been identified as Potential Critical Coarse Sediment Yield Areas (in the WMAA and presented in the WQMP) or;
  - Conduct a site-specific analysis to determine whether portions of a site identified as Potential CCSYAs are actual CCSYAs, and either:
    - Avoid development of those areas identified as CCSYAs, or;
    - Implement sediment supply BMPs such that there is no net impact to receiving waters

Critical Coarse Sediment Yield Site Specific Analysis

Step 1: Determine which portions of a site are significant sources of Bed Sediment to channel

Step 1A: Assessment of site soils and channel sediment to determine similarity

Step 1B: Determine whether onsite channels are capable of delivering sediment to receiving channel

Step 1C: Assess current and future channel conditions

Step 2: Avoid areas identified as significant sources of bed sediment

OR

Implement sediment supply BMPs to prevent net impacts to receiving channels

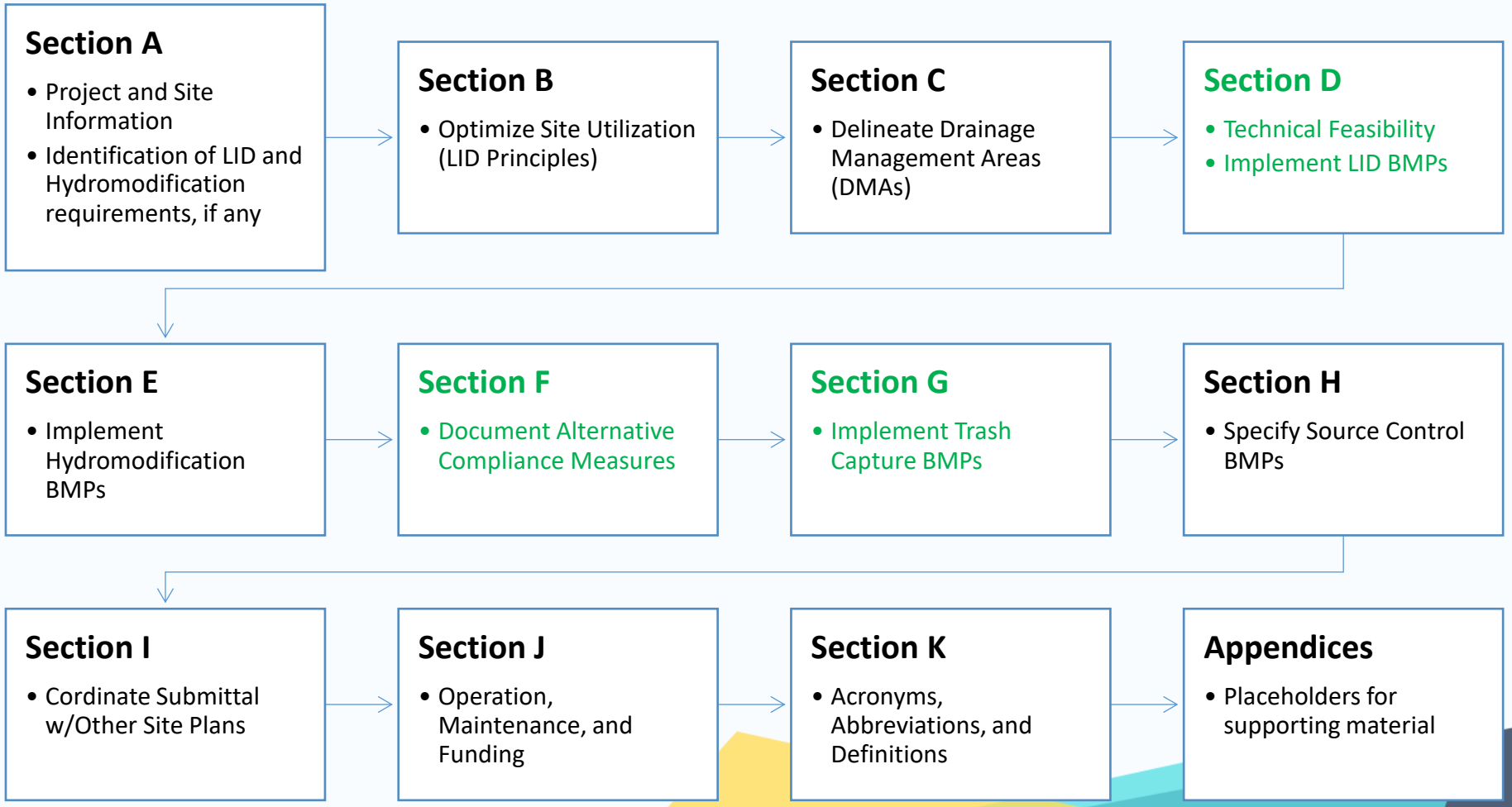
Case study in later slides

Alternative Compliance

- Alternative Compliance for pollutant control and hydromodification is now a potential option for all PDPs regardless of whether standard on-site approaches are feasible
  - Subject to local jurisdiction acceptance
  - Subject to acceptable alternative compliance option (options are evolving)
  - Pollutant Control: requires flow-through BMP for pollutants not retained on site prior to discharge to waters of the U.S.
- Alternative Compliance not available to comply with Critical Coarse Sediment Yield Area requirements
- More details later in slides

Break

WQMP Template Refresher



WQMP Template Sections

Template Section	Section Content	Major Changes
A	• Compile project and site information • Identify LID and Hydromodification requirements	• Reduction in hydromodification exempt areas (Pending WMAA acceptance)
B	• Optimize site utilization (LID Principles)	• Harvest and use must be considered for all projects and implemented where applicable and feasible (Use DCV in 72 hours)
C	• Delineate Drainage Management Areas (DMAs)	• Tree Well BMPs may be used to categorize more area as Type 'B' Self-Retaining Areas
D	• Implement LID BMPs	• Infiltration feasibility assessment process • Bioretention and Biofiltration BMPs: feasibility and sizing

WQMP Template Sections

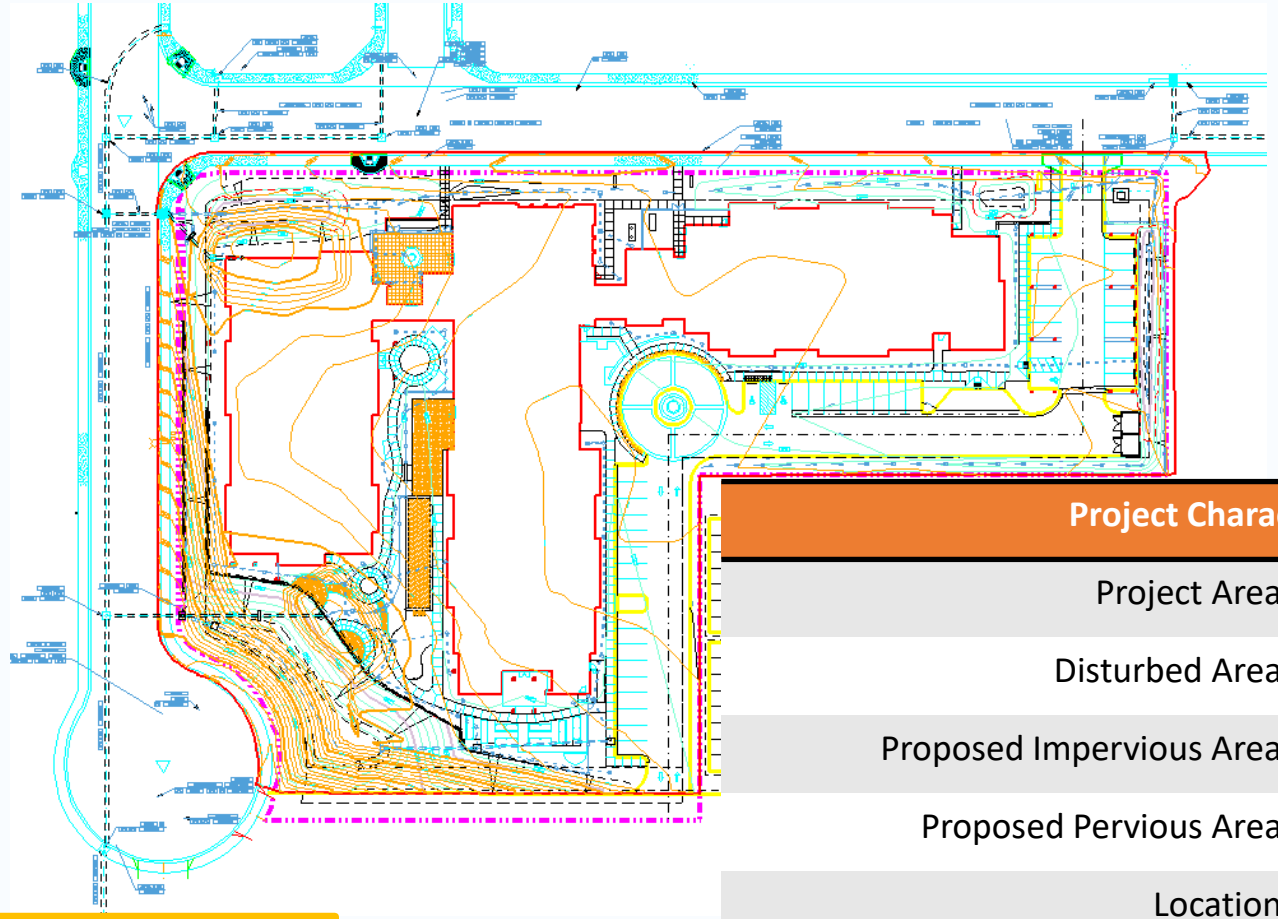
Template Section	Section Content	Major Changes
E	Implement hydromodification: • Hydrologic control BMPs • Sediment supply BMPs	• Alternative compliance no longer an option for complying with Critical Coarse Sediment Yield impacts
F	• Document alternative compliance	• Alternative compliance for pollutant treatment and flow duration control now potentially available for any site, regardless of LID feasibility
G	• Implement Trash Capture BMPs	• Entire section is new; applicability depends on project type and jurisdiction
H	• Source Control BMPs	• No major changes
I	• Coordinate Submittal with Other Site Plans	• No major changes
J	• Operation, Maintenance, and Funding	• No major changes

Case Studies

Case Studies

- 1: Basic Bioretention/ Biofiltration Selection and Sizing for Pollutant Control Requirements
  - 1a: Bioretention
  - 1b: Biofiltration
- 2: Large Bioretention/ Biofiltration Facility Design Approaches
- 3: Critical Coarse Sediment

Case Study 1: Hypothetical Site



Project Characteristics	
Project Area	3.1 Acres
Disturbed Area	3.1 Acres
Proposed Impervious Area	2.0 Acres
Proposed Pervious Area	1.1 Acres
Location	Temecula
Immediate Receiving Water	Santa Margarita River

Manual Section: 3.1
Template Section: A

Case Study 1: DCV Calculation

- After site Design BMPs have been planned and DMAs have been delineated, calculate DCV

$$\mathrm{DCV} = \mathrm{D}_{85} * \mathrm{C} * \mathrm{A}_{\mathrm{TRIB}}$$

$$C = 0.858 \cdot {I_f}^3 - 0.78 \cdot {I_f}^2 + 0.774 * I_f + 0.04$$

For 100% impervious DMA, I = 100 C = 0.892

D85 for Temecula = 0.95 inch

A_{TRIB} = 2.0 acres for entire impervious area as single DMA

$$\mathrm{DCV} = 0.95 * 0.892 * 2.0 * 3630 = \mathbf{6,152\ ft^3}$$

Manual Section: 2.6
Template Section: D

Case Study 1: LID Feasibility

- Determine whether infiltration can be implemented without creating unacceptable risks:
  - **Downstream Impacts to water rights or beneficial uses.** If such risks exist, they must be documented by a water rights evaluation.
  - **Groundwater quality.** Contaminated soils or groundwater must be documented with appropriate methods.
  - **Geotechnical Considerations.** Such conditions must be based on the opinion of a licensed engineer and presented in a geotechnical investigation report.
- For case study 1, none of these conditions exist.

Manual Section: 2.3
Template Section: D

Case Study 1: LID Feasibility

Step	Case Study Scenario 1a: Bioretention	Case Study Scenario 1b: Biofiltration with Partial Retention
Conduct Infiltration Testing	Average of test results within BMP: I = 3.6”/hour	Average of test results within BMP: I = 1.2”/hour
Apply Factor of Safety from LID Design Handbook	For double ring infiltrometer tests; FS = 3	
Calculate factored infiltration rate	$I_{factored}$ = 3.6”/hour / 3 = **1.2”/hour**	$I_{factored}$ = 1.2”/hour / 3 = **0.4”/hour**
Other feasibility issues	**Avoid utilities and buildings; otherwise ok to infiltrate**	**Avoid utilities and buildings; otherwise ok to infiltrate**
Determine LID Feasibility Track	**Full Infiltration (> 0.8”/hour)**	**Partial Infiltration (0.1 – 0.8”/hour)**

Manual Section: 2.3; Template Section: D

Case Study 1a: Bioretention

- Factored infiltration rate = 1.2”/hour

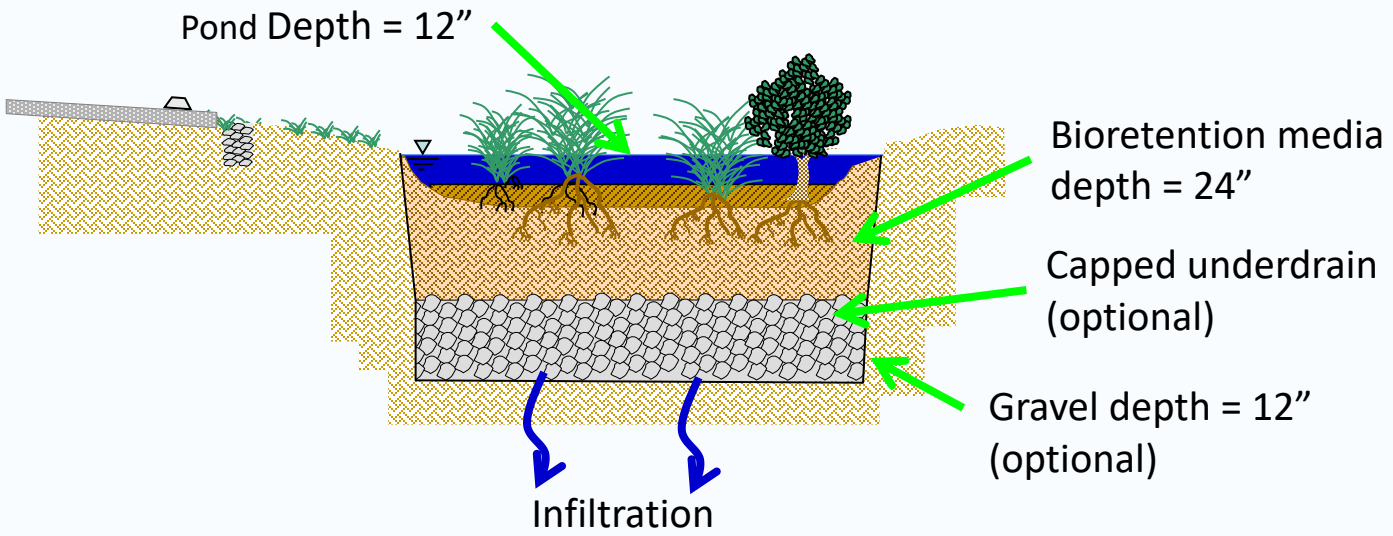
Factored Infiltration Rate (in/hour)	Potential LID BMPs	Design Requirements
> 0.8 in/hour	Bioretention Infiltration Basin Infiltration Trench Pervious Pavement (as BMP)	~~Should consider **resilient design**~~ **features** if rates only slightly above 0.8 inches/hour or are uncertain
0.1 – 0.8 in/hour	Biofiltration with Partial Infiltration Proprietary Biofiltration	Meet biofiltration sizing requirements and be designed to maximize infiltration
< 0.1 in/hour	Biofiltration with No Infiltration Proprietary Biofiltration	Permit rapid distribution of runoff across the entire tree well soil area

Fact Sheet 3.4: Bioretention

Sizing Standard: Retain 100% of the DCV

Manual Section: 2.3
Template Section: D

Case Study 1a: Bioretention Design



Effective Depth (ft): $d_e = d_p + [(0.3) \times d_s + (0.4) \times d_g]$

$d_e = 1 + [(0.3) \times 2 + (0.4) \times 1] = 2.0$ ft

Bioretention Fact Sheet; Template Section: D

Bioretention Facility - Design Procedure	BMP ID Case Study 1a	Legend:	Required Entries Calculated Cells

Company Name:	Geosyntec Consultants	Date:	5/24/2018
Designed by:	Myles Gray	County/City Case No.:	Training

Design Volume

Enter the area tributary to this feature	A_T=	2.0	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	6,152	ft³
Enter design infiltration rate (factored): refer to Section 2.3 of the WQMI	K_{design}=	1.20	in/hr

Bioretention Facility Surface Area

Depth of Surface Ponding Layer (6" minimum, 12" maximum)	d_p =	12.0	inches
Depth of Engineered Soil Media (24" to 36"; 18" allowed if vertically con:	d_s =	24.0	inches
Depth of Gravel Storage Layer (Optional Layer; up to 30")	d_g =	12.0	inches

Note: Check that storage in gravel does not exceed the amount that can enter these systems during a typical storm event. The depth of effective stored water should be less than 12 inches (30 inch bulk depth) unless higher permeability media is used to allow faster filling of this layer.

Total Effective Depth, d_E

$$d_E(ft) = d_p(ft) + [(0.3) \times d_S(ft) + (0.4) \times d_g(ft)]$$

d_E = 2.00 feet

Required Effective Footprint Area, A_{BMP}

$$A_{BMP}\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_{BMP} = 3,076 ft²

Proposed Surface Area (shall not be less than A_{BMP}) A= 3,100 ft²

Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side-slopes, this should be the contour that is midway between the floor of the basin and the maximum water qualty ponding depth of the basin. The underlying gravel layer should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Message: Facility meets the Minimum Footprint

Drawdown Time (must be less than 72 hours) T_{Dd} = 20.0 hr

Message: Facility meets drawdown time limitations

Minimum footprint (at mid pond)

Bioretention Sizing Spreadsheet Template Section: D

Case Study 1b: Biofiltration with Partial Infiltration

- Factored infiltration rate = 0.4”/hour

Factored Infiltration Rate (in/hour)	Potential LID BMPs	Design Requirements
> 0.8 in/hour	Bioretention Infiltration Basin Infiltration Trench Pervious Pavement (as BMP)	Should consider **resilient design features** if rates only slightly above 0.8 inches/hour or are uncertain
0.1 – 0.8 in/hour	Biofiltration with Partial Infiltration Proprietary Biofiltration	Meet biofiltration sizing requirements and be designed to maximize infiltration
< 0.1 in/hour	Biofiltration with No Infiltration Proprietary Biofiltration	Permit rapid distribution of runoff across the entire tree well soil area

Fact Sheet 3.4: Biofiltration with Partial Infiltration

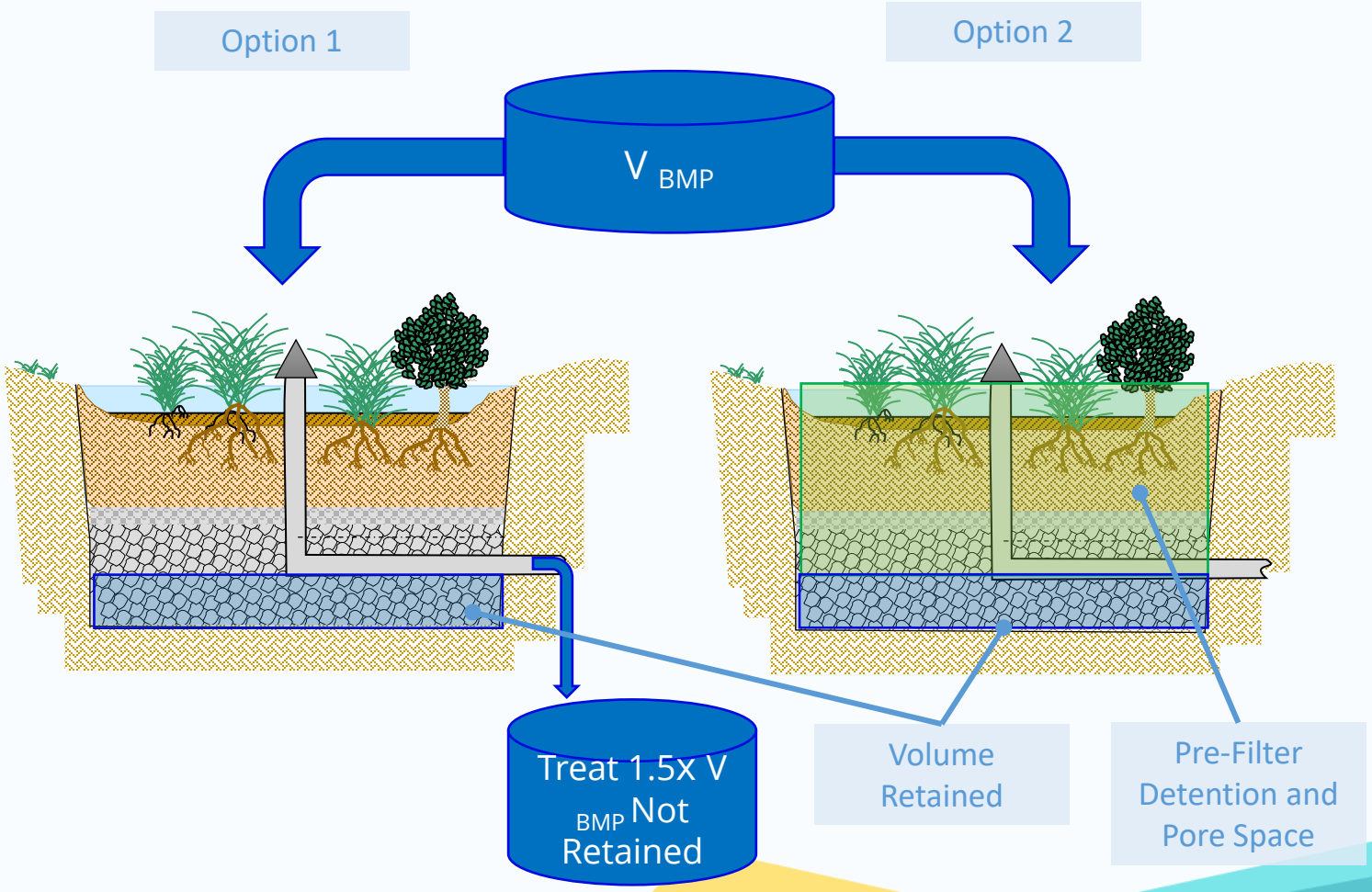
Sizing Standard: Have a static volume equal to 75% of the DCV

OR

Treat 150% of the DCV

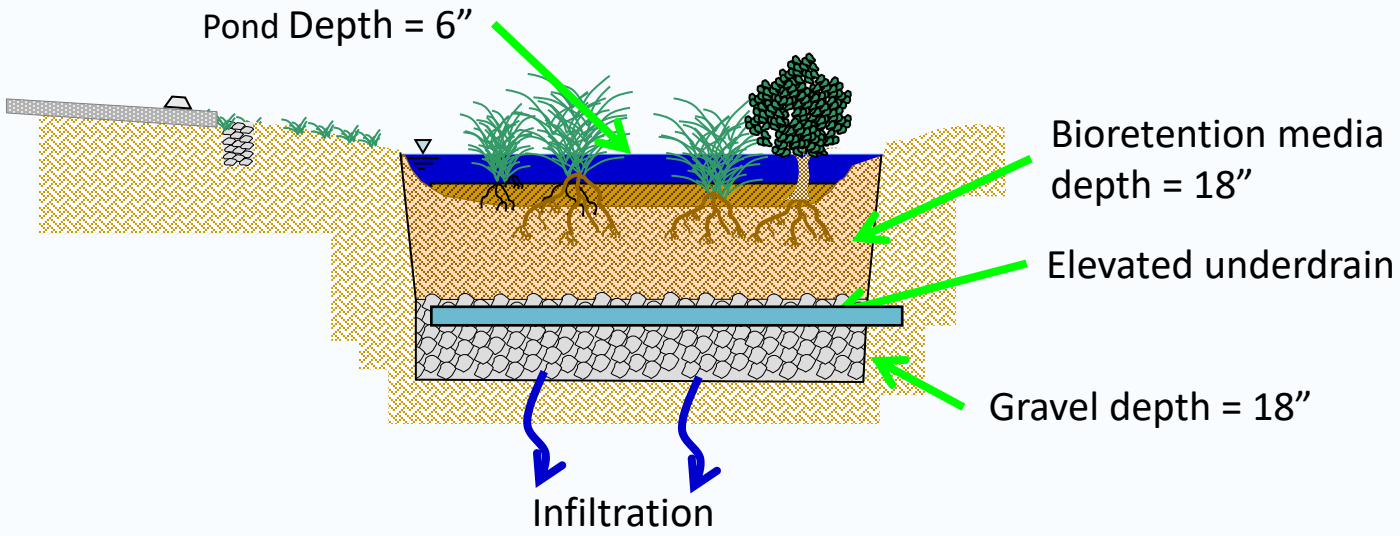
Manual Section: 2.3
Template Section: D

Biofiltration Sizing Options



Static Storage ≥ 0.75xDCV not Retained

Case Study 1b: Biofiltration with Partial Infiltration Design



Shallow profile system with vertical constraints

Biofiltration with Partial Infiltration Fact Sheet
Template Section: D

Case Study 1b: Biofiltration Sizing Spreadsheet (part 1)

Biofiltration with Partial Infiltration Facility - Design Procedure	BMP ID: Case Study 1b	Legend:	Required Entries / Calculated Cells
Company Name:	Geosyntec Consultants	Date:	5/24/2018
Designed by:	Myles Gray	County/City Case No.:	Training

Design Volume

Enter the area tributary to this feature	A_T =	2 acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP} =	6,152 ft^3
Enter initial estimate of footprint of BMP, $Area_{BMP}$ (Guidance: A reasonable starting point is 3% of the tributary impervious area)	$Area_{BMP}$ =	3,200 ft^2

Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side-slopes, this should be the contour that is midway between the floor of the basin and the maximum water quality ponding elevation of the basin. The underlying gravel layer (infiltration storage layer) should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Portion of DCV Reliably Retained

Depth of Gravel Infiltration Storage Layer (18" minimum; 30" maximum)	dg =	18.0 inches
Portion of V_{BMP} Reliably Retained via Infiltration Storage in Gravel Layer: $V_{retained} = d_g\,(in) \times 0.4 \times Area_{BMP}\,(ft^2) \times 1/12$	$V_{Retained}$ =	1920.0 ft^3
Portion of V_{BMP} not Reliably Retained: $V_{Not\ Reliably\ Retained} = V_{BMP} - V_{Retained}$	$V_{Not\ Reliably\ Retained}$ =	4232.0 ft^3

Case Study 1b: Biofiltration Sizing Spreadsheet (part 2)

RIVERSIDE COUNTY
WATERSHED PROTECTION

Biofiltration with Partial Retention Facility Surface Area

Depth of Surface Ponding Layer (6" minimum, 12" maximum)	d_P =	6.0	inches
Depth of Engineered Soil Media (24" to 36"; 18" if vertically constrained)	d_S =	18.0	inches
Design Media Filtration Rate (2.5 in/hr)	I_{design} =	2.5	in/hr
Allowable Routing Period, $T_{routing}$ (5 hrs)	$T_{routing}$ =	5.0	hr
Effective Biofiltration Depth, d_{E_bio}			
d_{E_bio} (ft) = (d_P + (0.3 x d_S) + (I_{design} * $T_{routing}$)) (ft)	d_{E_bio} =	2.0	ft
Effective Static Depth, $d_{E\_bio\_static}$			
$d_{E\_bio\_static}$ = (d_P + (0.3 * d_S)) (ft)	$d_{E\_bio\_static}$ =	1.0	ft
$V_{biofiltered}$ = d_{E_bio} * $Area_{BMP}$	$V_{biofiltered}$ =	6373.3	ft^3
$V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$	$V_{biofiltered\_static}$ =	3040.0	ft^3

Sizing Option 1 Result

Criteria 1:	$V_{biofiltered\ (with\ routing)}$ > 150% of $V_{not\ reliably\ retained}$	Results:	PASS

Sizing Option 2 Result

Criteria 2:	$V_{biofiltered\_static}$ > 0.75 x $V_{Not\ Reliably\ Retained}$	Results:	FAIL

Biofiltration with Partial Infiltration Sizing Spreadsheet Template Section: D

2- Large (Regional) Bioretention/ Biofiltration Facilities

- Fact Sheet 3.7: Guidance for Large Bioretention/ Biofiltration Facilities
  - Large/Multi-parcel sites, Drainage Areas > 5-acres
    - Must Follow Basin Guidelines (Appendix C to LID Handbook), and
    - Same Sizing w/Augmented Design Requirements for BMPs
  - Cross Section
    - 3 ft. max ponding,
    - 2 ft. min engineered soil media
  - Pretreatment
    - TAPE or 20% Forebay
  - Energy Dissipation
    - Velocity < 2 fps
  - Outlet Control
  - Flow Distribution

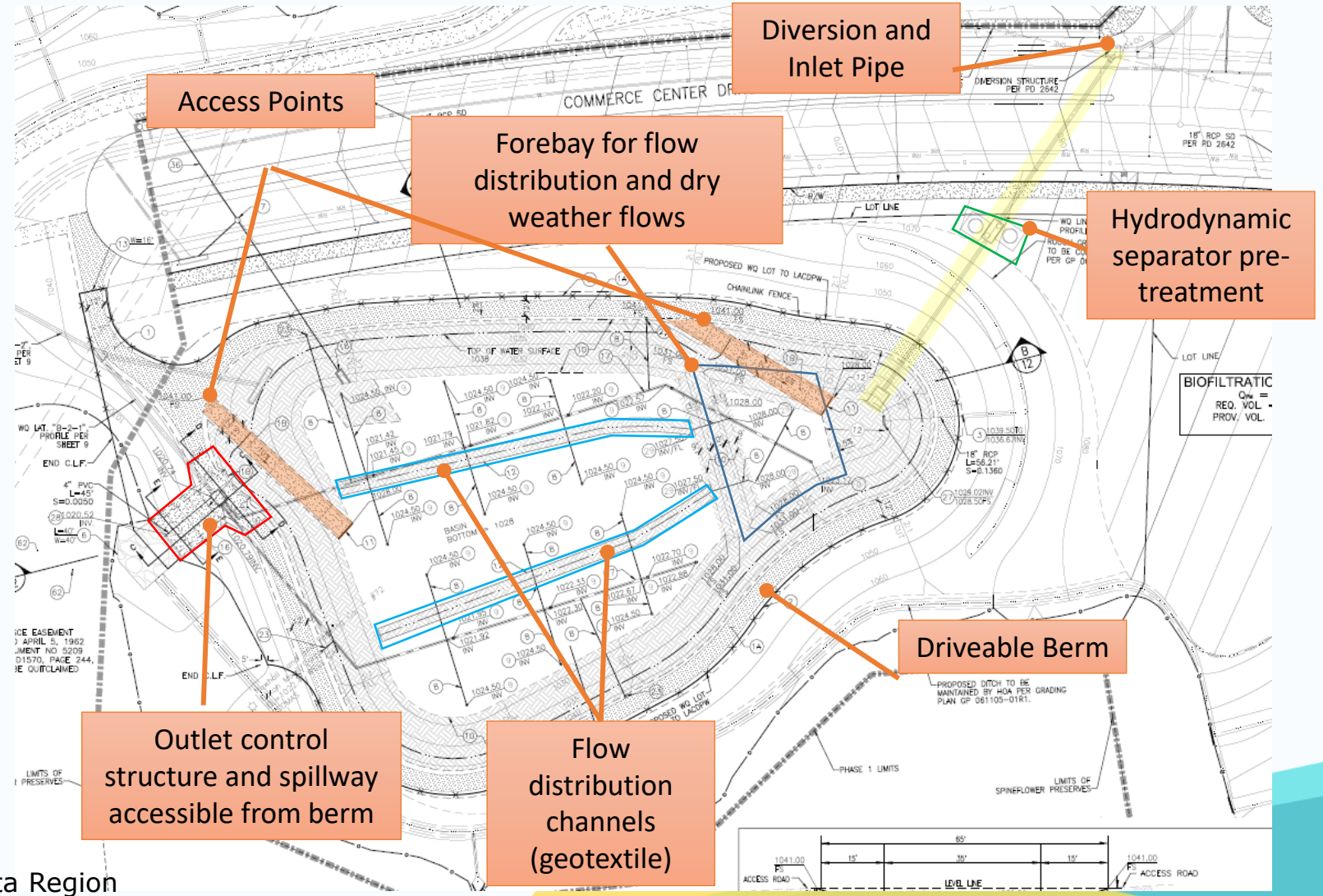
Table 1. Design Requirements for BMP Components

Component	Design Requirements
Pretreatment	Augmented
Cross Section Geometry	Augmented
Overflow	Augmented
Engineered Soil Media	Standard
Subsurface Storage Layer	Standard
Underdrain	Augmented
Energy Dissipation	Augmented
Internal Flow Distribution	Augmented
Media Properties and Outlet Control	Augmented
Landscaping	Standard
Vector Control	Standard
Maintenance Access	Augmented
Construction Considerations	Augmented
Sizing	Standard

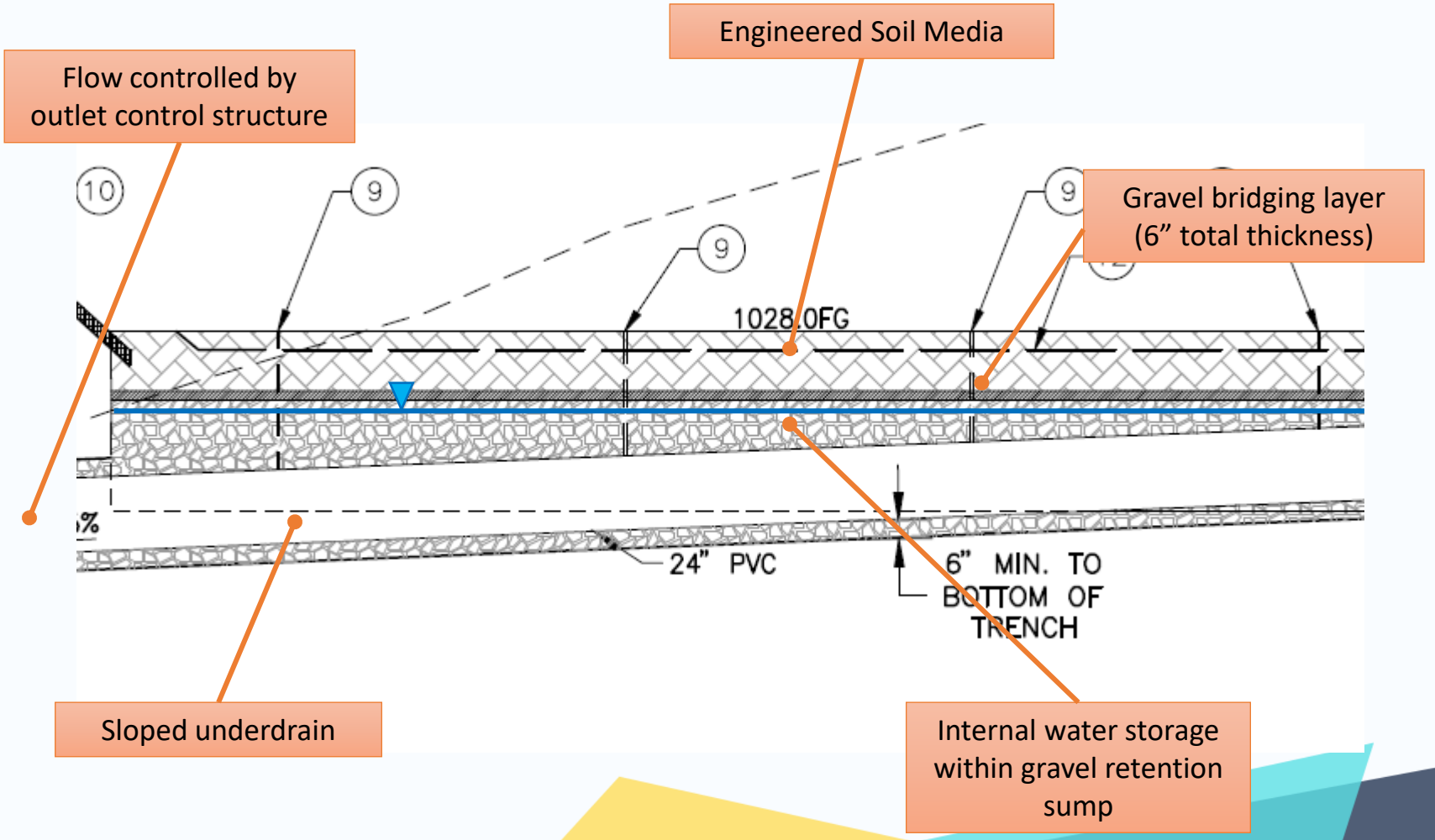
Why Augmented Design?

- Larger facilities see larger flows
  - Larger Pollutant Control Flows & Volumes
  - Larger Hydromodification Flows
  - Larger Flood Control Flows
- Larger flows = greater forces
- Greater potential for short circuiting through media when less than fully utilized
- More likely to receive flow from mixed land cover areas (potentially higher sediment load)
- Higher cost of failure/rehabilitation

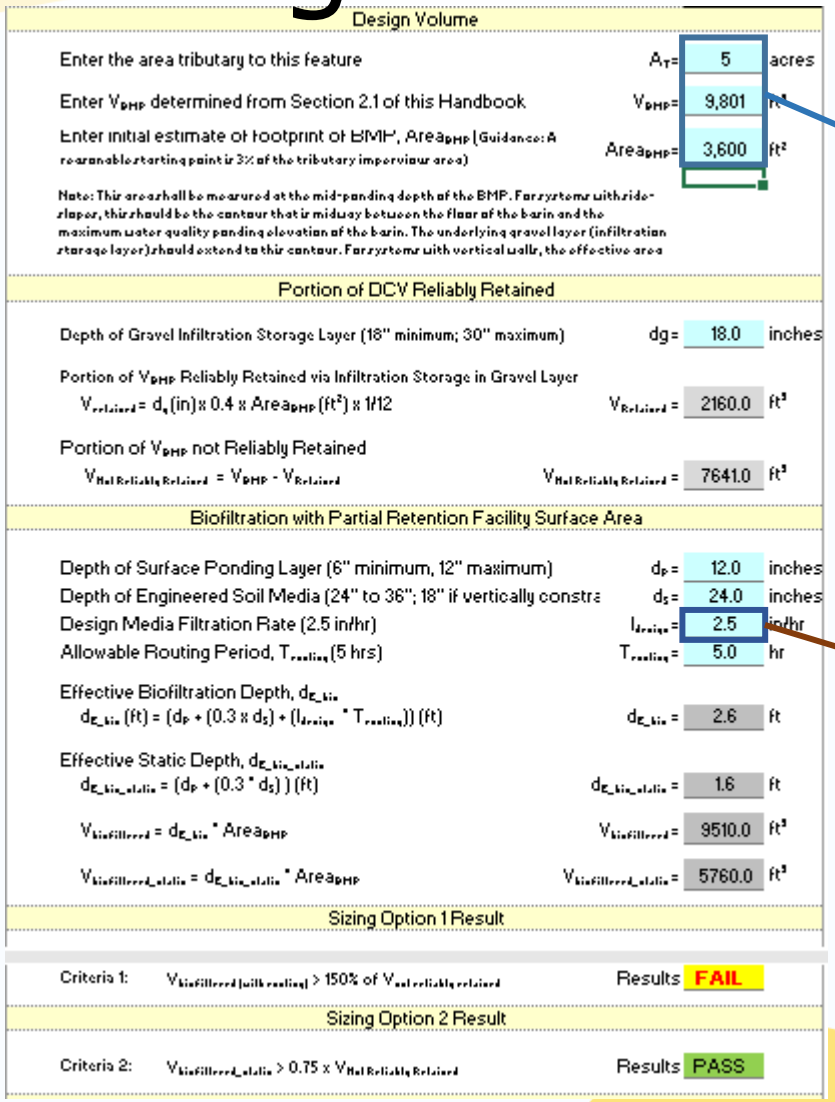
2-Augmented Components



2-Augmented Components



2-Large BMP Facilities



Design Volume			
Enter the area tributary to this feature	A_T =	5	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP} =	9,801	ft³
Enter initial estimate of footprint of BMP, $Area_{BMP}$ (Guidance: A reasonable starting point is 3% of the tributary impervious area)	$Area_{BMP}$ =	3,600	ft²
Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side slopes, this should be the contour that is midway between the floor of the basin and the maximum water quality ponding elevation of the basin. The underlying gravel layer (infiltration storage layer) should extend to this contour. For systems with vertical walls, the effective area			
Portion of DCV Reliably Retained			
Depth of Gravel Infiltration Storage Layer (18" minimum; 30" maximum)	d_g =	18.0	inches
Portion of V_{BMP} Reliably Retained via Infiltration Storage in Gravel Layer: $V_{reliable} = d_g$ (in) x 0.4 x $Area_{BMP}$ (ft²) x 1/12	$V_{Reliable}$ =	2160.0	ft³
Portion of V_{BMP} not Reliably Retained: $V_{Not\ Reliably\ Retained} = V_{BMP} - V_{Reliable}$	$V_{Not\ Reliably\ Retained}$ =	7641.0	ft³
Biofiltration with Partial Retention Facility Surface Area			
Depth of Surface Ponding Layer (6" minimum, 12" maximum)	d_P =	12.0	inches
Depth of Engineered Soil Media (24" to 36"; 18" if vertically constra	d_S =	24.0	inches
Design Media Filtration Rate (2.5 in/hr)	I_{design} =	2.5	in/hr
Allowable Routing Period, $T_{routing}$ (5 hrs)	$T_{routing}$ =	5.0	hr
Effective Biofiltration Depth, d_{E_bio}: d_{E_bio} (ft) = (d_P + (0.3 x d_S) + (I_{design} * $T_{routing}$)) (ft)	d_{E_bio} =	2.6	ft
Effective Static Depth, $d_{E\_bio\_static}$: $d_{E\_bio\_static}$ = (d_P + (0.3 * d_S)) (ft)	$d_{E\_bio\_static}$ =	1.6	ft
$V_{biofiltered} = d_{E\_bio}$ * $Area_{BMP}$	$V_{biofiltered}$ =	9510.0	ft³
$V_{biofiltered\_static} = d_{E\_bio\_static}$ * $Area_{BMP}$	$V_{biofiltered\_static}$ =	5760.0	ft³
Sizing Option 1 Result			
Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of $V_{Not\ reliably\ retained}$	Results	FAIL	
Sizing Option 2 Result			
Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x $V_{Not\ Reliably\ Retained}$	Results	PASS	

Forebay Volume: 0.2 x 3,600ft^2 x1ft =720 ft^3 (additional)

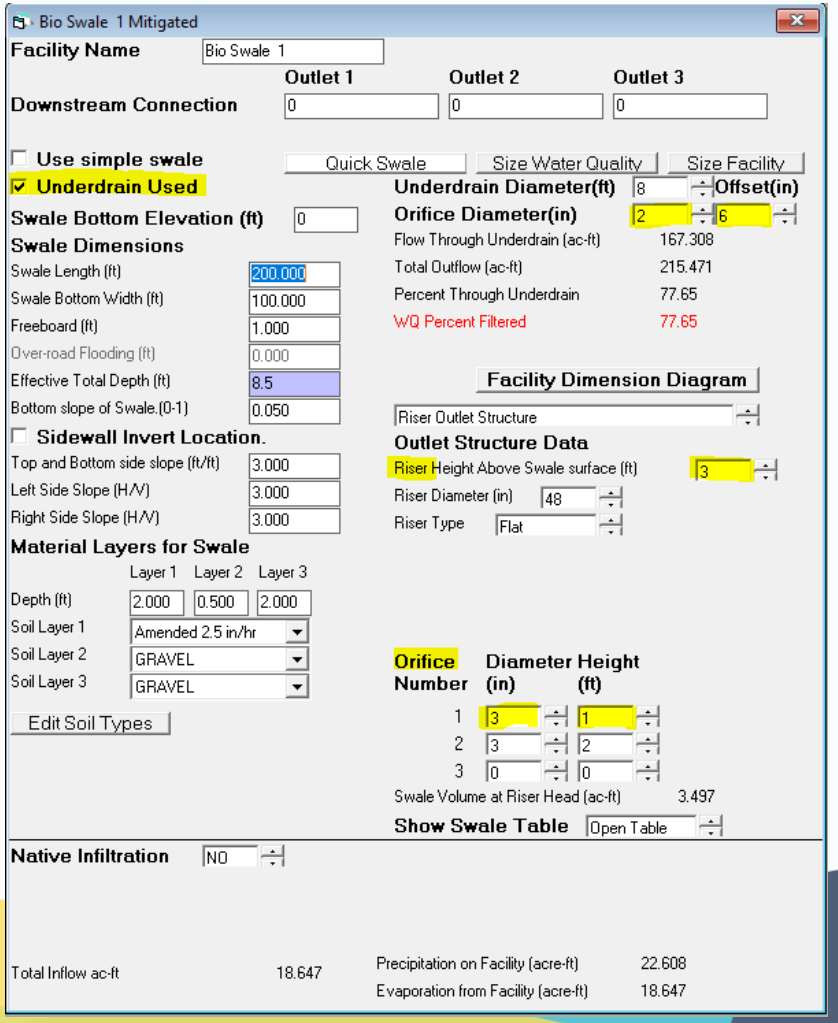
- Effective Media Filtration Rate: 2.5 in/hr
  - Underdrain Control Rate: 2.5 in/hr x 3600ft^2 x 1/12 x 1/3600= 0.21 cfs
  - Underdrain Size:

$$Q = \frac{\pi}{4} C_d d^2 \sqrt{2gh}$$

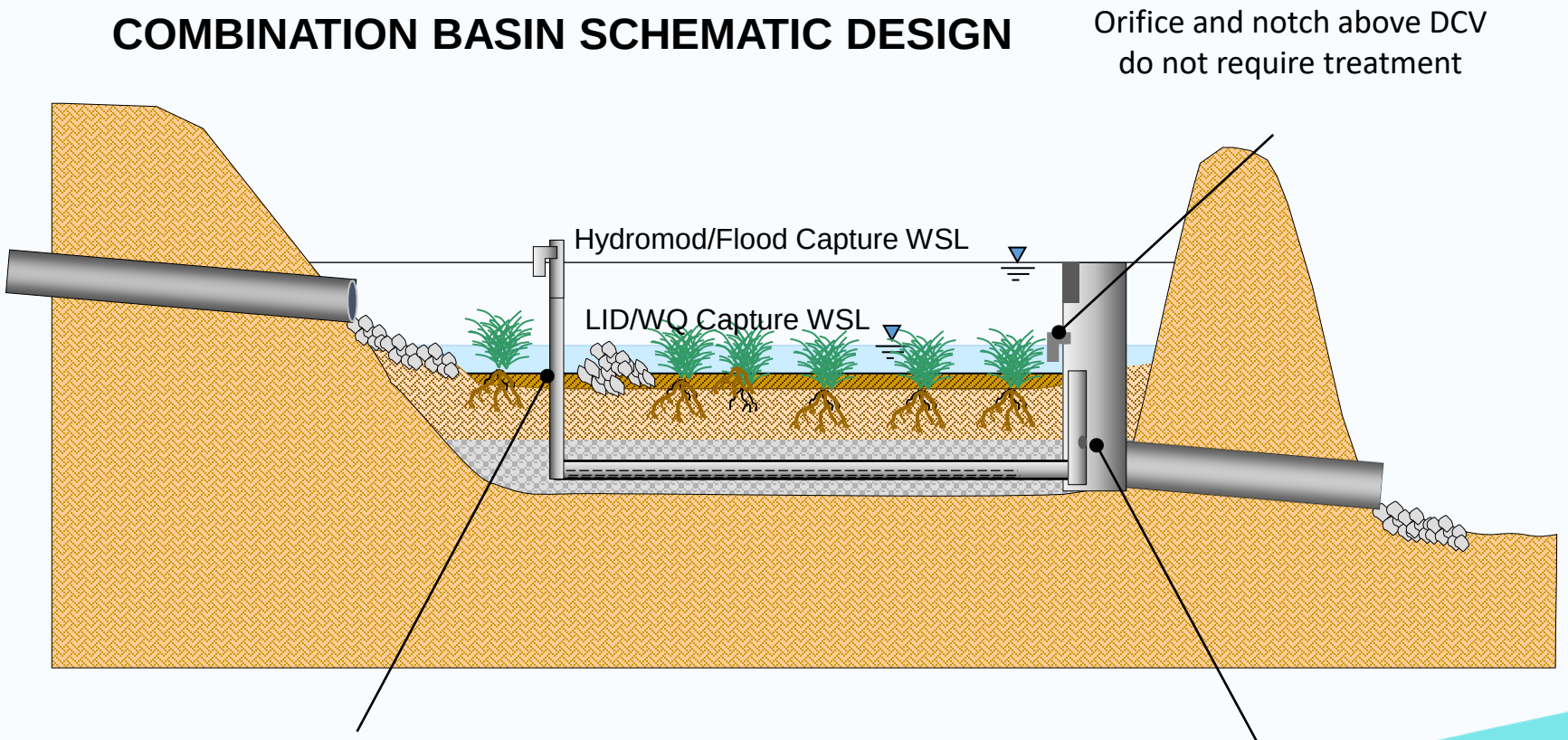
h=avg. head on orifice (ponding+media)/2
D=2.5 inches, Q=0.20 cfs

2-Large BMP Facilities, adding Hydromodification

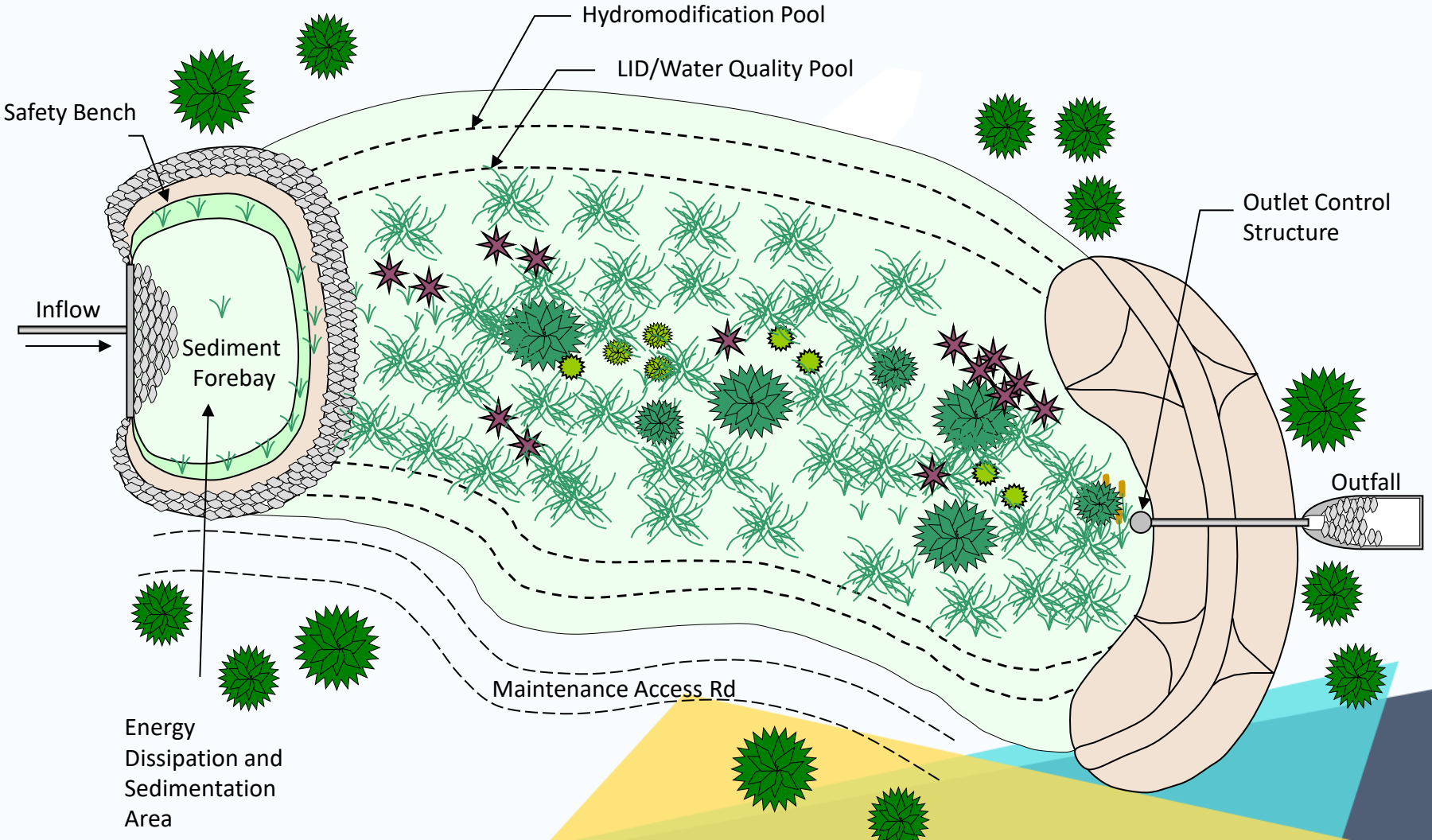
- Add additional ponding depth and/or gravel storage.
- Adjust low-flow orifice size for outlet control
  - WQ: 2.5 in. orifice
  - HMP: 2 in. orifice
- Add outlet riser in surface ponding
  - Elevate additional flow control orifices above WQ ponding depth
- Confirm WQ Performance is Met



2-Large BMP Facilities, adding Hydromodification

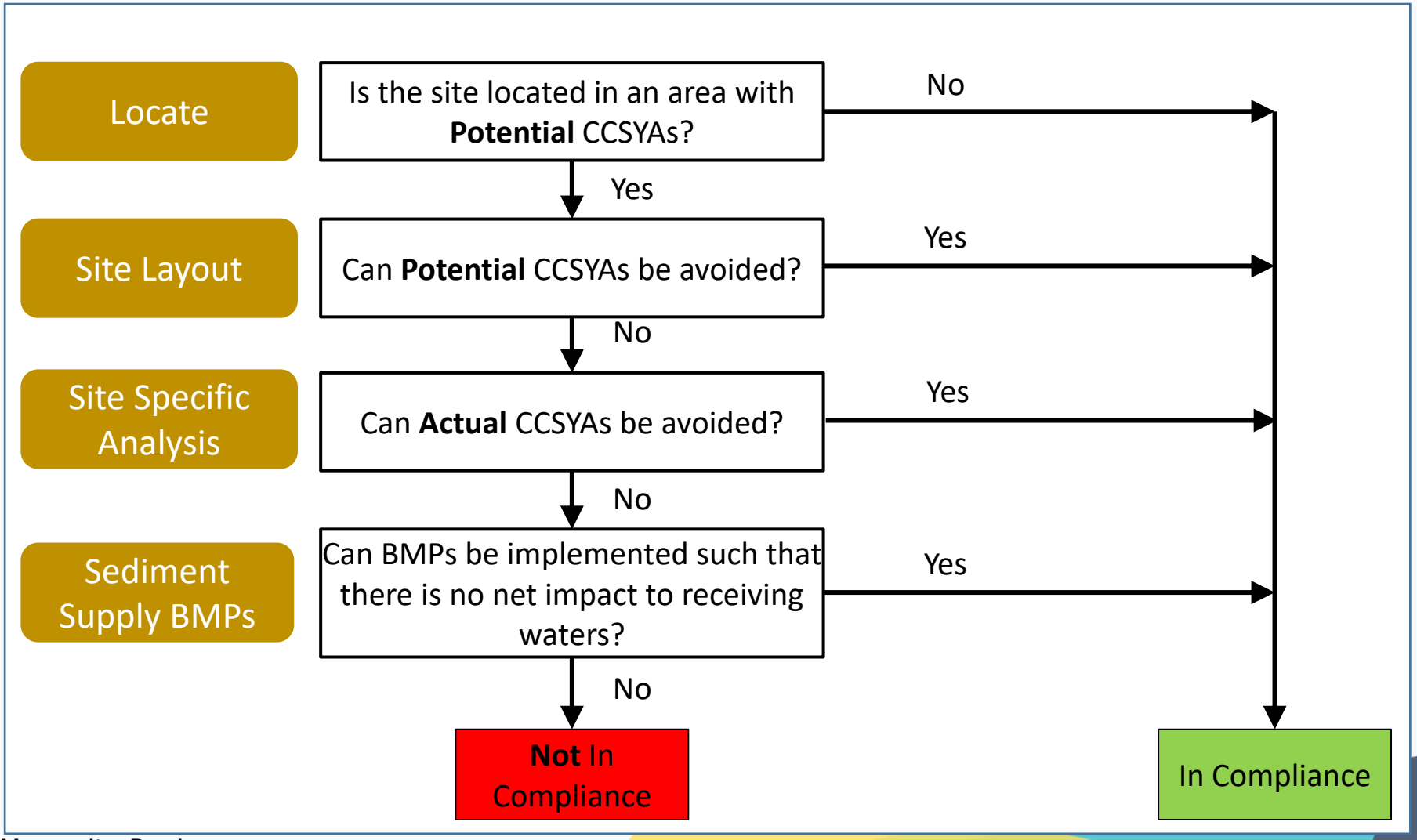


2-Large BMP Facilities, adding Hydromodification

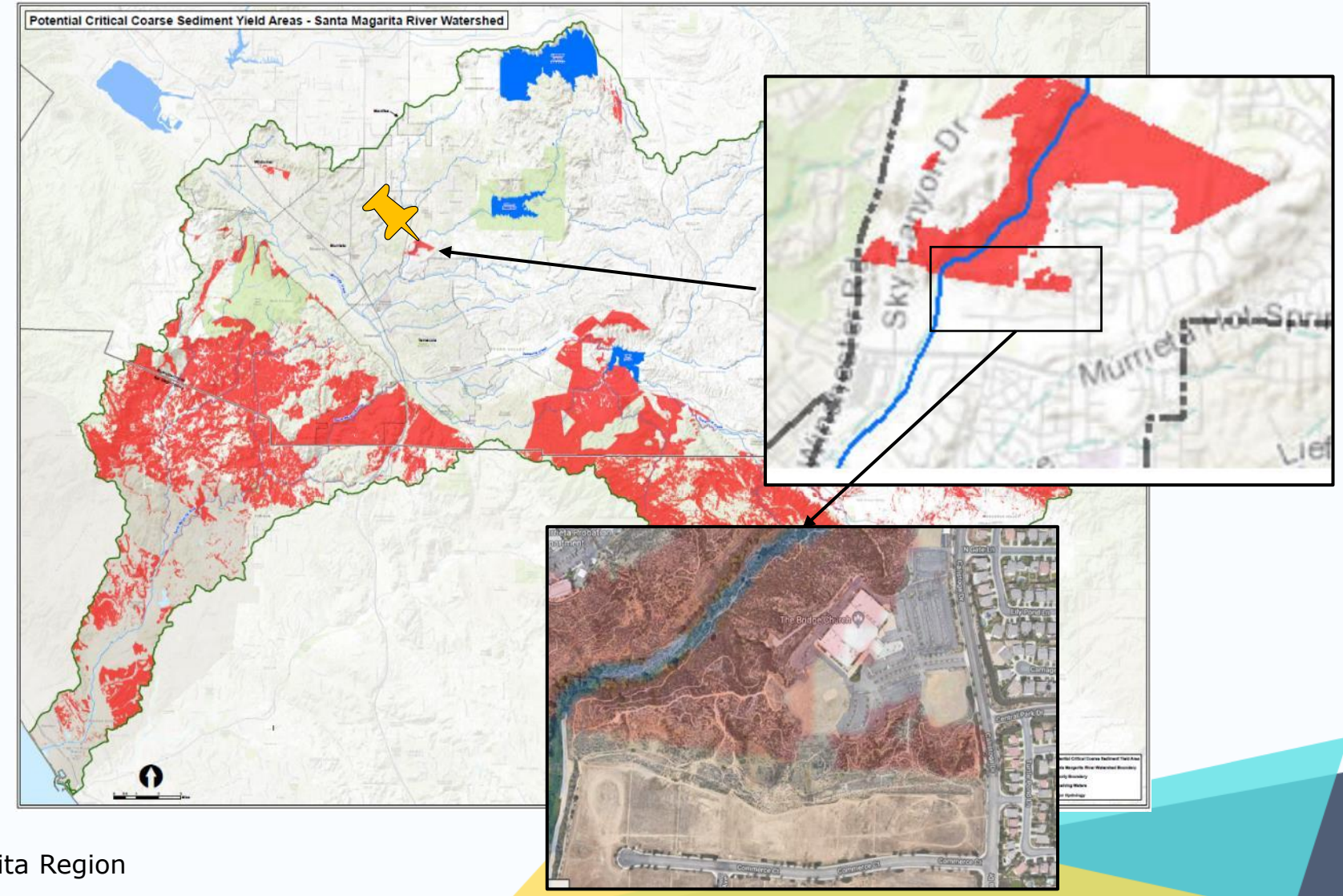


Critical Course Sediment

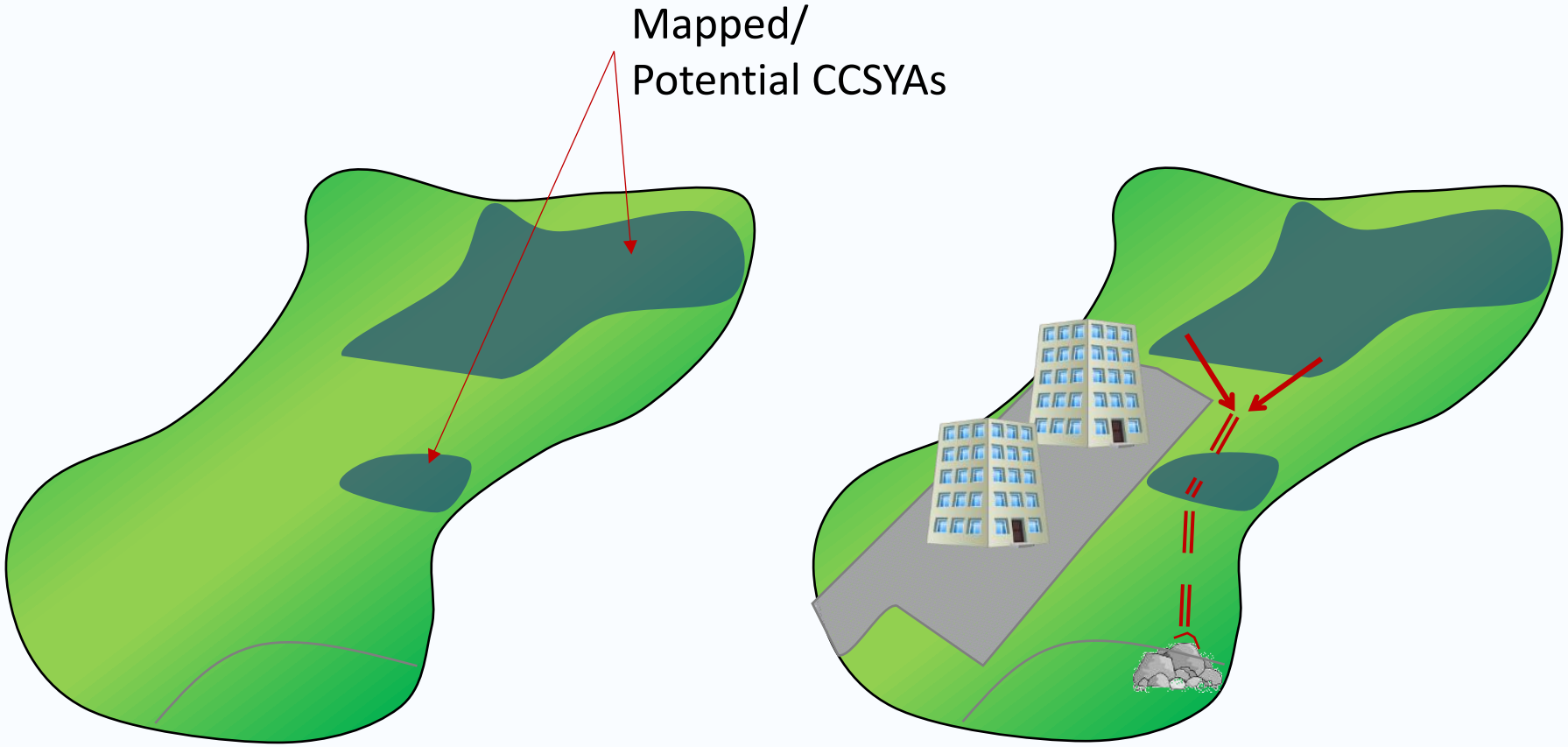
3-Critical Coarse Sediment



Site Location



Option 1: Avoid Potential CCSYAs



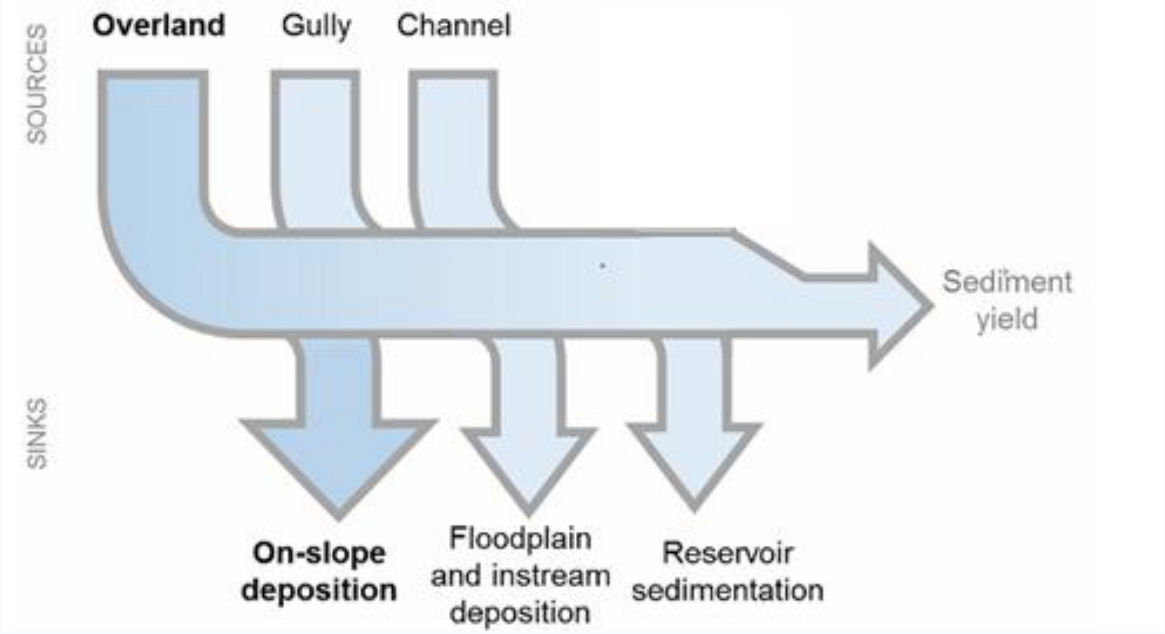
Avoid development of Potential CCSYAs and maintain onsite sediment transport pathways (e.g. channels)

Option 2: Site Specific Analysis

- Step 1: Determine portions of the project site that are significant sources of Bed Sediment Supply for receiving channels
  - Step 1A: Soil Assessment:
    - Sieve Size Comparison (Site vs. Channel)
    - Erodibility (K factor)
    - Topography (onsite channels)
    - Lithology

Option 2: Site Specific Analysis

- Step 1B Capability of onsite channels to deliver Bed Sediment Supply to downstream channels



Factors and Tools:

- Proximity to receiving waters
- Slope
- Flows & Velocities
- Sediment source
- Rainfall intensity

See Section 3.6.4.b

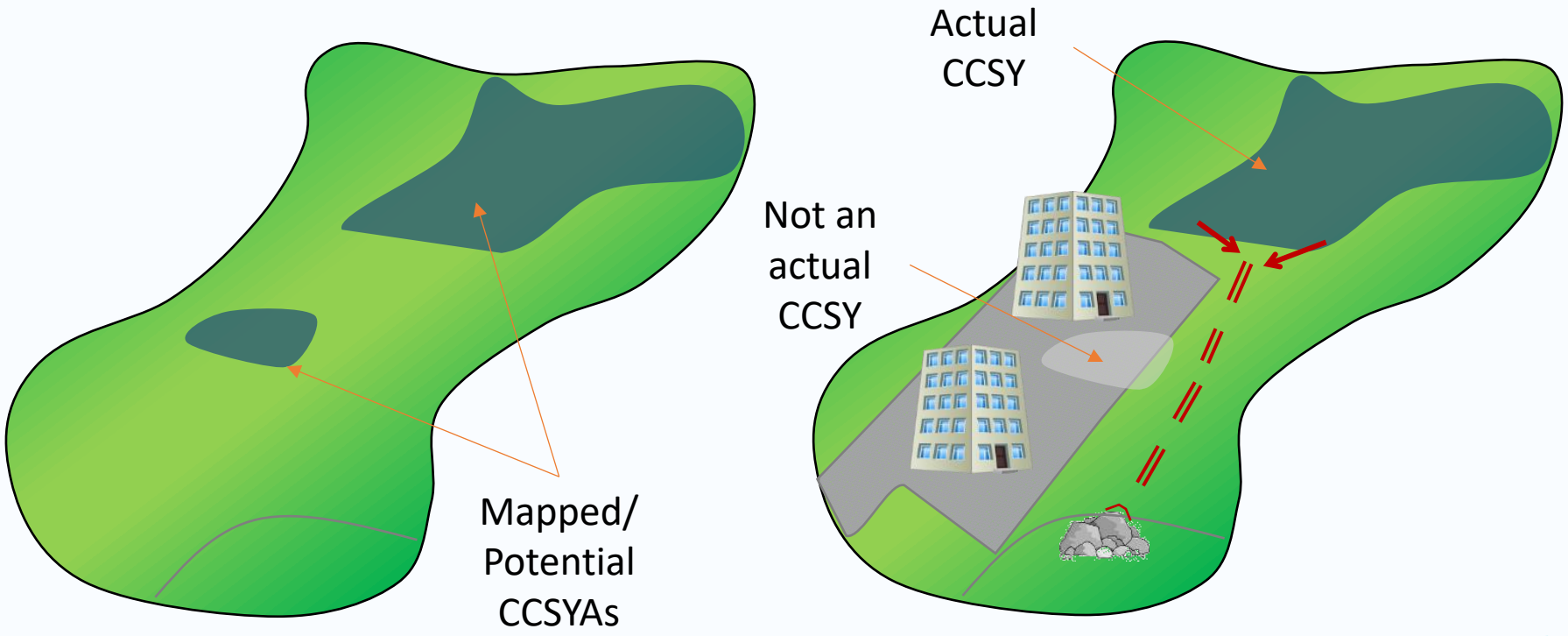
$$Sediment\ Delivery\ Ratio = \frac{Delivered\ Sediment}{Total\ Generated\ Sediment}$$

Option 2: Site Specific Analysis

- Step 1C: Present/Future Condition of Receiving Channel
  - Banks Stability
  - Incision & Degree of Incision (already impaired>>more sensitive)
  - Bed Sediment Gradation (gravel? cobbles?)
  - Sediment Regime of Channel (transport/supply limited)

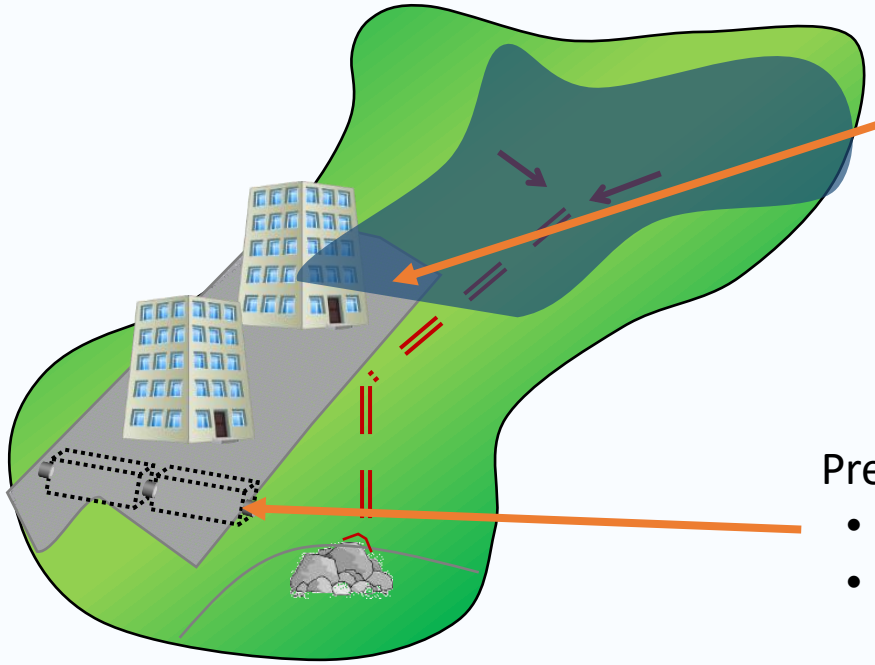
Option 2: Site Specific Analysis

Step 2: Avoid Areas Identified as Significant Sources of Bed Sediment Supply



Identify and avoid development of Actual CCSYAs and maintain onsite sediment transport pathways (e.g. channels)

Option 3: No Net Impact



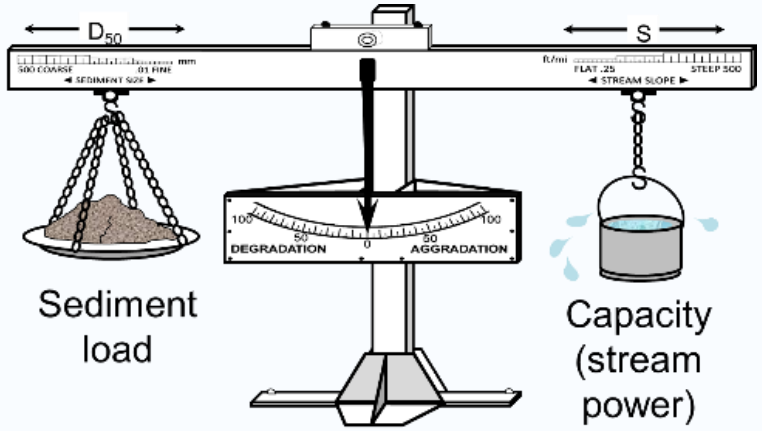
Unavoidable impacts to Actual CCSYA

Prevent net impacts:

- Additional flow control
- Other sediment supply BMPs

Option 3: No Net Impact

- Site Specific Continuous Simulation and Sediment Transport
- Reduce Transport Capacity (i.e. flows) to match Reduced Sediment Supply
  - Oversize Hydromod BMPs
- Example:
  - Supply Reduction: 30%
  - Supply Preserved: 1-0.3=0.7
  - Reduce downstream sediment transport by 30%.

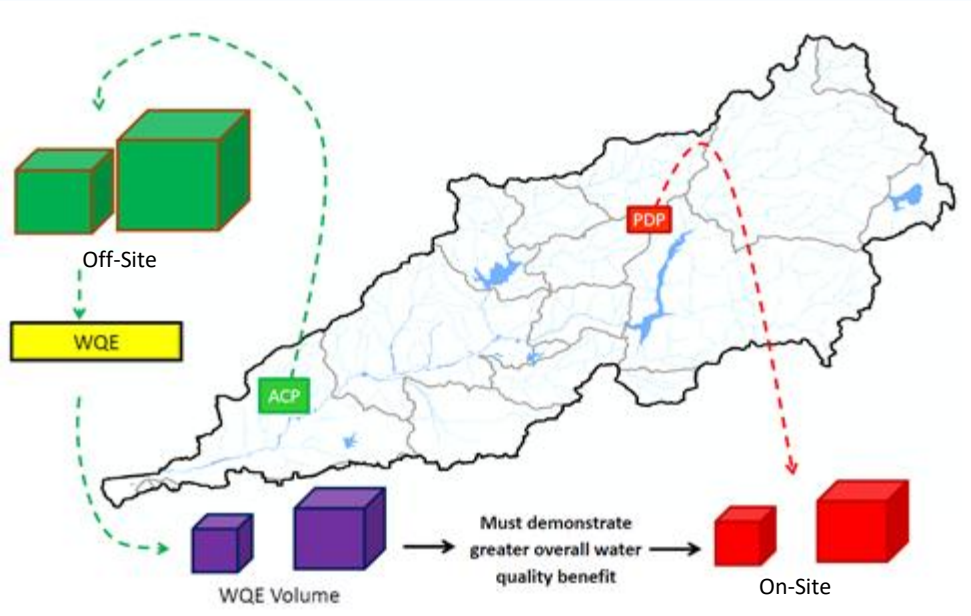


Alternative Compliance

Offsite compliance options in the new WQMP

What is Alternative Compliance?

- Allows qualifying PDPs to meet pollutant control and/or hydromodification flow control requirements at an offsite location via several pathways
- Water Quality Equivalency (WQE) Guidance must be followed
- Currently a project-applicant led ACP could be acceptable
- Additional regional efforts in progress



Basic Rules

- May be authorized at the discretion of the local jurisdiction
- Project Site and Alternative Compliance Site must meet location requirements, and
- Applicant must quantify benefit through use of **Water Quality Equivalency** and demonstrate greater overall water quality benefit

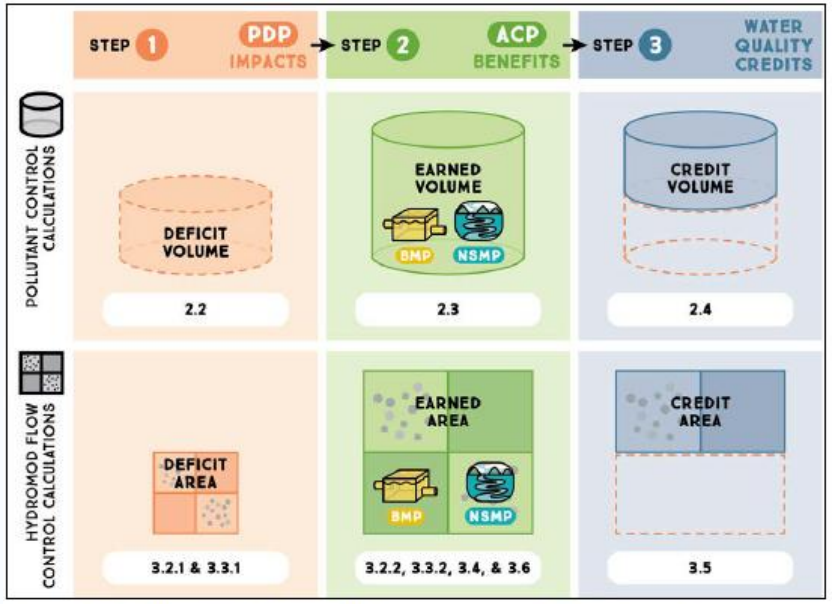
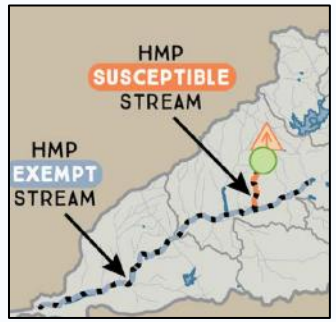
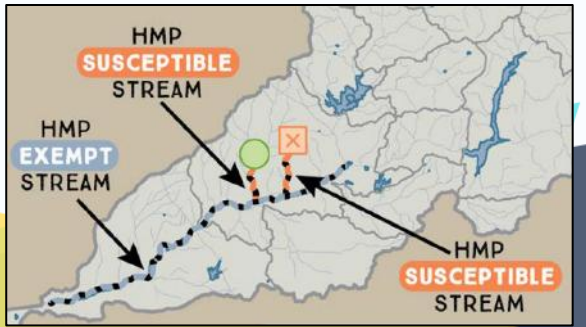


Figure 1-2: WQE Process for Stormwater Pollutant Control and Hydromodification Management





Basic Steps

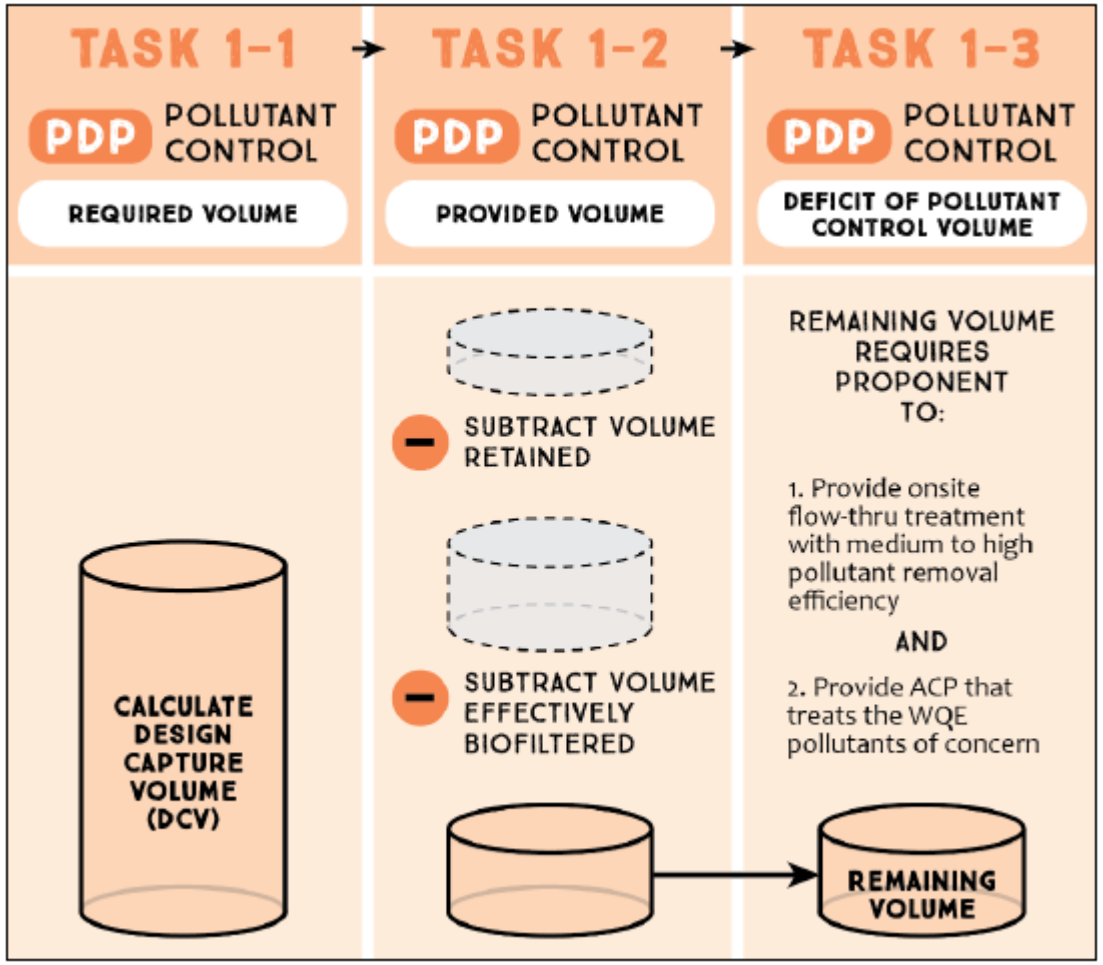


Figure 2-2: PDP Stormwater Pollutant Control Calculations

Determine Required Offsite Volume:
V_{BMP} - Onsite Treatment Volume

Treat portion of V_{BMP} Onsite

Provide Flow-thru for portion of V_{BMP} not Treated Onsite

Provide Offsite Treatement for V_{BMP} not Treated Onsite

V_{BMP} = DCV

Hydromod Area = DCIA

Basic Steps to Equivalency

Volume:
Onsite vs. Offsite
Tributary Area

Pollutant Loading:
Onsite vs. Offsite
Landuses and Area

Pollutant Removal:
Efficiency and Capture
of Offsite BMP

Earned Volume:
Must be Equal or
Greater than onsite
Deficit

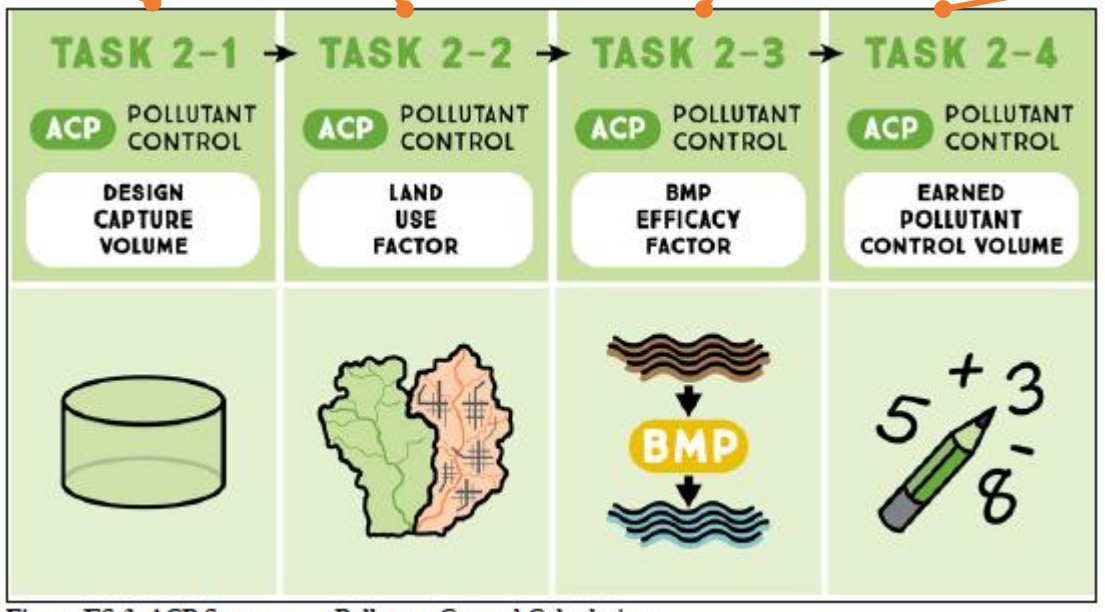
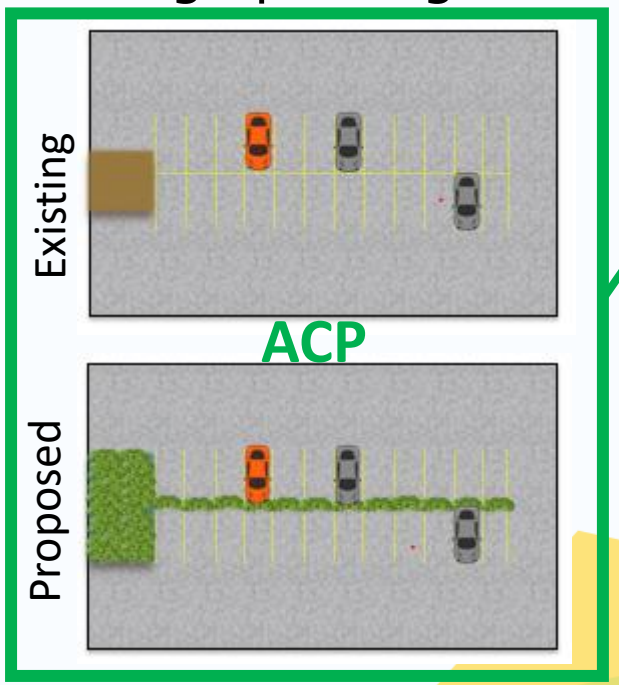
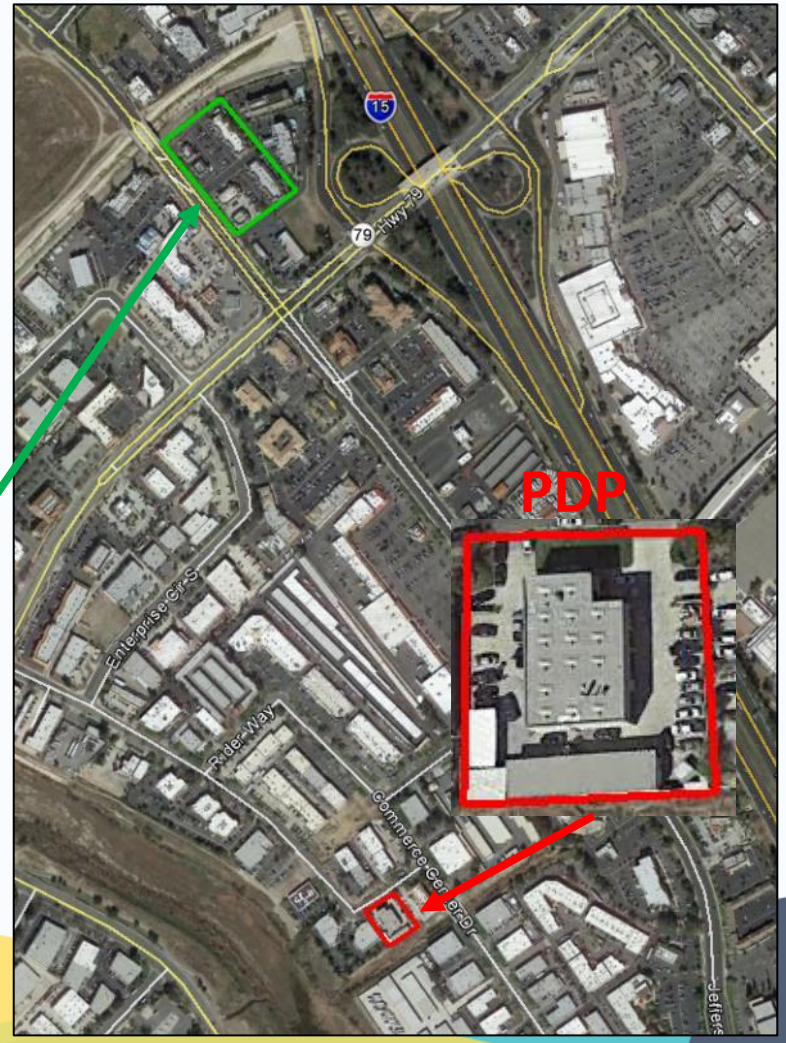


Figure ES-3: ACP Stormwater Pollutant Control Calculations

Example

- **Scenario:** Redevelopment PDP building on highly constrained site. **Onsite Deficit = 1200 ft³.**
  - Site owner also owns nearby property with large parking lot.





Water Quality Equivalency

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

Variables	Consideration
V_E: Earned Stormwater Pollutant Control Volume of ACP	Calculated Water Quality Credit
L: Land Use Factor	Pollutant Supply
V_2: Mitigated Condition Design Capture Volume at ACP	Pollutant Removal
B_2: Mitigated Condition BMP Efficacy Factor	Pollutant Removal
V_1: Impacted Condition Design Capture Volume at ACP	Change in Impacted Conditions
B_1: Impacted Condition BMP Efficacy Factor	Change in Impacted Conditions
ΔV: Change in Design Capture Volume (V_1-V_2) at ACP	Change in Impacted Conditions

Guidance available at: www.projectcleanwater.org

Land Use Factor (L)

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

Step 1: Identify WQE Pollutants of Concern for the WMA → **Step 2: Quantify Relative ACP Pollutant Concentration** → **Step 3: Quantify Relative PDP Pollutant Concentration** → **Step 4: Calculate Land Use Factor (Step 2/Step 3)**

Equation 2-2: Calculation of Weighted Average Relative Pollutant Concentrations

$$P_1 = \frac{\sum P_{1a}A_aC_a + P_{1b}A_bC_b + \ldots\ldots P_{1k}A_kC_k}{\sum A_aC_a + A_bC_b + \ldots\ldots A_kC_k}$$

Where:

P_1: Relative Pollutant 1 Concentration for ACP Tributary

P_{1a} - P_{1k}: Relative Pollutant 1 Concentration for Land Use a-k respectively (see Table 2-2).

C_a - C_k: Runoff Factor for Land Use a-k respectively (See Table 2-2).

A_a - A_k: Area (sf) of Land Use a-k respectively.

Automated Calculator

Automated Spreadsheet Calculation for Worksheet A.5: Land Use Factor Determination (Version 1.0)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	TCu	TPb	TZn	FC
Agriculture		0.10		0.10	0.45	1.00	1.00	1.00	1.00		
Commercial	15.00	0.80	4	0.80	0.13	0.16	0.16	0.56	0.48		
Education	5.00	0.50		0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial		0.90		0.90	0.13	0.19	0.15	0.54	0.68		
Multi Family Residential	5.00	0.60		0.60	0.10	0.13	0.13	0.14	0.15		
Orchard		0.10		0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential		0.30		0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential		0.40		0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation		0.90		0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space		0.10		0.10	0.16	0.10	0.10	0.12	0.10	0.10	
Water		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total	25.00	-	4.00	-	-	-	-	-	-	-	
Relative Pollutant Concentration for ACP Tributary [4]					0.12	0.16	0.15	0.43	0.39	0.79	0.66
Relative Pollutant Concentration for Reference Tributary [4]					0.13	0.16	0.16	0.56	0.48	1.00	0.87
Watershed Management Area					Santa Margarita River						
Hydrologic Unit					Santa Margarita (902.00)						
Land Use Factor [5]					-	**1.00**	**0.92**	-	-	-	**0.76**

ACP Tributary Area

PDP Tributary Area

Select Lowest L Factor

Calculators available at projectcleanwater.org

BMP Efficacy Factor (B)

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

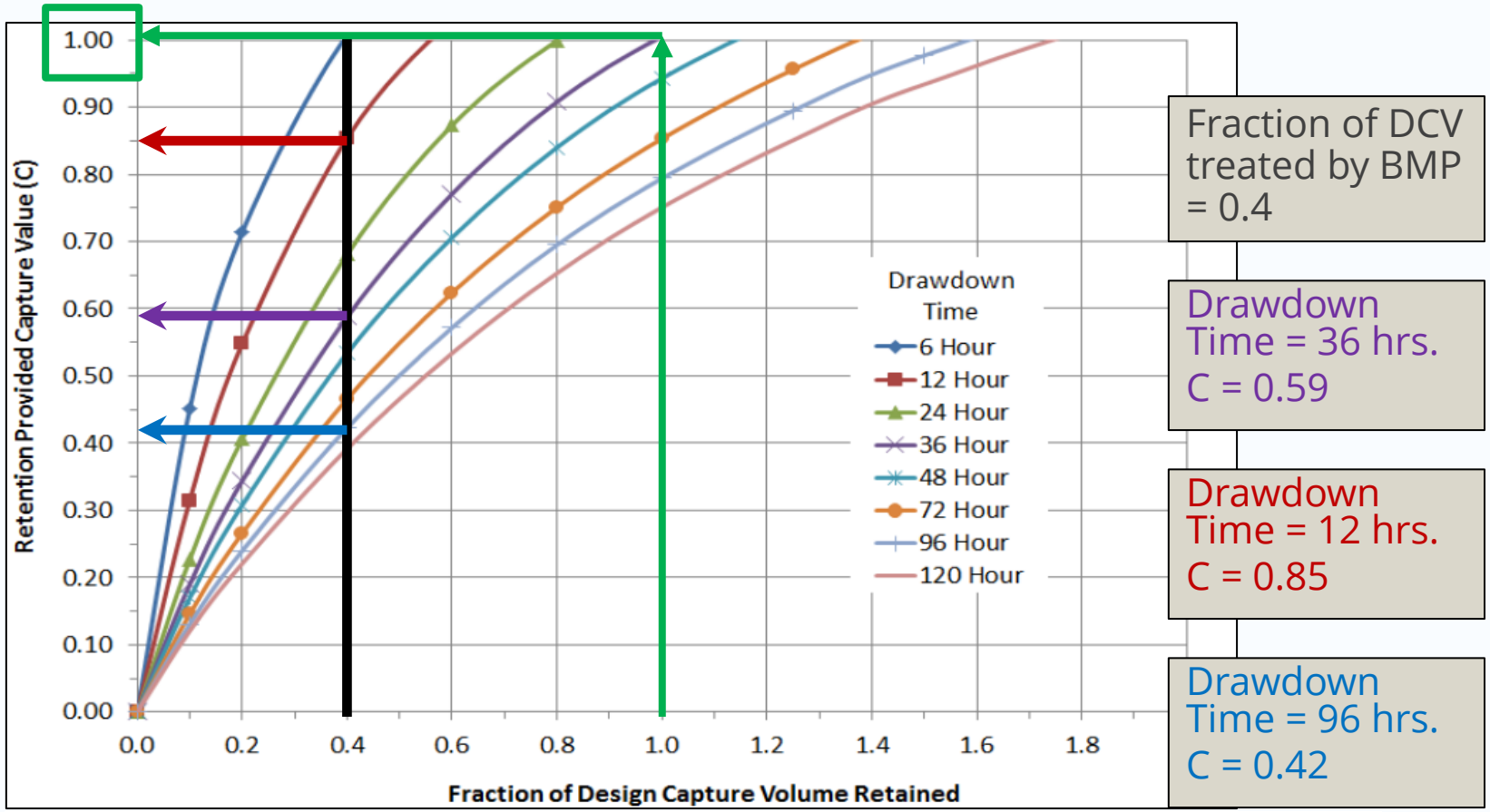
- BMP Efficacy Factor (B) is a function of the BMP's Pollutant Removal Efficiency (E) and Provided Capture (C)

B = E x C

Pollutant Removal Efficiency (E)

BMP Type	Pollutant Removal Efficiency (E)
Retention	1.00
Biofiltration	0.666
Partial Retention	1.00 for retention portion 0.666 for biofiltration portion
Flow-Thru	Currently unknown, refer to **Section 2.3.1.3.1** for a framework to establish values.
Treatment Train	Values from rows above

Provided Capture (C)



Fraction of DCV treated by BMP = 0.4

Drawdown Time = 36 hrs.
C = 0.59

Drawdown Time = 12 hrs.
C = 0.85

Drawdown Time = 96 hrs.
C = 0.42

Capture Nomographs from WQE Section 2

Smaller BMPs with Higher Drawdowns Provide Greater Capture

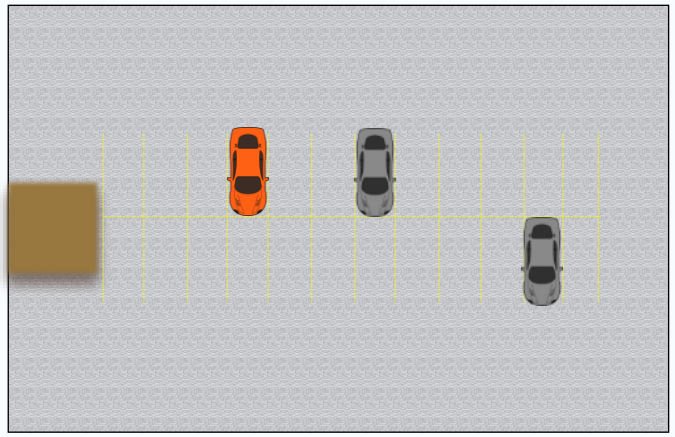
Design Capture Volume (V1, V2, ΔV)

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

- The volume of stormwater runoff produced from a 24-hour, 85th percentile storm
- The Design Capture Volume is a function of the tributary area, surface characteristics, and rainfall depth
- ΔV is the change in runoff volume due to change in surface characteristics

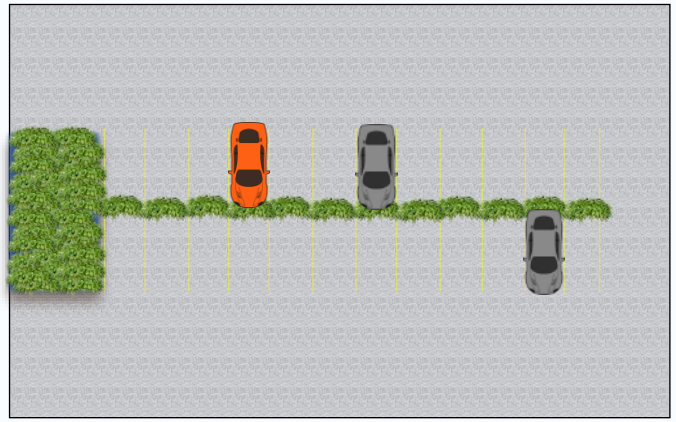
Example: Earned Volume

Impacted Condition ACP Site



L: 0.76
V_1: 2,500 ft^3
B_1: 0.00 *(no BMP in place)*

Mitigation Condition ACP Site



V_2: 2,000 ft^3
ΔV: 500 ft^3 *(2,500-2,000)*
B_2: 0.66 *(1x0.66)*

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

$$V_E = 0.76\,(500 + 2{,}000 \times 0.66 - 2{,}000 \times 0.00)$$

V_E = 1,380 ft^3 > Deficit = 1,200 ft^3

ACP Case Study Summary

- PDP site incorporated source controls and LID principles (site design)
- Off-site retrofit of parking lot offsets retention/ biofiltration requirements
- PDP provides treatment control for entire PDP site
  - Note, credit for this pollutant reduction was not claimed in this example, but possible
- Hydromodification did not apply in this case

You have successfully completed the WQMP Training

- Questions may be asked via:
  - Contacting your NPDES coordinator
  - Contacting Charlene Warren at RCFC & WCD, cwarren@rivco.org
  - Contacting the CASC presenter, Michael Gentile, at mgentile@cascinc.com