

Clean Water Services

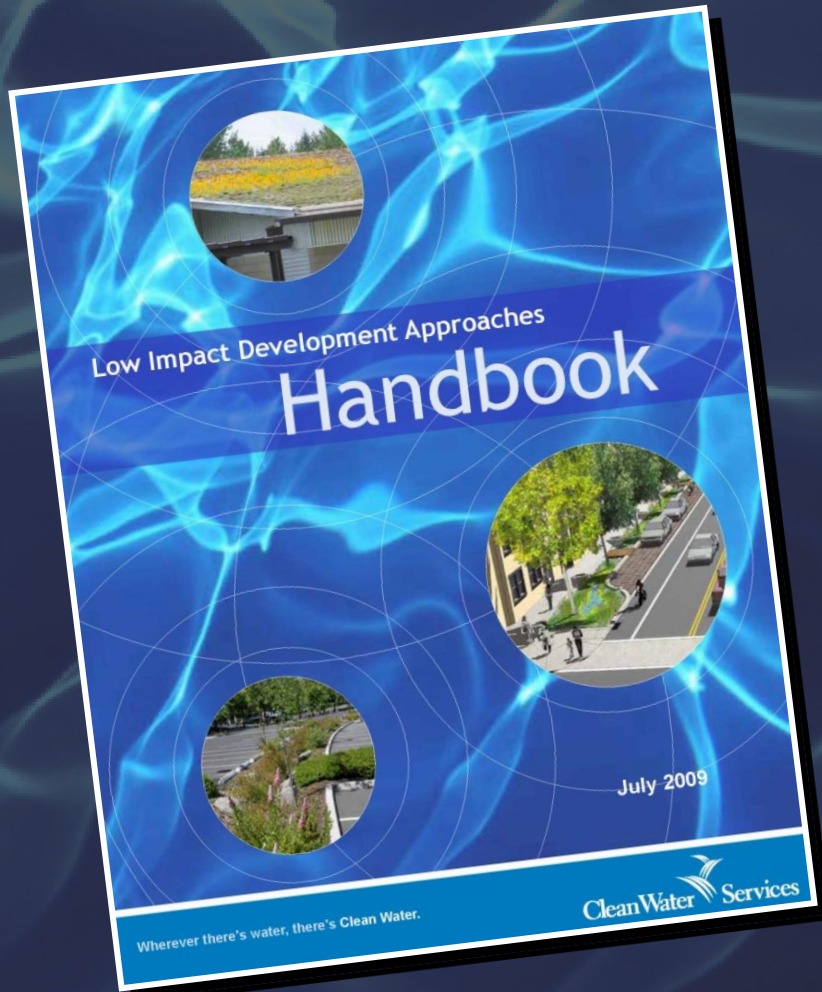
LOW IMPACT DEVELOPMENT APPROACHES

HANDBOOK



Green From the Ground Up
October 22, 2009
Carrie Pak

The LIDA Handbook



Agenda:

- **About Clean Water Services**
- **Handbook Purpose**
- **Brief Overview**
 - **Where Applicable?**
 - **Why LIDAs?**
 - **What are LIDAs?**
 - **Maintenance and Operation**

Tualatin River Watershed



Clean Water Services

- **Regional water resource management utility responsible for wastewater and stormwater management for the urbanized Washington County.**
- **Serve a population of more than 500,000.**



Clean Water Services

- **Mission**

Enhance the environment and quality of life in the Tualatin River Watershed through visionary and collaborative management of water resources in partnership with others.

- **Vision**

We provide cost-effective services and environmentally sensitive management of water resources for the Tualatin River watershed





VEGETATED SWALE



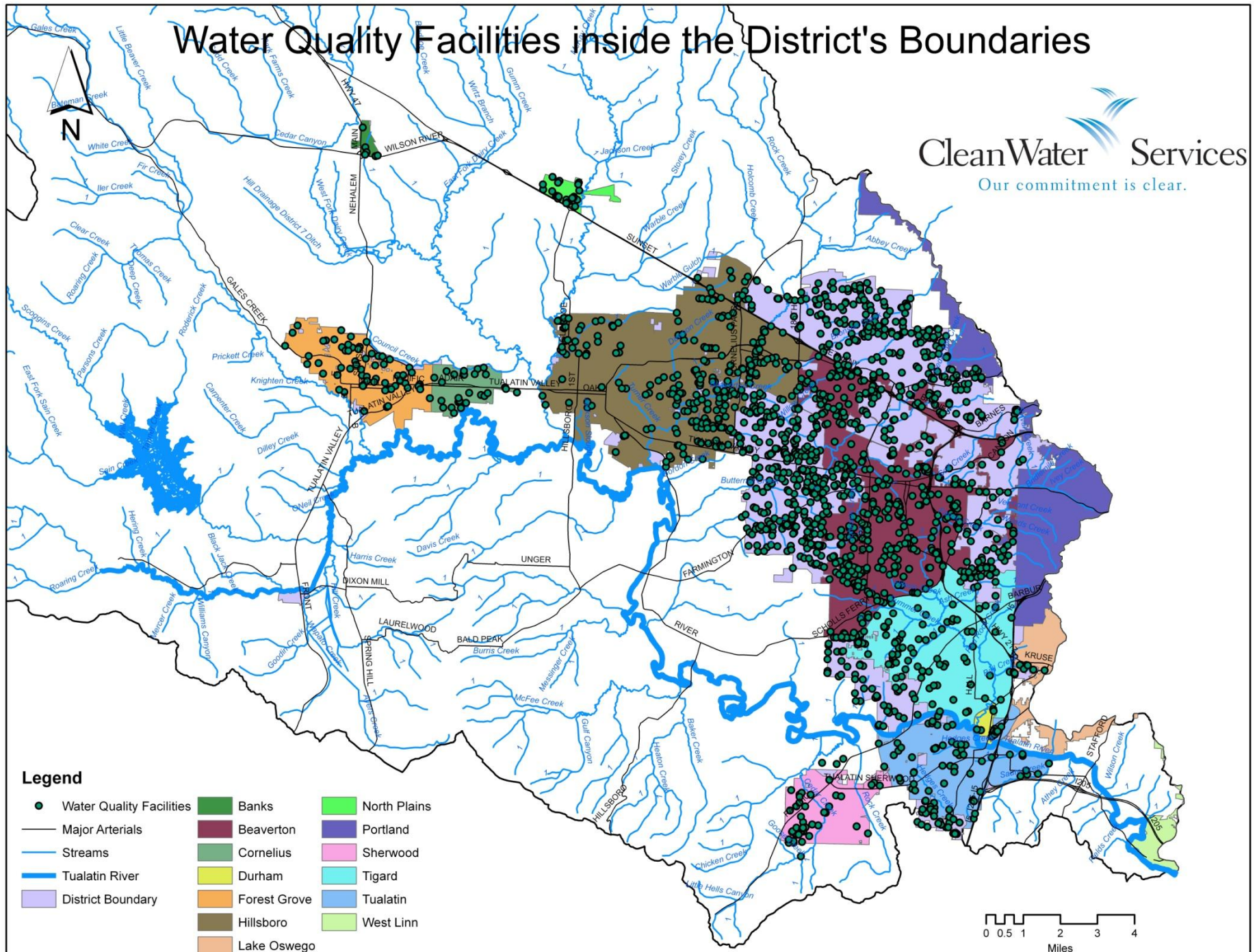
EXTENDED DRY BASIN



**CONSTRUCTED WATER
QUALITY WETLAND**

Water Quality Facilities inside the District's Boundaries

CleanWater Services
Our commitment is clear.



LIDA Handbook Purpose

- **Low Impact Development Approaches as an option for meeting stormwater quality requirements and refer to the LIDA Handbook.**
- **The LIDA Handbook provides detailed design guidance for LIDA facilities.**

Handbook Overview

- **Chapter 1 – Introduction**
 - **What are LIDAs & why use them**
- **Chapter 2 – Site Planning for LIDAs**
 - **Site Analysis & Planning for LIDAs**
 - **Selecting LIDAs to match site conditions**
- **Chapter 3 – LIDA Design Process**
 - **Design steps, LIDA Sizing Form**
- **Chapter 4 – LIDA Fact Sheets**
 - **Specific design info for each LIDA**
- **Appendices**
 - **Glossary, additional resources, maintenance, detail drawings**

LIDA Handbook Applicability

- **When to Use**
 - Site planning and design stages for projects inside CWS service area
 - When designing any water quality facility or LIDA (contains info for both)
 - Use in conjunction with CWS Design & Construction Standards



LIDA Handbook Applicability

- **The Handbook is a reference for all jurisdictions within the Clean Water Services service area in the Tualatin Basin.**
- **Users are encouraged to consult with local jurisdictions for additional requirements and standards.**
- **LIDAs do not replace Water Quality Sensitive Areas or Vegetated Corridors**
- **LIDAs should be selected to fit site conditions and local development and design requirements.**

What Are LIDA's?

LIDAs offer more options to comply with stormwater management requirements, and complement the water quality facilities and vegetated corridors that have been established as part of the Standards.

- **Most are vegetated landscape elements:**
 - **Planters**
 - **Filter Strips**
 - **Swales that filter and/or infiltrate**
- **Other LIDA facilities reduce impervious area and runoff volume:**
 - **Porous Pavements**
 - **Green Roofs**

What Are LIDA's?

The five objectives of LIDA are to:

- 1. Conserve Existing Resources**
- 2. Minimize Disturbance**
- 3. Minimize Soil Compaction**
- 4. Minimize Imperviousness**
- 5. Direct Runoff from Impervious Areas onto Pervious Areas**

Porous Pavement

a water permeable structural groundcover that provides a stable load-bearing surface without increasing a project's total impervious area.



Tigard Library



*Clean Water Services Field Operations
Center*

Green Roof

a lightweight vegetated roof system that reduces site impervious area and helps reduce stormwater runoff.



Clean Water Services Field Operations Center



Newburg, Oregon

Infiltration Planter/Rain Garden

a landscaped reservoir that collects, filters, and infiltrates stormwater runoff.



12th and Montgomery St., Portland



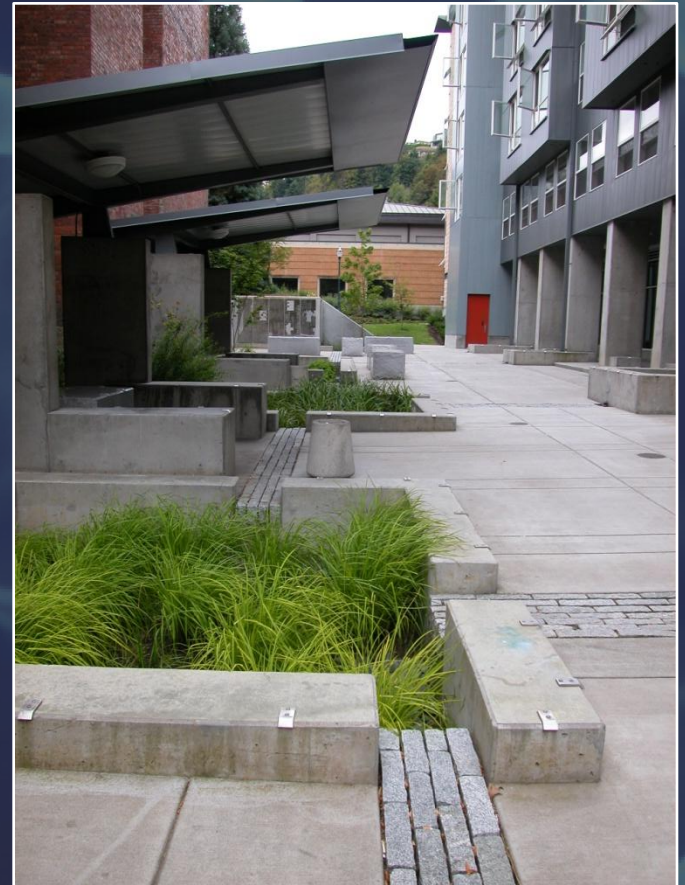
Fowler Middle School Retrofit, Tigard

Flow Through Planter

a structural landscaped reservoir that collects stormwater and filters out pollutants as the water passes through the facility.



River East Center, SE Portland



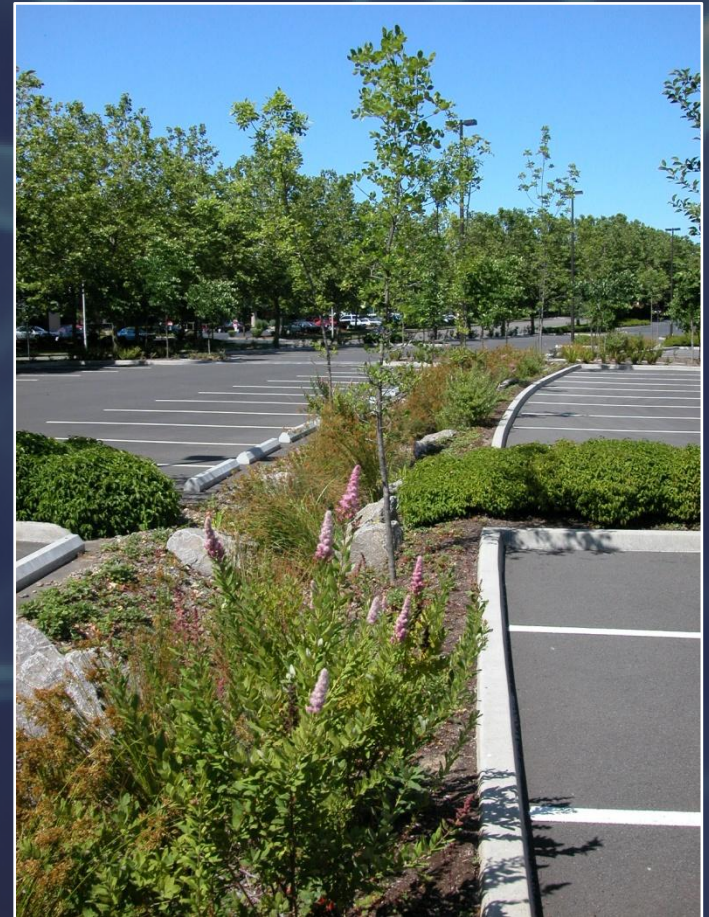
PSU Stephen Epler Hall

LIDA Swale

a narrow, gently sloping landscaped depression that collects, filters and conveys stormwater runoff.



THPRD PCC Rock Creek, Washington County



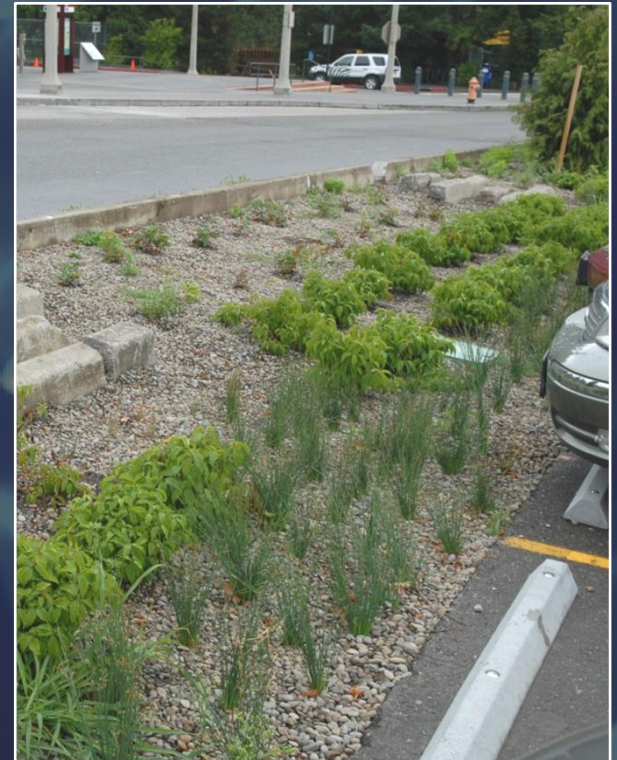
*Tanasbourne Office Building,
Washington County*

Vegetated Filter Strip

gently sloped vegetated area designed to receive stormwater sheet flows from adjacent impervious surfaces



Oregon Zoo Parking Lot, Portland



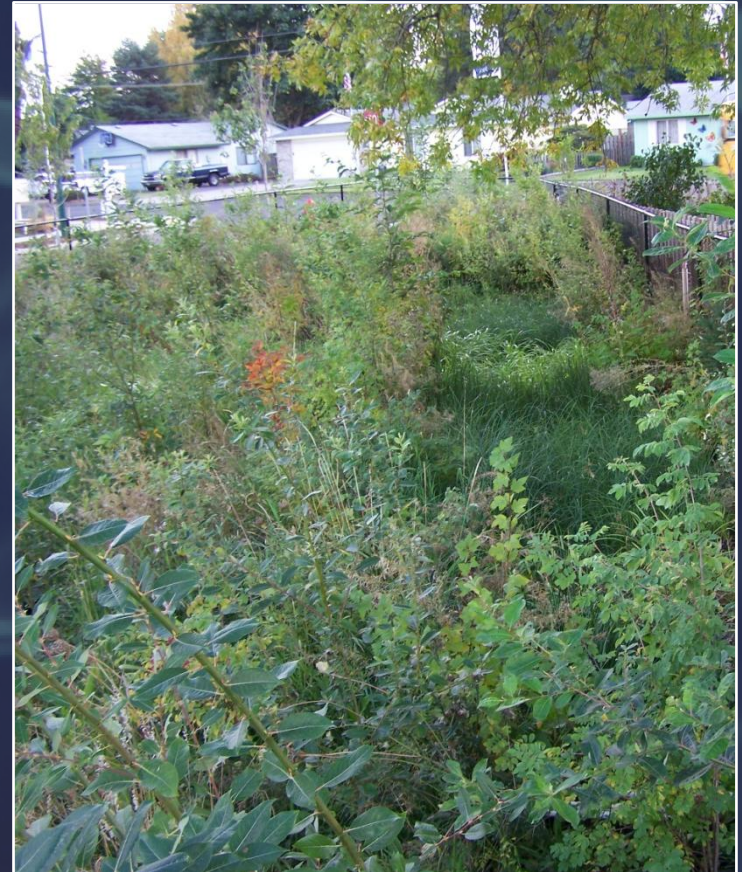
Oregon Zoo Parking Lot

Vegetated Swale

landscaped depression that collects and conveys stormwater runoff and is at least 100 feet in length.



Westhaven Subdivision, Washington County



Washington County

Extended Dry Basin

a shallow landscaped depression with a flat bottom and two or more cells that collects stormwater and releases it over time.



Washington County



Wood Creek, Washington County

Constructed Water Quality Wetland

a shallow landscaped depression that collects and allows pollutants to settle and filter out during storm events. Constructed wetlands have a permanent pool of water.



Oleson Woods Apartments, Tigard



Rock Creek Greenway

Low Impact Site Design Approaches

- **LIDA site design may also include:**
 - **Preservation of trees and vegetation (in addition to vegetated corridors)**
 - **Harvesting or re-use of stormwater for irrigation or toilet flushing**
 - **Lot size averaging and density transfers**
 - **Clustering or building/parking lot placement to avoid impacts to existing trees, vegetation, and habitat**

Why LIDA?

- **LIDAs add more options to the toolkit of stormwater management techniques**
- **LIDAs will reduce flashy runoff flows and other impacts of urban development on stream health**
- **LIDAs can help the County and Cities meet Tualatin Basin Goal 5 plan**

Developer Incentives

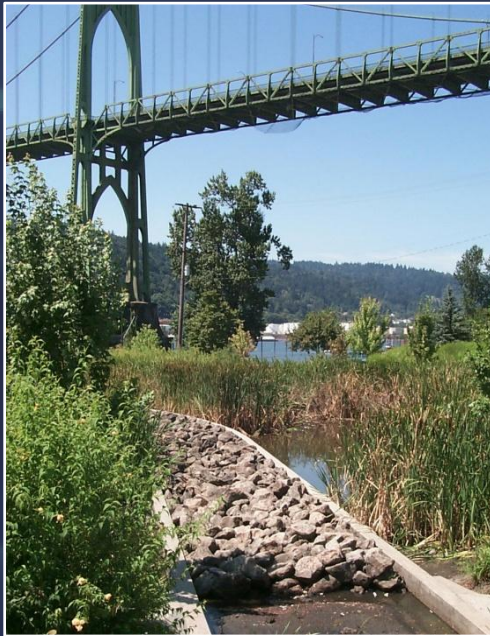
- LIDAs may be integrated with site landscaping
- LIDA design may reduce earthwork and piping
- Planning Dept's may offer density or building size bonuses or other incentives
- LEED and Earth Advantage credits

Why LIDA?

- LIDA facilities can be integrated into site design, landscape and architecture.
- LIDAs offer opportunities for artistic and creative design.
- LIDAs can enhance public awareness of urban stormwater impacts.



*Headwaters @ Tryon Creek,
SW Portland*



*Water Pollution Control Laboratory,
Portland*



Block 11, Washougal, WA



Seattle, WA



NW 10th and Hoyt, Portland



Glencoe Elementary School, Portland



New Seasons, Beaverton



New Seasons, SE Division St, Portland



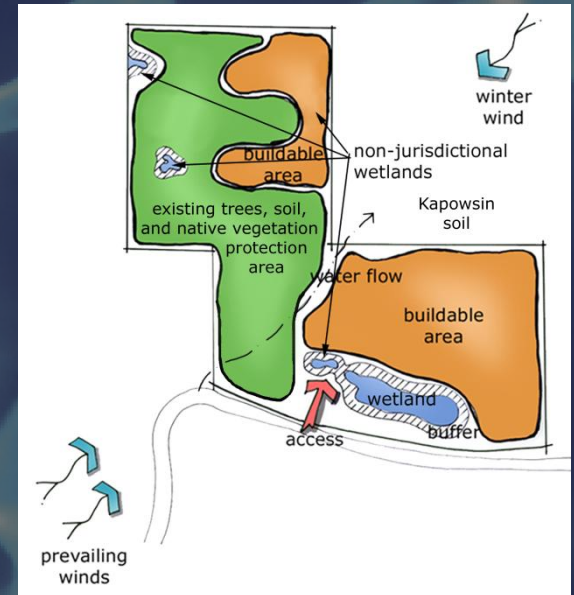
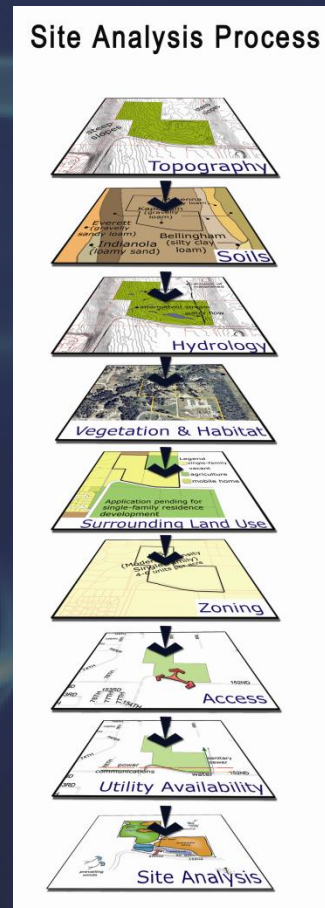
*Stephen Epler Hall at PSU,
Portland*



*Team Estrogen Warehouse,
Washington County*

Encouraging LIDA's in Site Planning

- **Effective Stormwater Management is best achieved through integration of stormwater objectives at the beginning of site planning.**



Site Design Process Using LIDA

- 1. Conserve Existing Resources**
- 2. Minimize Disturbance**
- 3. Minimize Soil Compaction**
- 4. Minimize Imperviousness**
- 5. Direct Runoff from Impervious Areas onto Pervious Areas**

How to Select LIDA Facilities

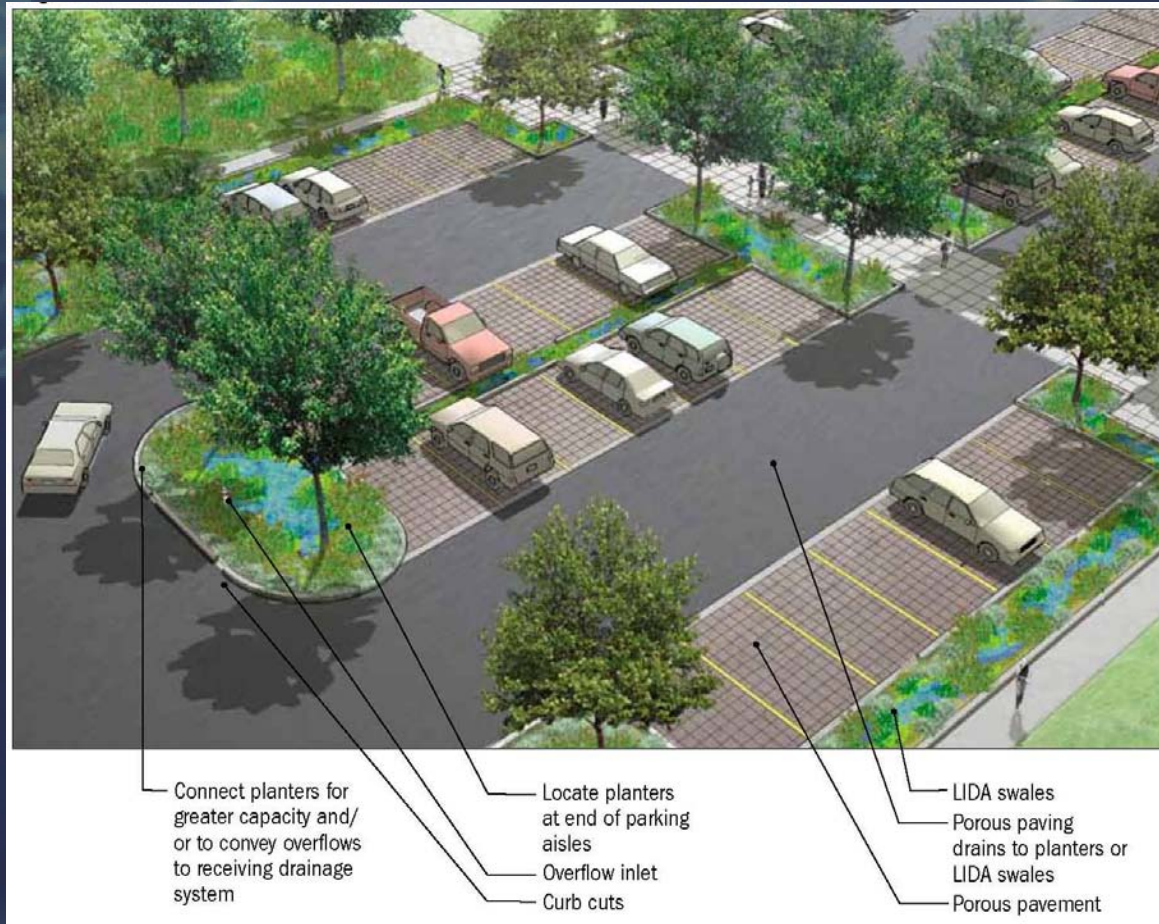
- **Considerations:**
 - **Infiltration vs. flow-through facilities**
 - **Public vs. private facilities**
 - **Adjacency of Vegetated Corridors**

	Green Roof	Porous Pavement	Flow-through Planter	Infiltration Planter/ Rain Garden	Vegetated Filter Strip	LIDA Swale
Reduce imperviousness	✓	✓				
Infiltrate		✓		✓	✓	✓
Detention/ flow control		✓		✓		
Provide Habitat			✓	✓	✓	✓
Near Vegetated Corridor			✓	✓	✓	✓
Private property	✓	✓	✓	✓	✓	✓
Private street		✓	✓	✓	✓	✓
Public Street/ROW*			✓		✓	✓
On or next to building	✓		✓			
Parking lot		✓	✓	✓	✓	✓
Landscaped area			✓	✓	✓	✓
Steep slope	✓		✓			
Soils with low infiltration rate	✓	✓	✓		✓	✓
High GW table	✓		✓		✓	✓
Contaminated soils	✓		✓			

* Check with local jurisdiction about use in ROW

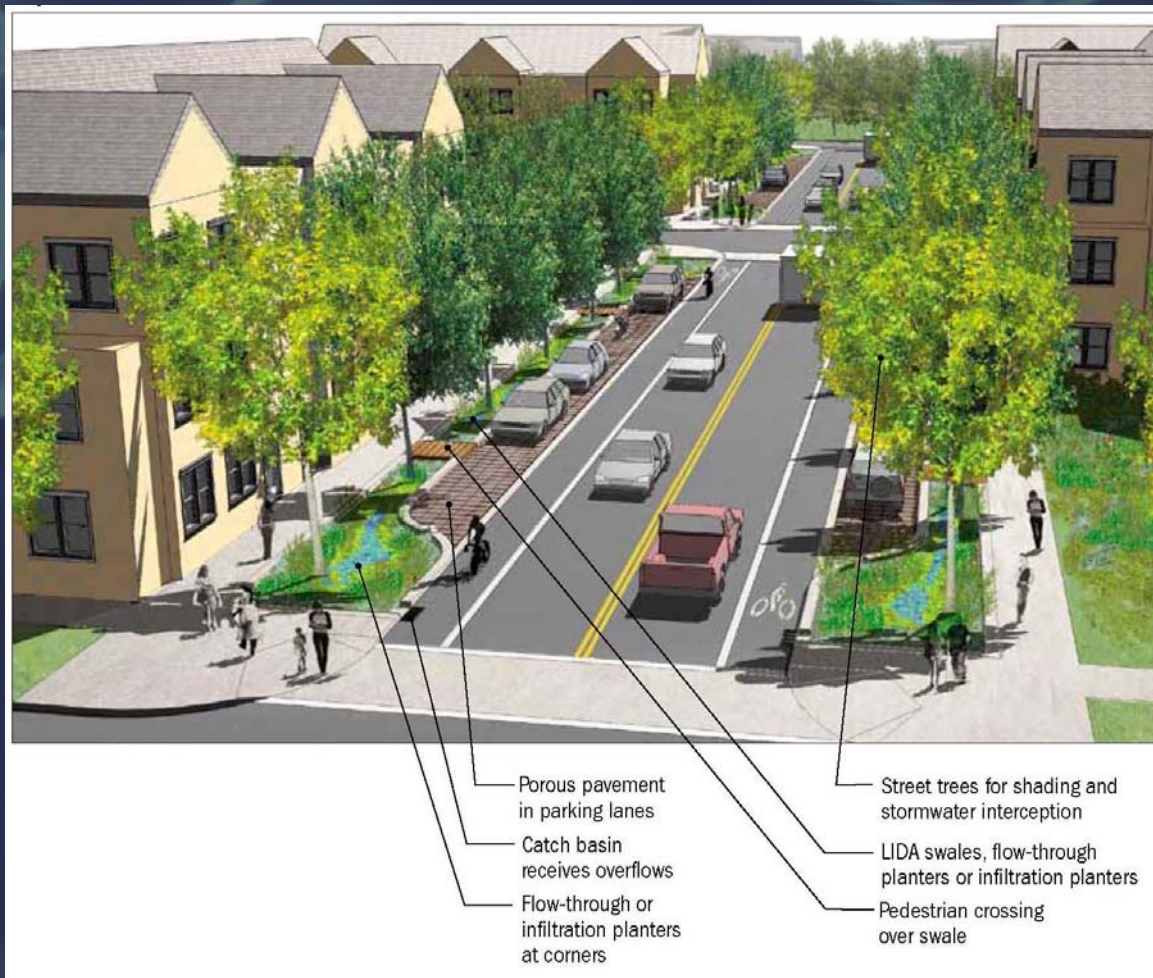
Integrating LIDAs Into Site Design

LIDAs IN PARKING AREAS



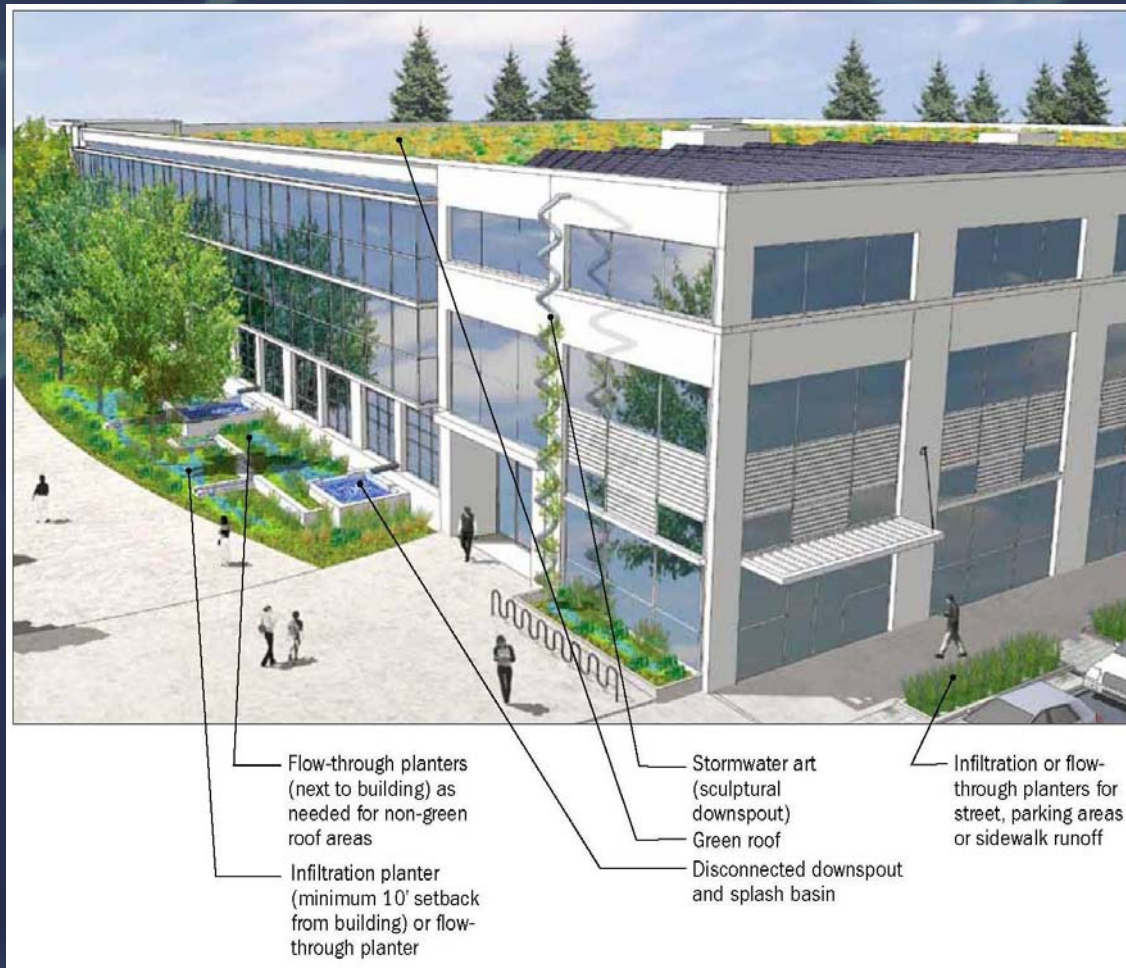
Integrating LIDAs Into Site Design

LIDAs IN STREETS



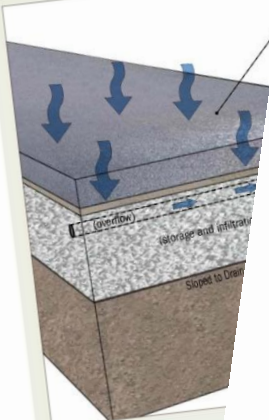
Integrating LIDAs Into Site Design

LIDAs FOR BUILDINGS & ADJACENT AREAS



LIDA Design – Fact Sheets

Porous Pavement



Description

Porous pavement is a water permeable groundcover that infiltrates precipitation stormwater runoff flows and volume temperatures. Porous pavement provides a load-bearing surface without increasing impervious area.

The two main categories of porous pavement are pervious concrete and asphalt pavers. Pervious concrete and asphalt pavers resemble their solid counterparts, but the solid material is replaced by void space for water to flow between them.

Application & Limitations

Porous pavement is not considered a treatment of runoff.

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Green Roof



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Description

A green roof (or ecoroof) is a lightweight vegetated roof system with waterproofing material, drainage, growing medium, and specially selected plants. A green roof can reduce site impervious area and manage stormwater runoff. Green roofs reduce peak runoff to near pre-development rates and reduce annual runoff volume by at least 50% (Cost Benefit Evaluation of EcoRoofs, Portland Bureau of Environmental Services, 2008). Green roofs also help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in dry seasons. Green roofs typically have thin layers of lightweight growing medium (4 to 8 inches) and low-growing succulent vegetation. Alternatively, roof gardens (8+ inches) are more heavily planted. Professional design consultation may be necessary to ensure the structural requirements of building codes are met. The design must be low maintenance and use irrigation only to sustain the health of vegetation.

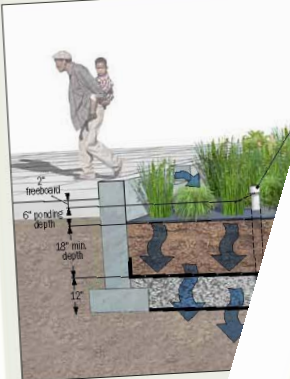
Application & Limitations

Green roofs may be water quality facilities. They can range of building type, slope, and pitch (3H:1V to 4:12 pitch (3H:1V) or control. Depending on the roof, the vegetation coverage, the structure, and options are available. The structure and options are available. The structure and options are available. The structure and options are available.

CleanWater Services

Low Impact Development Approaches Handbook

Infiltration Planter/Rain Garden

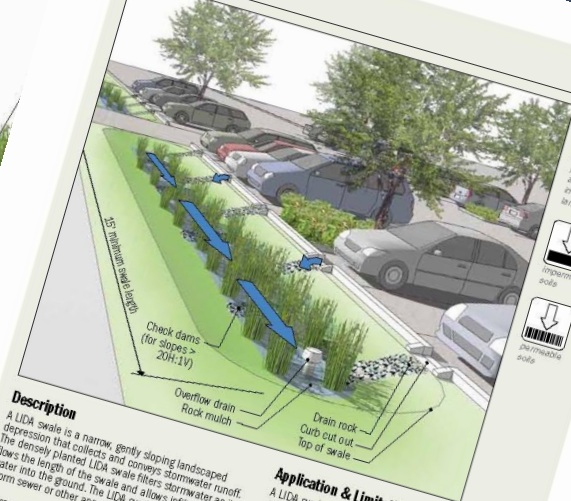


Description

Infiltration Planters (also known as rain gardens) are landscaped reservoirs that collect, filter, and store stormwater runoff, allowing pollutants to be filtered out as the water percolates through the soil and infiltrates into the ground. Infiltration planters typically require less piping than flow-through and a smaller facility size than traditional native soils allow for infiltration. Digging infiltration planters can vary in shape with or without walls to contain the water in a shallow, basin-like depression.

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LIDA Swale



Page 1 of 4

Description

A LIDA swale is a narrow, gently sloping landscaped depression that collects and conveys stormwater runoff. The densely planted LIDA swale filters stormwater as it flows the length of the swale and allows infiltration of water into the ground. The LIDA swale discharges to a storm sewer or other approved discharge point.

Compared to vegetated swales, LIDA swales may be shorter and narrower, but require deeper levels of amended soil and a subsurface drain rock layer to compensate for the smaller size and to function effectively.

Application & Limitations

A LIDA swale may help fulfill a site's landscaping area requirement. LIDA swales are approved to treat stormwater flowing from all types of impervious surfaces including private property and the public right-of-way, rooftops, parking lots, and streets. Check with the local jurisdiction if proposing to use a LIDA swale in the public right-of-way.



Low Impact Development Approaches Handbook

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LIDA Facilities Design Basics

- **<15,000 ft² Impervious Area can use Sizing Form**
- **Larger sites can be divided into smaller drainage areas (<15,000 ft²), use the larger water quality facilities or provide additional calculations**
- **Calculating Impervious Area Requiring Treatment from D&C Standards**

LIDA Sizing

TABLE 4-1
IMPERVIOUS AREA REQUIRING TREATMENT
ON REDEVELOPMENT SITES

Existing Impervious Area on Site	Existing Impervious Area Disturbed by Redevelopment	Impervious Area Required to Treat
< 5,280 sq.ft.	$\leq 100\%$	No new treatment required
$\geq 5,280$ sq.ft. and < 0.5 acres	< 1,000 sq.ft.	No new treatment required
	$\geq 1,000$ sq.ft.	100% of impervious area
≥ 0.5 acres and < 5 acres	< 1,000 sq.ft.	No new treatment required
	≥ 1000 sq.ft. and < 25%	Disturbed impervious area + 25% of undisturbed impervious area
	$\geq 25\%$ and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	$\geq 50\%$	100% of impervious area
≥ 5 acres	< 1,000 sq.ft.	No new treatment required
	≥ 1000 sq.ft. and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	$\geq 50\%$	100% of impervious area

LIDA Sizing Form

Clean Water Services LIDA Sizing Form

Project Title:	<input type="text"/>
Project Location:	<input type="text"/>
Contact Name/Title/Company:	<input type="text"/>
Phone/e-mail:	<input type="text"/>

STEP 1: Determine Impervious Area Requiring Treatment

Total Site Area (acres):	<input type="text"/>
Total Existing Impervious Area (sq.ft.):	<input type="text"/>
Proposed New Impervious Area (sq.ft.):	<input type="text"/>
Impervious Area Requiring Treatment (sq.ft.) (Refer to Design & Construction Standards Chapter 4 for instructions to calculate this area, which will be less than or equal to the new plus existing site impervious area.)	<input type="text"/>

STEP 2: Deduct Impervious Area LIDA Credits

Porous Pavement (sq. ft.):	<input type="text"/>
Green Roof (sq. ft.):	<input type="text"/>
Other Credits as approved (sq. ft.):	<input type="text"/>
Total Credits (sq. ft.):	<input type="text"/>
Remaining Impervious area (sq. ft.) (Total from Step 1 – Total Credits):	<input type="text"/>

STEP 3: Size LIDA Facilities for Remaining Impervious Area

	IA: Impervious area treated (sq.ft.)	SF, Sizing Factor	LIDA facility size (sq.ft.) (IA x SF)
Infiltration Planters/Rain Garden		0.06	
Flow-through Planter		0.06	
LIDA Swale		0.06	
Vegetated Filter Strip		0.06	

Total Impervious Area treated (sq.ft.)	<input type="text"/>	(*Must equal total from Step 2 or additional LIDA facilities or Water Quality Facilities must be added.)
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LIDA Sizing Example

Clean Water Services LIDA Sizing Form

Project Title:	West View Village
Project Location:	3124 West View Rd., Hillsboro
Contact Name/Title/Company:	John Doe Development
Phone/e-mail:	johnddevelopment.net

STEP 1: Determine Impervious Area Requiring Treatment

Total Site Area (acres):	0.45
Total Existing Impervious Area (sq.ft.):	8,000
Proposed New Impervious Area (sq.ft.):	10,000
Impervious Area Requiring Treatment (sq.ft.) (Refer to Design & Construction Standards Chapter 4 for instructions to calculate this area, which will be less than or equal to the new plus existing site impervious area.)	10,000

STEP 2: Deduct Impervious Area LIDA Credits

Porous Pavement (sq. ft.):	4,000
Green Roof (sq. ft.):	
Other Credits as approved (sq. ft.):	-
Total Credits (sq. ft.):	4,000
Remaining Impervious area (sq. ft.) (Total from Step 1 – Total Credits):	6,000

STEP 3: Size LIDA Facilities for Remaining Impervious Area

	IA: Impervious area treated (sq.ft.)	SF, Sizing Factor	LIDA facility size (sq.ft.) (IA x SF)
Infiltration Planters/Rain Garden	-	0.06	
Flow-through Planter	6,000	0.06	360
LIDA Swale	-	0.06	
Vegetated Filter Strip	-	0.06	

Total Impervious Area treated (sq.ft.)	6,000	(*Must equal total from Step 2 or additional LIDA facilities or Water Quality Facilities must be added.)
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LIDA Facilities Design Basics

- **Planters, LIDA Swale & Vegetated Filter Strip:**
 - Same sizing factor for most cases
 - 18” depth of amended growing medium
 - 12” drain rock depth for planters & swales
 - Fully vegetated as specified
- **Planters are level; LIDA swales & vegetated filter strips for longitudinal slope**

Appendices

- **Glossary of terms**
- **Web links to additional resources**
- **O&M**
- **CAD Details**

LIDA Operation & Maintenance

- **Maintenance Agreement Requirements**
- **Maintenance Checklists:**
 - One for each type of LIDA facility
 - Annual inspections required
 - Additional recommended inspections (type and frequency) are listed
 - Describes problems/conditions to look for and preferred maintenance practices/outcomes
 - Use as an inspection & enforcement tool

Flow-Through Planter Checklist

Annual inspections are required. This checklist describes inspection activities, and notes additional recommended inspections. Contact the design engineer, Clean Water Services or City representative for more information.

CHECK ✓	Recommended, in addition to required annual inspection	System Feature	Problem	Conditions to Check for	Preferred Conditions and Maintenance Practices
	Monthly from November through April Annually Required	General	Sediment Accumulation in Treatment Area	Sediment depth exceeds 3 inches	Sediment removed from vegetated treatment area; planter is level from side to side and drains freely toward outlet; no standing water within 24 hours after any major storm (1-inch in 24 hours)
	Monthly from November through April Annually Required	General	Erosion Scouring	Eroded or scoured planter bottom due to flow channelization, or higher flows	Repair ruts or bare areas by filling with topsoil during dry season; regrade and replant large bare areas
	Monthly from November through April and after any major storm (1-inch in 24 hours) Annually Required	General	Standing Water	Standing water in the planter between storms that does not drain freely	Remove sediment or trash blockages; improve end to end grade so there is no standing water 24 hours after any major storm (1-inch in 24 hours)
	Monthly from November through April Annually Required	General	Flow Not Distributed Evenly	Flows unevenly distributed through planter width due to uneven or clogged flow spreader	Level the spreader and clean so that flows spread evenly over entire planter width
	Annually Required	General	Settlement / Misalignment	Failure of planter has created a safety, function, or design problem	Planter replaced or repaired to design standards
	Monthly from November through April Annually Required	General	Constant Baseflow	Small, continual flow of water through the planter even after weeks without rain; planter bottom has an eroded, muddy channel	Add a low-flow pea gravel drain the length of the planter or bypass the baseflow around the planter
	Monthly from November through April Annually Required	General	Vegetation	Vegetation blocking more than 10% of the inlet pipe opening	No vegetation blocking inlet pipe opening

For More Information

- **To access the Handbook:**
 - **Clean Water Services Website**
 - **<http://www.cleanwaterservices.org/PermitCenter/NewsAndResources/default.aspx>**
- **Carrie Pak, PE**
 - **pakc@cleanwaterservices.org**
 - **503.681.3646**