# Storm Water Post-Construction Best Management Practices(BMP) Manual REVISION

Hawaii State Department of Transportation, Highways Division





TALEALAND DEPARTMENT OF TRANSPORTATION

www.stormwaterhawaii.com





### POST-CONSTRUCTION (PERMANENT) BMPS & LID

### **Post-Construction Best Management Practice (BMP):**

A specific practice intended to reduce storm water volume and/or the pollution typically associated with storm water runoff. Such practices may include LID design features, source control methods, or manufactured devices designed to capture pollutants and is synonymous with the terms Permanent BMP (PBMP) and Permanent Post-construction BMP.

### Low Impact Development (LID):

A comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds.



### Storm Water Post-Construction BMP Manual REVISION

what	Provide procedures and gu considered and implement HWYS new development, re	
when	The manual revision will be implementation date in 20 training event prior to impl	
how	After the implementation of to comply with the criteria provided in the revised ma	
understanding	<ul> <li>General organizational clarity and improve usab</li> <li>Separate post-construct NPDES Permit and more r</li> <li>Revised criteria for MS4 N of post-construction BMP</li> <li>Revised evaluation proce variance from LID BMP red BMPs.</li> <li>An Alternative Compliand treatment area cannot b</li> </ul>	

idelines to ensure that post-construction BMPs are ted, as applicable, throughout all phases of DOTedevelopment, and private construction projects.

e completed in November 2021 with an 22 to be determined. DOT-HWYS will conduct a ementation of the revised manual.

date, designers and design reviewers, will be required for the implementation and the design standards anual.

hanges to the structure of the manual to increase oility.

ion BMP criteria for areas covered under an MS4 ural areas that are not covered under a permit. IPDES Permit areas to increase the implementation Ps, prioritizing LID BMPs.

ess to determine whether a project qualifies for a quirements or an exemption from post-construction

ce process for projects in which the full required e addressed by post-construction BMPs.





#### Storm Water Post-Construction **Best Management Practices Manual**

#### DRAFT



### STORM WATER POST-CONSTRUCTION BMP MANUAL SECTIONS

ENVIRONMENTAL BACKGROUND
 AND INTRODUCTION

2. STORM WATER POST-CONSTRUCTION BEST MANAGEMENT PRACTICES

**3.** CRITERIA FOR MS4 PERMIT AREAS

> 4. CRITERIA FOR NON-MS4 PERMIT AREAS

**5** EXEMPTIONS AND VARIANCES

6. ALTERNATIVE COMPLIANCE

7. POST-CONSTRUCTION BMP DESIGN METHODOLOGY

8. POST-CONSTRUCTION BMP DEVELOPMENT IN PLANNING PHASE

9. POST-CONSTRUCTION BMP DEVELOPMENT IN DESIGN PHASE

**10.** INSPECTIONS, OPERATION, AND MAINTENANCE

### LID Treatment Control BMPs







### LID Treatment Control BMPs





### Non-LID Treatment Control BMPs







### Non-LID Treatment Control BMPs





# Private vs Public Construction Projects REVISED

ltem	
Public Construction Projects	All public construction impervious surface are Priority Projects that h required to implement regardless of the amo
Private Construction Projects	Post-construction BM one (1) acre or more or right-of-way. Post-construction BM located outside of DO



#### Description

or projects that result in one (1) acre or more of new required to implement LID BMPs and/or non-LID BMPs.

nave a high potential for pollutant discharge may be t post-construction BMPs at the discretion of DOT-HWYS ount of new impervious surface created.

Ps are not required for private construction projects unless of new impervious surface is created within the DOT-HWYS

Ps are highly encouraged for private construction projects T-HWYS right-of-way.

### Criteria for Public Construction Projects in MS4 Permit Areas Oahu and Maui

All public construction projects that result in one (1) acre or more of Disturbed Area are required to implement LID BMPs. **SREV** 

Priority Projects that have a high potential for pollutant discharge may be required to implement post-construction BMPs at the discretion of DOT-HWYS regardless of the amount of Disturbed Area.

**DISTURBANCE** – Any construction-related activity that results in the penetration, turning, or moving of soil including roadway construction, demolition, grading, grubbing, and reconstruction of pavement which exposes the underlying base course or bare soil. Disturbance does not include clearing that leaves soil intact nor does it include the operation of vehicles, staging, and storage of materials and equipment on paved surfaces.







### Criteria for Private Construction Projects in MS4 Permit Areas Oahu and Maui

Post-construction BMPs may be required at the discretion of DOT-HWYS regardless of project size for private construction projects located within the DOT-HWYS right-of-way if the project has the potential to discharge storm water runoff to the DOT-HWYS right-of-way.

Private construction projects located outside the DOT-HWYS right-of-way are considered to be in compliance with post-construction BMP requirements if the project complies with the storm water quality requirements of the applicable county.





### Criteria for Public Construction Projects in NON-MS4 Permit Areas

All public construction projects that result in one (1) acre or more of new impervious surface are required to implement LID BMPs and/or non-LID BMPs.

Priority Projects that have a high potential for pollutant discharge may be required to implement post-construction BMPs at the discretion of DOT-HWYS regardless of the amount of new impervious surface created.

**IMPERVIOUS SURFACE** – Surface area which allows little or no infiltration such as asphalt and concrete pavements, bridge decks, sidewalks, walkways, concrete slabs, and roofs.



### Criteria for Public Construction Projects in NON-MS4 Permit Areas

All public construction projects that result in one (1) acre or more of new impervious surface are required to implement LID BMPs and/or non-LID BMPs.

Priority Projects that have a high potential for pollutant discharge may be required to implement post-construction BMPs at the discretion of DOT-HWYS regardless of the amount of new impervious surface created.

**IMPERVIOUS SURFACE** – Surface area which allows little or no infiltration such as asphalt and concrete pavements, bridge decks, sidewalks, walkways, concrete slabs, and roofs.



### Criteria for Private Construction Projects in NON-MS4 Permit Areas

Post-construction BMPs are only required for private construction projects if one (1) acre or more of new impervious surface is created within the DOT-HWYS right-of-way.

Post-construction BMPs are highly encouraged for private construction projects located outside of DOT-HWYS right-of-way.



### **Exemptions and Variances from Post-Construction BMPs**

- . Projects that do not result in storm water discharge into the MS4 or state waters
- . Operations and Maintenance Activities oStructural Repairs **oBaseyard Maintenance and Repairs** oInstallation or Replacement of Pavement Striping and Pavement Markers
- . Pavement Preservation Treatments Treatments
- . Guardrail and Underground Utility Projects oGuardrail Installation or Replacement **OUtility Installation or Relocation**

oPavement Resurfacing, Restoration, or Rehabilitation projects in which improvements are confined to the impervious pavement layer such as Pavement Overlays, Cold Planing, Crack Sealing, or Similar



# Exemptions and Variances from Post-Construction BMPs

- Water Quality Improvements or Preservation
   OShoreline Protection
  - $\circ$ Landscaping
  - Oulvert Rehabilitation or Replacement
  - $\circ$ Installation of Post-Construction BMPs
  - $_{\odot}\textsc{Erosion}$  and Sediment Control
  - oRockfall Mitigation
- . Pedestrian Walkways or Bicycle Paths
- . "Minor" Disturbance Project
  - $\circ$ Signage
  - oADA Ramps
  - Bridges or Roads constructed above or below existing impervious areas

- . "Minor" Disturbance Project
  - $\circ$ Signage
  - oADA Ramps
  - Bridges or Roads constructed above or below existing impervious areas
- . Emergency Project
- . Temporary Project
- Projects that are currently in the design phase in which timing and scheduling of the project for advertising may make it infeasible to comply with this revised manual.
- . Federal-aid city or county projects





# **POST-CONSTRUCTION BMP DESIGN**



# **POST-CONSTRUCTION BMP DEVELOPMENT**

# **POST-CONSTRUCTION BMP DEVELOPMENT**

## **APPENDIX A – TREATMENT CONTROL BMPs**



### ULTRA-URBAN HIGHWAYS

- Limited right-of-way
- High land costs
- High traffic volume
- Large percentage of impervious surface
- Potential for utility conflicts
- Compacted soils or unknown subsurface conditions
- Reduced infiltration
- Higher levels of sediment, oils and grease, metals, litter, debris





# ALTERNATIVE COMPLIANCE

what	Strategy that allows addit provided in an alternative
when	Allowed when designer co cannot adequately treat t
how	DOT-HWYS will identify an additional water quality tr
why	<ul> <li>Provides flexibility for pr</li> <li>Can target specific sense</li> <li>Smaller post-construction</li> <li>combined into a larger</li> </ul>



ional water quality treatment to be watershed

an justify that post-construction BMPs the full Required Treatment Area

alternative watershed in which to provide eatment

ogram to meet MS4 Permit compliance sitive water bodies or pollutants ion BMPs from multiple projects may be single treatment device



# ALTERNATIVE COMPLIANCE NEW!







# ALTERNATIVE COMPLIANCE NEW!

- Allowed for public construction projects only
- DOT-HWYS will identify an alternative watershed of equal or higher priority
- TMDL or 303(d)-listed watersheds
- Credits and debits tracked per watershed









## **CREDIT TRACKING PROGRAM**

- Measured in units of "treatment area"
- Projects that treat **more** than what is required will generate a CREDIT
- Projects that treat **less** than what is required will generate a DEBIT
- If a project creates more debits than credits, designer shall submit a Variance Request Form to justify that all other options were evaluated and deemed infeasible.







#### **CREDITS**

- Post-construction BMPs are sized to treat an impervious area larger than the Required **Treatment Area**
- Project results in a reduction of impervious surface area
- Retrofit existing highway facilities
- Create a stand-alone post-construction BMP project to target specific watershed or pollutant

#### DEBITS

- Project results in an increase of impervious surface area
- Existing post-construction BMPs are removed or no longer provide treatment



### **POST-CONSTRUCTION BMP DESIGN METHODOLOGY**

New Development (ND) - construction of any new impervious surface intended for vehicular use.

- Roadway corridors
- Roadway intersections
- Roadway access ramps
- Roadway realignment

**Redevelopment (RD)** - occurs when any construction, reconstruction, alteration, or improvement is performed on existing impervious surfaces in which the underlying untreated aggregate or pervious subgrade is exposed or penetrated during construction.

Excludes pavement preservation treatments:

- Pavement overlays
- Crack sealing
- Pavement resurfacing

- Roadway widening
- Baseyard facilities
- Parking lots

- Cold planing (mill and fill)
- Slurry seals





### **POST-CONSTRUCTION BMP DESIGN METHODOLOGY**

Required Treatment Area  $(A_T)$  **REVISED** 



 $A_T = ND + (F \times RD) - A_{TF}$ 

Where  $A_T = Required Treatment Area (acres)$ F = Redevelopment Treatment Fraction = 0.25 for MS4 Permit areas = 0 for non-MS4 Permit areas A<sub>TE</sub> = Area Treated by Existing BMPs (acres)

- ND = New Development resulting in new impervious surface (acres)
- RD = Redevelopment of existing impervious surface (acres)



#### **Existing Condition**




Project Limits



Existing Pervious Area

#### **Proposed Condition**



#### **ARE POST-CONSTRUCTION BMPs REQUIRED?**

Existing Impervious Area



Existing Swale

4-lane paved road on Oahu Existing impervious area = 4 AC Existing vegetated swale treats 1 AC

All public construction projects that result in one (1) acre or more of Disturbed Area are required to implement LID BMPs



Existing Impervious Area



Disturbed (New Impervious) Pervious Area



Existing Swale

2 new lanes constructed = 2 AC 1 existing lane reconstructed = 1 AC <u>Disturbed pervious surface = 1 AC</u> TOTAL DISTURBED AREA = 4 AC > 1 AC

#### LID BMPs ARE REQUIRED









#### **Proposed Condition**







New Development Disturbed (New Impervious) Pervious Area



(Reconstructed Impervious)

Required Treatment Area  $(A_{T})$  $A_T = ND + (F \times RD) - A_{TE}$  $= 2 + (0.25 \times 1) - 1$ = 1.25 acres



#### **HOW MUCH TREATMENT IS REQUIRED?**



Existing Impervious Area





Existing Swale

2 new lanes constructed = 2 AC 1 existing lane reconstructed = 1 AC

Existing vegetated swale treats 1 AC

 $A_{T}$  = Required Treatment Area (acres)

- ND = New Development (acres)
- RD = Redevelopment (acres)
- F = Redevelopment Treatment Fraction
  - = 0.25 for MS4 Permit areas

A<sub>TE</sub> = Area Treated by Existing BMPs (acres)









### **TREATMENT CONTROL BMPs**



Incorporates storage to achieve water quality treatment through retention and infiltration of storm water runoff

Wet ponds

Wetlands

Infiltration facilities

**Bioretention facilities** 

#### FLOW-BASED BMPs



Treat storm water by capturing pollutants as they pass through filtration media, via infiltration, or sedimentation

#### Buffer strips

Vegetated swales

Media Filters



### **VOLUME-BASED BMP DESIGN REVISED**

#### Water Quality Volume (WQV)

#### $WQV = P x C x A_T x 3630$

Where WQV = Water Quality Volume (ft<sup>3</sup>)P = Design Storm Runoff Depth = 1 inch C = Volumetric Runoff Coefficient A<sub>T</sub> = Treatment Area (acres) 3630 = conversion factor







### FLOW-BASED BMP DESIGN

#### Water Quality Flow Rate (WQFR)

#### WQFR = $C x i x A_T$

- Where WQFR = Water Quality Flow Rate (cfs) C = Runoff Coefficient i = Rainfall Intensity = 0.4 in/hr
  - A<sub>T</sub> = Treatment Area (acres)







### POST-CONSTRUCTION BMP DEVELOPMENT SREVISED **IN PLANNING PHASE**

#### **Summary of Changes**

- Separate post-construction BMP planning concept report no longer required
- If a planning report, EA, or EIS is required for the project, include preliminary post-construction **BMP** information
- Otherwise, include BMP information in Post-Construction BMP Design Report during design phase



Post-Construction BMP information to include:

- BMP description
- TMDL or WLA requirements
- · Right-of-way requirements
- Maintenance requirements
- Construction cost estimate

Figures

- · Existing and proposed drainage maps
- · Post-construction BMP locations
- · Flood Zone designations and boundaries

Supporting Documentation

- · Hydrologic and hydraulic calculations
- BMP sizing calculations
- · Product data information
- Site photos (if critical to BMP selection)





# POST-CONSTRUCTION BMF

#### **Summary of Changes**

- Infiltration test requirements
- Minimum technological verification requirements for proprietary treatment devices
- Updated Post-Construction BMP Design Checklists for both MS4 and non-MS4 Permit areas
- New Variance Request Form for projects that do not meet the Required Treatment Area

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			RM WATER POST-CONSTRUCTIC		<ul><li>New Submittal</li><li>Resubmittal</li></ul>
			Project Informa	tion	
Proje	ect I	Name:			
Proje Proje	ect	D	STORM WATER POST-CONSTR ESIGN CHECKLIST FOR NON-MS	UCTION BMP 4 PERMIT AREA	AS I Resubmittal
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Distu	ırt	Project	Name:		
Annl	ici	Project Number: Island:			
Ema	il:	Project	STORM WATER	POST-CONSTR	UCTION BMP
		Waters VARIANCE REQUEST FORM			
		Disturb	Pro	oject information	
I. C	h€ on	Applica	Project Name:		
iı	nc	Email:	Project Number:	Island:	·
ty	yp		Project Route Name(s):	Milepost Be	egin/End:
8	1. 	1 Ch	Watershed Location(s):		
b	).	r. Che	Required Treatment Area (acres):	Provided Ir	reatment Area (acres):
		inc	Applicant Name:	Company: _	
		тур	Email:	Telephone:	
		a. ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Justification fo	r Project Water Q	Quality Debit
		D.	1. Check "Yes" for any applicable project conditions below which will incur a debit(s).		
C	). 		a. Where Low Impact Development (LID) BMPs are required, the designer shall		
Ċ			implement LID BMPs to the Maximum Extent Practicable. Indicate any site		
			treatment. Refer to Section 5.2 of types of constraints.	the manual for furth	ner descriptions of the vari
e	2.	C.	a.1 Hydrogeological Constraint		





# APPENDIX A – TREATMENT CONTROL BMPS SREVISED

### **Summary of Changes**

- Updated toolbox of treatment control BMPs
- Simplified BMP summary tables
- Revised BMP fact sheets to provide more detailed sizing procedures and design criteria
- Expanded BMP fact sheets for manufactured treatment devices
- Updated photos and diagrams





#### **Bioretention Facility**



Typical Targeted Pollutants for Removal		
Sediment	Х	
Nutrients	х	
Oil & Grease	Х	
Metals	х	
Trash	Х	
Bacteria	Х	

Other Cons	aderations <sup>1</sup>
Construction Cost	Moderate
Maintenance Cost	Moderate
Effective Life	5-20 years
The second states and second	a second and the second s

Manual 2019

SOURCE: New Jersey Developers Green Infrastructure Guide 2018

#### Description & Purpose

Bioretention facilities are vegetated depressions where storm water runoff is directed through vegetation and designed soil mixes for infiltration and treatment. Soil mix may include a combination of sand, organic matter, soil, or other media. Excess flows may be bypassed to drainage structures further downstream. Design variations include bioretention cells, bioretention swales, and bioretention planters. Smaller facilities are also commonly referred to as rain gardens.

#### Applications

A bioretention facility is a versatile post-construction BMP that provides water quality treatment, storm water volume reduction, and flow attenuation. Appropriate in locations where adequate space is available. The overall shape can be adjusted to fit within the allotted space so is well suited in a variety of urban settings including roadway applications, parking lots, and curb extensions for smaller devices.

#### Limitations

- Requires pretreatment upstream to capture sediment loadings which would otherwise lead to clogging and premature failure.



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# QUESTIONS?

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