



# PROTECT OUR WATER

MĀLAMA I KA WAI

*STATE OF HAWAII DEPARTMENT OF TRANSPORTATION*

[www.stormwaterhawaii.com](http://www.stormwaterhawaii.com)



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# STORM WATER MANAGEMENT PROGRAM ELEMENTS



PUBLIC EDUCATION AND OUTREACH

ILLCIT DISCHARGE DETECTION AND ELIMINATION

CONSTRUCTION SITE RUNOFF CONTROL

POST-CONSTRUCTION STORM WATER MANAGEMENT IN NEW DEVELOPMENT AND  
REDEVELOPMENT

POLLUTION PREVENTION/GOOD HOUSEKEEPING DEBRIS CONTROL BMPS

POLLUTION PREVENTION/GOOD HOUSEKEEPING CHEMICAL APPLICATIONS BMPS

POLLUTION PREVENTION/GOOD HOUSEKEEPING EROSION CONTROL BMPS

POLLUTION PREVENTION/GOOD HOUSEKEEPING MAINTENANCE ACTIVITIES BMPS

INDUSTRIAL AND COMMERCIAL ACTIVITIES DISCHARGE MANAGEMENT

MUNICIPAL INDUSTRIAL FACILITIES

MONITORING

TOTAL MAXIMUM DAILY LOAD

REPORTING



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# POST-CONSTRUCTION PROGRAM ELEMENTS



1. Revise the Storm Water Permanent BMPs Manual to include Low Impact Development (LID) requirements.
2. Review plans to ensure that appropriate permanent BMPs (PBMPs) have been included in project design and bid package.
3. Track inspection frequency and maintenance of PBMPs.
4. Provide education and outreach materials to parties applying for DOT-HWYS' permits.
5. Provide annual training for DOT-HWYS staff and contractors responsible for inspecting PBMPs and LID practices.





# POST-CONSTRUCTION PROGRAM ELEMENTS



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# SPEAKER



## RICHARD PRICE, P.E., LEED, CSM

- Email: [rprice@eaest.com](mailto:rprice@eaest.com)



# CHANGES TO DOT-HWYS PERMANENT BMP PROGRAM

August 2015

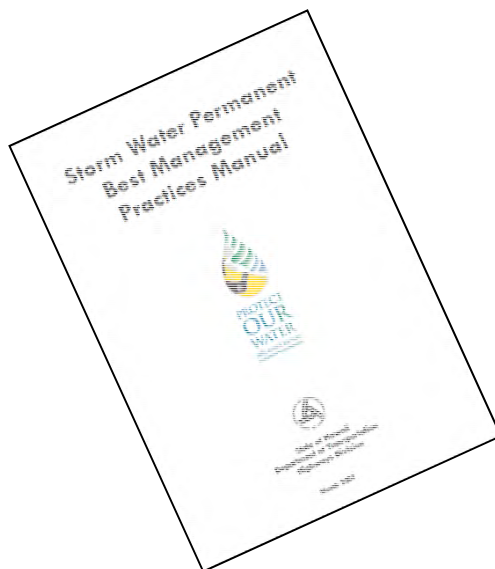


# STANDARDS FOR STORM WATER MANAGEMENT



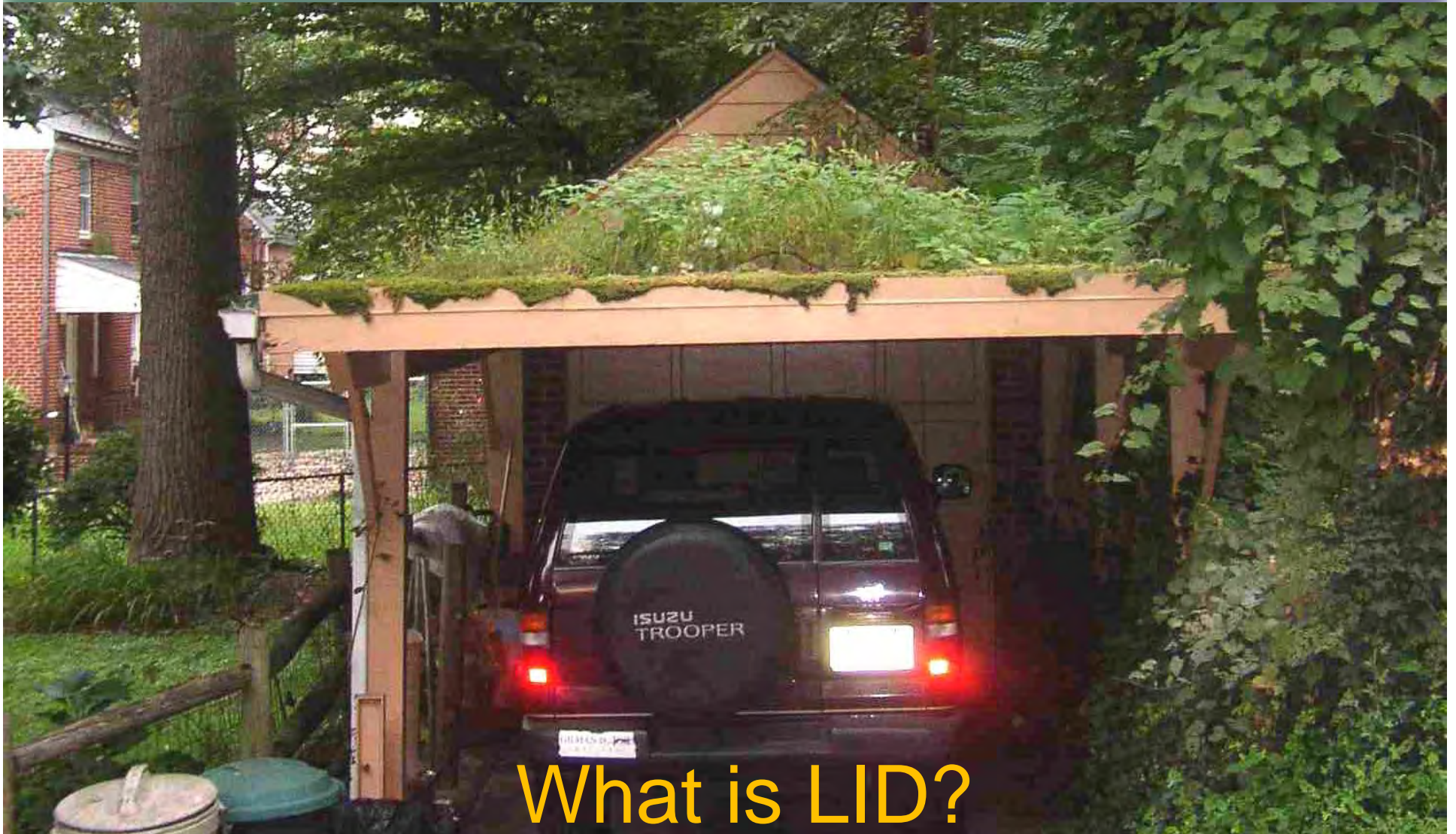
## Bottom Line Up Front

Projects (new or redevelopment) that generate one (1) acre or more of new impervious area must incorporate LID storm water controls unless qualifying for exemptions or variances





# STANDARDS FOR STORM WATER MANAGEMENT





# STANDARDS FOR STORM WATER MANAGEMENT



## What is 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.



# STANDARDS FOR STORM WATER MANAGEMENT



## What is LID?

LID is a strategy seeking to control storm water quality at its source, incorporating such elements as infiltration, retention, and biofiltration.





# STANDARDS FOR STORM WATER MANAGEMENT



## What is LID?

Storm water management practices which seek to mimic a site's predevelopment hydrology by minimizing disturbed areas and impervious cover and then infiltrating, storing, detaining, evapotranspiring, and/or biotreating storm water runoff close to its source.



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# STANDARDS FOR STORM WATER MANAGEMENT



What is LID?



# STANDARDS FOR STORM WATER MANAGEMENT



## What is LID?

An innovative stormwater management approach with a basic principle that is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls. LID's goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

<http://lid-stormwater.net>



# STANDARDS FOR STORM WATER MANAGEMENT



- Smaller projects less than one (1) acre, that have the potential to discharge pollutants to the MS4 may be required to install specific BMPs at the discretion of DOT-HWYS



# STANDARDS FOR STORM WATER MANAGEMENT



## Common Project Exemptions:

- Returns area to pre-development hydrologic conditions
- Does not discharge to State waters
- Operations and Maintenance Activities
- Water Quality Improvement or Preservation
- Emergency
- Temporary





# STANDARDS FOR STORM WATER MANAGEMENT



## Variances:

- Hydrogeological Constraints
- Physical Constraints
- Operational Constraints
- Other



# STANDARDS FOR STORM WATER MANAGEMENT



## Water Quality Design Volume

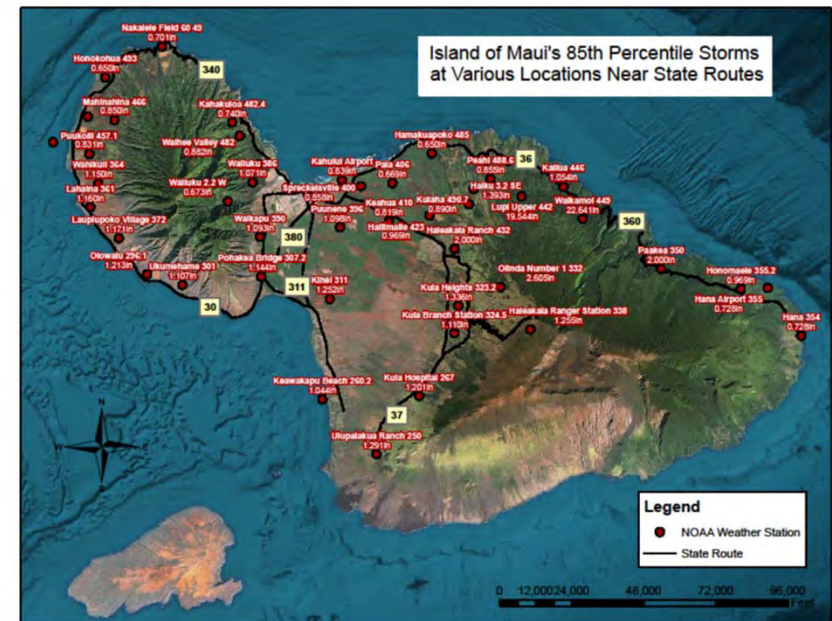
1-inch storm: 1" represents the design storm depth



# STANDARDS FOR STORM WATER MANAGEMENT

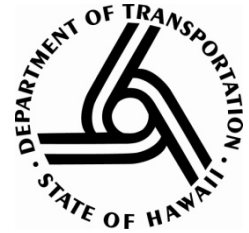
## Why 1 inch as the design storm?

- DOT-HWYS analyzed rainfall data from around the State near State Highways and determined that 1-inch is acceptable





# STANDARDS FOR STORM WATER MANAGEMENT

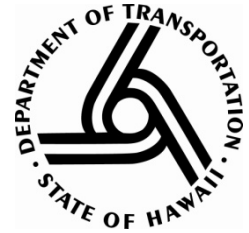


## Designing for Storm Water Controls

- Once 1 acre or more new impervious area is established, design for LID to treat the design volume
- If the complete volume cannot be treated, utilize LID where feasible and treat the remaining volume with alternative BMPs
- Consult with DOT-HWYS regarding any constraints that require a variance and alternative BMPs



# STANDARDS FOR STORM WATER MANAGEMENT



## Designing for Storm Water Controls (Con't)

- For smaller projects less than one acre that have the potential to pollute, apply source control. Such projects include:
  - Retail Gasoline Outlets
  - Automotive Repair Shops
  - Restaurants
  - Projects with Parking Lots with at least 10,000 square feet of total impervious area

# Introduction to Low Impact Development and Green Infrastructure

Hawaii DOT 2015

Neil Weinstein, P.E., ASLA, AICP, ENVSP  
Executive Director, LID Center



The Low Impact  
Development Center, Inc.







Courtesy: Ed Snodgrass

I want this now!!!! (whatever it is)









# Urban Redevelopment







Option 2













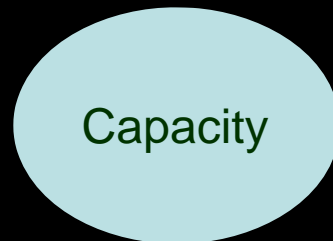




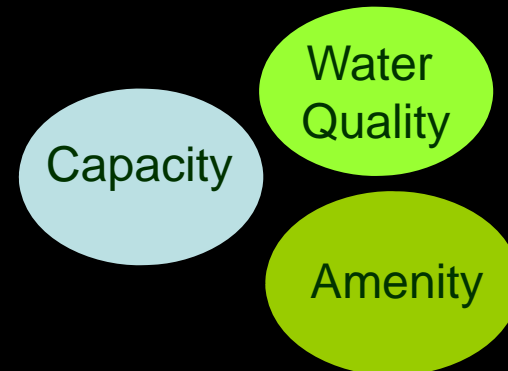
The Good Old Days!



Traditional Urban  
Drainage



Sustainable Urban  
Drainage



Adapted from Stahre



## Urban Drainage System

Current urban development directs stormwater runoff from roofs, parking lots, streets and landscapes into storm pipes and channels and out into the ocean.

The system is designed to carry runoff away from the site as quickly as possible to prevent flooding. Nutrients and contaminants are carried out to sea with it. Rainwater, a valuable resource, is treated as waste.



Urban stormwater management system

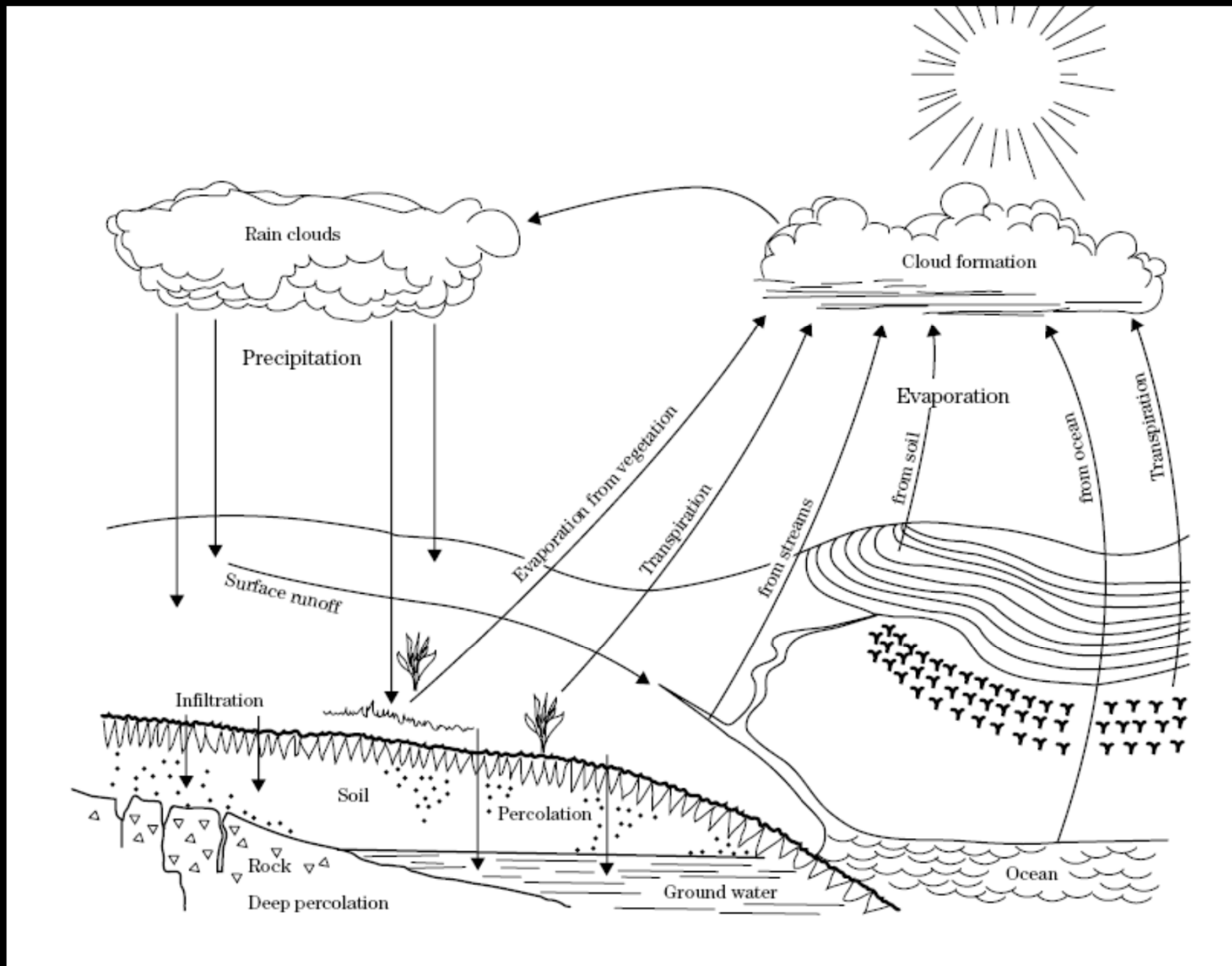


Natural stormwater management system

## Natural Drainage System

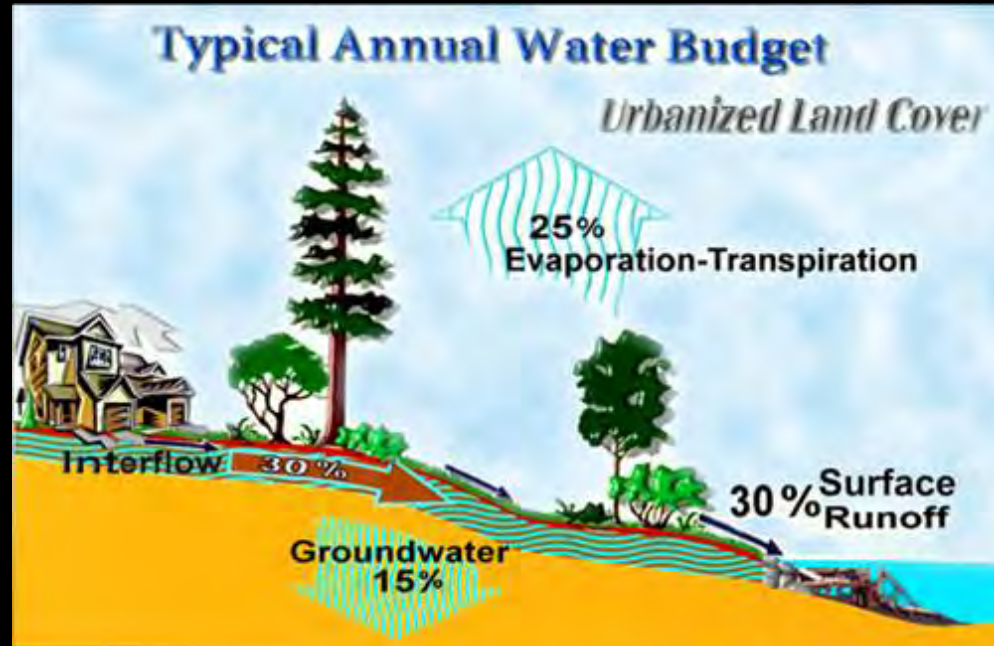
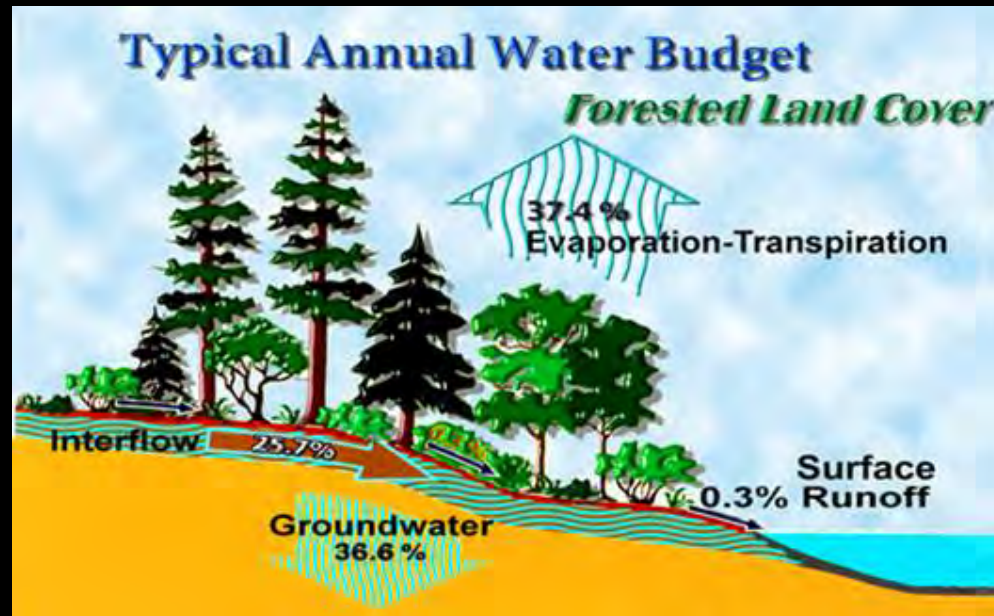
In a natural system, rainfall is soaked up by leaves and soil. Riparian systems act as sponges, holding water after rain and slowly releasing it over time.

Tree canopy alone can prevent up to 17% of rainfall from reaching the ground (Alexander 2006). Root systems prevent sedimentation and erosion. Nutrients and contaminants are filtered through permeable soil before recharging the groundwater table to replenish supply.



USDA

## Natural Runoff Processes



# Forested vs. Urban Land Cover

Courtesy Chris May





**Drinking Water**

**Stormwater**

**LID is Sustainable  
Integrated  
Infrastructure**

**Wastewater**

# Stormwater is an asset!



Buckman Terrace Portland





Integrated into Sites...

# and buildings



The temperature above Chicago's City Hall green roof averages 10 -15°F lower than the black tar roof. Difference can be 50°F or greater during the summer.

Energy savings of \$3,600 per year.

Courtesy Roofmeadow





# Planning and Design to Reduce Impacts and Update Infrastructure

Courtesy City of Seattle







# Decentralized controls

## Integrated into urban infrastructure

| BMP                     | Infiltration | ET* | Interception | Conveyance | Detention | Retention | Reuse** |
|-------------------------|--------------|-----|--------------|------------|-----------|-----------|---------|
| Downspout Disconnection | ●            | ○   |              |            | ○         | ●         |         |
| Filter Strips           | ○            | ○   | ○            | ○          |           | ○         |         |
| Infiltration Practices  | ●            |     |              | ○          |           | ●         |         |
| Pocket Wetlands         | ●            | ●   | ○            |            | ●         | ●         |         |
| Porous Pavement         | ●            |     |              |            | ●         | ●         |         |
| Rain Barrels/Cisterns   |              |     |              |            |           | ●         | ●       |
| Rain Gardens            | ●            | ●   | ○            |            | ●         | ●         |         |
| Soil Amendments         | ●            |     |              |            | ○         | ●         |         |
| Tree Box Filters        | ●            | ●   | ○            |            | ●         | ●         |         |
| Vegetated Roofs         | ●            | ●   | ○            |            | ●         | ●         |         |
| Vegetated Swales        | ●            | ○   | ○            | ●          | ●         | ○         |         |

\* Evapotranspiration

\*\* Collected water can be used for landscaping, non-potable building uses (e.g., toilets), or as raw water to be treated for drinking.

Key: ● High reliance    ● Medium reliance    ○ Low reliance    Blank: N/A

Rankings are qualitative. "High reliance" means that the process is integral to the BMP's ability to meet stormwater management objectives, and that the BMP uses the process to its full potential in the urban environment. "Medium reliance" was assigned when a process is a secondary component of the BMP's operation, or when the BMP does not use the process to its full potential. "Low reliance" means that the process only marginally contributes to the BMP's ability to meet stormwater management objectives. The rationale for ranking hydrologic cycle elements is given in Section 2.3.2.



- Analyze site hydrology over a continuous, long-term meteorological record using the SWMM engine
- Be intelligible to users without prior modeling experience or hydrology expertise
- Require only a minimum amount of readily available site information
- Produce technically sound and defensible results for screening level analysis

LID Design

Porous Pavement

Continuous Porous Pavement systems are excavated areas filled with gravel and paved over with a porous concrete or asphalt mix. Normally all rainfall will immediately pass through the pavement into the gravel storage layer below it where it can infiltrate at natural rates into the site's native soil.

Gravel layers are typically 6 to 18 inches high.

The Capture Ratio is the percent of the treated area that is replaced with porous pavement.

[Learn more ...](#)

Gravel Layer Thickness (inches)

18

% Capture Ratio

100

Auto-Size

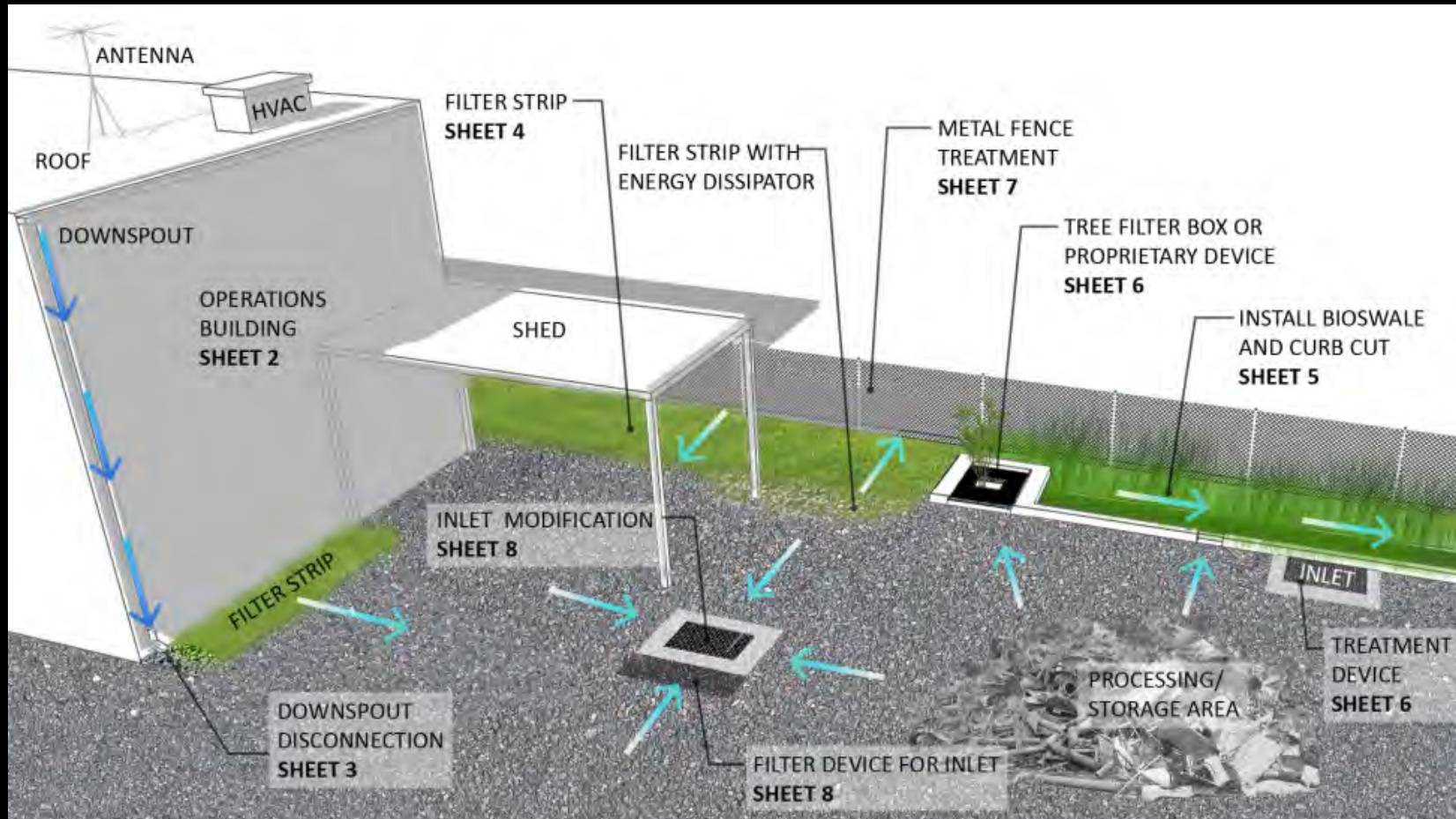
Restore Defaults

Accept

Cancel

# EPA's National Stormwater Calculator

# Select appropriate technologies



LID for Navy Industrial Facilities



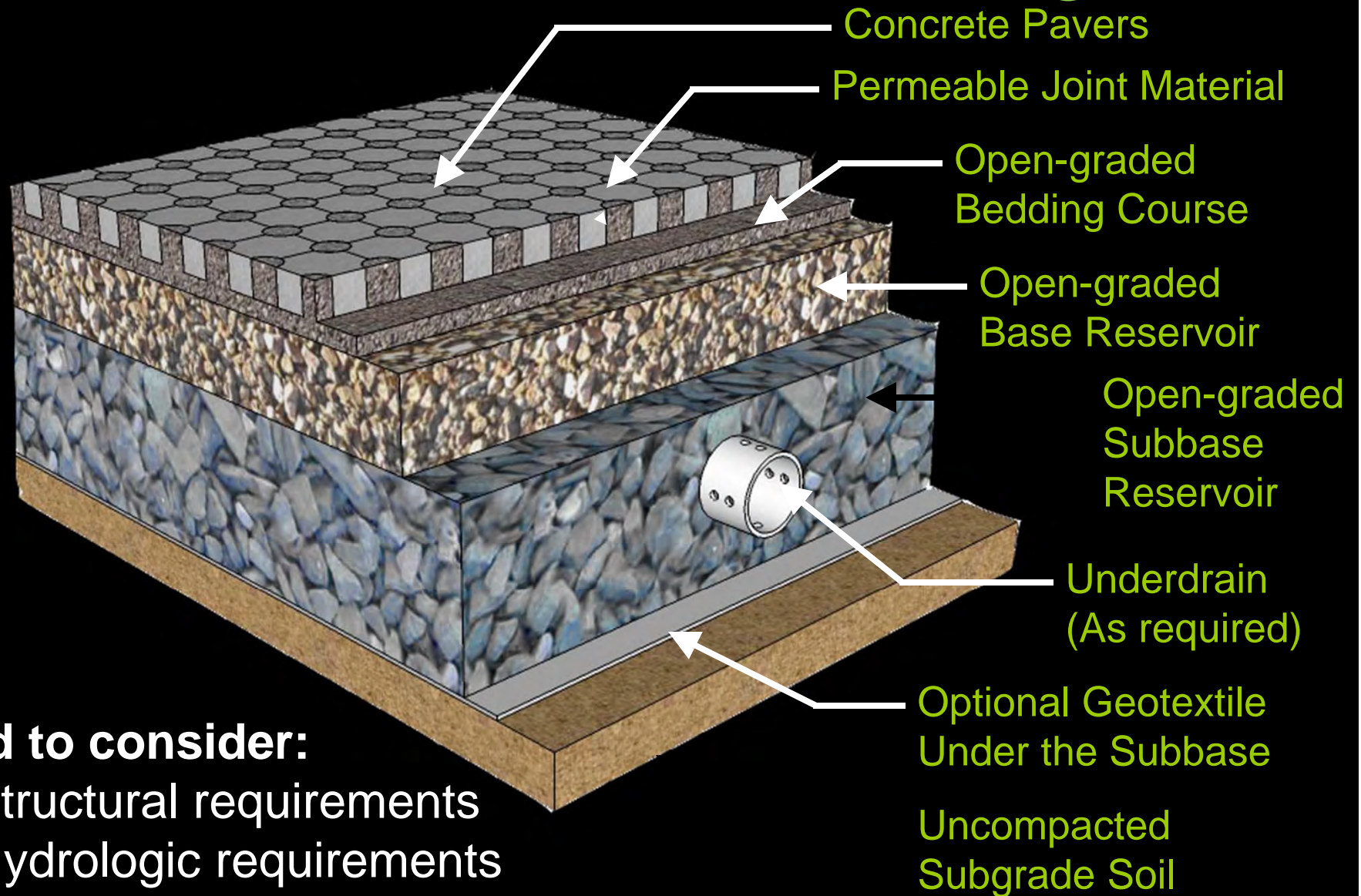
# Many Variations and Flexibility!



Courtesy CDF



# Permeable Pavement Design



**Need to consider:**  
Structural requirements  
Hydrologic requirements



# Pilots, Pilots, Pilots, and more Pilots!



Navy and Army LID Projects

# Bioretention Trench



Washington Navy Yard



Plant and “Media” selection are critical

Survive neglect

Green credits!!

















***Building 166 Permeable Pavement***









Maplewood, Minnesota

Courtesy Barr Engineering





# Rain garden in commercial parking lot

Oakland, California



# Town of Capitol Heights Green Street Master Plan

- **Two Goals:**
  - A ***green street master plan*** to encourage the use of green infrastructure and low-impact development practices for new and retrofitted road projects.
  - A ***preliminary green street design*** for one street within the town that can serve as a future green street demonstration project

# Town of Capitol Heights Green Street Master Plan

- **Public Participation/Place Setting:**

- Outreach events
- Town Environmental Committee Meeting
- In-person and online surveys
- Review/incorporation of existing studies & planning efforts

Town of Capitol Heights Green Street Master Plan  
Project Survey

The Low Impact Development Center, a non-profit organization located in Beltsville, MD, received a grant to develop a green street master plan and preliminary design for a 1/2-2 street block within the Town of Capitol Heights. With the guidance of Mayor Kito James and the Town Council members, we are soliciting community feedback to help in the street selection process. The final street selected for the preliminary street design is limited to one of the Town's three main thoroughfares, which are:

- Old Central Avenue
- Chamber Avenue/Capitol Heights Boulevard
- Brooke Road/Suffolk Avenue

We are now taking your input. If you have any comments, please email us at [info@lidcenter.org](mailto:info@lidcenter.org) or call us at 410-326-1234.

Town of Capitol Heights Green Streets Design Project Survey

6. How do you rate the appearance of existing main streets in Capitol Heights?

☐ Very poor  
☐ Poor  
☐ Neutral  
☐ Good  
☐ Very good  
☐ I don't know

7. During and after storm events, the Town of Capitol Heights experiences:

☐ Street flooding  
☐ Standing water in street gutters  
☐ Water ponding in low areas  
☐ Flooded homes and businesses  
☐ None of the above  
☐ I don't know

8. Rank the following street from 1 to 3 for your preference, with 1 being your most preferred, and 3 being your least preferred. Write "no opinion" if you have no preference.

Old Central Avenue \_\_\_\_\_  
Chamber Avenue/Capitol Heights Boulevard \_\_\_\_\_  
Brooke Road/Suffolk Avenue \_\_\_\_\_

9. What characteristics of your top ranked street made you select it?

\_\_\_\_\_

\_\_\_\_\_

February 25, 2012 | Low Impact Development Center Green Streets Survey

Commercial Main Street, Before picture  
Source: San Mateo Countywide Water Pollution Prevention Program

Commercial Main Street, After (rendered image)  
Source: San Mateo Countywide Water Pollution Prevention Program

Commercial Main Street, Before picture  
Source: San Mateo Countywide Water Pollution Prevention Program

Commercial Main Street, After (rendered image)  
Source: San Mateo Countywide Water Pollution Prevention Program

2. What do you like about the images (either before or after)?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. What don't you like about the images (either before or after)?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

February 25, 2012 | Low Impact Development Center Green Streets Survey



# Green Street Survey Responses

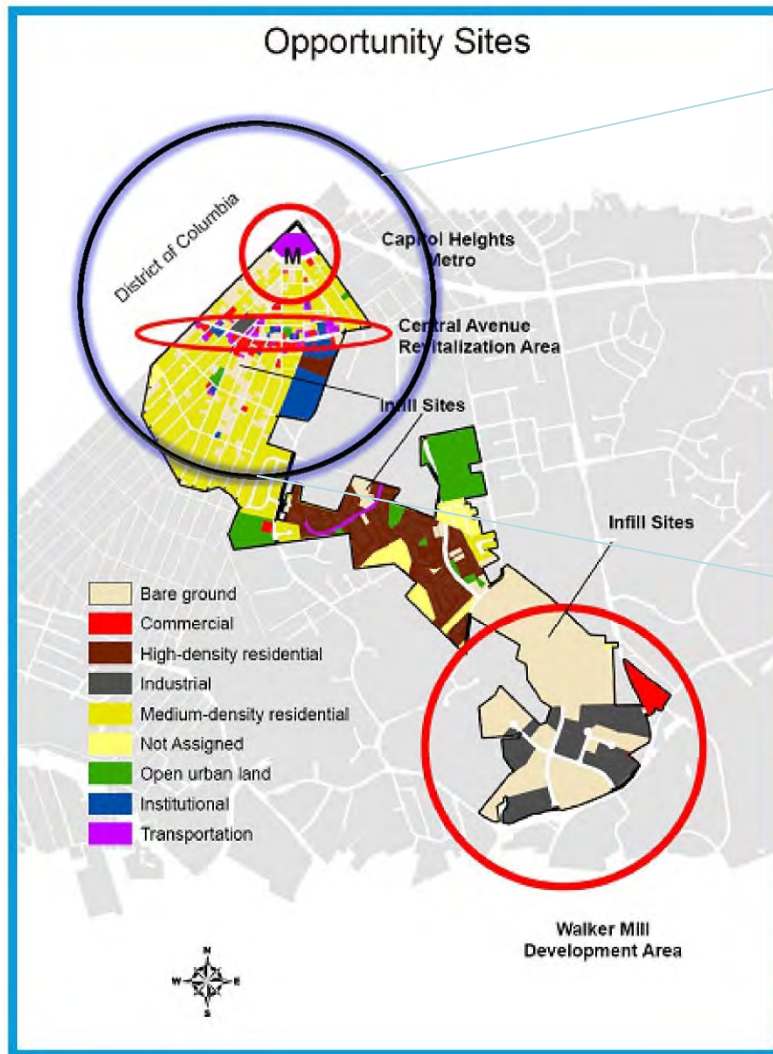
## Top 4 considerations related to main streets:

- Improving the look of the streetscape
  - Improving neighborhood walkability/connectivity & pedestrian friendliness
  - Reduce crime & vandalism
  - Improve the environment
- Ranked equally
- Ranked fourth

## Greatest safety concerns:

- Safety for children going to/coming from school
- Drivers not yielding to pedestrians
- Lack of crosswalks

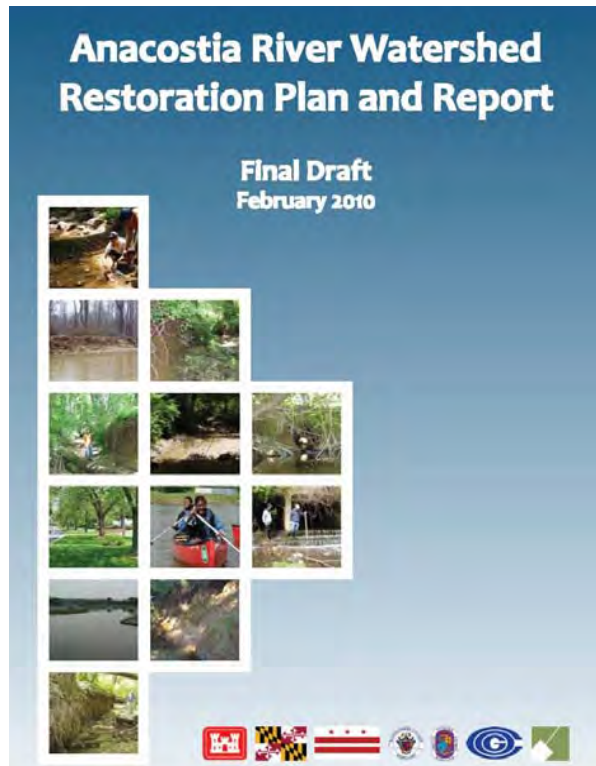
# Community Sustainability Plan



**Green strategies:** Incorporate LID/ environmentally sensitive storm water management in all new development; repair/replace streets in the most environmentally responsible way; increase the tree canopy; and encourage green jobs



# Anacostia Restoration Plan



- ◆ = Stormwater retrofit
- ◆ = Riparian reforestation
- = Trash reduction
- ◆ = Stream restoration
- ◆ = Parkland Acquisition

# Green Street Selection Process

1. **Community Input.** Sites are evaluated based on community concerns regarding safety, environmental factors, economic factors, aesthetics, etc.
2. **Screening.** Sites are then evaluated to determine if they're a good candidate based on a range of factors, including street slope, sidewalk widths, building setbacks, utilities in footway, street trees, soils, and drainage areas.
3. **Selection.** The final road selected for preliminary design is selected based upon feasibility, cost-effectiveness, a consideration of any planning activities, and the potential to team up with other concurrent projects.



# Final Preliminary Design

## Capitol Heights Blvd / Chamber Ave

## Preliminary Green Street Design



CAPITOL HEIGHTS BLVD LOOKING SOUTH



METRO PARK LOOKING WEST



CHAMBER AVE LOOKING SOUTH



MAIN STREET



METRO EDGE



METRO CORE



Preliminary Green Street Design



# CHANGES TO DOT-HWYS PERMANENT BMP PROGRAM

August 2015

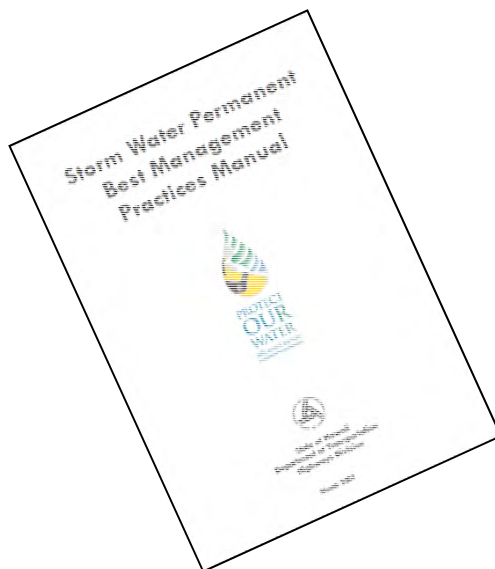


# STANDARDS FOR STORM WATER MANAGEMENT



## Bottom Line Up Front

Projects (new or redevelopment) that generate one (1) acre or more of new impervious area must incorporate LID storm water controls unless qualifying for exemptions or variances







# STANDARDS FOR STORM WATER MANAGEMENT



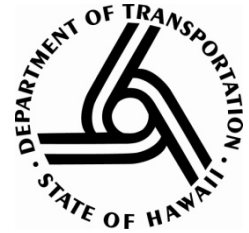
Any project (new or redevelopment) is required to install a permanent BMP(s) for storm water management if it generates equal to or greater than one (1) acre of new permanent impervious surface

**CURRENTLY**

**(UP TO OCTOBER 2015)**



# STANDARDS FOR STORM WATER MANAGEMENT



All projects (new development or redevelopment) that disturb (1) acre or more of land reviewed.

- Greater than one (1) acre of new permanent impervious surface requires LID PBMP
- Smaller projects (less than one acre new impervious) that have the potential to discharge pollutants to the MS4 may be required to install specific BMPs



**FUTURE**

**(AFTER OCTOBER 2015)**



# STANDARDS FOR STORM WATER MANAGEMENT



(CONTINUED)

- All permanent BMP projects are required to install LID BMP(s)
- *However.* Some projects may qualify for exemptions and or variances from this requirement to install LID BMP(s). Projects that qualify for variance from LID must install alternative permanent BMPs approved by DOT-HWYS



**FUTURE**  
**(AFTER OCTOBER 2015)**





# STANDARDS FOR STORM WATER MANAGEMENT



## Variances:

- Hydrogeological Constraints
- Physical Constraints
- Operational Constraints
- Other



# STANDARDS FOR STORM WATER MANAGEMENT



## Variances: Hydrogeological Constraints

| Constraints                                    | Safety Concern  |
|--|---|
| <b>Permeability</b>                            | Soil under BMP basin invert does not allow for water to permeate less than 0.5 in/hr  |
| <b>Depth to Ground Water</b>                   | BMP invert is closer than 3 ft depth to seasonally high groundwater table   |
| <b>Distance to Drinking Water</b>              | BMP is closer than 50 ft to nearest groundwater well for drinking   |
| <b>Distance to Septic System</b>               | BMP is closer than 35 ft to nearest septic system   |
| <b>Slope Stability</b>                         | BMP and infiltration would destabilize slope or cause landslide   |
| <b>Structural Impacts to Buildings/Roadbed</b> | BMP is close to the nearest building foundation or roadbed. Proximity is dependent on BMP type, but minimum is 10 feet distance |
| <b>Sensitive Downstream Areas</b>              | Instituting BMPs would significantly affect downstream habitats   |



# STANDARDS FOR STORM WATER MANAGEMENT



## Variances: Physical Constraints

| Constraints                  | Safety Concern   |
|------------------------------|--|
| Space Constraints            | Instituting LID BMPs to MEP doesn't yield enough treatment for WQDV  |
| Site Slope                   | Usable flat area doesn't yield enough treatment for WQDV   |
| Lack of Right of Way         | Project is closer than 10 ft to the nearest property line and no memorandum of understanding or joint ownership has been established |
| Contaminated Subsoil         | Project is in the vicinity of industrial contamination   |
| Sensitive Community Site     | Excavation for BMP would permanently damage a community resource (e.g. wildlife refuge)  |
| Sensitive Archeological Site | Excavation for BMP would result in disturbance of remains or artifacts   |





# STANDARDS FOR STORM WATER MANAGEMENT



## Variances:

- Operational Constraints

| Constraints                                | Safety Concern   |
|--|--|
| Strength/Loading Requirements for Pavement | BMP is closer than 10 feet to pavement   |
| No Application for Water Reuse             | Landscaping or green roof is not an option due to space, energy systems, electrical, or mechanical systems |
| Hazardous Operations                       | Nature of site's permanent operations leave potential for mobilizing pollutants via proposed BMPs          |

- Other

| Constraints/Non Applicability | Description  |
|-------------------------------|--|
| Legality                      | Implementing a BMP in the project would violate Federal or State Law |



# STANDARDS FOR STORM WATER MANAGEMENT



## Exemptions:

- Returns area to pre-development hydrologic conditions
- Does not discharge to State waters
- Operations and Maintenance Activities
- Water Quality Improvement or Preservation
- Emergency
- Temporary



# STANDARDS FOR STORM WATER MANAGEMENT



## The Design Volume:

1-inch. By the Total Drainage Area = Design Volume

$$WQDV = C \times 1'' \times A \times 3630$$

WQDV= water quality design volume in cubic feet

C= runoff coefficient (refer to PBMP manual)

A= total drainage area in ACRES

3630= conversion factor

1'' represents the design storm depth (using a more conservative value is acceptable)



# STANDARDS FOR STORM WATER MANAGEMENT

## Table 6-1. Values of Runoff Coefficients, C

| Type of Surface                     | Runoff Coefficient (C) |
|-------------------------------------|------------------------|
| <b>Rural Areas</b>                  |                        |
| <b>Concrete or asphalt pavement</b> | <b>0.90 - 0.95</b>     |
| <b>Gravel roadways or shoulders</b> | <b>0.4 - 0.6</b>       |
| <b>Bare earth</b>                   | <b>0.2 - 0.9</b>       |
| <b>Steep grassed areas (2:1)</b>    | <b>0.5 - 0.7</b>       |
| <b>Turf meadows</b>                 | <b>0.1 - 0.4</b>       |
| <b>Forested areas</b>               | <b>0.1 - 0.3</b>       |
| <b>Cultivated fields</b>            | <b>0.2 - 0.4</b>       |



# STANDARDS FOR STORM WATER MANAGEMENT

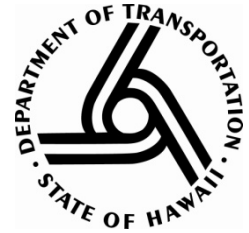


## Implementation:

- Calculate WQ Design Volume
- Collect site data:
  - Soil type
  - Depth to ground water
  - Perc tests
  - Site history
- Assess/Select LID BMPs to infiltrate, store, detain, evapotransporate, and/or bio-treat the WQ Volume



# STANDARDS FOR STORM WATER MANAGEMENT



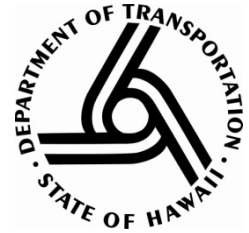
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- If, due to variances, the complete volume cannot be treated, utilize LID where feasible and treat the remaining volume with alternative BMPs
- Consult with DOT-HWYS regarding any constraints that require a variance and alternative BMPs





# STANDARDS FOR STORM WATER MANAGEMENT



## Designing for Storm Water Controls (Con't)

- For smaller projects less than one acre that have the potential to pollute, apply source control. Such projects include:
  - Retail Gasoline Outlets
  - Automotive Repair Shops
  - Restaurants
  - Projects with Parking Lots with at least 10,000 square feet of total impervious area



# STANDARDS FOR STORM WATER MANAGEMENT



## Questions?





# GROUP PROJECT



## INTRODUCTION

## LUNCH

## GROUP PROJECT WORKING SESSION



# Low Impact Development and Green Infrastructure in the Linear Environment

Presented By:  
The Low Impact Development (LID) Center, Inc.  
HI DOT 2015



The Low Impact Development Center, Inc.  
A non-profit water resources and sustainable design organization  
[www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org)



# Green Highways and Green Infrastructure

# Presentation Overview

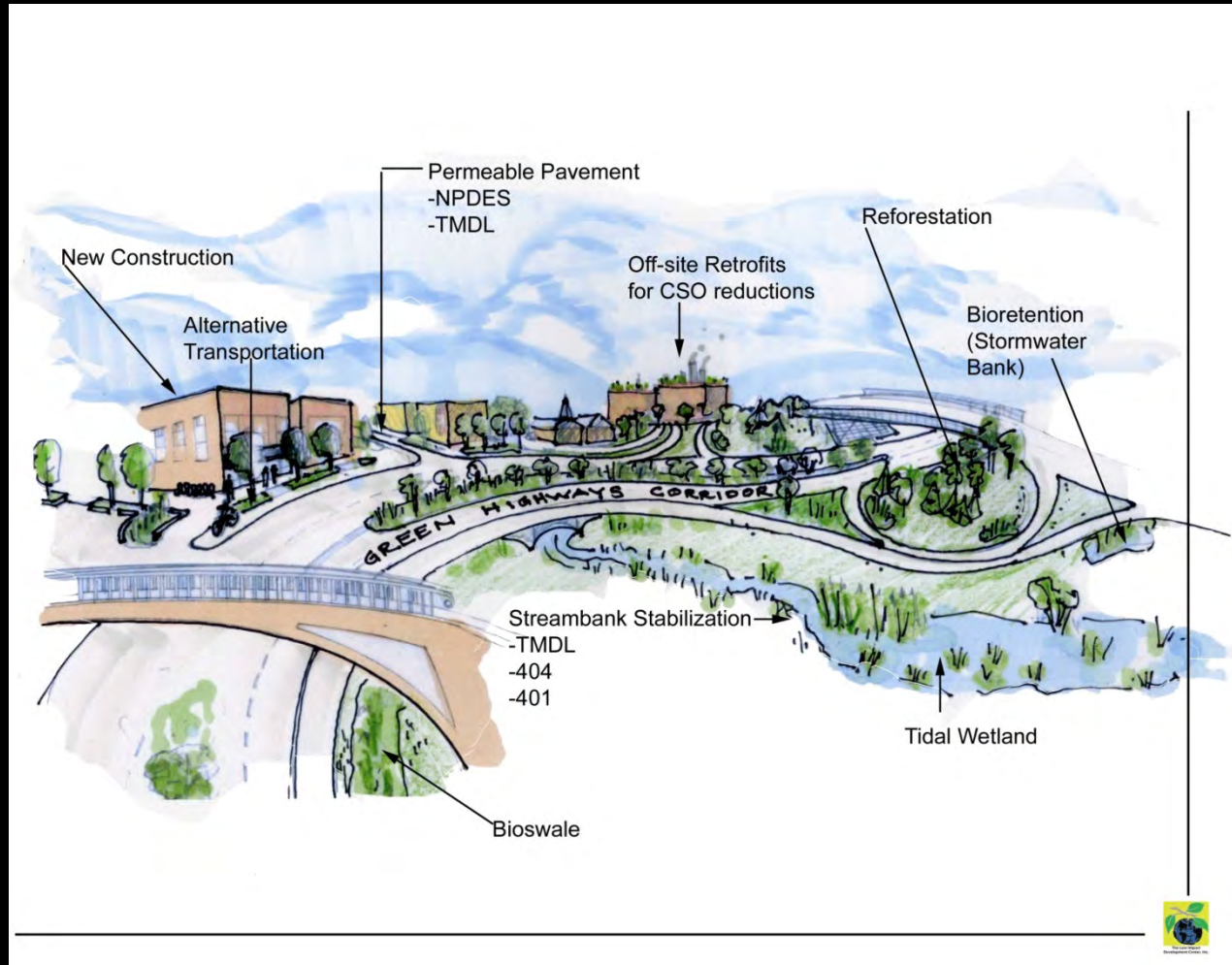
- ▶ Basic principles for linear projects
- ▶ State-of-the-practice and research
- ▶ Projects/Lessons learned



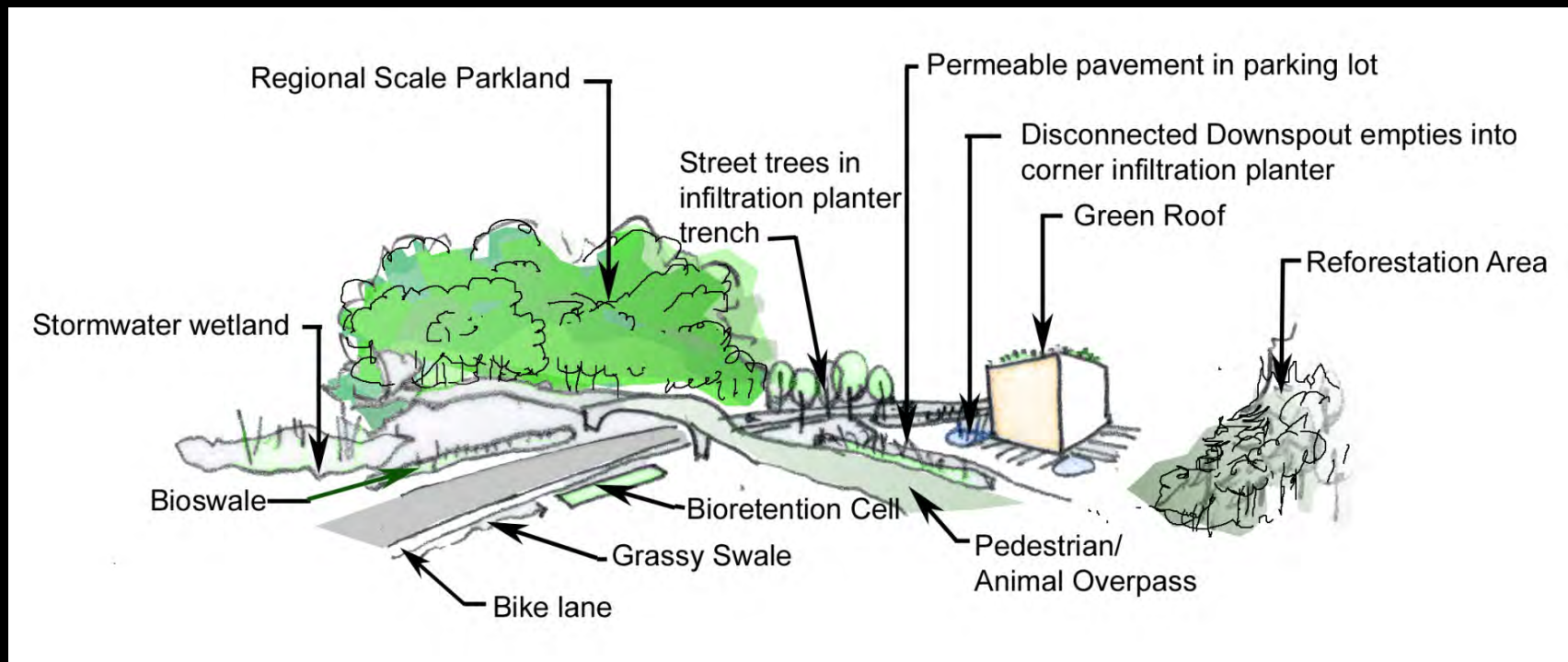
# Green Infrastructure



# Regulatory and Resource Programs



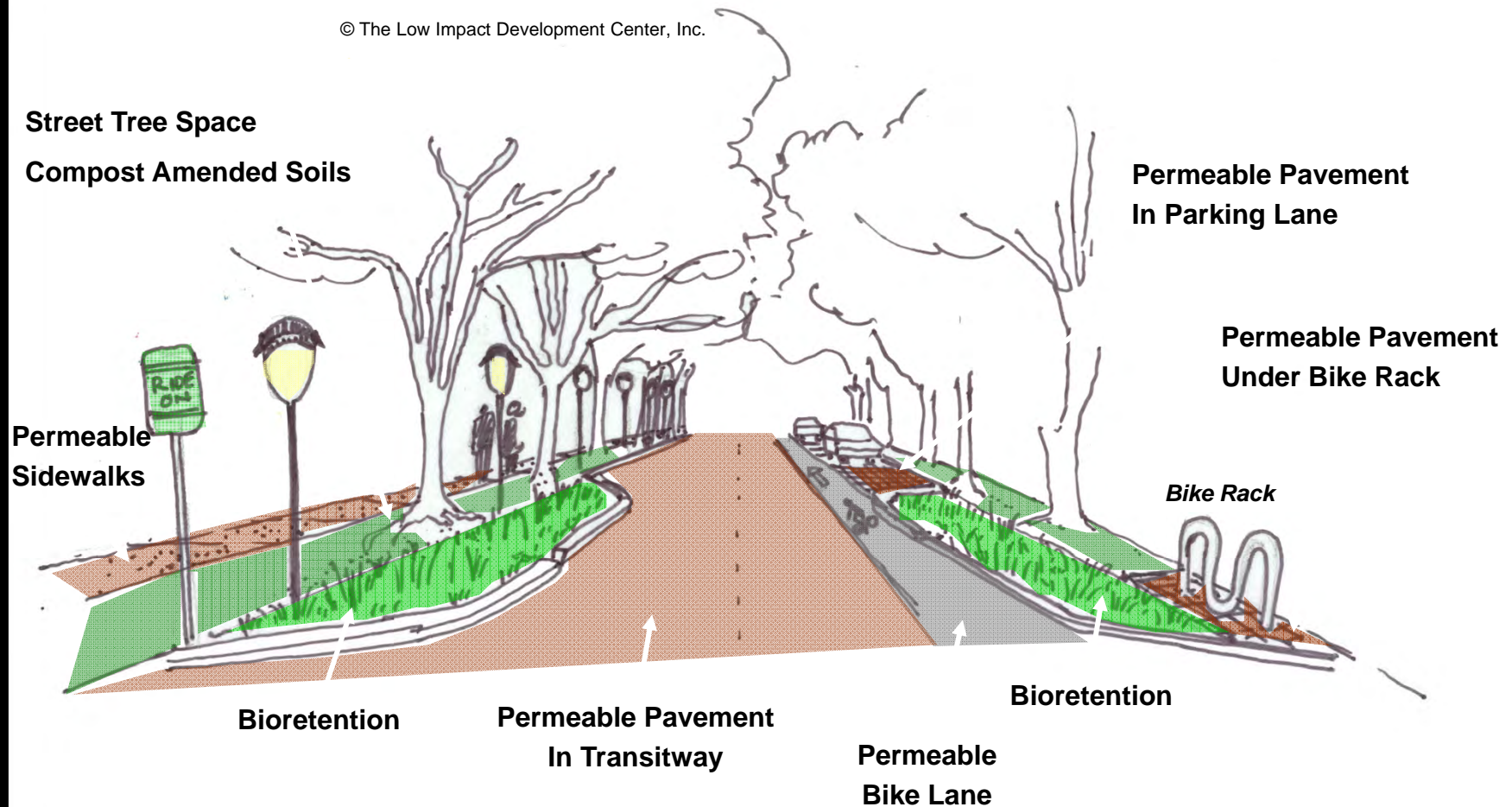
# Green Infrastructure Concepts





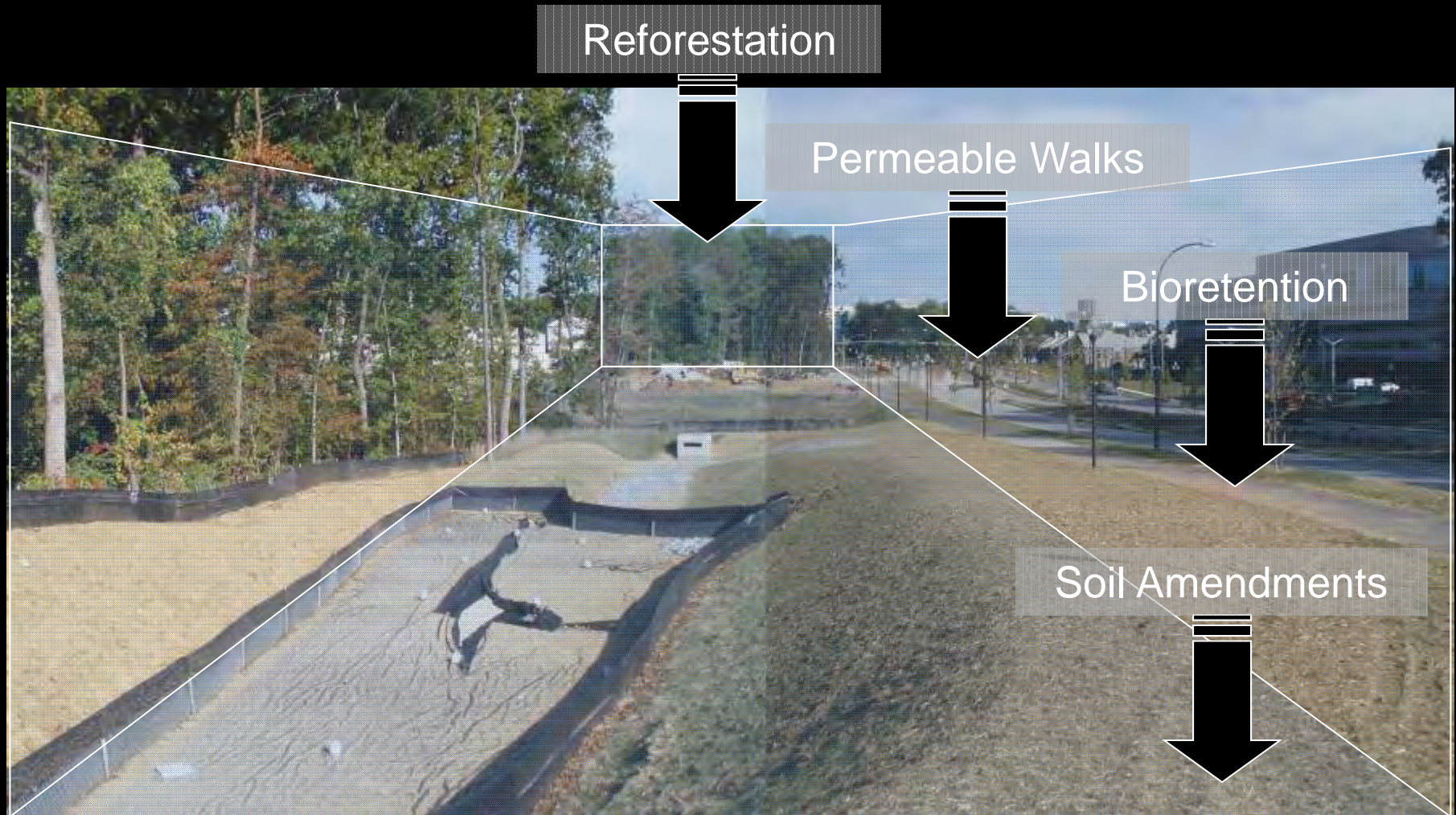
# What makes a highway or street green?

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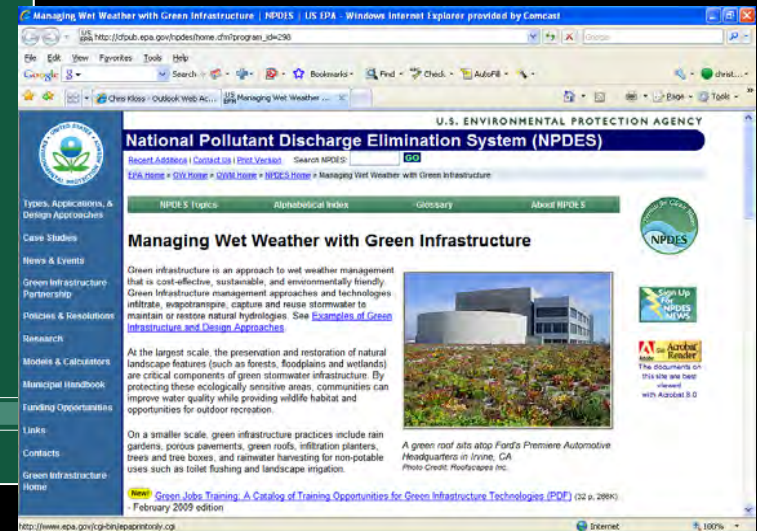
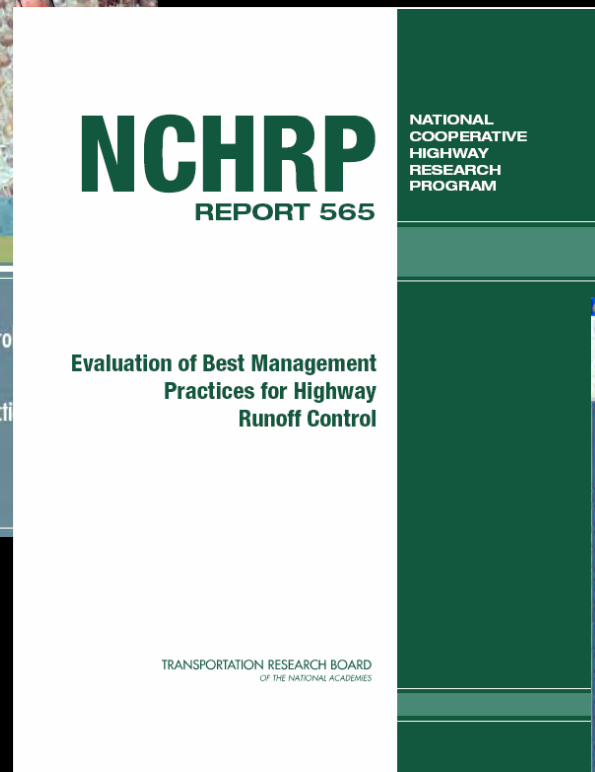
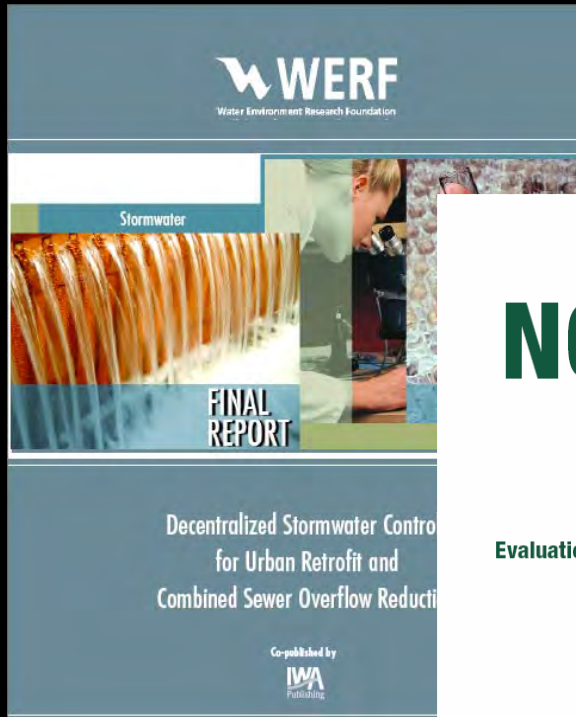
# Green Strategies



End of Pipe vs. LID/Green Infrastructure



# Research and Guidance





# Relevant NCHRP Publications

- **NCHRP 728:** Guidelines for Evaluating and Selecting Modifications to Existing Roadway Drainage Infrastructure to Improve Water Quality in Ultra-Urban Areas
- **NCHRP 792:** Long-Term Performance and Life-Cycle Costs of Stormwater Best Management Practices
- **NCHRP 444:** Pollutant Load Reductions for Total Maximum Daily Loads for Highways
- **NCHRP 612:** Safe and Aesthetic Design of Urban Roadside Treatments
- **NCHRP 565:** Evaluation of Best Management Practices for Highway Runoff Control (Low Impact Development)

# NCHRP 25-37 Watershed Based Approach to Stormwater Management

- Linear facilities often do not have sufficient ROW for BMPs
- Offsite in-kind and out-of-kind approaches at the watershed level
- Development of “equivalencies” or ratios of mitigation
- Use of readily available data
- Toolbox can be modified for local values and data



# Toolbox Process

- Location / Unit Area Runoff Volume
- Characteristic Runoff Quality
- Representative BMP Type
- Volume Capture/Reduction Goal



Volume or  
Mass  
Removed /  
Impervious  
Acre Treated



- Credits from Bank or Exchange
- Offsite Impervious Acres Treated
- Multipliers to Account for:
  - Location in Watershed
  - Land Use Treated
  - BMP Type Applied / Effectiveness
  - Uncertainty in Watershed Benefit



- Mitigation Type
- Ranked Ecosystem Services Improved
- Volume or Mass Equivalent per Mitigation Length or Area
- Multipliers to Account for Uncertainty in Watershed Benefit



# Watershed Characterization

WBSMT

4/3/2014 17:31



NCHRP Watershed-Based Stormwater  
Mitigation Toolbox (WBSMT) v1.2014.04

## STEP 1 - Watershed Characterization

### 1 Project

Project information to identify this project

Project Name: optional

Watershed: optional

Description: optional

Username: optional

### 2 LOCATION

Select a location on the map or use drop down menu to select a state and pin gage

#### Map Select



#### Refine Selection

State  
Gage ID

#### Location Climate

|                                      |        |
|--------------------------------------|--------|
| COOP ID                              | 356751 |
| Elevation (ft)                       | 19     |
| Average Annual Precip. Depth (in)    | 36.7   |
| Overide Ave. Ann. Precip. Depth (in) |        |

### 3 PROJECT MITIGATION CONSIDERATIONS

Enter information on the appropriate target (multiple targets are not allowed)

Is there a TMDL or listed impairment?

No

If Yes, the constituent of concern is:

Phosphorus

Find out at:

EnviroMapper

### 4 GOALS

Enter information on the appropriate target (multiple targets are not allowed)

- ☒ Regulatory **Comply with NPDES permit**
- ☒ Hydraulics **Manage flow characteristics upstream, within, or downstream of project**
- ☒ Hydrology **Improve runoff characteristics (peak shaving and/or volume reduction)**
- ☒ **Reduce downstream pollutant loads and concentrations (TSS, Nutrients, Volume Flow)**
- ☒ Water Quality **Improve/minimize downstream temperature impact**
- ☒ **Mitigation for development in other areas**
- ☒ **Opportunistic BMP installation**
- ☒ Toxicity **Reduce acute toxicity of runoff**
- ☒ **Reduce chronic toxicity of runoff**

Target % Runoff Capture

80%

Target % Volume Reduction

20%

Target % Constituent Reduction

20%

# Watershed Opportunities

WBSMT

4/3/2014 17:31



## Step 3 - Mitigation Approaches

### 1 PROJECT

Project Information Form  
(Identify this project)

Project Name:

optional

Watershed:

optional

Description:

optional

Username:

optional

### 2 POTENTIAL MITIGATION APPROACHES

Enter information on the approach selected (multiple approaches are allowed)

Project Site Only

Watershed-based Approach

Combined Approach



Permittee Responsible

In-Lieu Fee

Mitigation Banking

### 3 ECOSYSTEM SERVICES

Observe and record ecosystem services Rank & priority

#### Rank of Ecosystem Services

Water Supply

Biodiversity

Food Provisioning

Flood Protection / Conveyance

Navigability

Recreation

Wetland restoration/creation

Sediment supply and demand (transport) for channel morphology and overbank soil supply

### 4 PERMITEE RESPONSIBLE MITIGATION OPTIONS

#### Mitigation Options

Stream Stabilization/Conservation

Upland Stabilization

Wetland restoration/creation

Buffer Stabilization

Sediment Removal/Dredging

#### Detail of Ecosystem Service Linkage

Tier 1: Qualitative ranking (low, medium, high) of known benefits

Tier 2: Quantitative - Direct determination Equivalency of pollutant load reduction

Tier 3: Modeling /predictions (carbon fixation, productivity)

### 5 IN-LIEU FEE

Regulatory In lieu fee and Bank Information Tracking System (RIBITS)

RIBITS

### 6 MITIGATION BANKING

Regulatory In lieu fee and Bank Information Tracking System (RIBITS)

RIBITS

## STEP 6 - Out-of-Kind Options

## 1 PROJECT INFO

Project Information: I-5 Lane Addition Tualatin Watershed, OR ( John Smith )

2 OFF-SITE  
ADJUSTMENT

| LOAD REDUCTION FACTOR                    | DEFAULT | VALUE |
|--|---------|-------|
| Offsite Load Reduction Adjustment Factor | 2       | 2     |

3 BENEFICIAL  
USES

| BENEFICIAL USE APPLICABILITY             | DEFAULT | VALUE |
|--|---------|-------|
| Aquatic life / warm and cold habitats    | 1       | 1     |
| Drinking water supply                    | 1       | 0     |
| Primary and Secondary Contact recreation | 1       | 0     |
| Fish Consumption (edible seafood)        | 1       | 0     |
| Aesthetics                               | 1       | 1     |
| Industrial Uses                          | 1       | 0     |
| Wildlife / terrestrial life              | 1       | 1     |
| Rare and endangered species              | 1       | 0     |
| Wetland Habitat                          | 1       | 1     |

Note: 0 - Beneficial use not applicable or important, 1 - Beneficial use applicable or important, 2-Beneficial use applicable and impaired

4 ECOSYSTEM  
SERVICES

|  | DEFAULT<br>PRIORITY<br>RANK | USER PRIORITY<br>RANK |
|--|-----------------------------|-----------------------|
| <b>WATERSHED ECOSYSTEM SERVICE RANKS</b> |                             |                       |
| Biodiversity Conservation                | 4                           | 1                     |
| Clean and Plentiful Water                | 4                           | 3                     |
| Food, Fuel, and Materials                | 1                           | 4                     |
| Natural Hazard Mitigation                | 3                           | 2                     |
| Recreation, Culture, and Aesthetics      | 1                           | 1                     |

Note: Score range is 1 - 5, Lower is better

5 MITIGATION  
MEASURES

| MITIGATION MEASURES                      | DEFAULT<br>PRIORITY<br>SCORE<br>(sums<br>to 1.0) | USER PRIORITY<br>SCORE<br>(sums<br>to 1.0) | DEFAULT<br>OPPORTUNITY<br>SCORE<br>(Range is 0 - 1) | USER<br>OPPORTUNITY<br>SCORE<br>(Range<br>is 0 - 1) |
|--|--|--|---|---|
| Stream Improvement Techniques            | 0.00   | 0.00                                       | 1.00  | 1.00  |
| Upland Stabilization                     | 0.00   | 0.00                                       | 0.25  | 0.25  |
| Reducing Impervious Surface Connectivity | 0.75   | 0.75                                       | 0.00  | 0.00  |
| Wetland Restoration / Creation           | 0.25   | 0.25                                       | 0.75  | 0.75  |
| <b>Check Sum</b>                         | 1.00   | 1.00                                       |   |   |

Note: Score range is 0 - 1, Higher is better

Use User Priority Scores instead of default scores

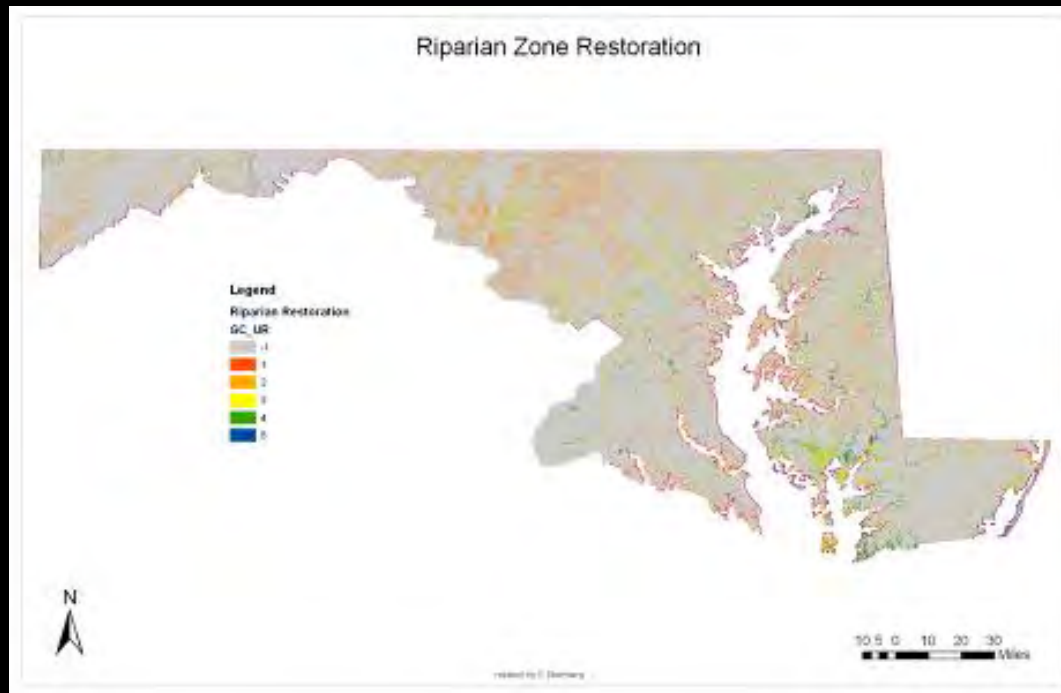
6 MITIGATION  
RATIOS

| MITIGATION MEASURES                      | FINAL SCORE | DEFAULT<br>FOOTPRINT<br>RATIO | USER<br>FOOTPRINT<br>RATIO | APPROX.<br>FOOTPRINT (ac) |
|--|-------------|-------------------------------|----------------------------|---------------------------|
| Stream Improvement Techniques            | 0.000       | 0.100                         | 0.100                      | 1.17                      |
| Upland Stabilization                     | 0.000       | 0.031                         | 0.031                      | 0.36                      |
| Reducing Impervious Surface Connectivity | 0.000       | 1.000                         | 1.000                      | 11.65                     |
| Wetland Restoration / Creation           | 0.188       | 0.050                         | 0.050                      | 0.58                      |

Note: Score range is 0 - 1, Higher is better



# Watershed Resources Registry



EPA Region 3 Office of Water

## Riparian Zone Restoration

Map and score areas near a stream, but not in a stream, where the natural condition of the riparian zone has been compromised. Examples include areas where the stream quality is impaired, agricultural uses extend right up to the stream, woody vegetation has been removed, etc.



### Green Streets Toolkit

**What is a Green Street?**  
Publicly owned streets that incorporate green infrastructure (GI) into the urban landscape. These streets are designed to manage stormwater runoff and improve air quality, while also providing aesthetic and recreational benefits. Green streets can be implemented in a variety of ways, from simple plantings to more complex systems like permeable pavement and bioswales. The toolkit provides guidance on how to design, implement, and maintain green streets.

**Benefits of Green Streets**  
Green streets provide a variety of benefits, including improved water quality, reduced stormwater runoff, increased air quality, and enhanced aesthetics. They also provide a variety of ecosystem services, such as carbon sequestration and habitat for wildlife. Green streets can also improve public health by providing a more pleasant environment for walking and biking.

DRAFT / DO NOT DISTRIBUTE

Green Infrastructure & Low Impact Development Transportation Handbook 15



## Green Infrastructure/ Low Impact Development Linear Transportation and Parking Lot Resource Notebook

Washington DC  
June 2012

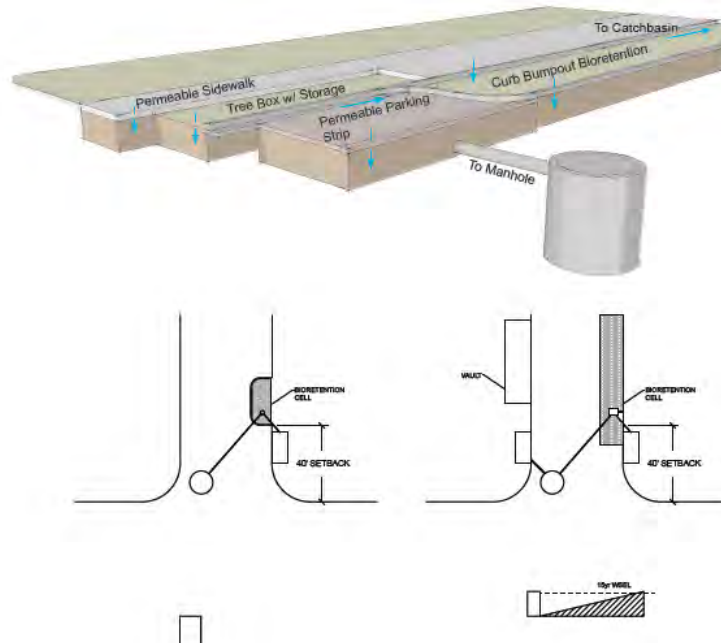
Prepared for:  
USEPA Office of  
Water, Office of  
Wetlands, Oceans, and  
Watersheds Nonpoint  
Source Branch

DRAFT / DO NOT  
DISTRIBUTE

# EPA Resources

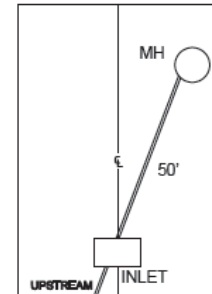
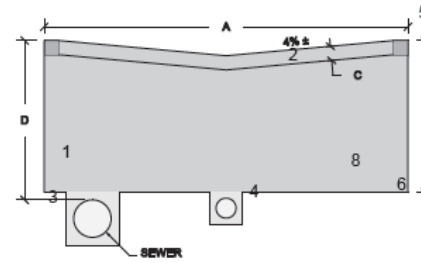
## Street Section

7.0



## Permeable Alleys

1.1



### Key Notes

#### Dimensions

- A 12 ft. ±
- B Depth set by structural/ swm storage 2 to 3 ft.
- C Ck with astm and software for structural
- D Assume 4 ft. to top of sd inlets 3 ft. ±

#### Detail Notes

- 1 Assume #2/57/8 matrix with
- 2 Concrete depth 8 ± inch pav
- 3 Per std. trench pvc and hdp
- 4 Underdrain to inlet
- 5 Curb/deep curb maybe requir

e if requir  
or mh. Ck  
v peak an  
s above 3

id ratio x  
3:1 ratio o  
un on or

| Page | Item | Name                     | V/T | W          | D  | Storage Ratio | T     | Use             |
|------|------|--------------------------|-----|------------|----|---------------|-------|-----------------|
| 2    | 1.1  | Permeable Alleys         | V,T | 12'        | 3' | 90:1 per lane | Route | ROW             |
| 3    | 1.2  | Permeable Parking Aisles | V,T | VAR        | 3' | 90:1 per lane | Route | ROW/<br>Private |
| 4    | 1.3  | Tree Pit                 | V,T | VAR(4'-6') | 3' | 30:1          | Route | ROW             |
| 5    | 1.4  | Sidewalk                 | V,T | VAR        | 3' | 9:1           | Route | ROW             |
| 6    | 1.5  | Patio                    | V,T | VAR        | 3' | 9:1           | Route | Private         |
| 7    | 2.1  | Cistern/Rain Barrel      | V,T | VAR        | -- | 1 gal=230 in  | Route | Private         |
| 8    | 3.1  | Roof                     | V,T | VAR        | -- | 1:1           | Route | Private         |
| 9    | 4.1  | Supplemental Storage     | V,T | VAR        | -- | 1 gal=230 in  | Route |                 |
| 10   | 5.1  | Downspout Disconnect     | V,T | VAR        | -- | N/A           |       | Private         |
| 11   | 6.1  | Bioretention Cell        | V,T | VAR        | 3' | 100:1         | Route | Private         |
| 12   | 6.2  | Bioswale/Swale           |     | VAR        | 3' | 45:1          |       | ROW/<br>Private |
| 13   | 6.3  | Planter Wall             | V,T | VAR        | -- | 40:1          |       | ROW             |



**Anacostia Waterfront**  
Transportation Architecture Design Standards



District of Columbia  
District Department of Transportation  
Infrastructure Project Management Administration

Standards  
and  
Templates



# Some DMV Urban Project Examples

- Grants and leveraging
- Retrofits
- Revitalization
- Construction and maintenance  
lessons learned

## Grant Driven



The Town of Edmonston, Maryland

Community revitalization through the use of low impact development, attraction of green businesses, and attention to health by encouraging biking and walking.

ARRA funded and leveraged  
SHA dollars



[illegible]





Maintained

# Leveraging Transportation and Stormwater Programs: New York Avenue Corridor

| Proposed Project  | Project Parameters |                              |                            | Social Function         |                                   |  | Human Health                 |                               | Environmental Function                 |                          |                                  |                             |                              |  |                            |   | Economic Function                          |                                 |   | Overall Rating (L/M/H) |
|---|--------------------|------------------------------|----------------------------|-------------------------|-----------------------------------|--|------------------------------|-------------------------------|--|--------------------------|----------------------------------|-----------------------------|------------------------------|--|----------------------------|---|--|---------------------------------|---|------------------------|
|   | Within CSD (Y/N)   | DC Government Property (Y/N) | Project Timeline (S/M/L/N) | Green Reference (L/M/H) | Neighborhood Connectivity (L/M/H) | Conformance with Master Plan/ Area Rec.s (Y/N) | Improved Air Quality (L/M/H) | Heat Stress Reduction (L/M/H) | Links ROW to Private Property (Y/N/NA) | Site Suitability (L/M/H) | Volume Reduction Benefit (L/M/H) | Peak Flow Attenuate (L/M/H) | Groundwater Recharge (L/M/H) | Water Quality & Ecological Benefit (L/M/H) | Carbon Footprint Reduction | Local Green Jobs (Y/N)                  | Avoided Stormwater Treatment Costs (L/M/H) | Increased Property Values (Y/N) |   |                        |
| <div>○ -low/short</div> <div>● -medium</div> <div>● -high/long</div> <div>✓ -yes</div> <div>⊗ -no</div> <div>NA -not applicable</div> |                    |                              |                            |                         |                                   |  |                              |                               |  |                          |                                  |                             |                              |  |                            |   |  |                                 |   |                        |
| Bus Stop A  | ⊗                  | ✓                            | ○                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ○ |                        |
| Bus Stop B  | ⊗                  | ✓                            | ○                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ○ |                        |
| Bus Stop C  | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ● |                        |
| Bus Stop D  | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ● |                        |
| Bus Stop E  | ✓                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ● |                        |
| Bus Stop F  | ✓                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ● |                        |
| Bus Stop G  | ✓                  | ✓                            | ○                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ○                                | ○                           | ○                            | ○  | ○                          | ⊗                                       | ○  | ✓                               | ○ |                        |
| Multi-use trail, south side of New York Avenue NE   | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ○                             | NA                                     | ●                        | ○                                | ○                           | ○                            | ●  | ●                          | ✓                                       | ●  | ✓                               | ● |                        |
| Multi-use trail connection - proposed New York Ave NE multi-use trail & Metropolitan Branch Trail                                     | ⊗                  | ⊗                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ○                             | NA                                     | ●                        | ○                                | ○                           | ○                            | ●  | ●                          | ✓                                       | ○  | ✓                               | ● |                        |
| Multi-use trail, Florida Avenue NE to Bridge**  | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            |                               | NA                                     | ●                        | ○                                | ○                           | ○                            | NA   | ●                          | ✓                                       | NA   | ✓                               | ○ |                        |
| Multi-use trail, Bridge to Penn Street NE   | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ○                             | NA                                     | ●                        | ○                                | ○                           | ○                            | ○  | ●                          | ✓                                       | ○  | ✓                               | ● |                        |
| Multi-use trail, Penn Street NE to Brentwood Parkway NE   | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            |                               | NA                                     | ●                        | ○                                | ○                           | ○                            | ○  | ●                          | ✓                                       | ○  | ✓                               | ○ |                        |
| Multi-use trail, Brentwood Pkwy NE to West Virginia Ave NE/ Montana Ave NE  | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ●                             | NA                                     | ●                        | ○                                | ○                           | ○                            | ●  | ●                          | ✓                                       | ○  | ✓                               | ● |                        |
| Entrance to Florida Avenue Market off New York Avenue   | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ○                            | ○                             | ✓                                      | ●                        | ●                                | ●                           | ●                            | ○  | ○                          | ✓                                       | ○  | ✓                               | ● |                        |
| Montana Circle Bioretention   | ✓                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ●                             | NA                                     | ●                        | ●                                | ●                           | ●                            | ●  | ●                          | ✓                                       | ●  | ✓                               | ● |                        |
| Montana Circle Curb Cuts  | ✓                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ●                             | ✓                                      | ●                        | ●                                | ●                           | ●                            | ●  | ●                          | ✓                                       | ●  | ✓                               | ● |                        |
| DC Property Yard at Montana Avenue NE   | ✓                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ●                             | ✓                                      | ●                        | ●                                | ●                           | ●                            | ●  | ●                          | District of Columbia Office of Planning |  |                                 |   |                        |
| Mount Olivet Road and Capitol Avenue NE   | ⊗                  | ✓                            | ●                          | ●                       | ●                                 | ✓  | ●                            | ●                             | ✓                                      | ●                        | ●                                | ●                           | ●                            | ●  | ●                          |   |  |                                 |   |                        |

District of Columbia  
Office of Planning





# Nannie Helen Burroughs

A 1.5 mile long minor arterial pilot project for innovative, environmentally-progressive practices integrated with economic revitalization efforts



## Nannie Helen Burroughs Avenue Great Street

### Proposed Low Impact Development Practices

Stormwater solutions which support sustainable urban design













#### Bioswale

- Linear bioretention feature, may mimic natural stream channel form
- Reduces runoff volume as water is conveyed
- Removes stormwater pollutants: organics, sediment, metals
- Provides habitat and green space

**Possible locations:**

- Near Eastern Ave. DC Welcome Sign
- Between 48<sup>th</sup> and 49<sup>th</sup> streets

#### Bioretention Cell

- Small-scale shallow vegetated depression
- Reduces runoff volume
- Removes stormwater pollutants: organics, sediment, metals
- Provides habitat and green space

**Possible locations:**

**Rain Gardens:**

- 50<sup>th</sup> to 51<sup>st</sup> Street, north sidewalk bulge area
- 50<sup>th</sup> to 51<sup>st</sup> Street, south sidewalk bulge area

**Planters:**

- 48<sup>th</sup> Street, north & south bus stop bump outs
- 51<sup>st</sup> to Division, north side (6) & south side (3) sidewalk

#### Permeable Pavement

- Reduces runoff volume
- Removes pollutants: sediment, oils and grease, metals
- Reduces urban heat island
- Aesthetic value: many color and pattern options
- ADA compliant pavement

**Possible locations:**

- North side of 48<sup>th</sup> to 49<sup>th</sup>
- Between 51<sup>st</sup> and Division Ave.

#### Vegetated Filter Strip

- Includes soil amendments and sustainable landscaping
- Reduces runoff volume
- Provides habitat and green space

**Possible locations:**

- 48<sup>th</sup> Street, Slope on the north side of NHB
- 50<sup>th</sup> to 51<sup>st</sup> Street, Median
- 51<sup>st</sup> Street to Division, Median
- Division to 55<sup>th</sup> Street, Median

#### Street Trees

- Reduces runoff volume
- Reduces urban heat island
- Improves air quality
- Reduces noise and wind effects
- Provides shade

**Healthy tree pilot locations:**

- (structural soil under permeable pavement)
- 51<sup>st</sup> St. to Division Ave.
- North side of 48<sup>th</sup> to 49<sup>th</sup>

Nannie Helen Burroughs Ave. is a neighborhood street with "green" practices that builds on its history and park-like context with great access to Watts Branch trail and the Kenilworth Aquatic gardens.

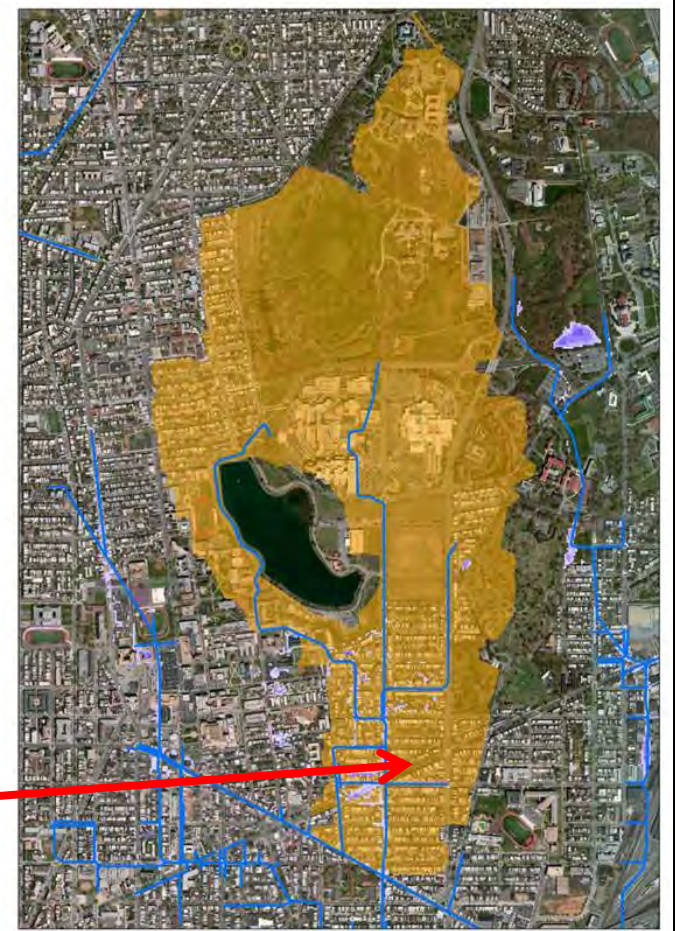
**The Low Impact Development Center**  
www.lowimpactdevelopment.org

**For additional information, please contact:**  
District Department of Transportation (DDOT) 64 New York Avenue,  
Ali Shakeri, PE Ward 7 & 8 Program Manager (202) 671-6712 or ali.shakeri@ddot.dc.gov





Intersection of Rhode Island Avenue and 1<sup>st</sup> Street N.W.



Bloomington: Integrating  
Green and Grey  
Approaches





Bloomingdale Grey/ Green  
Solution





Step One: Intercept  
the Stormwater





Green Alleys

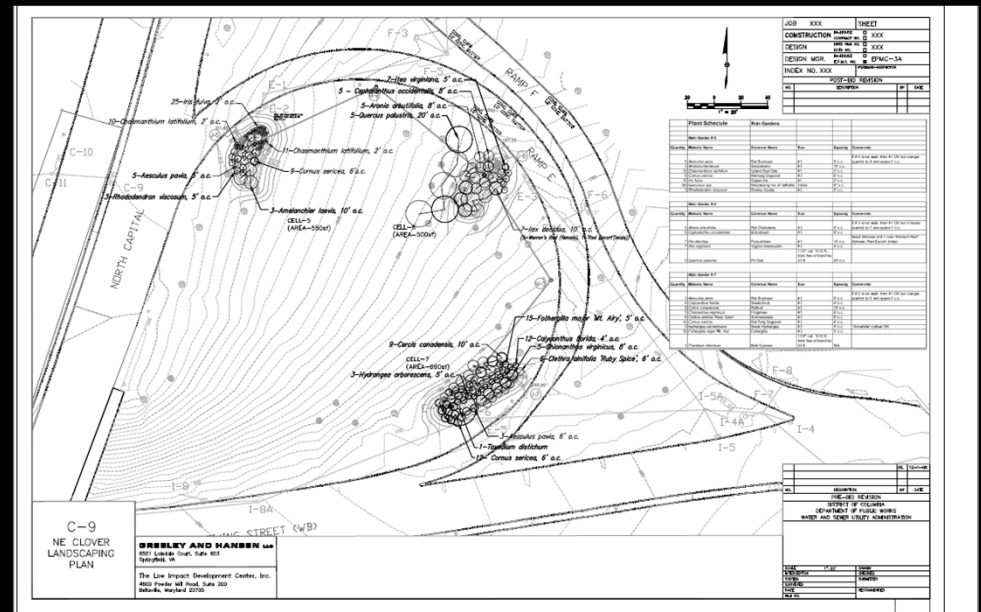




Pretreatment to  
Capture Road  
“Stuff”



# Lessons Learned



Afforestation, permeable pavement and bioretention cells on two cloverleaves.









Plant Location  
and Type are  
Critical









# Unapproved Material Substitutions



Specifications,  
Inspection, Certification



# UPDATE ON THE CITY'S NPDES MS4 PERMIT PROGRAM

## POST-CONSTRUCTION BMP PROGRAM



PLEASE HELP PROTECT OUR WATERS...FOR LIFE  
HAWAII STATE DOT PERMANENT BMP WORKSHOP

August 2015

# STORM WATER MANAGEMENT PROGRAM REQUIRED ELEMENTS

**Public Participation &  
Outreach**



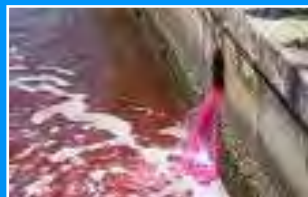
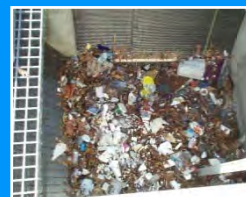
**Pollution Prevention and  
Good Housekeeping**



**Construction  
Site Runoff  
Control**



**Post Construction  
Storm Water  
Management**



**Illicit Discharge Detection  
& Elimination**



**Monitoring &  
Implementation Plans**



**Industrial & Commercial  
Discharge**



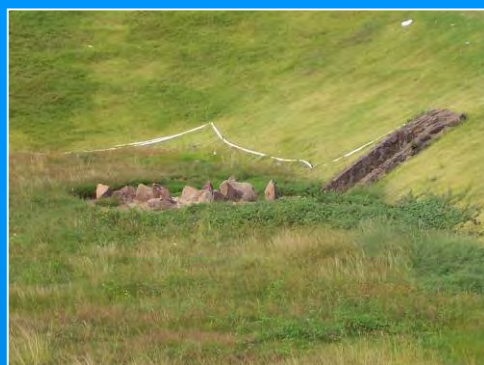


# Post Construction Storm Water Management

Reducing pollutant discharge from new development & redevelopment construction sites



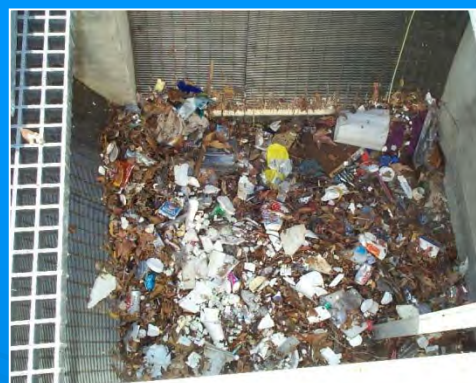
**Pollution Prevention BMPs**



**Structural Source Control BMPs**



**Site Design BMPs**



**Treatment BMPs**



# BACKGROUND

**EPA MS4 Audit conducted on April 23-25, 2013**

**City received a Notice of Apparent Violation Letter on October 16, 2013**

## **Post Construction BMP Program – Potential Violations**

- **Inadequate Training for City Inspectors**
- **Exemptions under Current City Revised Drainage Standards**
- **Inconsistent application of LIDs for smaller sites**
- **Lack of guidance for preferential BMPs**

# BACKGROUND

## MUNICIPAL SEPARATE STORM SEWER SYSTEM



(MS4)

discharge



RECEIVING  
WATERS



## MS4 PERMIT

Reissued JAN 15, 2015

Permit Became  
Effective on FEB. 16,  
2015

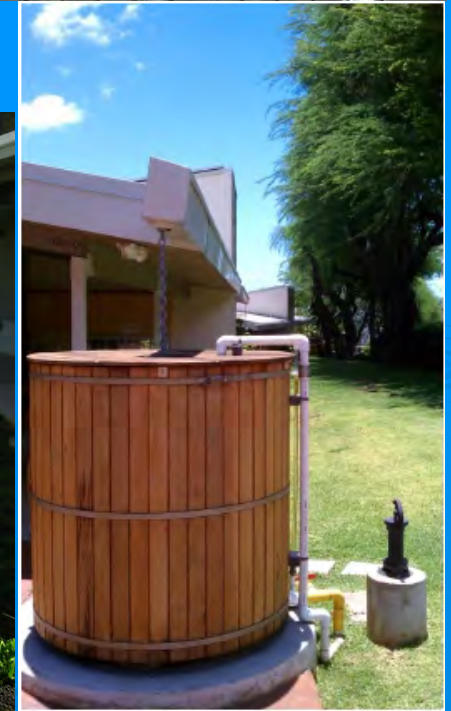
Permit Expires on  
JAN 15, 2020





# Revised Drainage Standards

- ❑ **Current City Revised Drainage Standards became effective on June 1, 2013**
- ❑ **Deadline to submit revised standards up to 18 months after effective date of permit (~August 2016)**



# CURRENT

## Drainage Standards Summary

| Priority  | Description   |
|-----------|---|
| <b>A1</b> | Disturb $\geq$ 5 acres of land during construction  |
| <b>A2</b> | Disturb 1 - 5 acres of land during construction   |
| <b>B</b>  | Disturb $<$ 1 acre during construction, create at least 10,000 sq-ft of total impervious surface, and is a Retail Gas Station, Auto Repair Shop, Restaurant and Parking Lot |

# REVISED

## Drainage Standards Summary

| Priority      | Description  |
|---------------|--|
| A             | Disturb $\geq$ <del>5</del> 1 acres of land during construction  |
| <del>A2</del> | <del>Disturb 1 - 5 acres of land during construction</del>   |
| B             | Disturb < 1 acre during construction, create at least 10,000 sq-ft of total impervious surface, and is a Retail Gas Station, Auto Repair Shop, Restaurant, Parking Lot, <b>Retail Mall, Industrial Park, Building &gt; 100 ft tall</b> |



# BMP Sizing Criteria

| BMP Type     | Sizing Criteria  |
|--------------|--|
| Volume Based | Rainfall depth of 1 inch   |
| Flow Based   | Rainfall intensity of 0.4 in/hr  |
| Area Based   | 10% of contributing area<br>or<br>100% of contributing flow path                         |
| Demand Based | 80% of total annual runoff is captured<br>and<br>80% of total annual reuse demand is met |

# Source Control BMPs

Low-technology practices designed to prevent pollutants from contacting storm water runoff and/or prevent discharge of contaminated runoff to the MS4

- Stenciling storm drain inlets
- Covering fueling and storage areas
- Grading dumpster, fueling, and storage areas to prevent run-on & runoff
- Using dumpsters with lids
- Paving high risk areas with concrete instead of asphalt



Gas station, Kapolei, HI

# Treatment Control BMPs

Volume or Flow through based practices designed to settle, filter and remove pollutants within storm water runoff

- Catch Basin Inlet Filters
- Hydrodynamic Separators
- Vegetative Buffer Strips
- Vegetative Swales
- Detention Basins



CB Filter



Detention Basin



Vegetative Swales



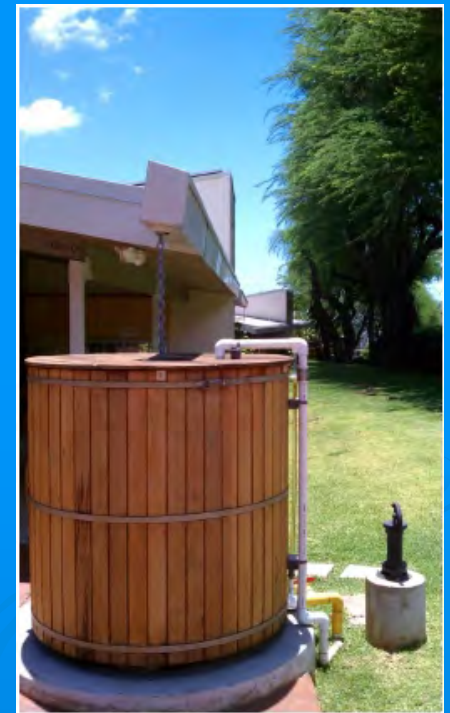
# Low Impact Development (LID) BMPs

LID treatment measures include harvesting and reuse, infiltration, evapotranspiration or biotreatment of storm water runoff as close to its source

- Infiltration Basins
- Bioretention
- Green Roofs
- Permeable Pavement
- Cisterns/Rain Barrels



Green Roof

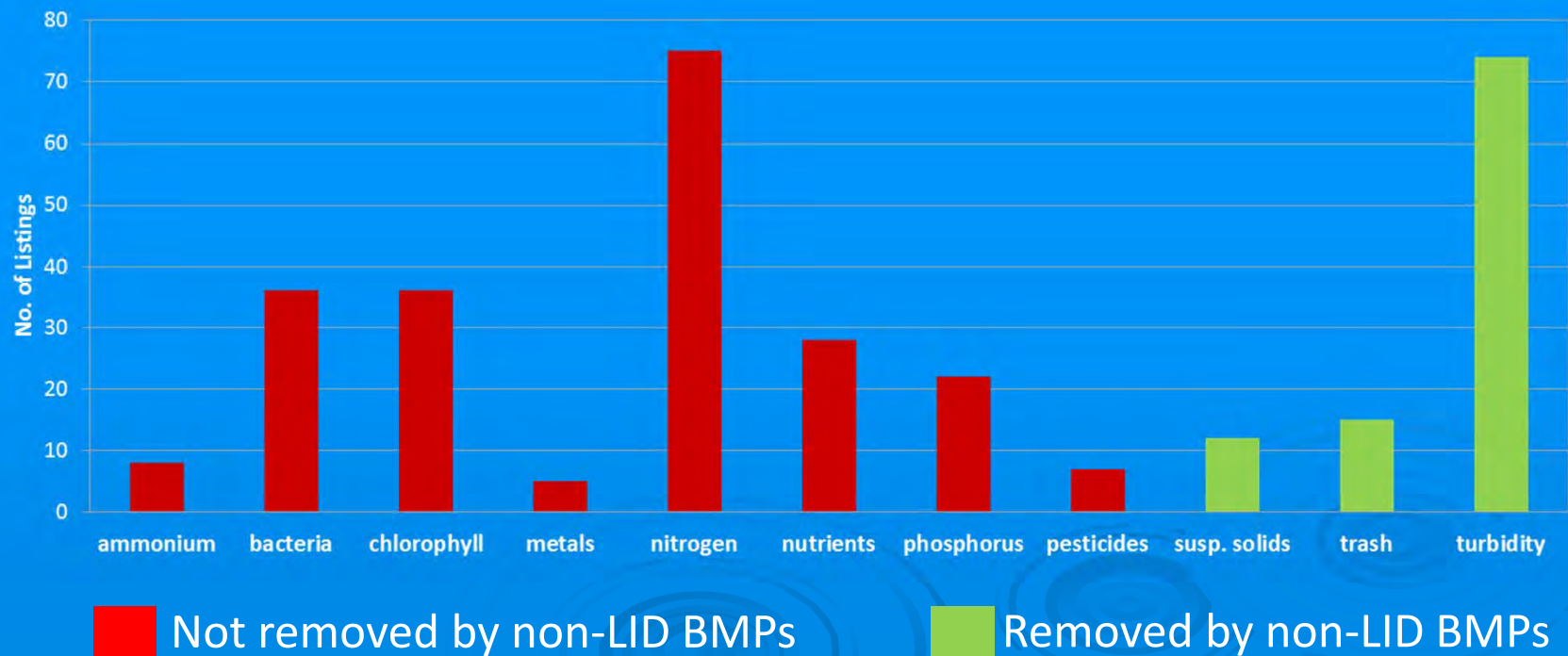


Cistern

# Why LID's?

## non-LID BMPs don't address Pollutants of Concern

- 117 waterbodies on 2014 303(d) List
- 319 total pollutant listings





# Storm Drainage Standards Update

- ❑ LID Requirements for all new development and redevelopment projects greater than 1 acre (Priority A and B)
- ❑ Expand the types of smaller projects for post-construction BMPs (Priority B) to include
  - Parking Lots greater than 20 stalls
  - Buildings greater than 100-feet tall
  - Retail Malls
  - Industrial Parks
- ❑ Require 1.5x the Water Quality Volume (WQV) for any treat and release practices (i.e. biofiltration)





## Storm Drainage Standards Update (Cont'd)

- ❑ Requirement to prepare a separate Post-Construction BMP Plan that identifies both LID, Treatment and Source Control BMPs on the drawing
- ❑ Requirement for submitting a Storm Water Applicability Checklist that prioritizes and identifies the need, type and location for permanent post-construction BMPs.
- ❑ Requirement for submitting a Storm Water Quality Checklist for all projects. Checklist will include attaching an O&M Plan outlining inspection and maintenance responsibilities.



## Storm Drainage Standards Update (Cont'd)

- ❑ Expand on City's Storm Water BMP Guide to include a risk ranking process (low, medium and high) for prioritizing BMP selection that factors in maintenance performance and pollutant removal effectiveness for site specific pollutants of concern.
- ❑ Requirement for submitting a Covenant Master Agreement or similar document that must be signed by the owner/developer or authorized representative.
- ❑ Requirement for a Certificate of Completion - Licensed Professional Engineer to inspect and confirm that the BMPs have been installed in conformance to the approved construction plans prior to permit closure.

## Honolulu Zoo Parking Lot – Bioretention (Rain Gardens)

### Maintenance is Critical



**BEFORE**



**AFTER**

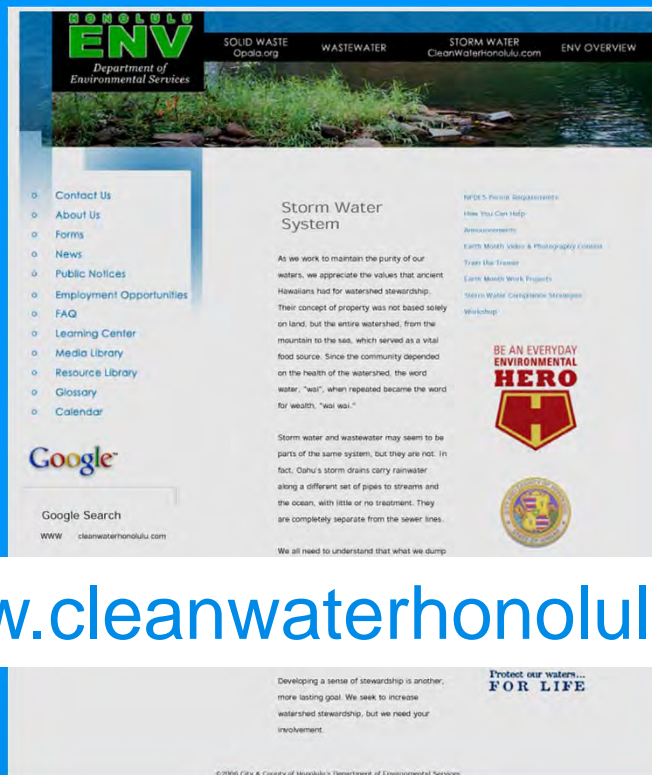


# QUESTIONS



# THANK YOU

## For More Information:



[www.cleanwaterhonolulu.com](http://www.cleanwaterhonolulu.com)

**RANDALL WAKUMOTO, BRANCH  
HEAD**

**Storm Water Quality Branch**

**Ph: 768-3242**

**Email: [rwakumoto@honolulu.gov](mailto:rwakumoto@honolulu.gov)**

**City & County of Honolulu  
Department of Facility  
Maintenance**



**Environmental Concern Line**

**768-3300**



# GROUP PROJECT



## RESULTS





PROTECT  
OUR WATER

MĀLAMA I KA WAI  
STATE OF HAWAII DEPARTMENT OF TRANSPORTATION

www.stormwaterhawaii.com

# GROUP PROJECT TABLE SECTION X



Table 19  
Page 3 of 3

LEGEND:

- NEW PAVED ROAD
- DOT ROW
- BUILDINGS
- PROPERTY BOUNDARY
- RIPRAP
- CULVERT
- FLOW DIRECTION
- 70 ELEVATION CONTOUR
- 3042 PARCEL ID
- WETLAND

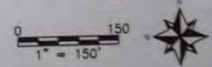
PROJECT IMPERVIOUS AREA = 2.28 ACRES

PROPERTY NORTH OF PROJECT:  
COMMERCIAL AREA = 15.45 ACRES  
IMPERVIOUS AREA PERCENTAGE = 72%

PROPERTY SOUTH OF PROJECT:  
RESIDENTIAL AREA = 10.75 ACRES  
IMPERVIOUS AREA PERCENTAGE = 45%

■ = Majik Boxes  
■ = Infiltration Trench

Table 19





# QUESTIONS AND WRAP-UP



PROTECT  
OUR WATER

MĀLAMA I KA WAI

STATE OF HAWAII DEPARTMENT OF TRANSPORTATION

[www.stormwaterhawaii.com](http://www.stormwaterhawaii.com)