

# What Does Green Mean in Portland, Oregon?

Portland Bureau of  
Environmental Services



## 2007 NACWA Summer Conference

July 18, 2007

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Portland, Oregon

# Presentation Outline

- Portland Overview
- Incorporating Green Infrastructure
- Modeling and Monitoring
- Public Outreach and Participation











City of Portland Today  
25 sq. miles rooftops  
45 sq. miles pavement  
City 135 sq. miles

# Portland's CSO Program 1991 - 2011

- **Cornerstone Projects**
  - Cost-effective stormwater inflow control measures initiated in 1993
  - Downspout Disconnection, Stormwater Sumps, Sewer Separation, Stream Separation
- **Columbia Slough Protection Projects**
  - Large conveyance and storage conduit
  - Pumping and treatment at CBWTP – CSO Facility
- **Willamette River Protection Projects**
  - Deep tunnel storage and conveyance
  - Pumping and treatment at Willamette CSO Facility



Portland's  
CLEAN RIVER PLAN



*Prepared by the Bureau of Environmental Services  
City of Portland, Oregon • March 2000*

TEN ACTIONS  
FOR SUCCESS

# Urban Stormwater Issues

## Getting from Grey to Green

- Protect Water Quality
  - Meet regulatory requirements such as MS4, NPDES, UIC, TMDL, ESA
- Reduce Peak Flows
  - Stop basement sewer backups
  - Prevent Erosion
- Reduce Flow Volume
  - CSO compliance
  - Prevent flooding



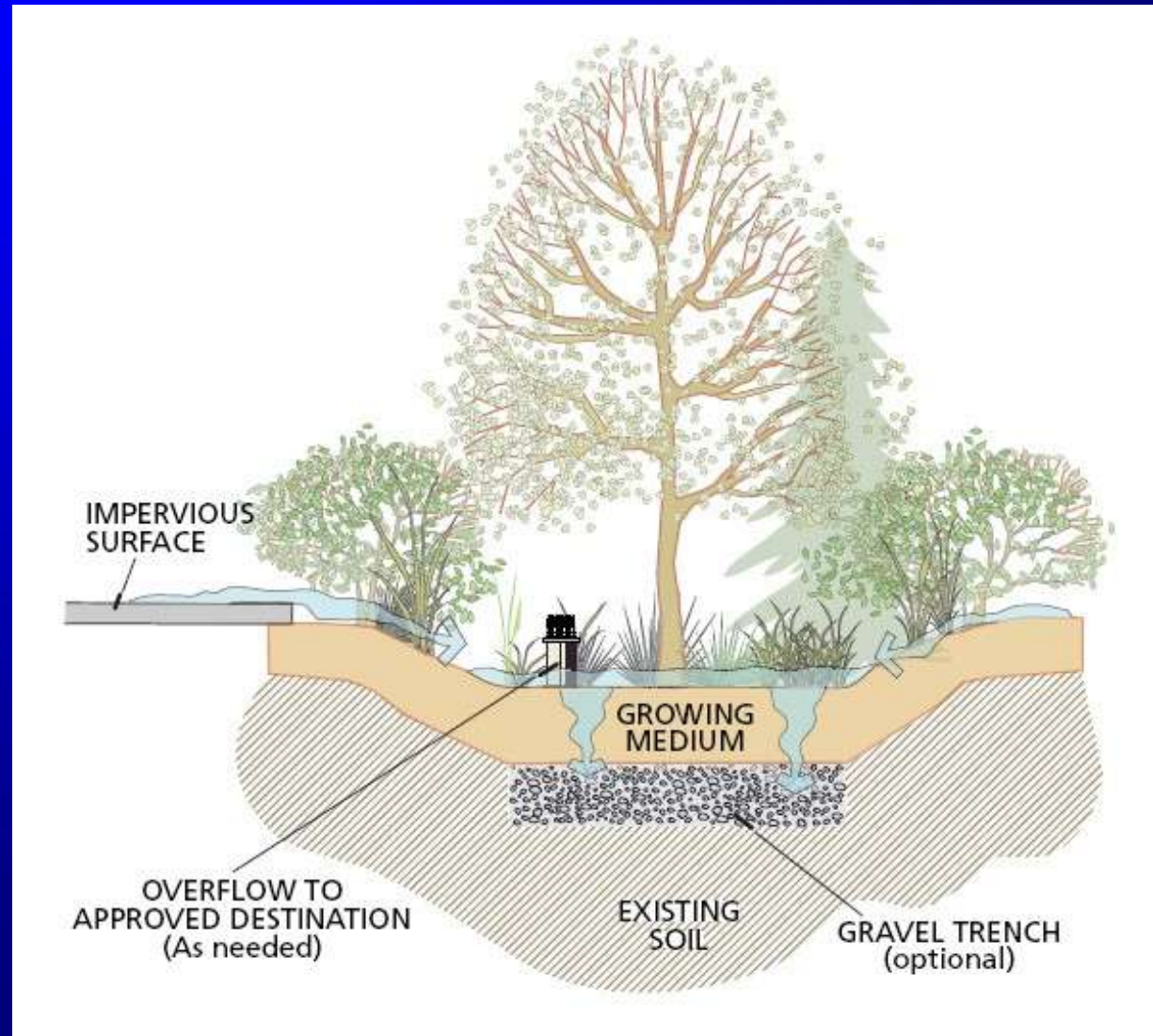
# Green Solutions Guiding Principles

1. Manage stormwater runoff both at the source and at the surface.
2. Use plants and soil to slow, filter, cleanse, and infiltrate runoff.
3. Design facilities that aesthetically enhance the community.



# Vegetated Infiltration Basins

- Rain Gardens
- Bioretention Facilities







**OMSI Parking Lot Landscape Swales**



# OMSI Parking Lot Landscape Swales



MAY 21 2001



# Buckman Heights Apartments – Infiltration garden





# Buckman Heights Apartments Infiltration Gardens



MAY 18 2001



**Buckman Heights Apartments  
Parking Lot Infiltration Hedge**



MAY 16 2001



**Buckman Heights Apartments parking lot curb cuts**



JUL 14 2009



# Glencoe Elementary Schoolyard

Before the raingarden





# Glencoe Elementary School Raingarden





# Glencoe Elementary School Raingarden





# Glencoe Parking Lot - landscape swale



2004 5 28





**Tabor School before Raingarden**





**Tabor School Raingarden**





**NE Siskiyou Green Street –  
Before Stormwater Curb Extensions**





**NE Siskiyou Green Street – Stormwater Curb Extensions**





**NE Siskiyou Green Street – Stormwater Curb Extensions**



# NE Siskiyou Green Street – first spring



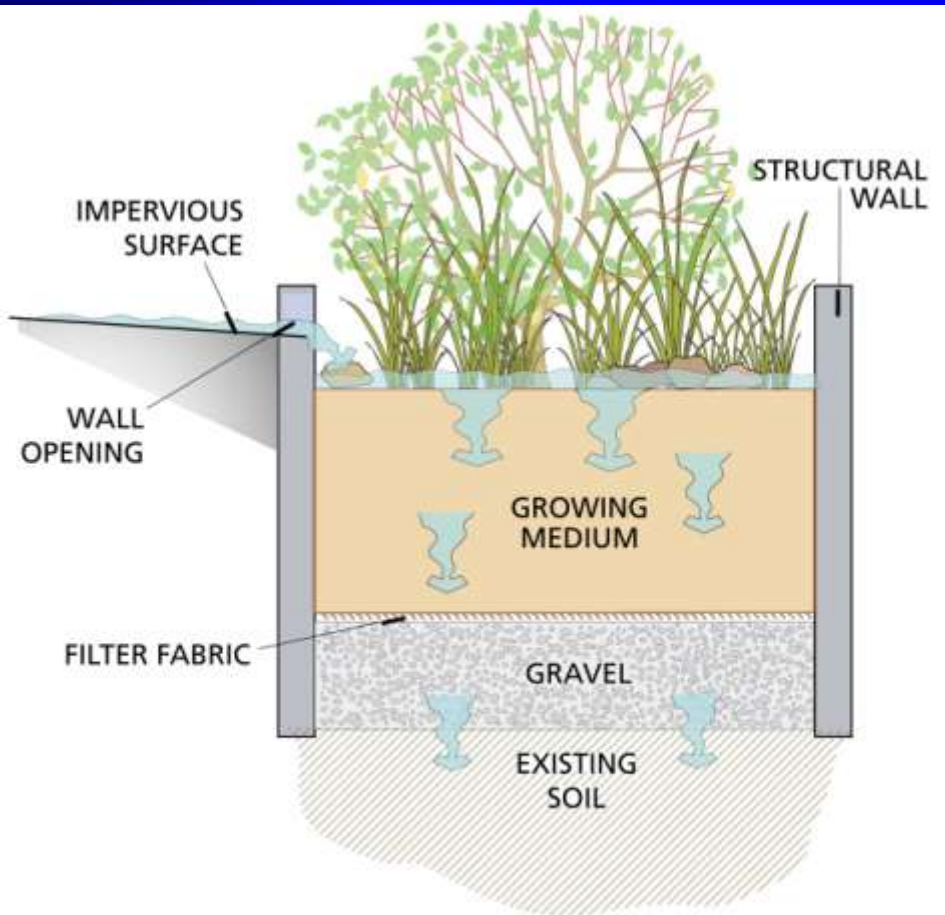


# NE Siskiyou Green Street Stormwater Curb Extensions

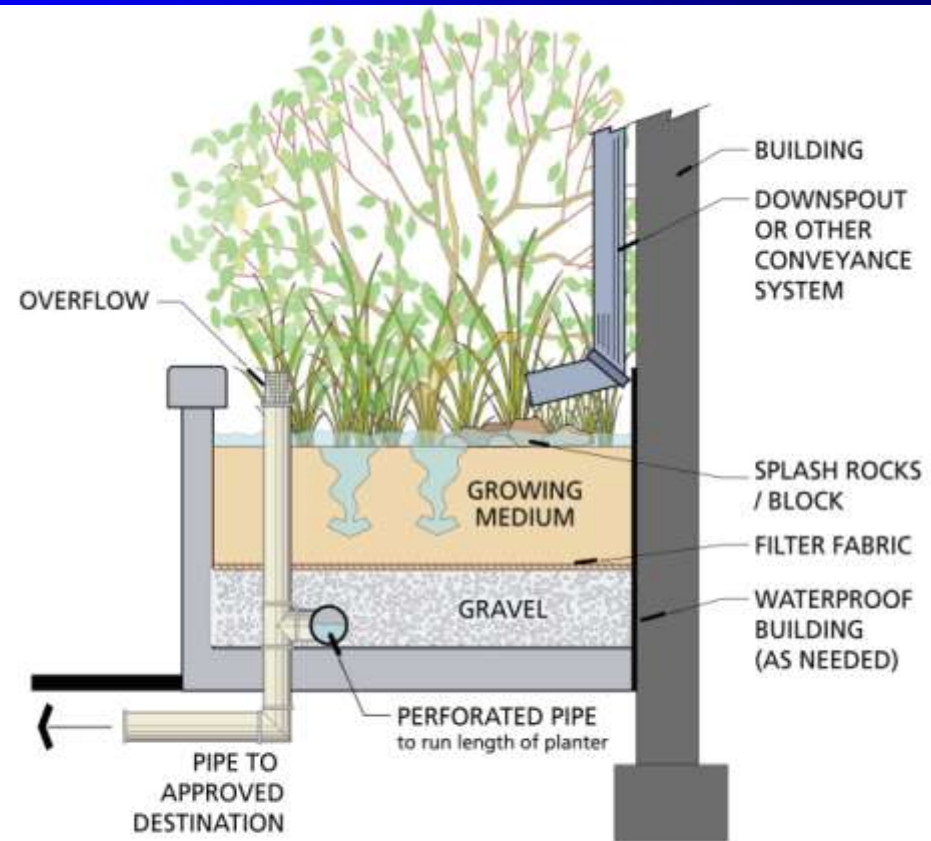




# Stormwater Planters



Infiltration Planter



Flow-Through Planter





**SW 12<sup>th</sup> Avenue Green Street – Street Stormwater Planters**



# SW 12<sup>th</sup> Avenue Green Street – Street Stormwater Planters





# Sandy Blvd - Infiltration Planter Design 2005



NE DAVIS ST

NE 15TH AVE

NE SANDY BLVD

NE 16TH AVE

303

1500



# Sandy Blvd - Infiltration Planter 2007







**Sandy Blvd - Infiltration Planter  
2007**



# Mississippi Commons





**New Seasons Market  
Raingarden sculpture**



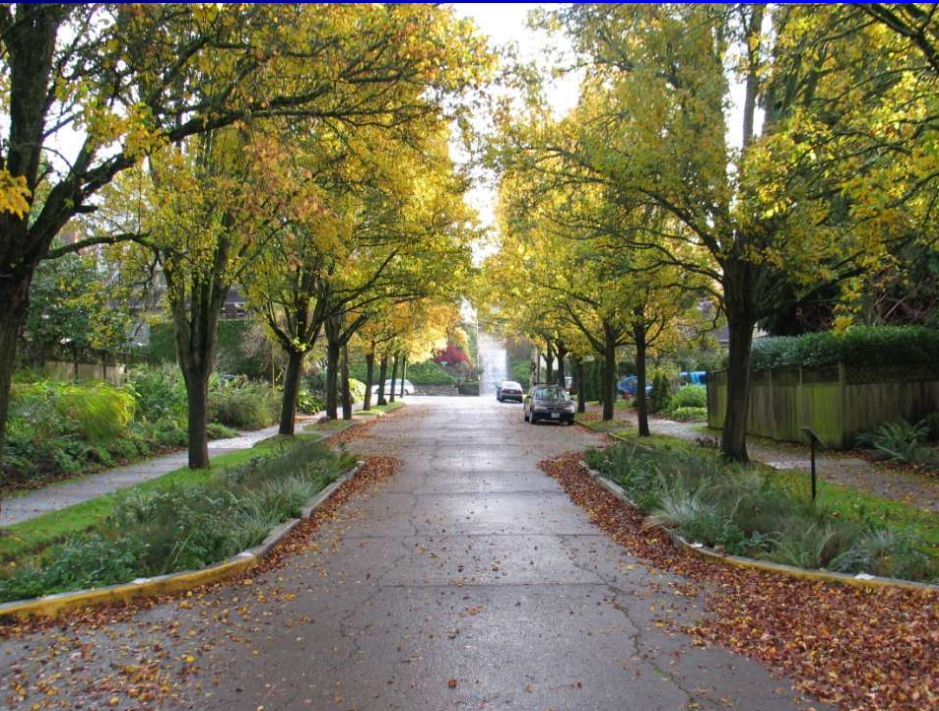




**New Seasons Market  
Stormwater planters on Division Street**



# Green Infrastructure Maintenance





# Maintenance Frequency

- **Startup (during the first two years)**
- **Long-term (after two years)**





# Maintenance Costs

Tracking costs to determine long-term financing need





# Who does the maintenance work



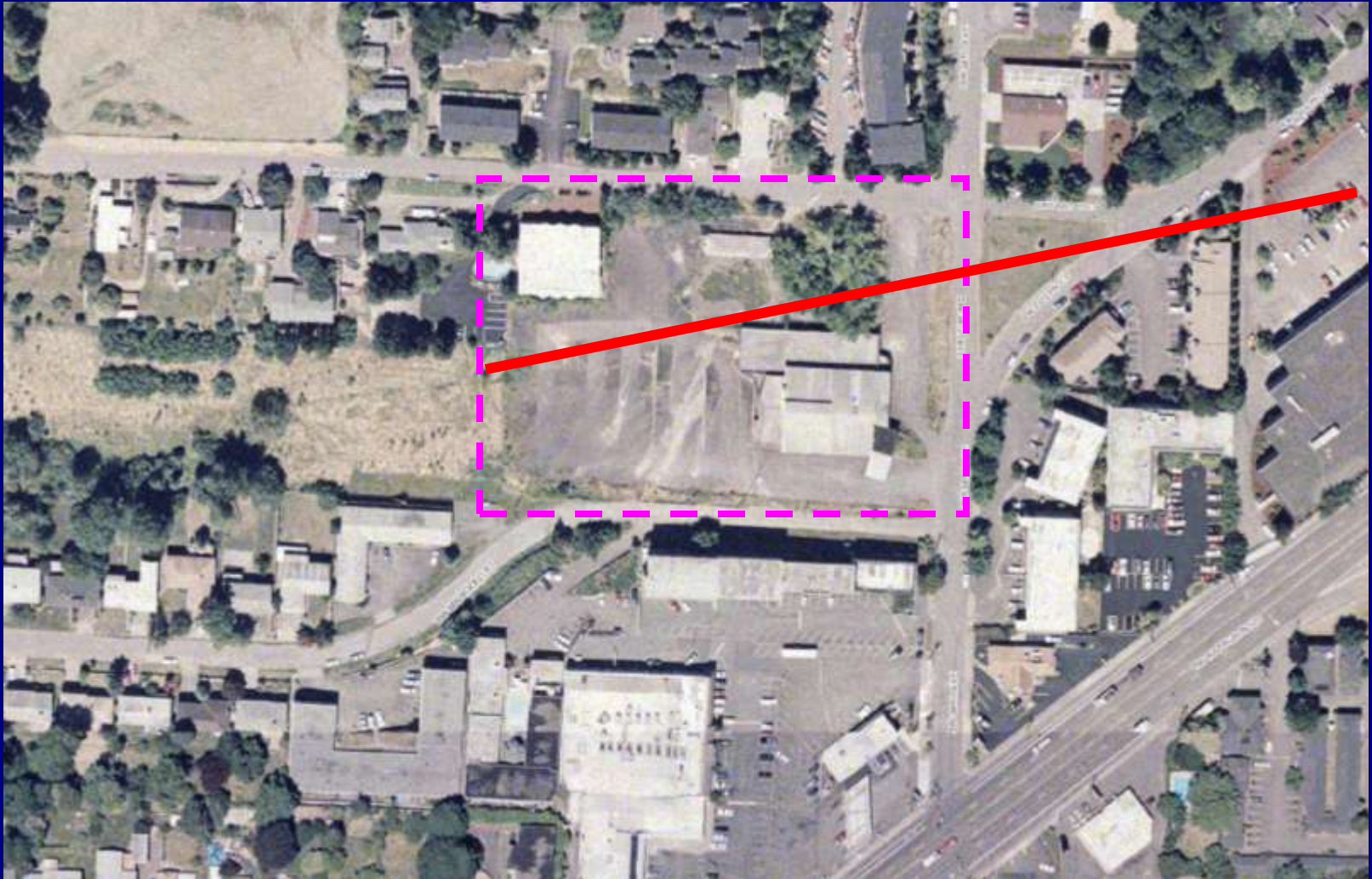


# Lessons Learned





# Tryon Creek Headwaters



(2001 Photo)





**Tryon Headwaters - before**

**NOV 7 2002**





**Portland Traffic determined this street wasn't really needed. So we can put the creek back? Yes, if you pay for it.**



# Tryon Creek Headwaters Apartments and Rowhouses

Creek Restoration

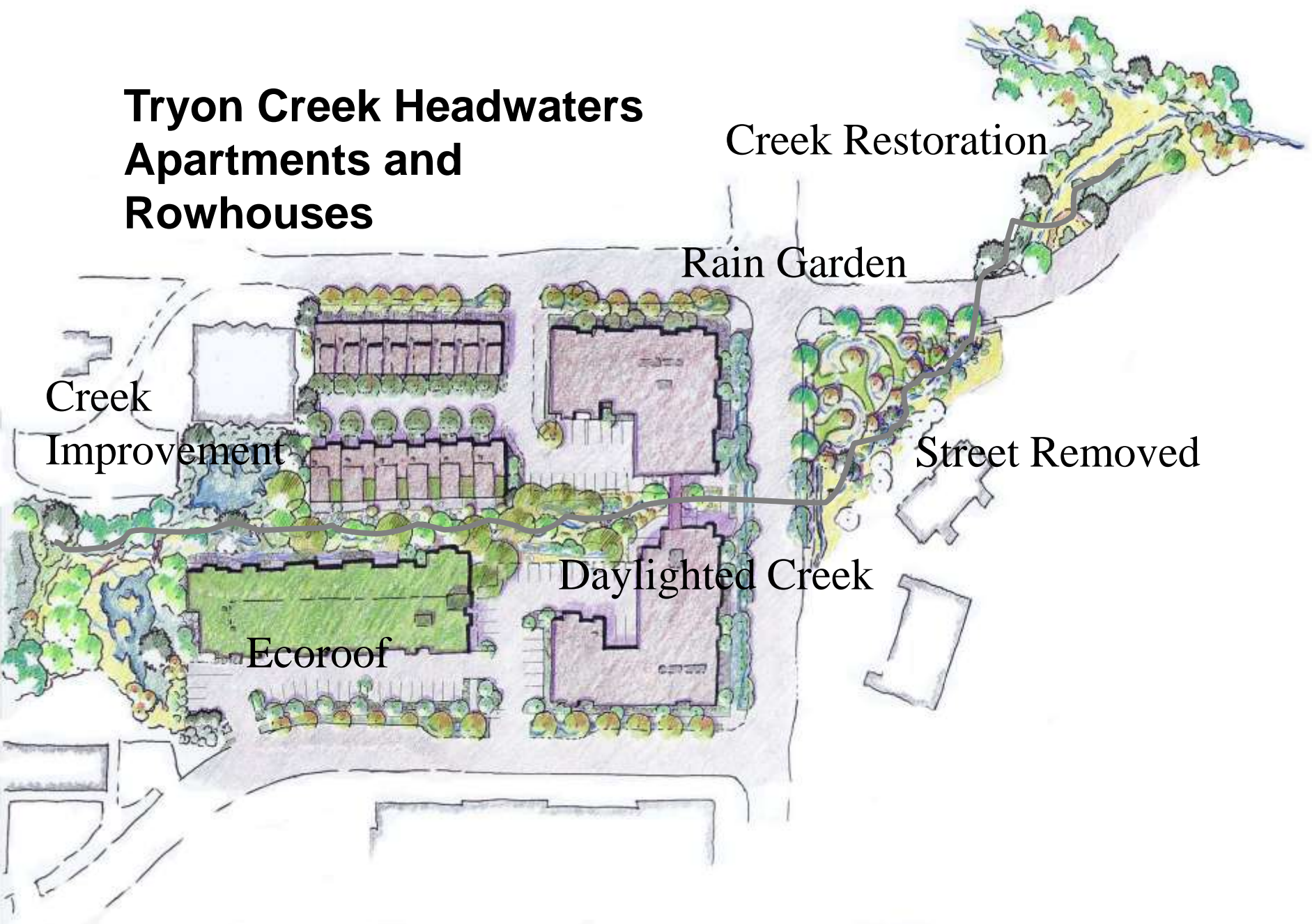
Rain Garden

Creek  
Improvement

Street Removed

Daylighted Creek

Ecoroof





# Tryon Creek Headwaters Project – Stream Daylighting

Partnership with development to achieve watershed objectives





# Tryon Creek Headwaters



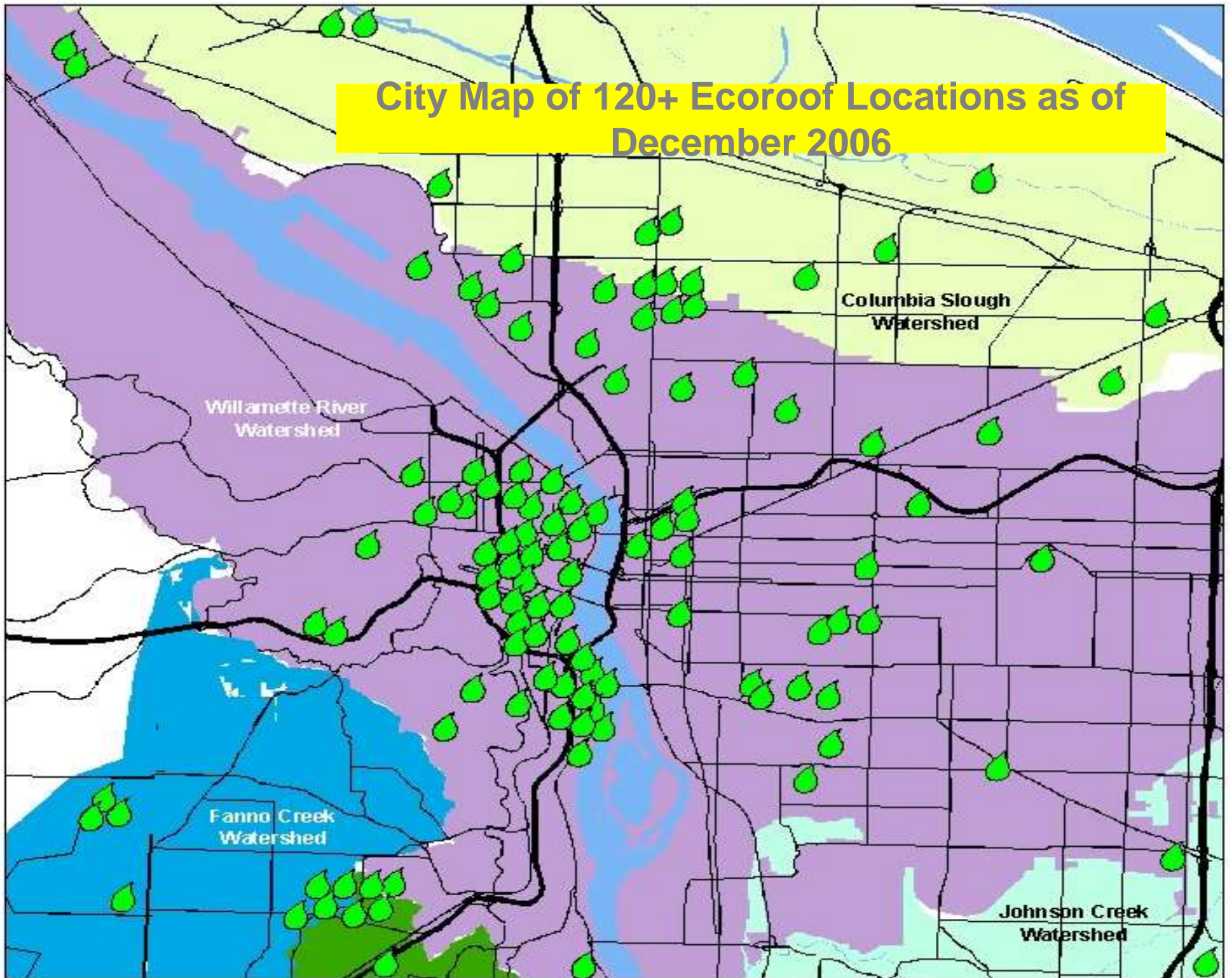


# Tryon Creek Headwater Returns





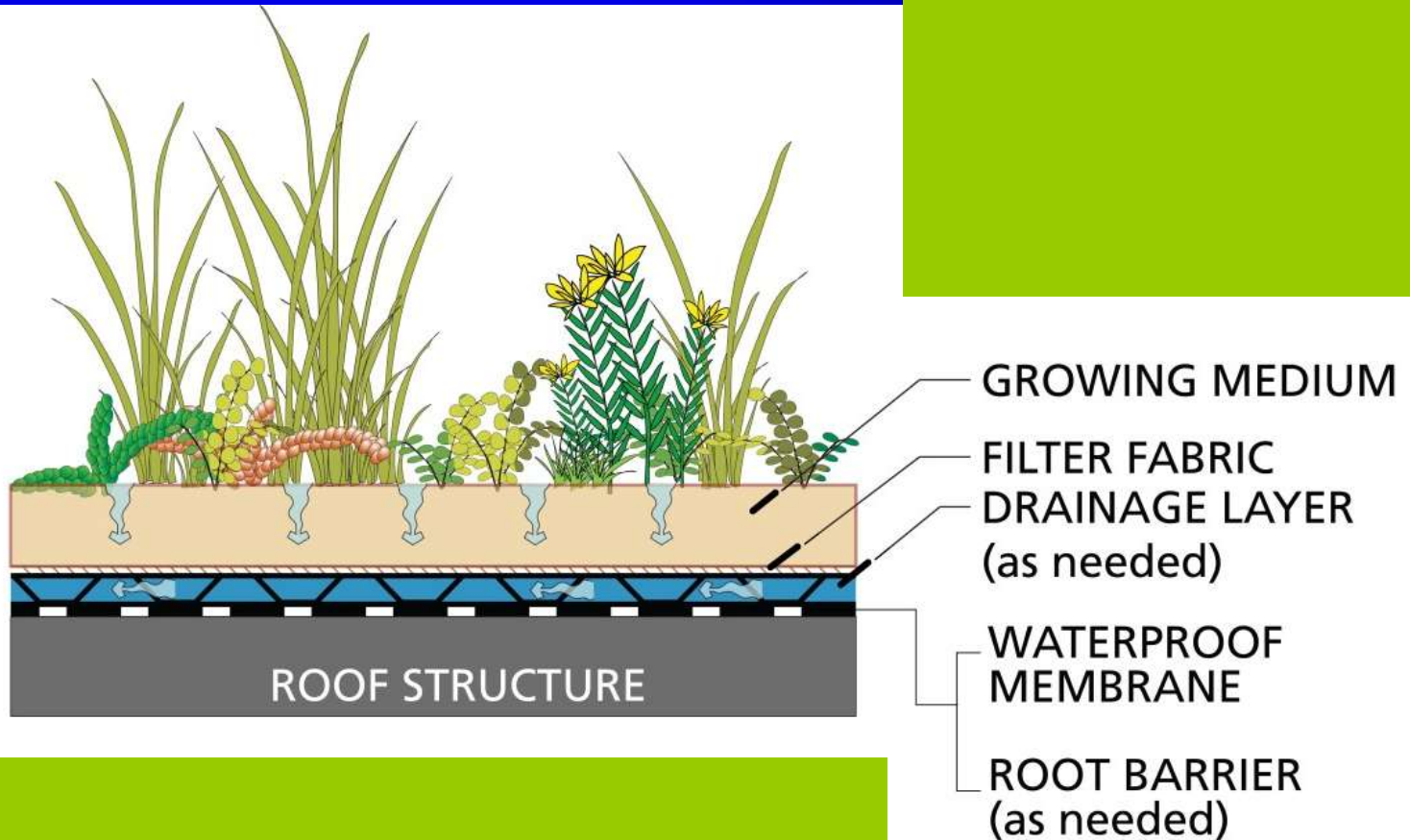
**City Map of 120+ Ecoroof Locations as of  
December 2006**





# Ecoroofs

- Green Roofs
- Roof Gardens





# Ecoroofs - Hamilton Apts





# Multnomah County Building before Ecoroof





# Multnomah County Building Ecoroof





# Ecoroofs - Peak Flow

Facility	Monitoring Period	Size (sq ft)	Soil	Peak Flow Reduction
Hamilton Apts, West Side (Hamilton West)	4 years Jan 2002 – Dec 2005	3,700	5" heavy	<b>97%</b>
Hamilton Apts, East Side (Hamilton East)		3,800	3" light	<b>95%</b>
Multnomah County Green Roof	1½ years Jul 2004 – Dec 2005	7,000	6" light	<b>86%</b>



# Ecoroofs - Flow Volume

Facility	Monitoring Period	Size (sq ft)	Soil	Volume Retention
Hamilton Apts, West Side (Hamilton West)	4 years Jan 2002 – Dec 2005	3,700	5" heavy	<b>56%</b>
Hamilton Apts, East Side (Hamilton East)		3,800	3" light	<b>27%</b>
Multnomah County Green Roof	1½ years Jul 2004 – Dec 2005	7,000	6" light	<b>3%</b>



# Portland Building Roof – 15<sup>th</sup> floor Westside





# Portland Building Ecoroof – 15<sup>th</sup> floor Westside

















# Ecoroofs - Lessons Learned

- peak flows
  - reductions of 86–97%
- volume retention
  - annual retention as high as 63%
  - dependent on soil media
- be careful with irrigation
  - limits benefits during the summer months
  - overwatering can lead to substantial runoff



# Ecoroofs - Lessons Learned

Soil media selection must balance:

- structural load
- ability to retain runoff volume
- vegetation support
- limit the export of metals and nutrients
- performance may improve over time?



**Ecoroof Habitat and Bio-diversity**  
**Honey bee on Garage ecoroof**  
**“Hens and Chicks flowers”**





# Westmoreland Permeable Pavement Project





# Monitoring Performance of Green Solutions

- Quantify benefits to watersheds and sewer systems
- Identify design and maintenance issues
  - design variables
  - maintenance frequency / level of effort
- Quantify changes over time
  - variations with facility age, season, soil moisture







# Flow Testing





# Flow Testing

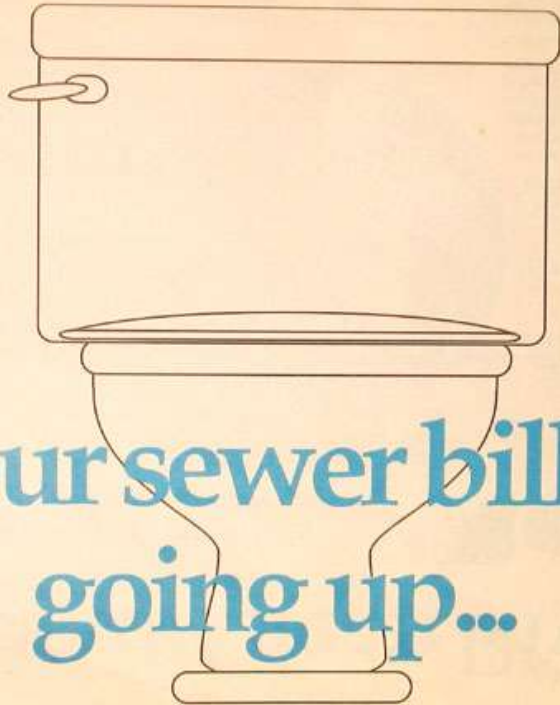




# Information and Community Outreach

- Long term public information strategy
- Transparent Process – How sewer and stormwater rate dollars are being spent
- Community involvement with decision making
- Incentives and Partnerships – Clean River Rewards and Innovative Wet Weather





Your sewer bill is  
going up...

1991



### *You're investing in Portland.*

On July 1 your sewer bill will increase from \$11.46 per month to \$14.15 per month. This \$2.75 increase is needed to maintain and improve the city's sewer system. Keeping the sewer system operating efficiently helps keep Portland a healthy and clean place to live, work and play.

### *It's a big job, but somebody's got to do it.*

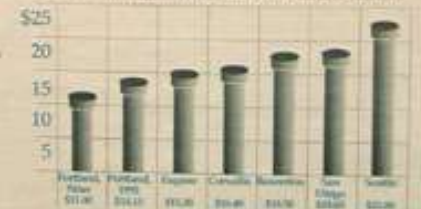
The sewer system today is made up of more than 1,000 miles of sewer line, 10 pump stations and two wastewater treatment plants. The system provides storm and sanitary sewer service to more than 300,000 residents and 11,000 commercial and industrial facilities. Portland's Bureau of Environmental Services operates, maintains and improves the system, which cleans approximately 70 million gallons of wastewater per day—enough to fill more than 3,000 backyard swimming pools.

### *After 100 years, you'd need a face lift too.*

Parts of the city's sewer system are more than 100 years old. This means that maintenance, repair and in some cases, rebuilding are needed to keep the system operating efficiently. Thirty years ago major renovations were made to the system. At that time the system was "state of the art" technology. But today, water quality standards are higher and population growth has put new demands on our sewer system. Not all of our facilities can meet these demands.

### *How we compare.*

Here's how Portland's monthly sewer rates compare with other cities. It's still the best bargain around.





**DOWNSPOUT DISCONNECTION**

# CLEAN RIVER WORKS




ENVIRONMENTAL SERVICES  
CITY OF PORTLAND

**823-5858**



**DOWNSPOUT DISCONNECTION**

# CLEAN RIVER WORKS



ENVIRONMENTAL SERVICES  
CITY OF PORTLAND

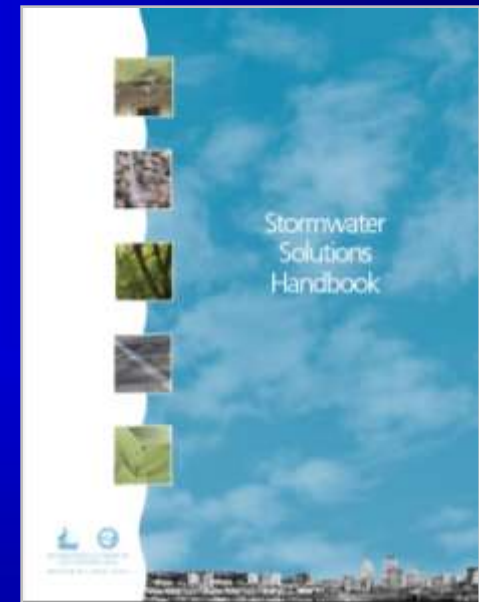
**823-5858**



# Stormwater Management Education



Stormwater Management Manual



Stormwater Solutions Handbook



# WARNING!

## Sewage

Avoid contact with river after rain.



ENVIRONMENTAL SERVICES, CITY OF PORTLAND 823-2479

QUARTERS

## PORTLAND ROCKS

The competition for volunteers started last winter. Over 2000 people signed up. It's not just what you read in the book. You can see it. An 8-page Portland Department of Environmental Services and agency partner...

after the flush



A River Renewed

REMOVE Invasive Plants

Stormwater Cycling

Is your lawn chemical-free?

## City of Portland Portland Harbor Superfund Program

STATUS REPORT

### Lower Willamette Group Activities

Members of the LWG are working under a formal consent order with the U. S. Environmental Protection Agency (EPA) and its Federal, state and Tribal partners to plan and implement the Portland Harbor Remedial Investigation and Feasibility Study (RI/FS), which is expected to be complete in late 2007.

The following is a summary of activities conducted between April 2005 and June 2005.

#### Technical Work Round 2 Sampling and Reporting

- Round 2 sampling started in summer 2004 and will continue through fall 2005. The sampling was organized into 4 phases. The information from Round 2 will be used to determine the types and distribution of chemicals in surface and buried sediments, beach sediment, surface water and gross water. Round 2 sampling also includes direct measures of current toxicity and analysis of chemicals in lower Willamette invertebrates.
- The Round 2A sampling work in 2004 and early 2005 was piloted in the Round 2A Sediment Data Report. The report contains data and posting of selected results from over 500 site locations. It was submitted to EPA in July 2005. The data is expected later this year, and in 2006.
- In preparation for Round 2B sampling in summer 2005, the LWG completed various sampling and quality assurance work in consultation with EPA and Partners.



workable other City programs, under the comprehensive framework of Portland Harbor Remediation, an integrated approach that links all activities and issues related to the Willamette River.

The City of Portland is a member of the Lower Willamette Round, a coalition of Portland Harbor business and civic agencies that is jointly managing the Round for the total state of the Superfund work. That will lead to how much and what type of contamination exists, if there are any hot spots, how far it extends from the contamination, and the best options for clean-up of the contamination. This information is ongoing and will be completed over the next few years.

In addition, the City operates about 20 monitoring or control water treatment outfalls, within Portland Harbor. The outfalls data monitor which can transport oil, metals, oil grease, bacteria, and chemicals to the river. These materials may threaten water quality and impact Willamette River ecosystems. The City is working with the Oregon Department of Environmental Quality (ODEQ) to identify and reduce sources of contamination to the downstream system and to improve the Willamette River.



# ECOROOF

**B**efore this neighborhood was developed, forest absorbed rainwater. Today, rain falls on buildings, streets, sidewalks, and other hard surfaces and runs off into the Willamette River. Stormwater runoff that isn't properly managed can wash dirt, oil, and other pollutants into rivers and streams. An ecoroof is a lightweight, low-maintenance, waterproof roof that soaks up rain, reducing runoff. Ecoroofs also help keep streets and streams healthy by cooling runoff, reducing urban heat, and removing pollutants from stormwater.

This ecoroof tank is one of five built in 2005 at Community Garden sites around Portland by community volunteers and Community Garden Staff. The tanks protect gardeners from the weather, raise awareness of storm benefits and provide a community bulletin board space.



For ecoroof information, call 503-423-7740 or visit [www.clearwaters-jobs.org](http://www.clearwaters-jobs.org).

For Portland Community Gardens information, call 503-423-7612 or email [comp@pdemilms.portland.or.us](mailto:comp@pdemilms.portland.or.us).





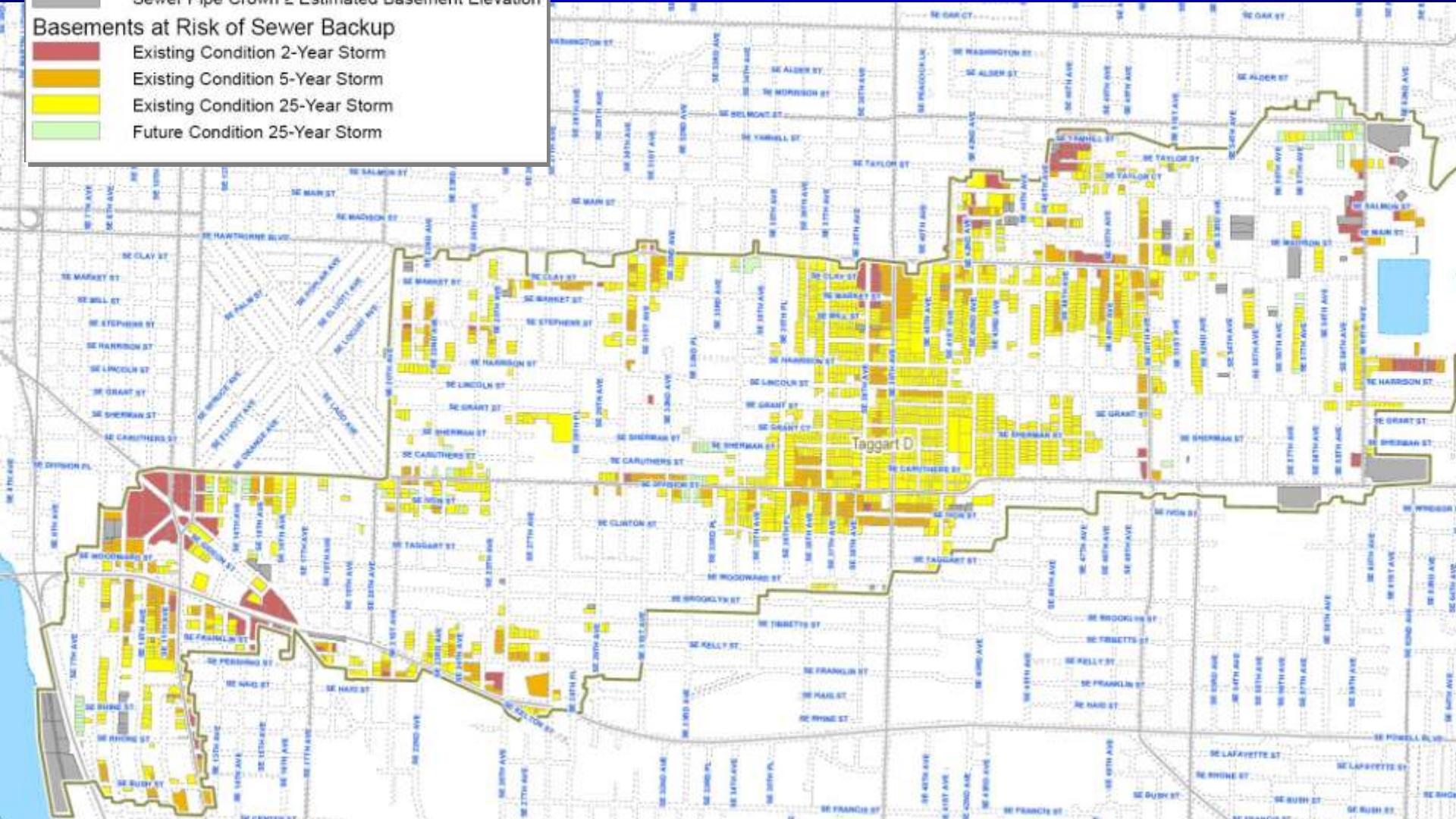
# Taggart –D Current Basement Flooding Risk Map

**Legend**

-  City of Portland
-  Combined Sewer Basin Boundary
-  Right-of-Way
-  Rivers and Lakes
-  Streams and Creeks
-  Freeways
-  Arterial Streets
-  Sewer Pipe Crown  $\geq$  Estimated Basement Elevation

**Basements at Risk of Sewer Backup**

-  Existing Condition 2-Year Storm
-  Existing Condition 5-Year Storm
-  Existing Condition 25-Year Storm
-  Future Condition 25-Year Storm

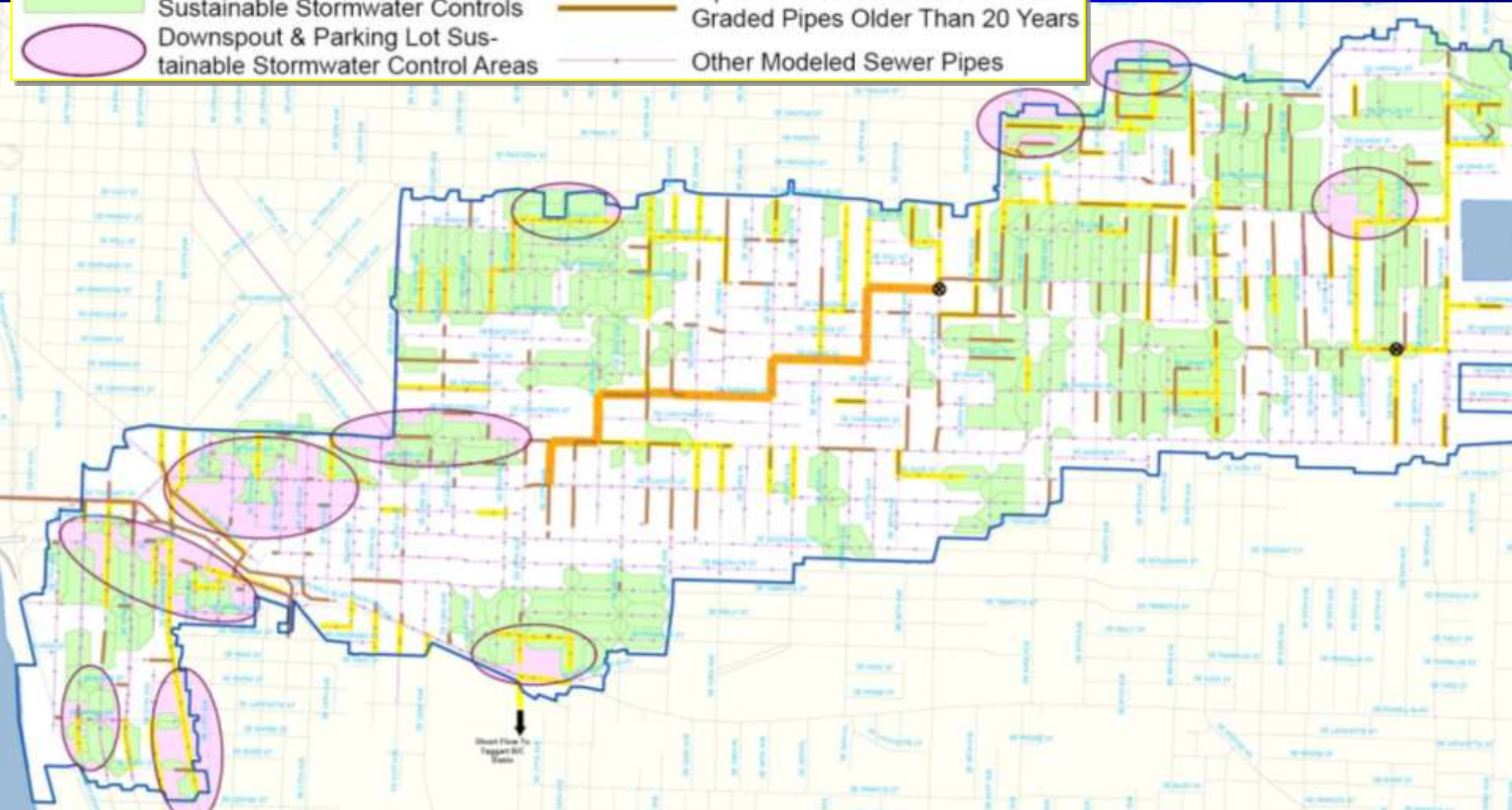




# Taggart –D Recommended Projects Overview

## LEGEND

- City of Portland Boundary
- Taggart D Boundary
- Street Drainage Area with Sustainable Stormwater Controls
- Downspout & Parking Lot Sustainable Stormwater Control Areas
- Proposed Diversions
- New Parallel Trunk Line
- New Combined Sewer Pipes
- Pipes in Poor Condition And Non-Graded Pipes Older Than 20 Years
- Other Modeled Sewer Pipes





# Working for Clean Rivers

