



DEPARTMENT OF  
**ECOLOGY**  
State of Washington

# **Low Impact Development**

Rain Gardens and Bioretention

May 22, 2013

# How to Participate in a Webinar

The screenshot displays a webinar interface. At the top, a navigation bar includes a 'RETURN' button and icons for 'Participants', 'Chat', and 'Annotate'. A red arrow points from the 'navigation bar' label to the 'RETURN' button. Another red arrow points from the 'chat feature' label to the 'Chat' icon. The main content area shows a slide with the title 'How Can Nurseries Prepare to Meet the Native Plant Needs of LID?' and a photograph of a plant with white flowers. Below the photo, the text reads 'Associate Ecologist' and 'Herrera Environmental Consultants'. The bottom of the screen shows a Windows taskbar with the Start button, Internet Explorer, File Explorer, and a media player icon, along with the system clock showing 12:19 PM on 5/13/2013.

You are viewing: Cascadia Consulting's Application

RETURN

Participants Chat Annotate

Viewing Cascadia Consulting's appli

How Can Nurseries Prepare to Meet the Native Plant Needs of LID?

navigation bar

chat feature

Associate Ecologist  
Herrera Environmental Consultants

12:19 PM  
5/13/2013

# Using Chat

The image shows a presentation slide titled "How Can Nurseries Prepare to Meet the Native Plant Needs of LID?". The slide features a photograph of a plant with small white flowers. A red arrow points from the text "chat window" to the chat window. Another red arrow points from the text "Send to drop down menu" to the "Send to:" dropdown menu in the chat window. The chat window is titled "Chat" and has a "Send" button. The presentation slide also includes the text "Associate Ecologist" and "Herrera Environmental Consult". The Windows taskbar at the bottom shows the time as 12:22 PM on 5/13/2013.

You are viewing: Cascadia Consulting's Application

Viewing Cascadia Consulting's applic...

## How Can Nurseries Prepare to Meet the Native Plant Needs of LID?

chat window

Associate Ecologist  
Herrera Environmental Consult

Send to: Cascadi... (Host & Presenter) Send

Send to drop down menu

12:22 PM  
5/13/2013

# Polling

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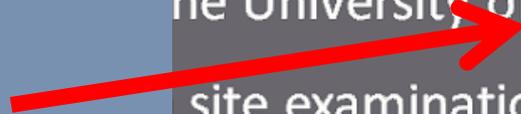
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**Polling** [Close]

Remaining time: 4:49      Time limit: 5:00

Poll Questions:

1. are you there?

a.yes

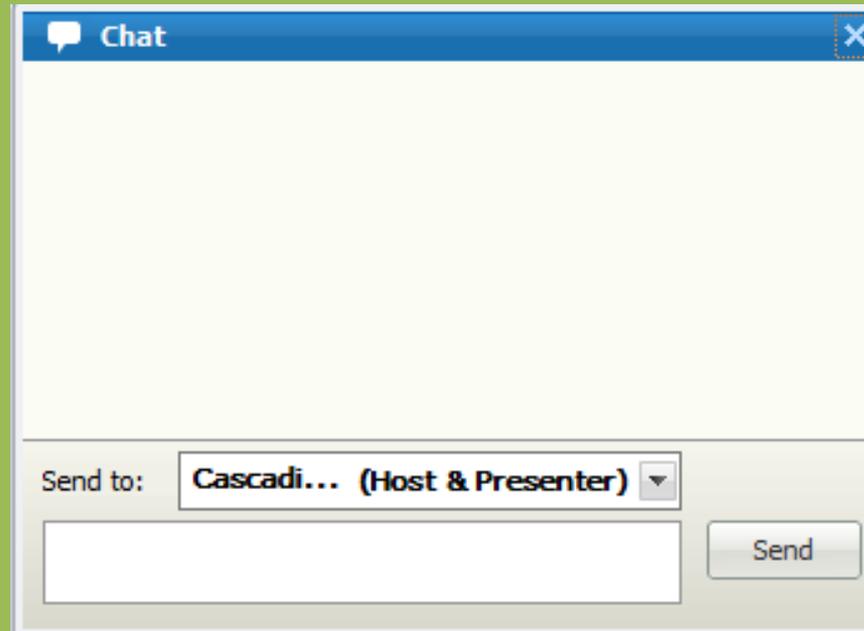
b.no

Submit

The poll has ended.

# Question Answer Period

Please send questions via **Chat** throughout the presentation to be answered during the question period at the end of the presentation.



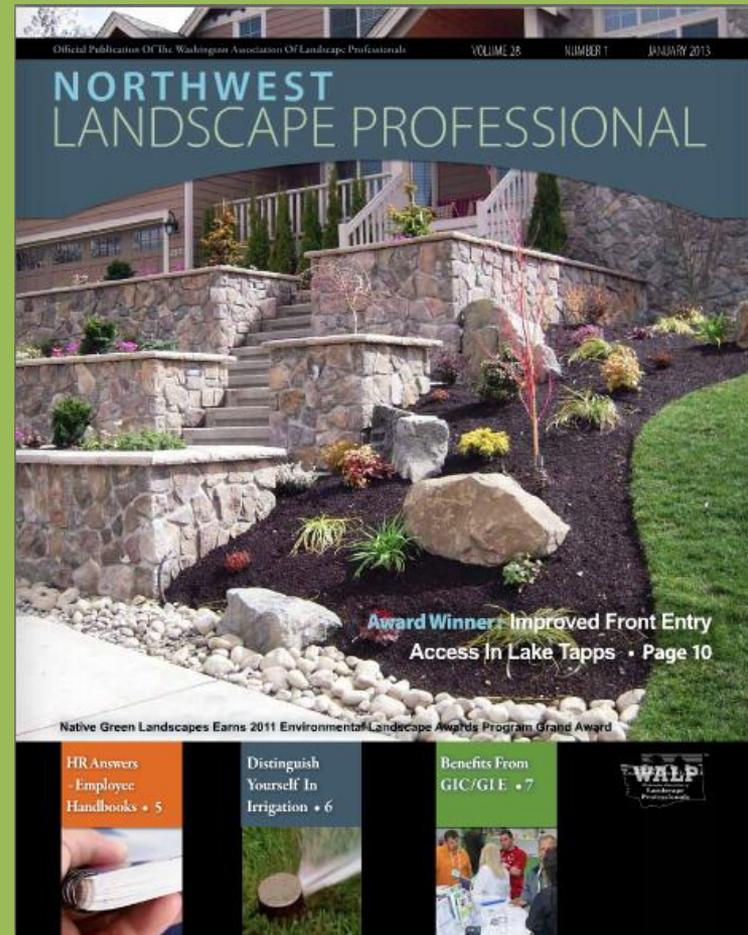
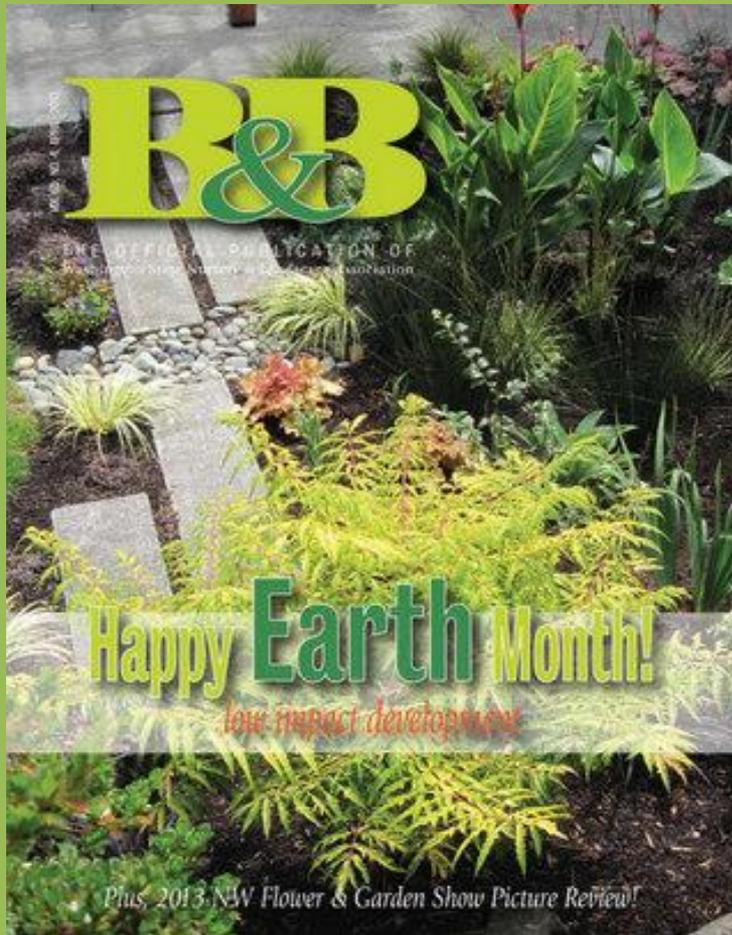


Patty Anderson  
Executive Director  
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Breanne Chavez  
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# Look for Upcoming Articles In:



# Low Impact Development

## Introduction

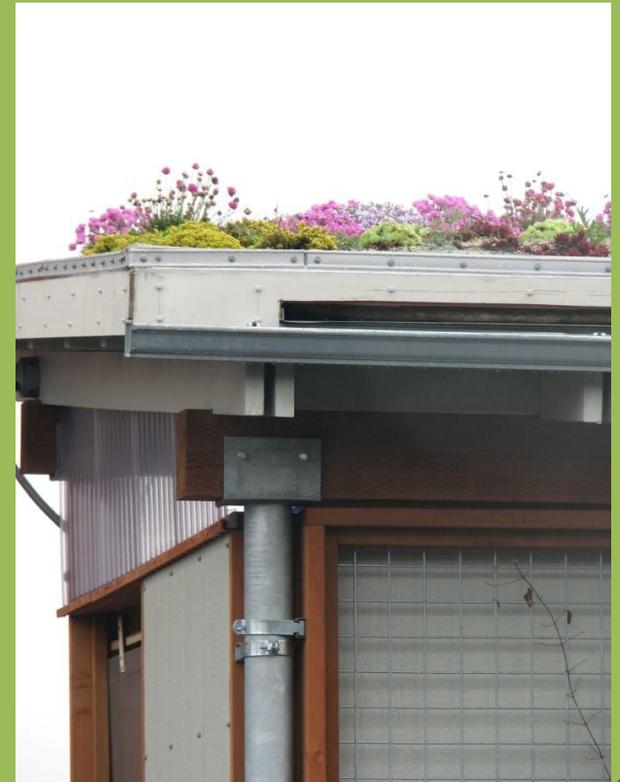


# Low Impact Development (LID)

Is a design, planning and engineering approach to managing stormwater runoff

LID includes:

- Rain gardens
- Bioretention
- Permeable pavement / pavers
- Green roofs
- Rain water harvesting
- Green walls



# Stormwater Runoff

- **Impervious Surfaces**
  - Roads
  - Roof tops
- **Pollutants**
  - Oil
  - Heavy metals
  - Silts
- **Affected Natural Areas**
  - Wetlands
  - Streams
  - Water bodies



# Stormwater Runoff Can Lead To:

- Erosion
- Pollution of Soils and Water Bodies
- Sedimentation to Water Bodies
- Combined Sewage Overflows
- Loss of Wildlife Habitat



# LID principles

## Conserve

- trees
- plants
- healthy soils

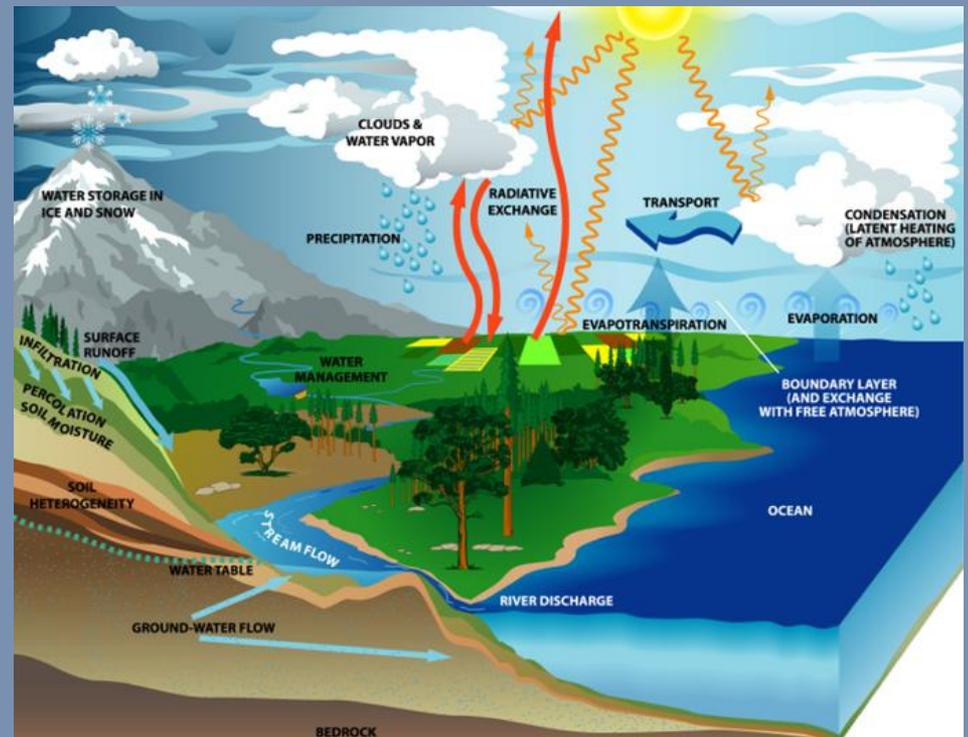
## Minimize

- impervious surfaces
- native vegetation loss
- stormwater runoff



# Benefits of LID

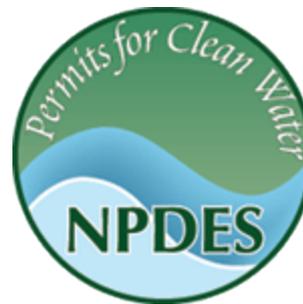
- Reduces and slows stormwater runoff
- Protects water quality
- Restores ecosystem services including:
  - Water infiltration
  - Groundwater recharge
  - Pollution interception and filtration
  - CO2 sequestration
  - Protection of habitat for beneficial wildlife



Hydrologic (water) cycle

# Stormwater is Regulated

- Clean Water Act
- National Pollution Discharge Elimination System (NPDES)
- Washington State Department of Ecology
- Municipal permits



# Regulatory Changes are Coming

- Western Washington - LID will be required in new development and re-development
- Eastern Washington - LID allowed
- Timeline depends on population size
  - Earliest: June 2015 (Seattle and surrounding cities)
  - Latest: June 2018

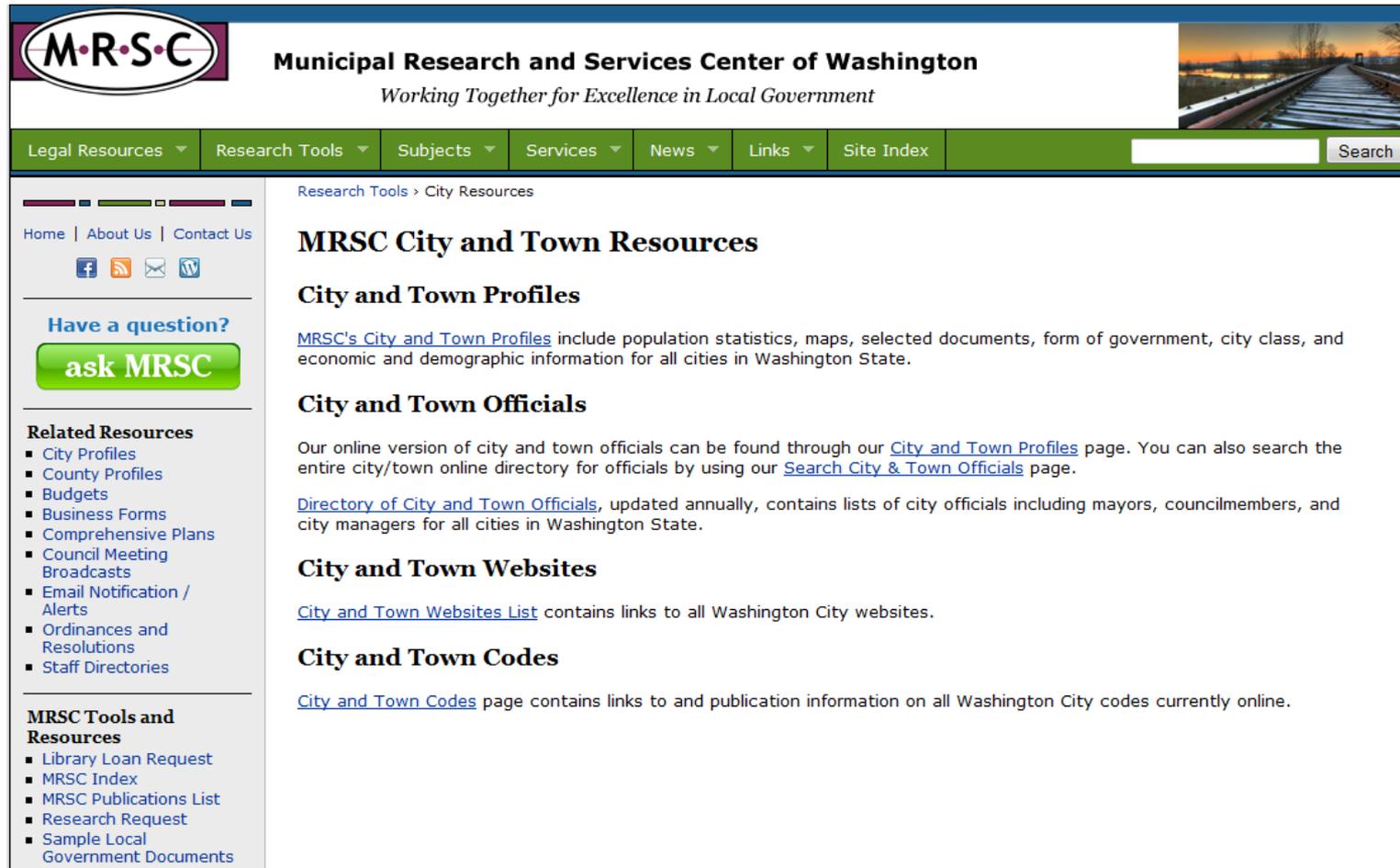


DEPARTMENT OF  
**ECOLOGY**  
State of Washington

# Provide Input

Get in touch with your local officials while the develop regulations:

<http://www.mrsc.org/research/research.aspx>



The screenshot displays the homepage of the Municipal Research and Services Center of Washington (MRSC). The header features the MRSC logo and the tagline "Working Together for Excellence in Local Government". A navigation bar includes links for Legal Resources, Research Tools, Subjects, Services, News, Links, and Site Index, along with a search box. The main content area is titled "MRSC City and Town Resources" and includes sections for City and Town Profiles, City and Town Officials, City and Town Websites, and City and Town Codes. A sidebar on the left provides quick links, social media icons, and a "ask MRSC" button.

**M.R.S.C.**  
**Municipal Research and Services Center of Washington**  
*Working Together for Excellence in Local Government*

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**Have a question?**  
**ask MRSC**

**Related Resources**

- City Profiles
- County Profiles
- Budgets
- Business Forms
- Comprehensive Plans
- Council Meeting Broadcasts
- Email Notification / Alerts
- Ordinances and Resolutions
- Staff Directories

**MRSC Tools and Resources**

- Library Loan Request
- MRSC Index
- MRSC Publications List
- Research Request
- Sample Local Government Documents

Research Tools > City Resources

## MRSC City and Town Resources

### City and Town Profiles

MRSC's [City and Town Profiles](#) include population statistics, maps, selected documents, form of government, city class, and economic and demographic information for all cities in Washington State.

### City and Town Officials

Our online version of city and town officials can be found through our [City and Town Profiles](#) page. You can also search the entire city/town online directory for officials by using our [Search City & Town Officials](#) page.

[Directory of City and Town Officials](#), updated annually, contains lists of city officials including mayors, councilmembers, and city managers for all cities in Washington State.

### City and Town Websites

[City and Town Websites List](#) contains links to all Washington City websites.

### City and Town Codes

[City and Town Codes](#) page contains links to and publication information on all Washington City codes currently online.

# Chris Webb



- Civil Engineer
- LEED Fellow
- Maul, Foster & Alongi Inc.
- 20 years of sustainable development experience
- Member of the technical advisory committee for the 2012 Eastern WA LID manual

# Jessi Bloom



- Wetland Science and Management , University of Washington
- Owner of NW Bloom Ecological Landscapes
- Author of *Free Range Chicken Gardens* and co-author of *The Wetland Handbook*

# Bioretention and Rain Gardens

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# Bioretention and Rain Gardens

## Outline

- Why Bioretention? What does it do?
- Rain Gardens vs. Bioretention
- Basic components & their function
- Present different configurations
- Design with lessons learned
- Construction with lessons learned
- Operations and Maintenance
- Business opportunities



# Bioretention and Rain Gardens

## What are they?

- Small vegetated depression in the ground receiving stormwater flows from small drainage basins
- Part of an LID approach

## What do they do?

- Provide Water Quality Treatment
- Address Water Quantity (retention)
  - Infiltration
  - Evapotranspiration
  - Detention



# Bioretention vs. Rain Gardens

## Bioretention

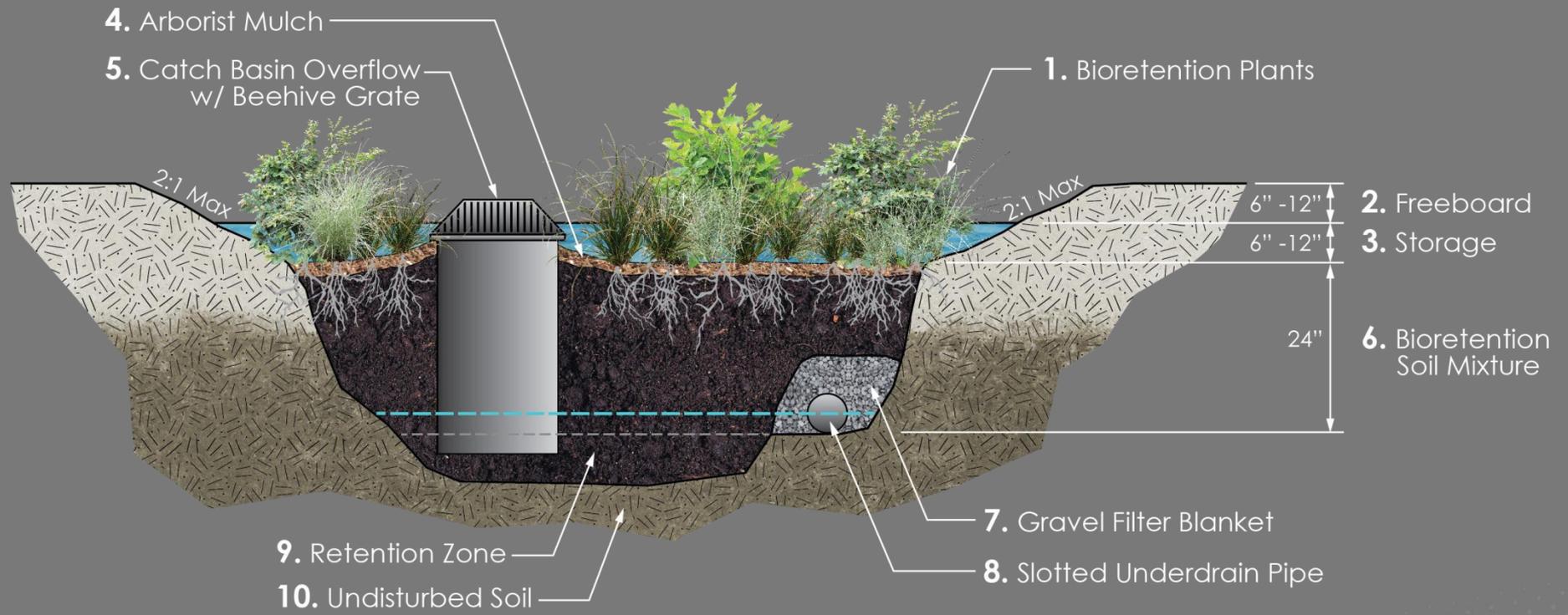
- Typically designed by an engineer
- Tighter specifications
- Fully replaced soil
- Typically built by a contractor
- Inspected by an agency and part of a regulated stormwater system
- On private lot or in public ROW

## Rain Garden

- Typically design is based on sizing tables and handbooks
- Looser specifications
- Fully replaced or amended soils
- Built by landscape professional, contractor, community group or homeowner
- Typically not inspected by an agency
- On private lots



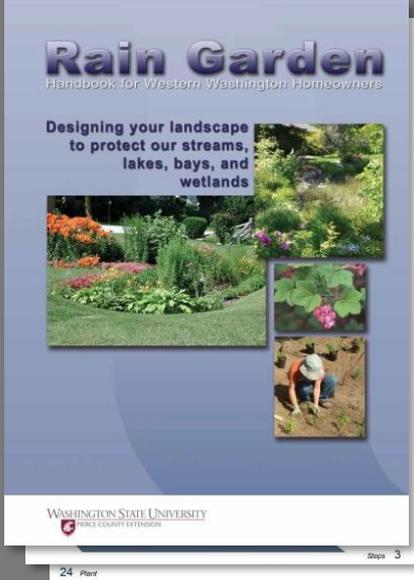
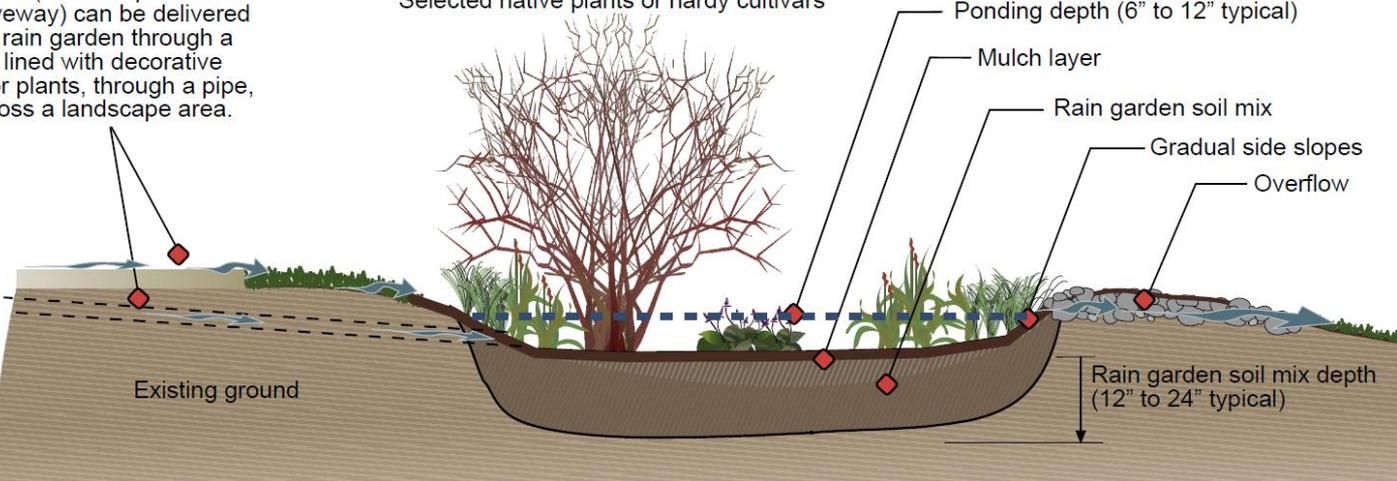
# Bioretention



# Rain Garden

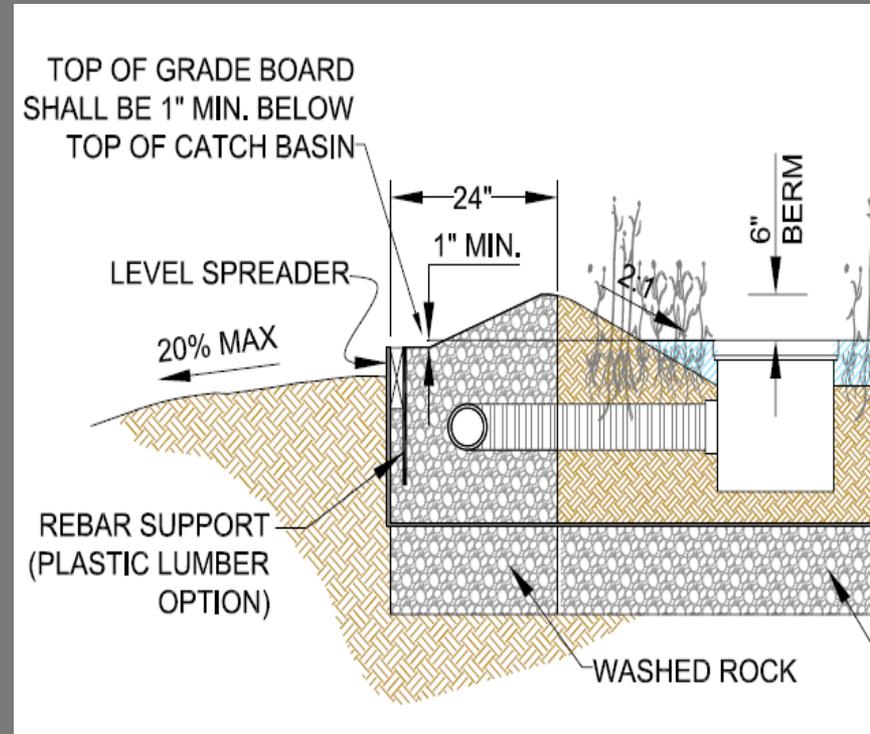
Water flowing off impervious surfaces (for example a roof or driveway) can be delivered to the rain garden through a swale lined with decorative rock or plants, through a pipe, or across a landscape area.

Selected native plants or hardy cultivars

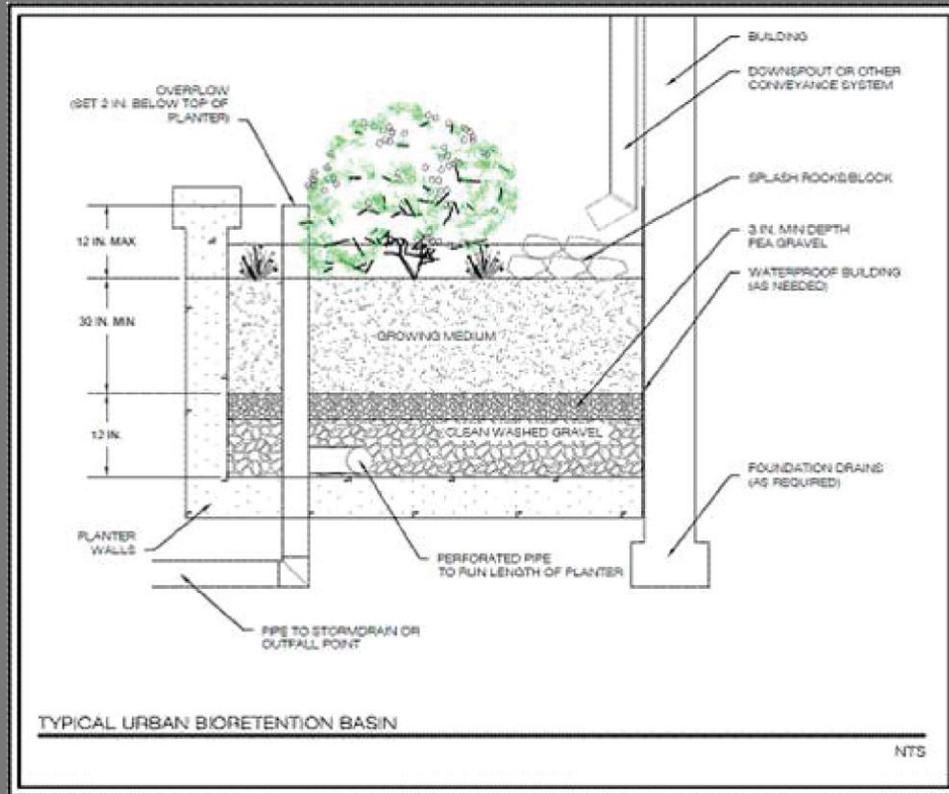


# Configuration Variations

- Underdrain
- Recharge zone
- Integrated infiltration trench
- Integrated level spreader
- Entry Design
  - Forebay (piped)
  - Rock pads (piped)
  - Sheet flow along an edge
  - Intermittent curb



# Bioretention Planter Box



# Bioretention in Urban Setting

Taylor 28 Apartments (Seattle)



# Bioretention Integrated with Building



Runnel with fin wall adjacent to viewing window

Federal Way Regional Library



Rain garden with runnel splash area in background



# Bioretention in Right of Way

First privately built bioretention in public ROW in Bellingham (2007)



# Bioretention in Right of Way



# Bioretention at Private Development

Using part of the ROW



Incorporating Art



# Bioretention Retrofit Examples



Bioretention traffic calming area in Portland...



Green Stormwater Infrastructure (GSI) in Seattle...



# Cost Comparison

## Seattle's Green Stormwater Infrastructure Projects

	Local street SEA Street	Local street Traditional	Collector street Cascade	Collector street Traditional	Broadview Green Grid 15 block area
Community Benefits	<ul style="list-style-type: none"> <li>one sidewalk per block</li> <li>new street paving</li> <li>traffic calming</li> <li>high neighborhood aesthetic</li> </ul>	<ul style="list-style-type: none"> <li>two sidewalks per block</li> <li>new street paving</li> <li>no traffic calming</li> <li>no neighborhood aesthetic</li> </ul>	<ul style="list-style-type: none"> <li>no street improvement</li> <li>moderate neighborhood aesthetic</li> </ul>	<ul style="list-style-type: none"> <li>no street improvement</li> <li>no neighborhood aesthetic</li> </ul>	<ul style="list-style-type: none"> <li>both 'SEA Street' and 'Cascade' types</li> <li>one sidewalk per block</li> <li>new paving</li> <li>high neighborhood aesthetic</li> </ul>
Ecological Benefits	<ul style="list-style-type: none"> <li>high protection for aquatic biota</li> <li>mimics natural process</li> <li>bio-remediate pollutants</li> </ul>	<ul style="list-style-type: none"> <li>high protection from flooding</li> <li>some water quality</li> </ul>	<ul style="list-style-type: none"> <li>high water quality protection</li> <li>some flood protection</li> </ul>	<ul style="list-style-type: none"> <li>high protection from flooding</li> <li>some water quality</li> </ul>	<ul style="list-style-type: none"> <li>high water quality &amp; aquatic biota protection</li> <li>some flood protection</li> <li>excellent monitoring opportunity</li> </ul>
% impervious area	35%	35%	35%	35%	35%
Cost per block (330 linear feet)	\$325,000	\$425,000	\$285,000	\$520,400	Average per block: \$280,000



# Key Design Issues

- Plant Selection
- Mulch
- Bioretention soil mix (BSM)
- Sizing
- Determining infiltration rate of native soil (PIT test)
- Determine infiltration rate for BSM
- Under-drain
- Entry design
- Overflow design



# Key Construction Issues

- Staging
- Sourcing materials
  - BSM
  - Gravel filter blanket
  - Mulch
- Testing soil for specification
- Protecting the work from siltation
- Prevent compaction
- Grades
- Temporary irrigation (2-3 years/establishment)



# Lessons Learned

## Design

- No filter fabric!
- Cells to be flat
- Base flows
- Don't make cells too big
- Integration with surrounding grade and specifying elevations
- Soil specification
- Plant selection
- Mulch specification
- O&M



# Lessons Learned

## Construction

- Erosion Control
- Compaction of sub soil
- Pre-mixed vs. site mixed soil vs. tilling
- Testing of soil / approved vendors
- Temporary irrigation



# Operations & Maintenance

- Overall (Trash removal, pest control (IPM), No fertilizer (organic slow release possible, probably not needed))
- Plants (weeding, pruning, replacement/removal)
- Mulch (remove contaminated, replace as needed)
- Structures (cleaning sump)



# Business Opportunities



## Project Types

- Homeowner built
- Non-profit group built
- Individual lots
- Subdivisions
- Commercial development
- Public right of way
- Retrofits



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- Homeowner built
- Non-profit group built
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# Rain Gardens

## Jessi Bloom, CPH

May 22, 2013



**Jessi @ nwbloom .com**



**www. nwbloom .com**



**@jessibloom**



**Jessica Bloom**



**N.W. Bloom Ecological Landscapes  
Chicken Gardens  
Practical Permaculture Design**



**N.W. BLOOM**  
EcoLogical Landscapes

# A Wetland, Plant-Nerd's Background



## Brief background:

- Environmental Horticulture Degree (LWTC) *1997*
- Wetland Science and Management Program (UW) *2000*
- King Conservation District – Wetland Plant Coop/co-author of the Wetland Handbook
- N.W. Bloom - EcoLogical Landscapes *2000-Present*





# Some of the local trainings available



- Department of Ecology trainings
- WSU extension
- Conservation District
- Professional Associations (WSNLA/WALP, etc)
- City of Seattle Public Utilities – Rainwise program
- 12,000 Rain garden program
- UW Botanic Gardens Educational program
- Workshops – hand's on training (*NW Bloom is having one this summer*)

# Opportunities in the Green Industry



As new development and redevelopment occur an increasing amount of LID will be used.

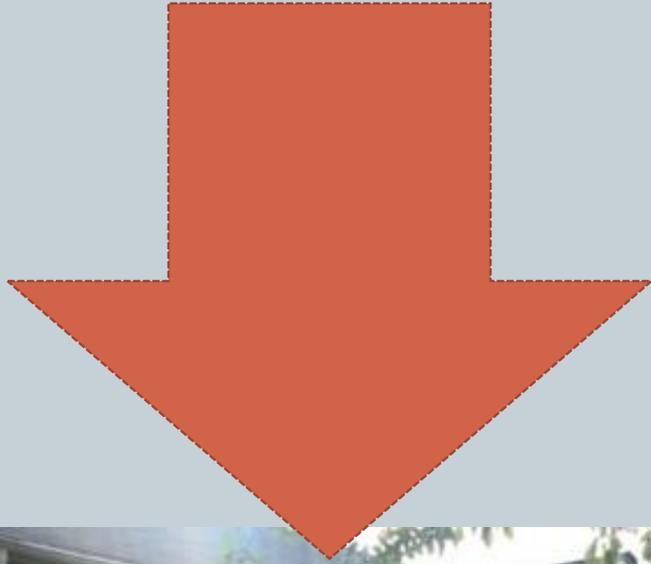
Opportunities will exist on:

- Commercial property
- Public land
- Right of ways
- Private property

Good for designers, contractors and nurseries to include:

- Raingardens/Bioretenention
- Water Harvesting
- Permeable Paving
- Green Roofs/Walls

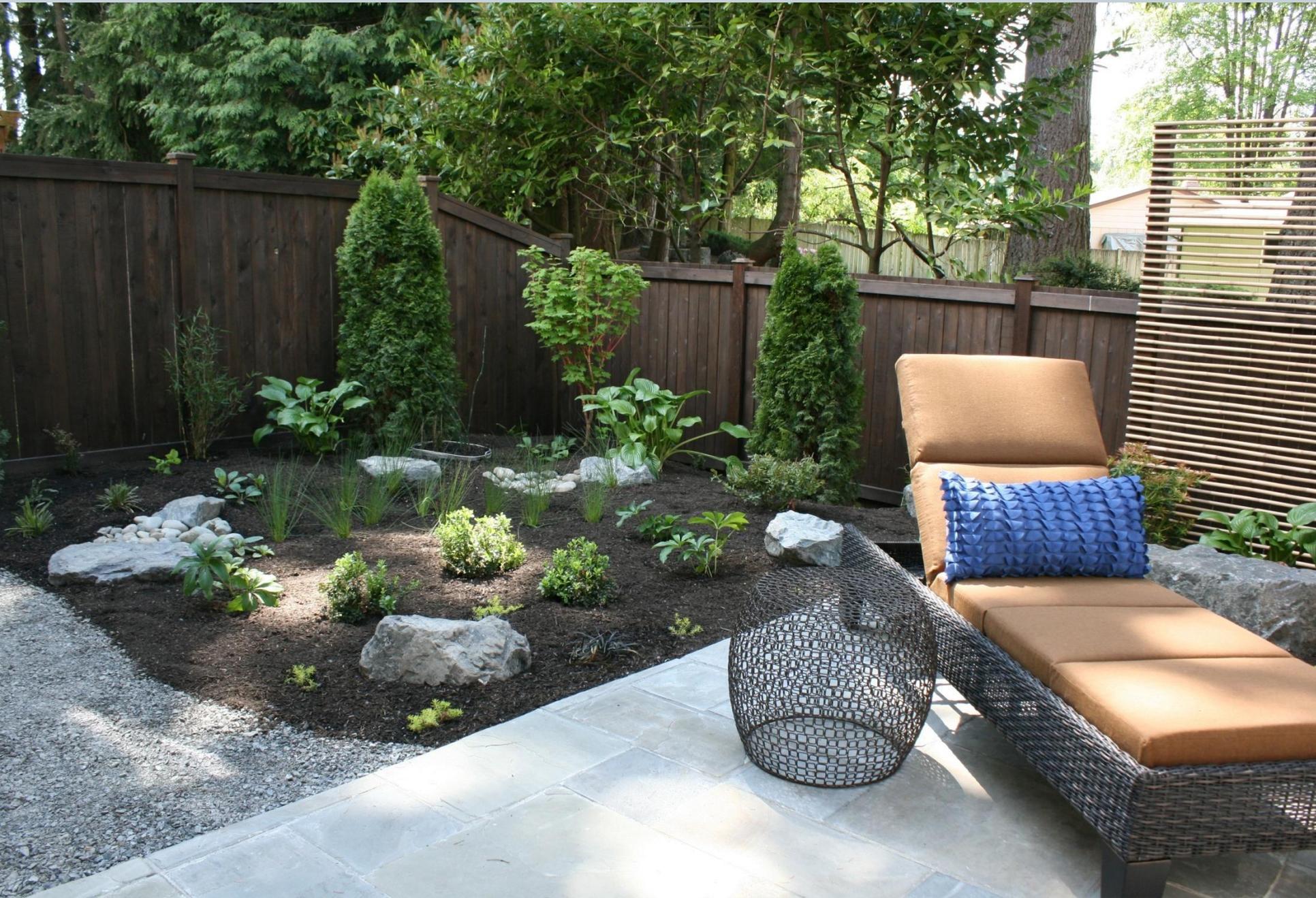
# The first rebate raingarden project



# Marketing LID/Raingardens



- Know your market/audience!
- Client driven motivation: is it “sexy”? Or a regulatory decision?
- Elevator pitch: Explain the benefits to existing clients: global, local and personal
- Build your portfolio and experience
- Social media
- Conventional advertising



# LID Benefits



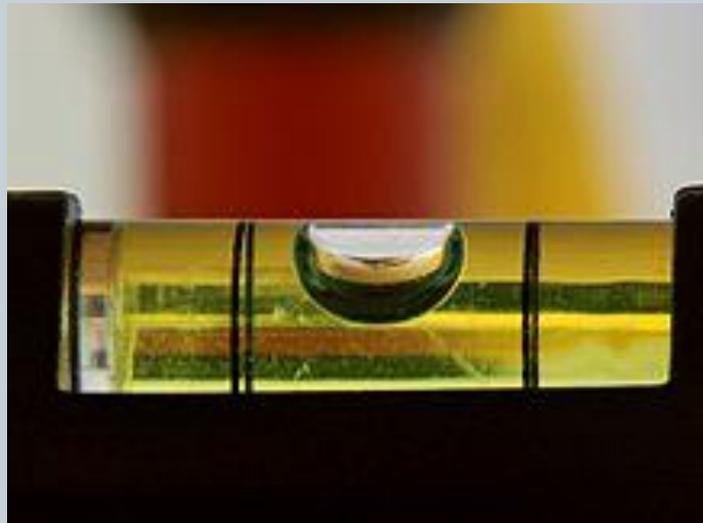
- Reduces and slows stormwater runoff
- Protects water quality
- Restores ecosystem services
  - Water infiltration
  - Groundwater recharge
  - Pollution interception & filtration
  - CO<sub>2</sub> sequestration
  - Restoration of habitat for beneficial wildlife



# Tools Needed



- **The Basics:** shovels, pick ax, muscle
- **Power Equipment:** Sod cutter, jackhammer, transits
- **Heavy Equipment:** excavators, skid steers...



# Heavy Equipment



What to consider with heavy machinery:

- Weight and distribution (soil compaction)
- Width (site restrictions)
- Digging depth (or lifting capacity)
- Skilled operators
- Safety
- Rental fees



# Estimating Costs



- Is \$3.50/sqft possible?
- Time & material
- Per project
- Line item within a larger project
- Overhead
- Profit Margin



**SAMPLE BID SHEET:**

<u>Item</u>	<u>Description</u>	<u>Est Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total Price</u>	<u>Unit Price</u>	<u>Total Price</u>	<u>Unit Price</u>	<u>Total Price</u>
1	Prepare Water Pollution Program	1	LS	\$ 150.000	\$ 150.00	\$ 1,500.00	\$ 1,500.00	\$ 300.00	\$ 300.00
2	Water Pollution Program	1	LS	\$ 400.000	\$ 400.00	\$ 1,000.00	\$ 1,000.00	\$ 500.00	\$ 500.00
3	Construction Site Management	1	LS	\$ 1,000.000	\$ 1,000.00	\$ 3,500.00	\$ 3,500.00	\$ 300.00	\$ 300.00
4	Exploratory Excavations (Potholes)	17	EA	\$ 600.000	\$ 10,200.00	\$ 500.00	\$ 8,500.00	\$ 42.00	\$ 714.00
5	Mobilization	1	LS	\$ 1,583.000	\$ 1,583.00	\$ 4,000.00	\$ 4,000.00	\$ 18,000.00	\$ 18,000.00
6	Construction Area Signs	4	EA	\$ 100.000	\$ 400.00	\$ 250.00	\$ 1,000.00	\$ 250.00	\$ 1,000.00
7	Temp[orary Business Entry Signs	7	EA	\$ 146.000	\$ 1,022.00	\$ 300.00	\$ 2,100.00	\$ 100.00	\$ 700.00
8	Traffic Control	1	LS	\$ 1,000.000	\$ 1,000.00	\$ 3,000.00	\$ 3,000.00	\$ 4,700.00	\$ 4,700.00
9	Asjust to Gratte Water Meter Box and Water Vaolve Covers	3	EA	\$ 150.000	\$ 450.00	\$ 200.00	\$ 600.00	\$ 115.00	\$ 345.00
10	Adjust to Grade Utility Boxes	1	EA	\$ 150.000	\$ 150.00	\$ 300.00	\$ 300.00	\$ 115.00	\$ 115.00
11	Remove Concrete Sidewalk and Island Concrete Surfacing and Base	5,960	SF	\$ 2.000	\$ 11,920.00	\$ 4.00	\$ 23,840.00	\$ 2.90	\$ 17,284.00
12	Remove Concrete Curb and Gutter and Base	475	LF	\$ 8.500	\$ 4,037.50	\$ 8.00	\$ 3,800.00	\$ 8.00	\$ 3,800.00
13	Remove Asphalt Concrete Paving and Base	950	SF	\$ 4.000	\$ 3,800.00	\$ 5.50	\$ 5,225.00	\$ 4.90	\$ 4,655.00
14	Clearing, Grubbing, Delmolition & Earthwork	1	LS	\$ 4,657.000	\$ 4,657.00	\$ 4,500.00	\$ 4,500.00	\$ 13,000.00	\$ 13,000.00
15	Planting	1	LS	\$ 35,760.000	\$ 35,760.00	\$ 42,200.00	\$ 42,200.00	\$ 30,000.00	\$ 30,000.00
16	Installation of Irigation System	1	LS	\$ 25,300.000	\$ 25,300.00	\$ 31,000.00	\$ 31,000.00	\$ 34,000.00	\$ 34,000.00
17	Curb Inlet Grates and Frames	38	EA	\$ 700.000	\$ 26,800.00	\$ 480.00	\$ 18,240.00	\$ 660.00	\$ 25,080.00
18	Hot Mix Asphalt	100	TON	\$ 149.000	\$ 14,900.00	\$ 200.00	\$ 20,000.00	\$ 136.00	\$ 13,600.00
19	Install Subsurface Drain (SDR 35)	370	LF	\$ 38.000	\$ 14,060.00	\$ 25.00	\$ 9,250.00	\$ 41.00	\$ 15,170.00
20	Connect to 24" RCP	7	EA	\$ 150.000	\$ 1,050.00	\$ 250.00	\$ 1,750.00	\$ 600.00	\$ 4,200.00
21	Install Storm Drain Manhole	1	EA	\$ 5,900.000	\$ 5,900.00	\$ 2,500.00	\$ 2,500.00	\$ 9,000.00	\$ 9,000.00
22	Concrete Curb & Gutter (Type A2-6) and Base	475	LF	\$ 24.500	\$ 11,637.50	\$ 30.00	\$ 14,250.00	\$ 24.00	\$ 11,400.00
23	Concrete Sidewalk and Base	5,900	SF	\$ 8.150	\$ 48,085.00	\$ 6.30	\$ 37,170.00	\$ 12.00	\$ 70,800.00
24	Project Information Sign	1	EA	\$ 1,300.000	\$ 1,300.00	\$ 500.00	\$ 500.00	\$ 1,000.00	\$ 1,000.00
25	Allowance for Interpretive Signs	2	EA	\$ 7,000.000	\$ 14,000.00	\$ 7,000.00	\$ 14,000.00	\$ 7,000.00	\$ 14,000.00
<b>TOTAL</b>					<b>\$ 239,362.00</b>		<b>\$ 253,725.00</b>		<b>\$ 293,663.00</b>

# Lessons Learned:



- Calculations are critical
- Do *several* infiltration tests
- Locate your utilities and TV 1-800-424-5555
- Be leery...of partial DIY projects and over engineered plans for a simple raingarden
- Think of having disclaimers
- Be ready to adapt to the site

# GRADING... Don't get it wrong!



- Transits to measure elevations – the best option but costs more
- Levels of all sizes
- String lines and bubbles
- WATER! Will not lie...
- Test runs at each stage of installation

Don't forget  
to use me for  
proper  
grading!



# What happened here?





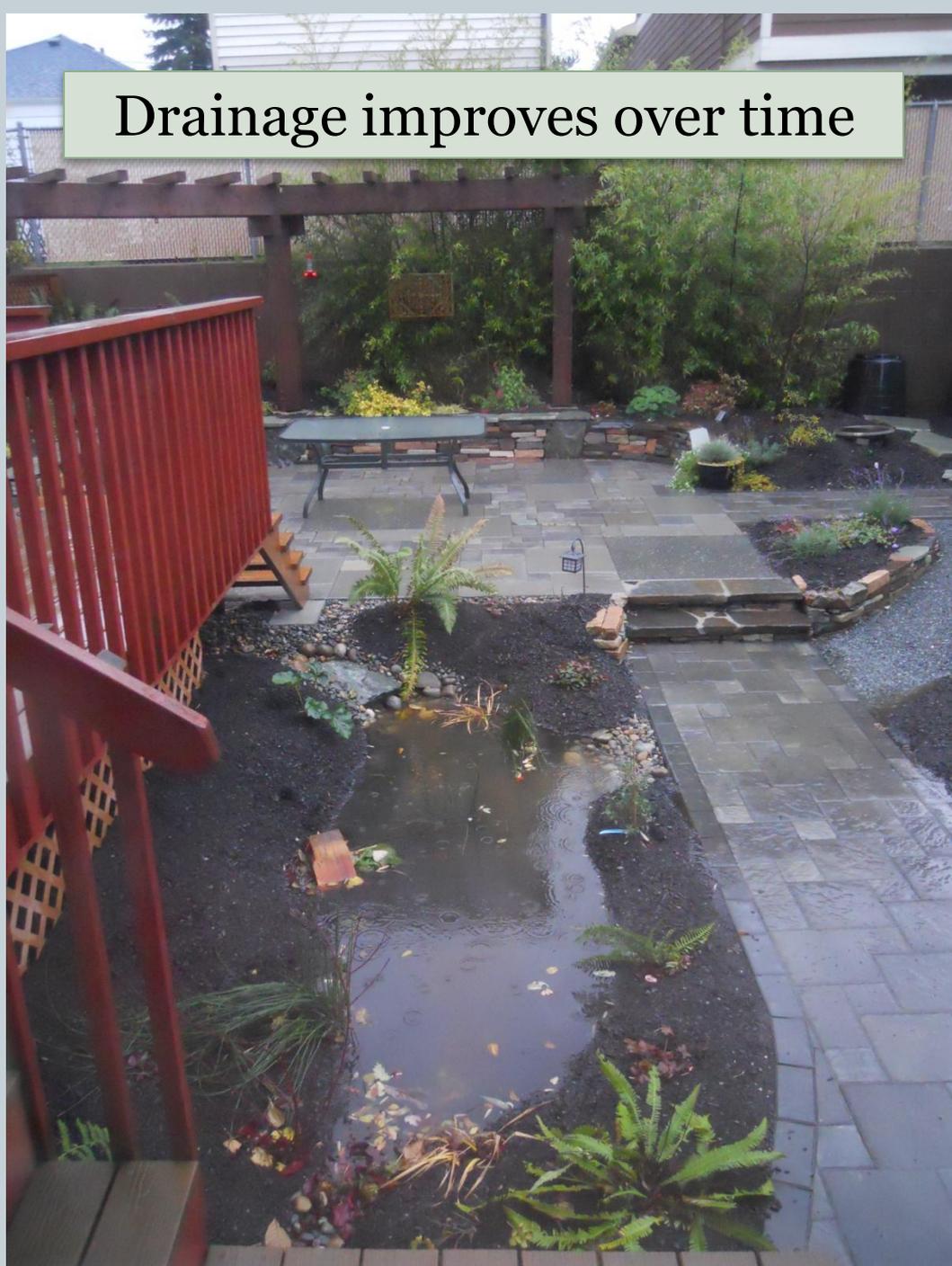
# Rain gardens fit in the site and style...







Drainage improves over time





**Same rain  
garden  
One year  
later...**



**Again, two  
years  
later...**





# Plant Selection Criteria for Rain Gardens



- Right Plant, Right Place
- Low maintenance – Plants reach a mature height of 2 1/2' with minimal pruning in lower zone
- Wildlife Habitat Potential – Berries, nuts and flowers
- Mix of evergreen and deciduous plants
- Flowers
- NW Natives
- Availability (Easy to find and/or replace)
- Tough and hardy in our climate and growing conditions