Clean Water Services

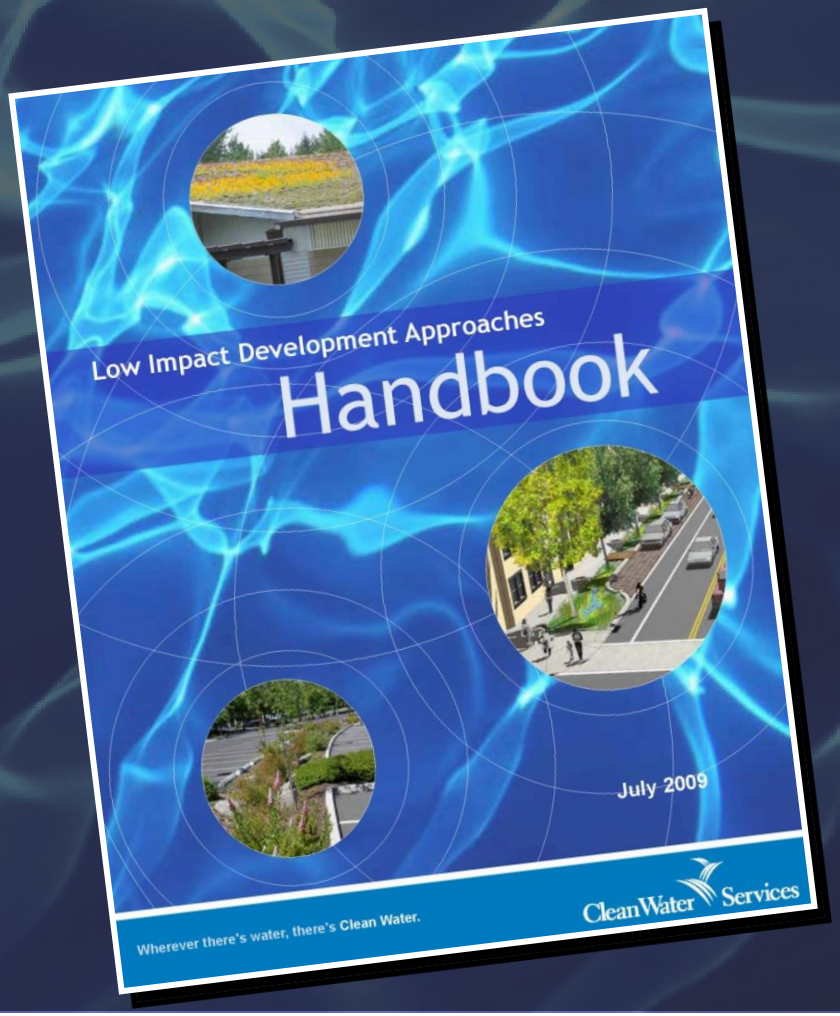
LOW IMPACT DEVELOPMENT APPROACHES

HANDBOOK

Green From the Ground Up
October 22, 2009
Carrie Pak

Clean Water Services

The LIDA Handbook

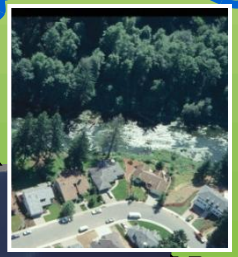


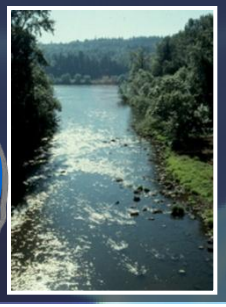
Agenda:

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

Clean Water Services

Tualatin River Watershed





Clean Water Services

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

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

Clean Water Services

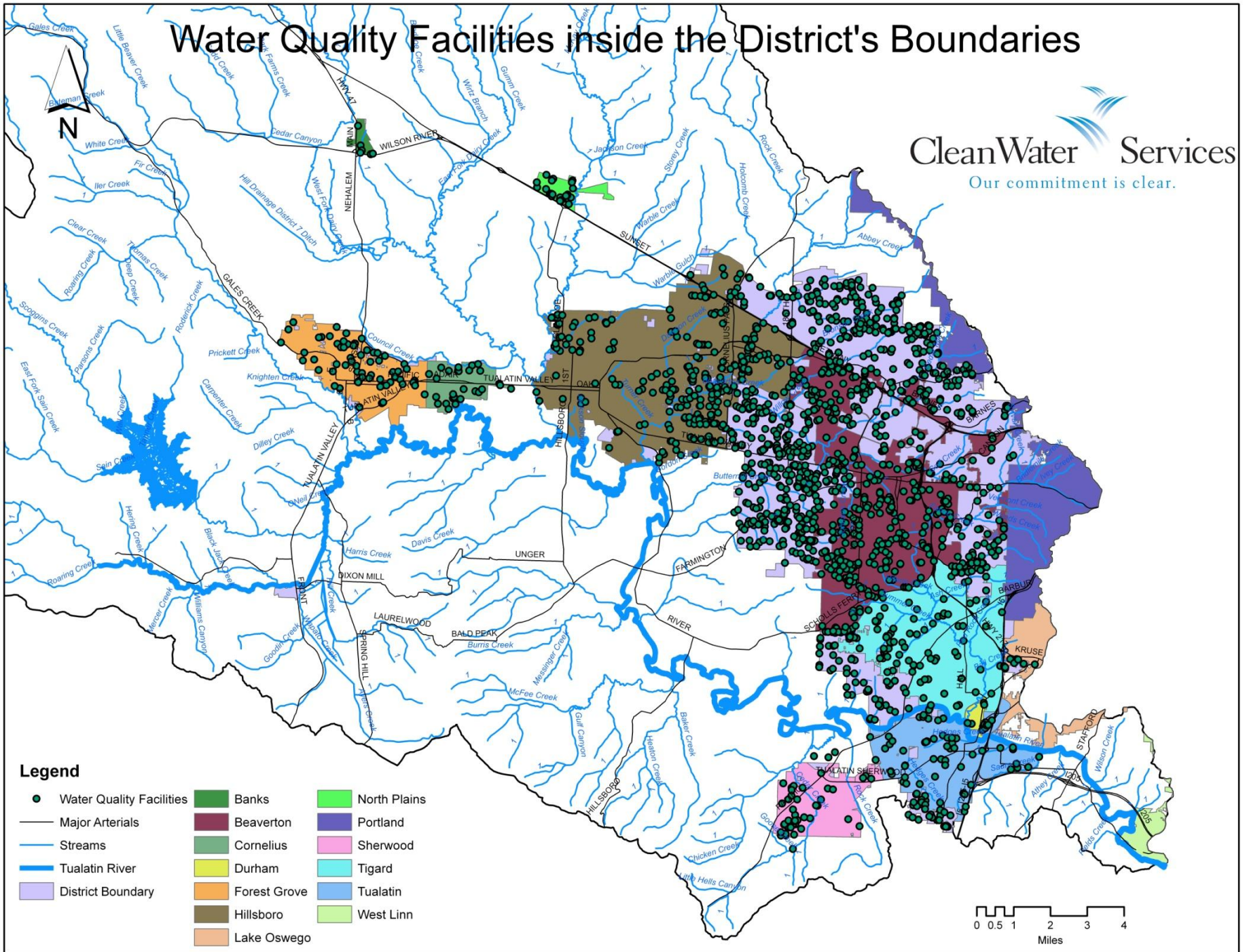
Clean Water Services

EXTENDED DRY BASIN

CONSTRUCTED WATER QUALITY WETLAND

Clean Water Services

Water Quality Facilities inside the District's Boundaries



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**

Clean Water Services

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

Clean Water Services

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

Clean Water Services

Infiltration Planter/Rain Garden

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

12th and Montgomery St., Portland

Fowler Middle School Retrofit, Tigard

Clean Water Services

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

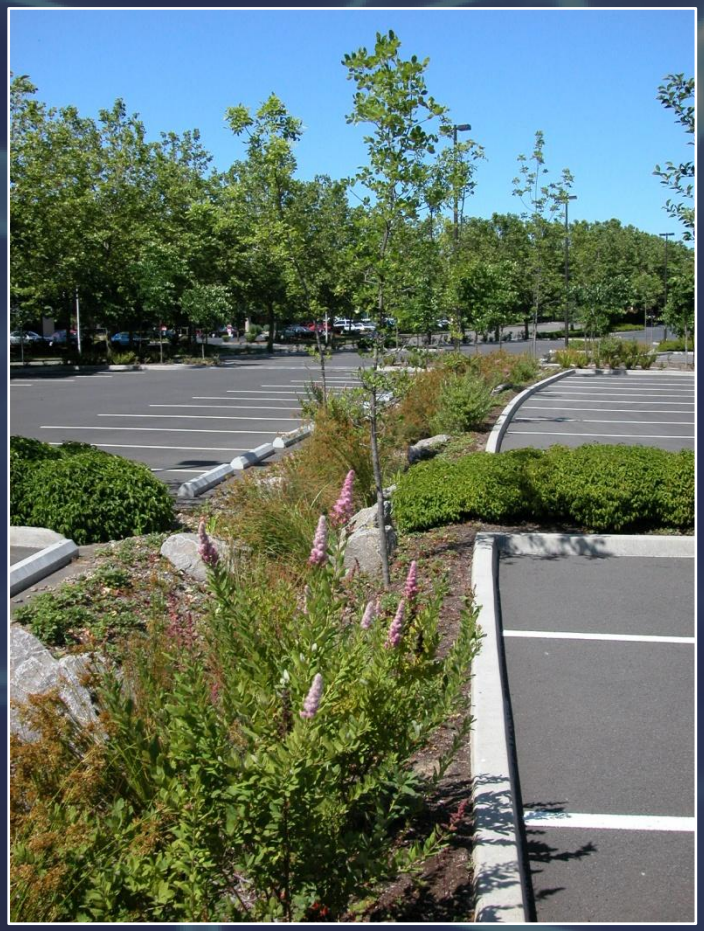
PSU Stephen Epler Hall

Clean Water Services

LIDA Swale

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

THPRD PCC Rock Creek, Washington County



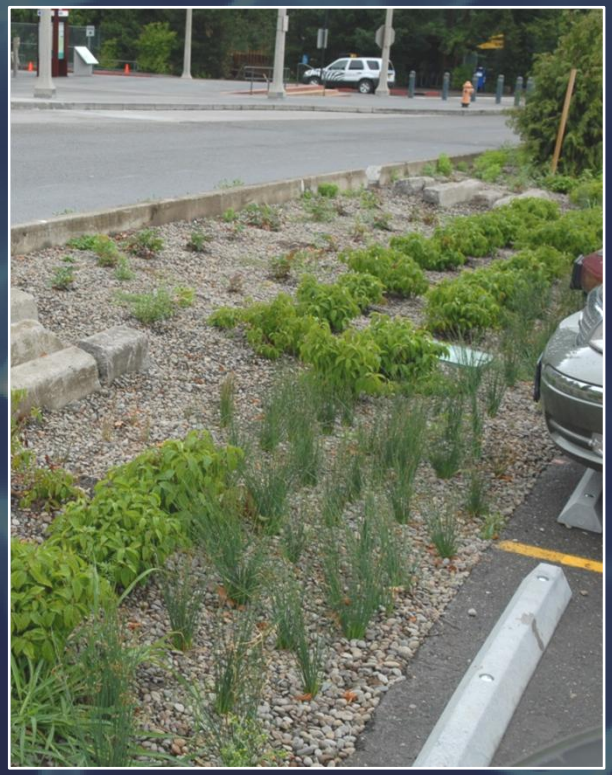
Tanasbourne Office Building, Washington County

Clean Water Services

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

Clean Water Services

Vegetated Swale

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

Westhaven Subdivision, Washington County

Washington County

Clean Water Services

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

Clean Water Services

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

Clean Water Services

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

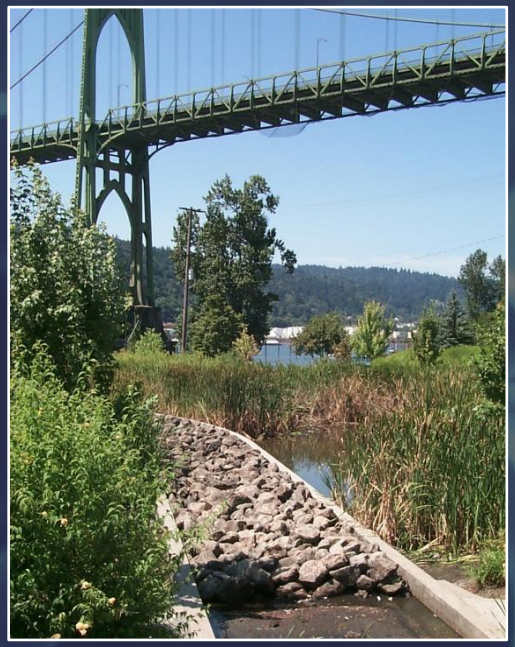
Developer Incentives

- 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

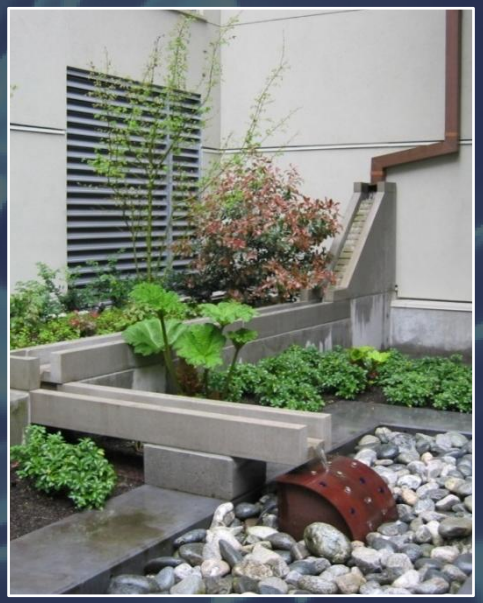


Water Pollution Control Laboratory, Portland

Block 11, Washougal, WA

Seattle, WA

Clean Water Services



NW 10th and Hoyt, Portland

Glencoe Elementary School, Portland

New Seasons, Beaverton

New Seasons, SE Division St, Portland

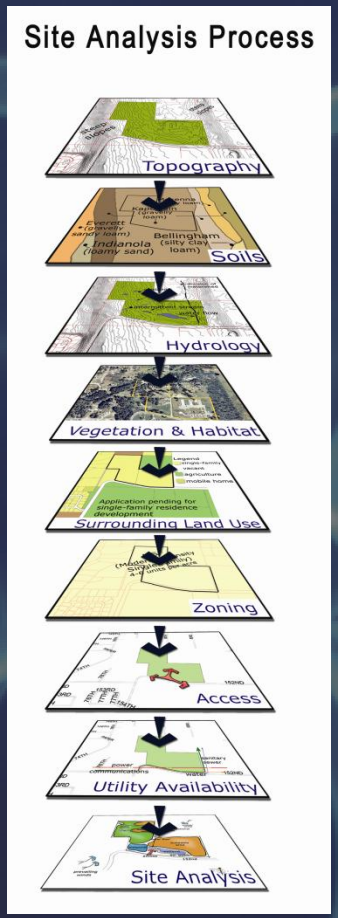
Stephen Epler Hall at PSU, Portland

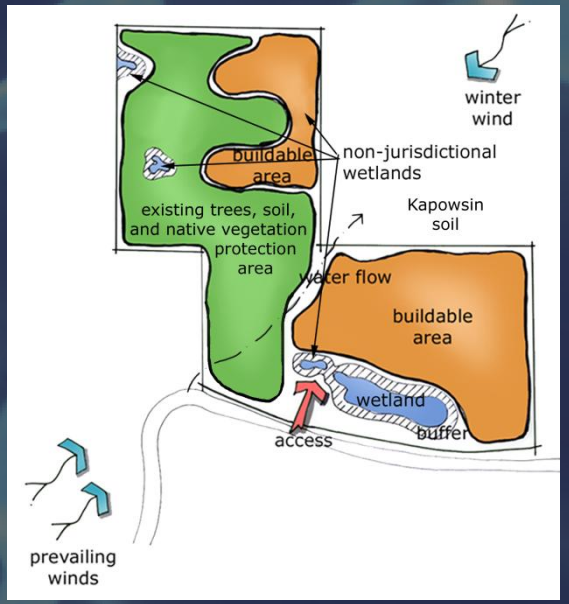
Team Estrogen Warehouse, Washington County

Clean Water Services

Encouraging LIDA's in Site Planning

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





Clean Water Services

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

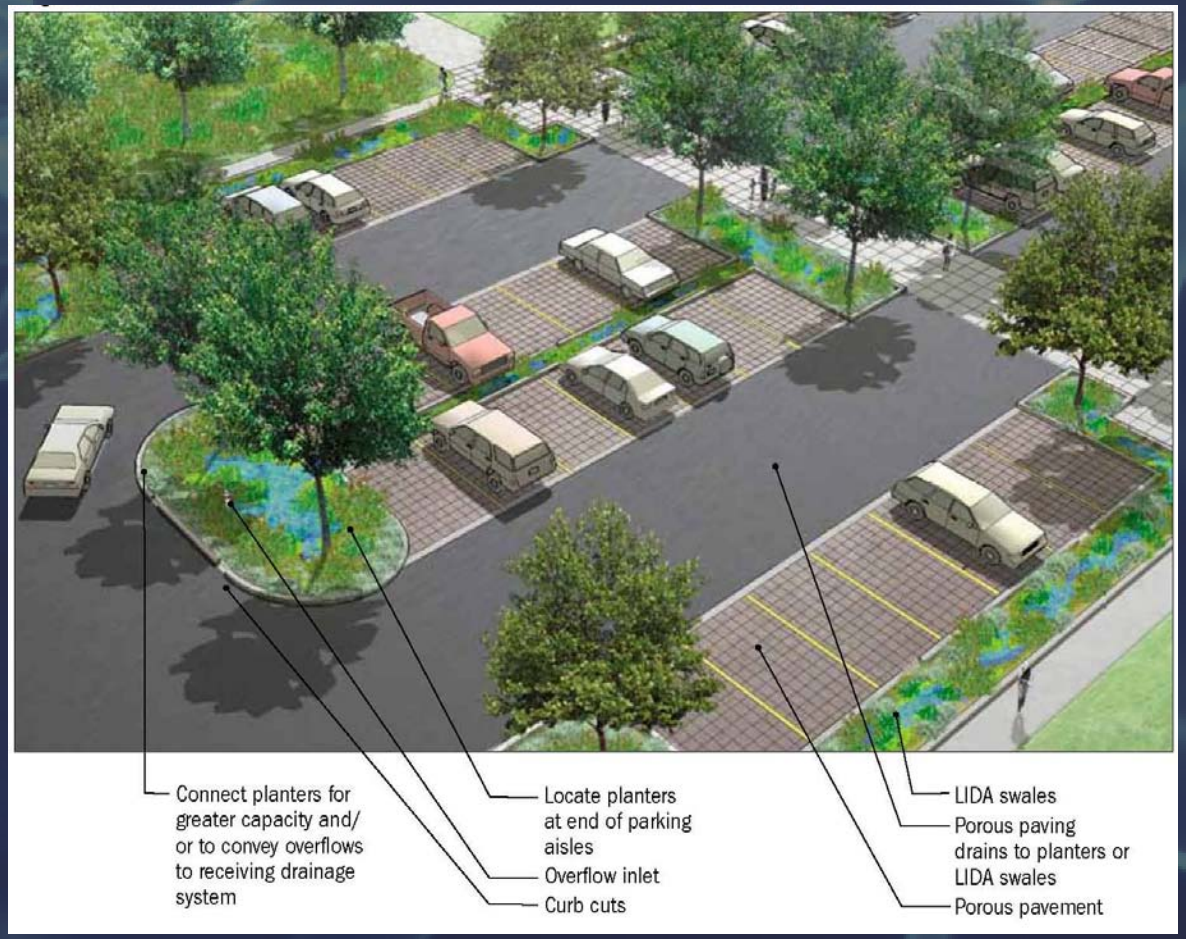
- **Considerations:**
  - **Infiltration vs. flow-through facilities**
  - **Public vs. private facilities**
  - **Adjacency of Vegetated Corridors**

	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 juristiction about use in ROW

Integrating LIDAs Into Site Design

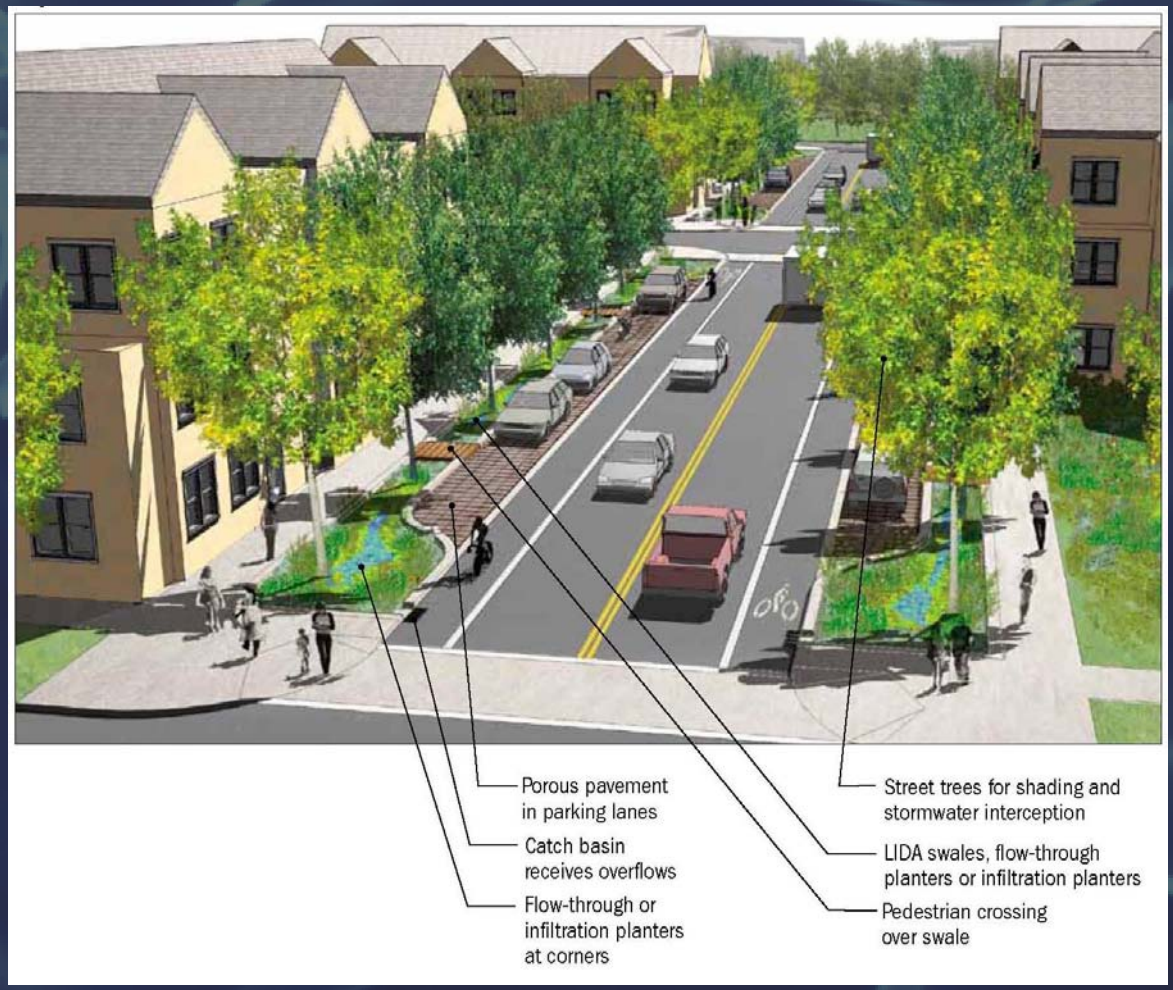
LIDAs IN PARKING AREAS



Clean Water Services

Integrating LIDAs Into Site Design

LIDAs IN STREETS



Clean Water Services

Integrating LIDAs Into Site Design

LIDAs FOR BUILDINGS & ADJACENT AREAS

Clean Water Services

LIDA Design – Fact Sheets

Clean Water Services

LIDA Facilities Design Basics

- **<15,000 ft^2 Impervious Area can use Sizing Form**
- **Larger sites can be divided into smaller drainage areas (<15,000 ft^2), 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.	≤ 100%	No new treatment required
≥ 5,280 sq.ft. and < 0.5 acres	< 1,000 sq.ft.	No new treatment required
	≥ 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
	≥ 25% and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	≥ 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
	≥ 50%	100% of impervious area

LIDA Sizing Form

Clean Water Services LIDA Sizing Form

Project Title: _____

Project Location: _____

Contact Name/Title/Company: _____

Phone/e-mail: _____

STEP 1: Determine Impervious Area Requiring Treatment

Total Site Area (acres):

Total Existing Impervious Area (sq.ft.):

Proposed New Impervious Area (sq.ft.):

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.)

STEP 2: Deduct Impervious Area LIDA Credits

Porous Pavement (sq. ft.):

Green Roof (sq. ft.):

Other Credits as approved (sq. ft.):

Total Credits (sq. ft.):

Remaining Impervious area (sq. ft.)
(Total from Step 1 – Total Credits):

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.)

(*Must equal total from Step 2 or additional LIDA facilities or Water Quality Facilities must be added.)

Clean Water Services

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.)

Clean Water Services

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**

Clean Water Services