Sustainability & Innovation in Municipal Stormwater Management

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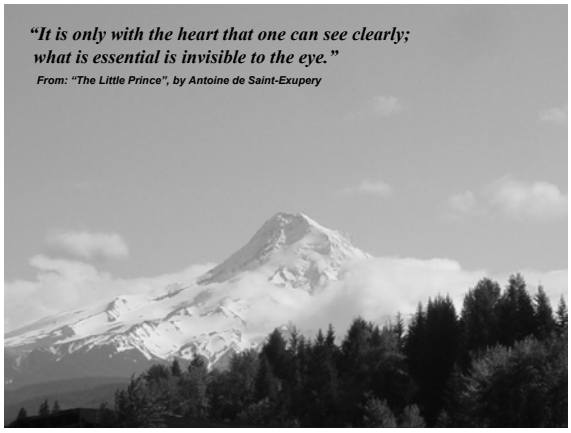
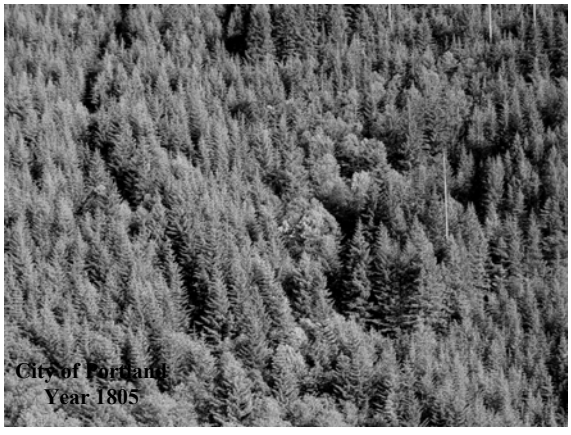
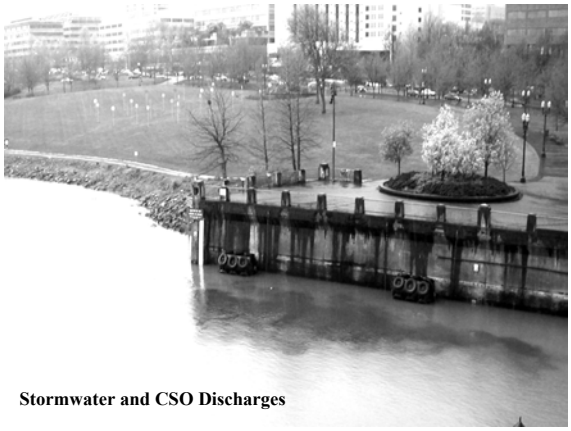


"It is only with the heart that one can see clearly; what is essential is invisible to the eye."

From: "The Little Prince", by Antoine de Saint-Exupery

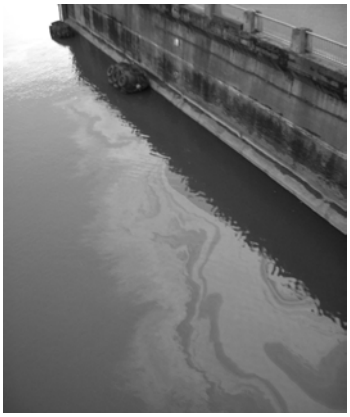


City of Portland
Year 1805

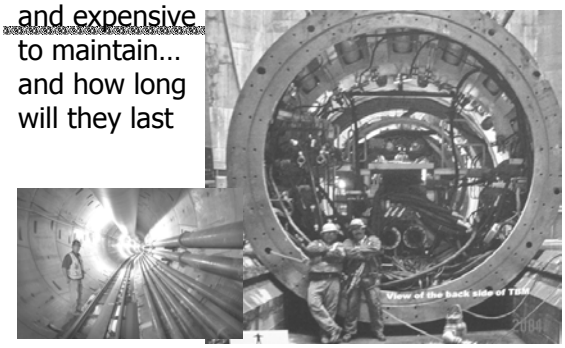


Stormwater and CSO Discharges

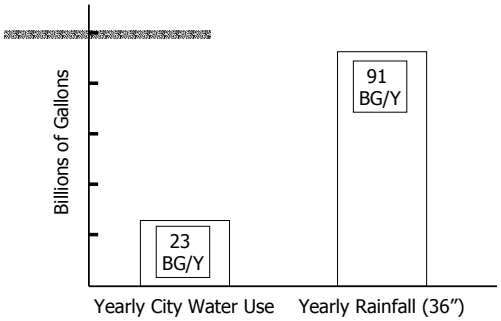
Gasoline spill downtown floats on river surface for several miles down-stream



CSO tunnels are expensive to build ~ Portland's $1.4 Billion, and expensive to maintain… and how long will they last



Water Use and Rainfall



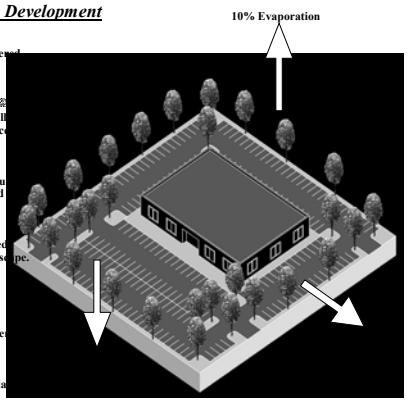
California Man

Sustainable Stormwater Management Techniques (landscape approaches)

1. Remove and or prevent runoff into;
   - Combined Sewer System,
   - Receiving waters
   - Municipal Stormwater System;
   - Sewer Basement Backups,
2. Reduce infrastructure and O&M;
3. Improve neighborhoods and enhance livability.

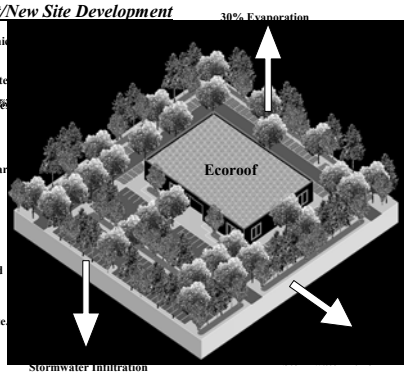
Conventional Site Development

- Site area is completely altered from pre-development conditions.
- Minimal landscape area allows few opportunities for surface stormwater management.
- Large impervious areas due to oversized parking stalls and travel lanes.
- Non-native, non-diversified plant material used in landscape.
- Underutilized roof area.
- Majority of site stormwater runoff conveyed off-site.
- Sterile environment for plants, animals, and people.



Sustainable Retrofit/New Site Development

- Site area is designed, to mimic pre-development conditions.
- Impervious paving is mitigated by reducing parking stall and travelway dimensions and use of pervious paving for overflow parking.
- New landscape areas are created (old landscape areas are expanded) allowing new opportunities for surface stormwater management.
- Ecoroof is used instead of conventional roofing.
- Native plant species are used throughout landscape areas.
- The majority or all of site stormwater is managed on-site.
- Extensive tree planting to intercept rainfall and cover impervious surfaces.



Dollars and Sense – ?
Stormwater Discount based on application of Sustainable Stormwater Management Techniques (ssmt)

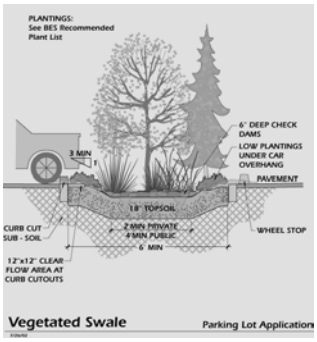
Conventional Site Design – no ssmt
Impervious surfaces = 78,000 sf x $0.08892 = $6940
(20,000 sf roof, 58,000 sf asphalt and concrete)
Landscaping = 10,000 sf (no fee)
Annual Stormwater Drainage Fee = $0.08892 x 78,000 = **$6,940**

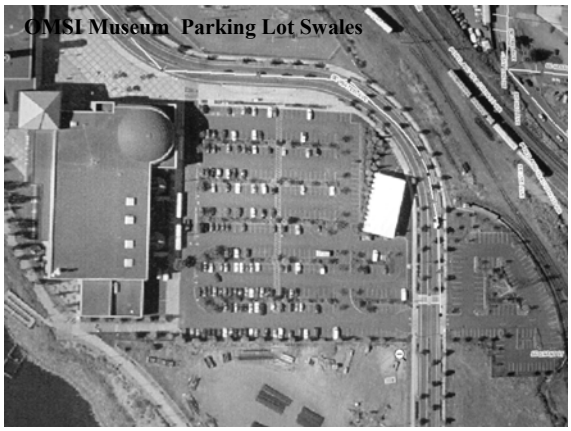
Sustainable Site Design – with ssmt
Impervious surfaces = 10,000 sf x $0.08892 x .65 = $580
Landscaping = 20,000 sf (no fee)
Ecoroof = 20,000 sf x $0.08892 x .65 = $1,155
Porous Paving = 38,000 sf x $0.08892 x .65 = $2,195
Annual Stormwater Drainage Fee = **$3,930**

Above cost estimates are preliminary

Landscape swales, infiltration gardens flow through planters for new or retrofits projects.

This is the basic approach that can be adapted to almost any site



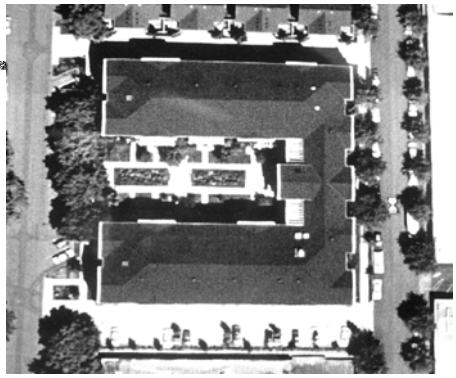

OMSI Museum Parking Lot Swales


OMSI Museum Bio-swales
1992


OMSI Museum
Bio-swales, constructed 1992
Under ODOT brdge

OMSI Museum Bio-swales
Saved $78,000

Buckman Heights Apartments



Buckman Heights Apartments – Infiltration garden

Buckman Heights Apartments Infiltration Gardens

Buckman Heights Apartments

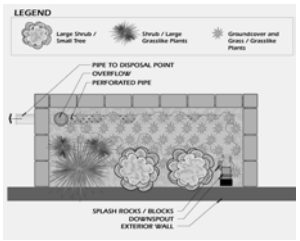
Buckman Heights Apartments
Parking lot infiltration landscape

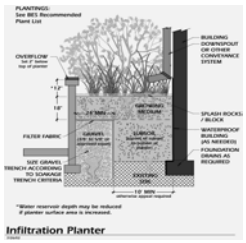
Buckman Heights Apartments parking lot curb cuts

City On-site Stormwater Management Requirements and Landscape Standards result in cost effective land utilization and reduce drainage fees.

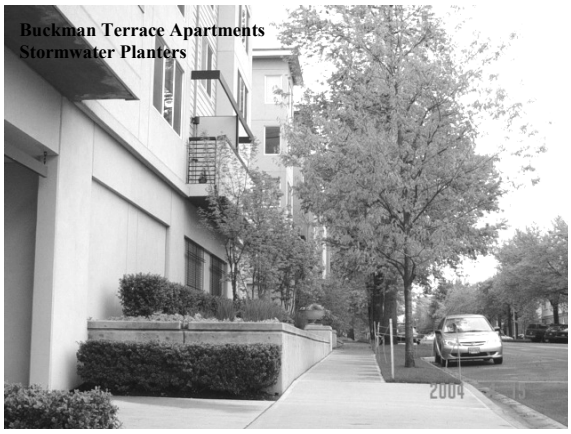
New Approaches:

Using Landscape Techniques to filter, detain, retain, cool, use, re-use, prevent and infiltrate runoff






Buckman Terrace Apartments


Buckman Terrace Apartments
Stormwater Planters

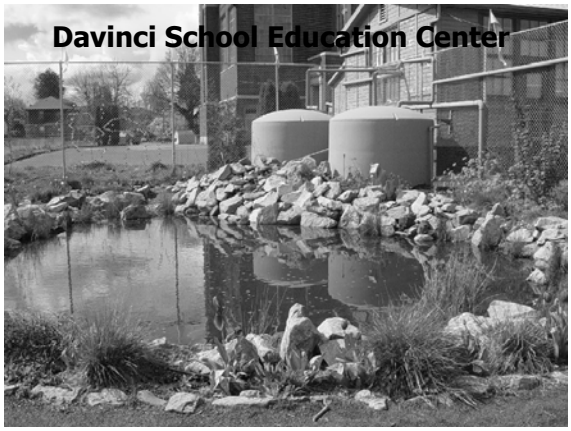

Oregon Convention Center

Oregon Convention Center
Stormwater Feature and Management

Oregon Convention Center
Stormwater Feature and Management

Parking Garage retrofit to infiltrate stormwater

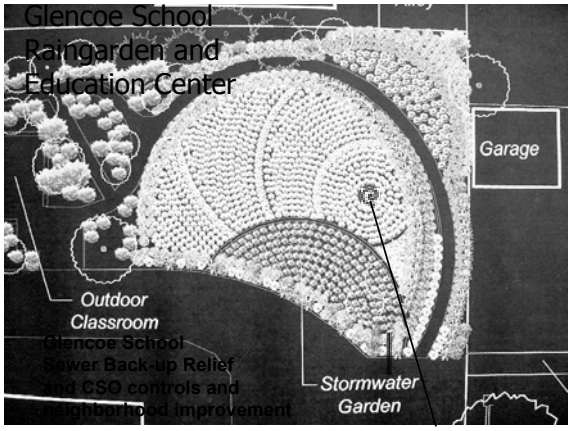
Davinci School Education Center



Glencoe School Parking Lot retrofit - before

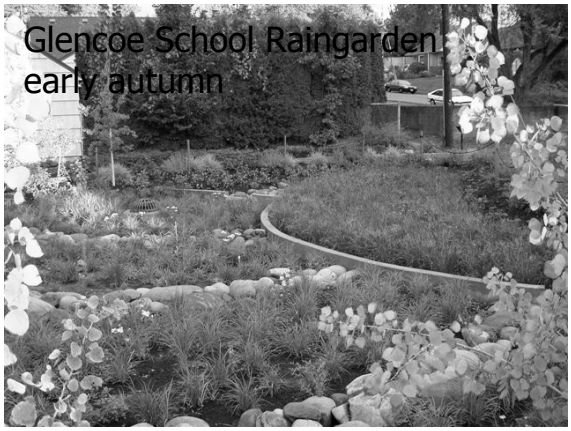
Glencoe Parking Lot – landscape planter/swale

Glencoe School Raingarden and Education Center

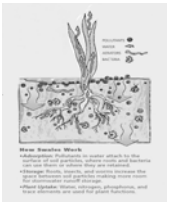


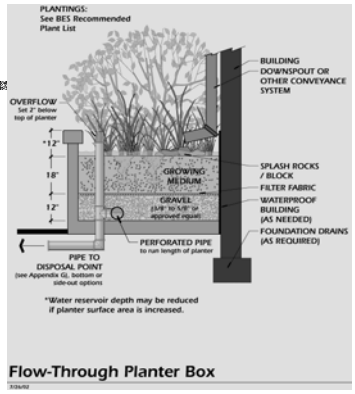
Glencoe School Raingarden Simulated storm test

Glencoe School Raingarden early autumn



Manage,
Use and Re-use

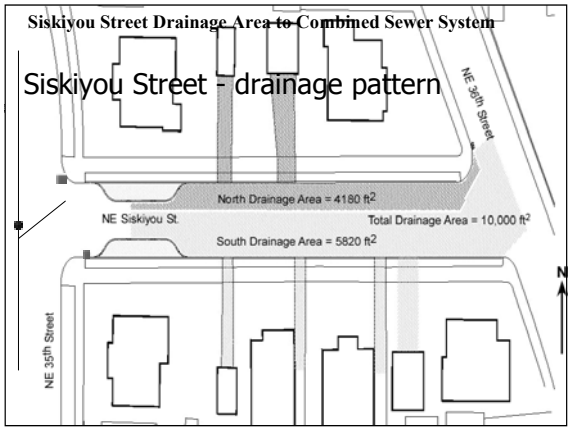




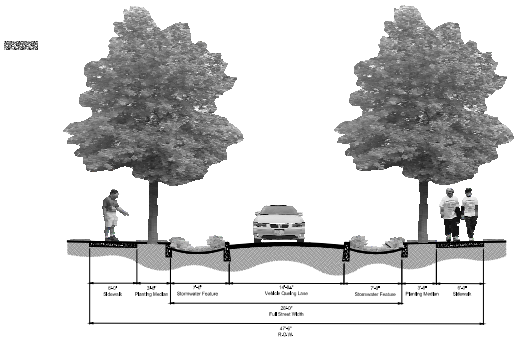
Portland State University
Stormwater planters and runoff reuse

NE Siskiyou Green Street

Existing conditions looking east



NE Siskiyou - Green Street

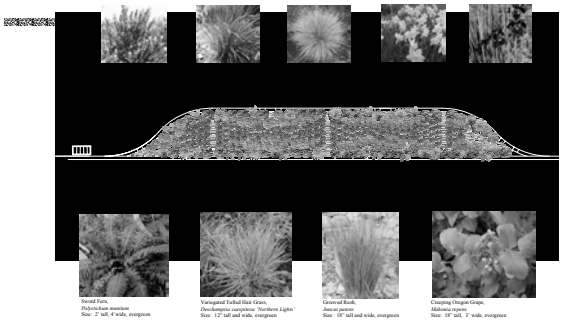


Drawn by: Kevin Perry

NE Siskiyou Green Street ~ *The Woodland Garden Option*

Accent Perennials & Bulbs

(20% of landscape area)




NE Siskiyou - Green Street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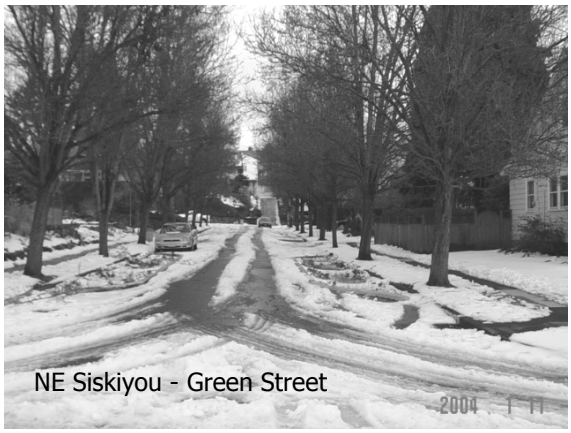
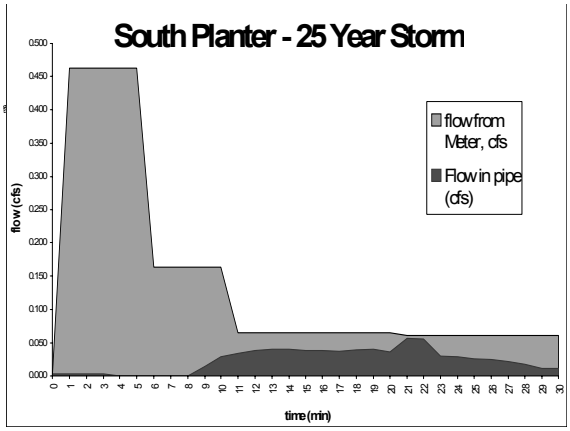
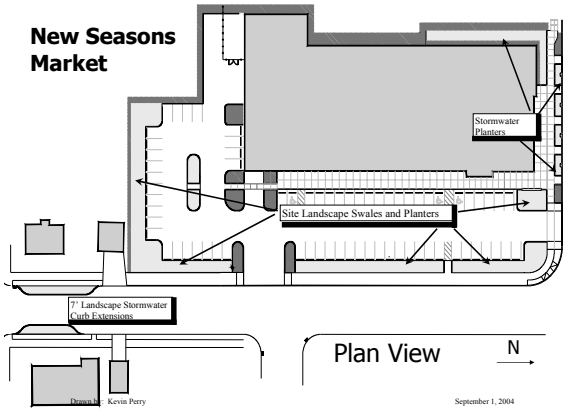


NE Siskiyou - Green Street

NE Siskiyou - Green Street


Fire Hydrant Hose Tests
conducted on demo projects


South Planter - 25 Year Storm
flow from Meter, cfs
Flow in pipe (cfs)
flow (cfs)
time (min)

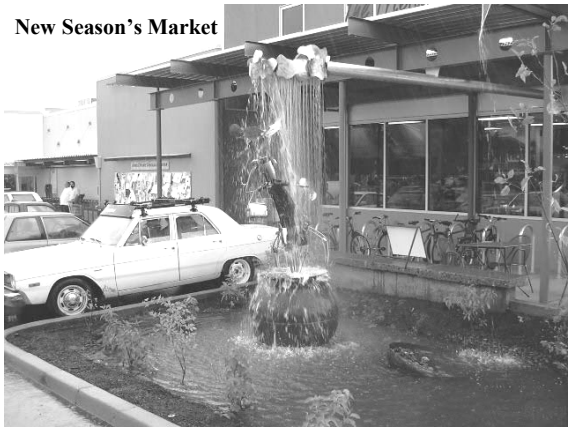


SUSTAINABLE STORMWATER SOLUTIONS

SE 20th Avenue & Clinton

Community Awareness

New Season's Market



Integrated stormwater with landscape

Commercial Street

SE Division Street

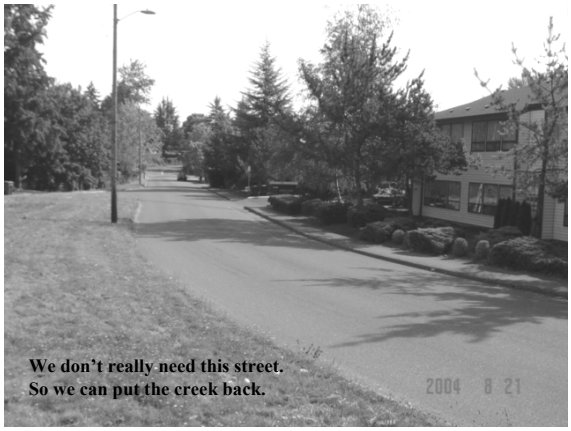
Landscape Planters in sidewalk area take Street runoff. Commercial/Retail zone

Newly Planted stormwater Planters

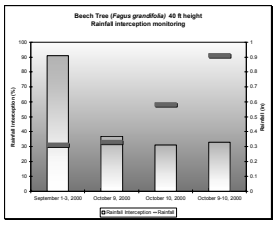

SW 12th Ave Stormwater Planters

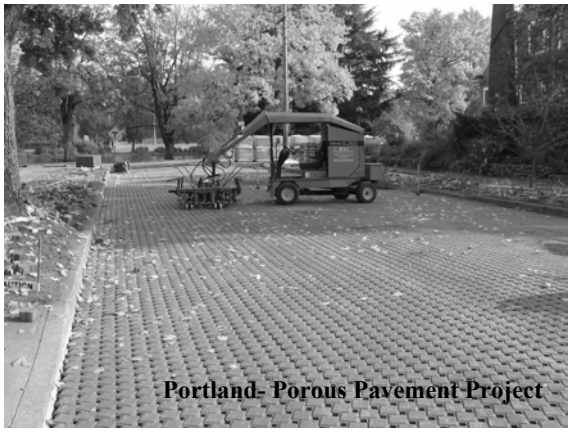

Tryon Creek
Headwaters Project


THE HEADWATER



Portland
Environmental Services
Rainfall Interception
Test Tree

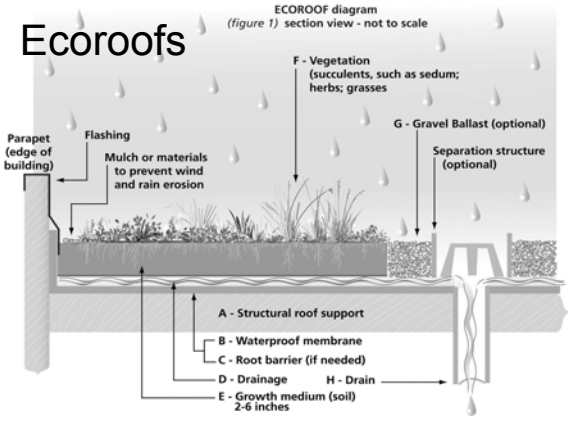


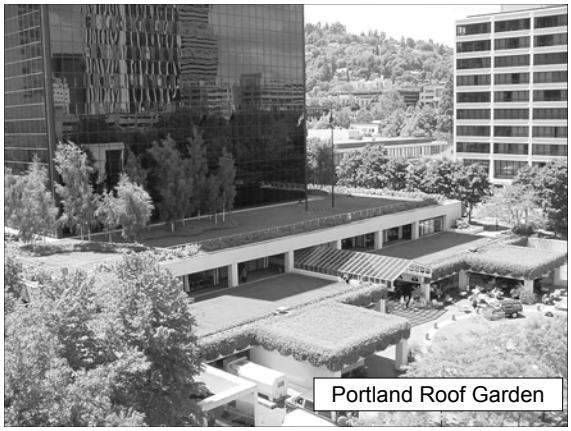


Portland- Porous Pavement Project

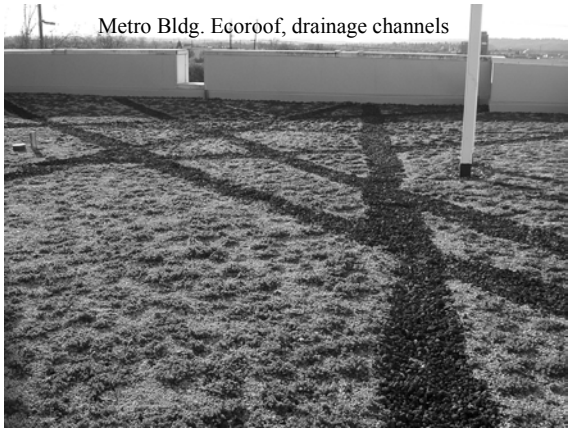
Pervious pavers at ONRC (5825 N. Greeley)

Ecoroofs

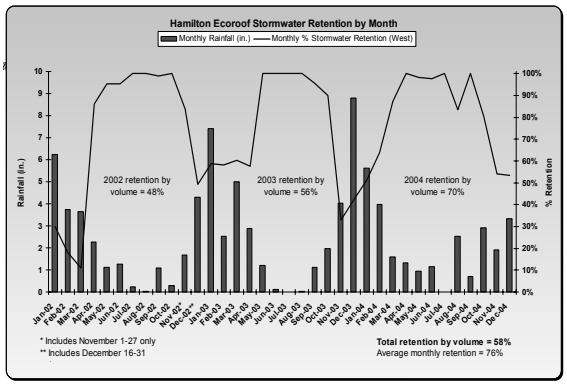



Portland Roof Garden

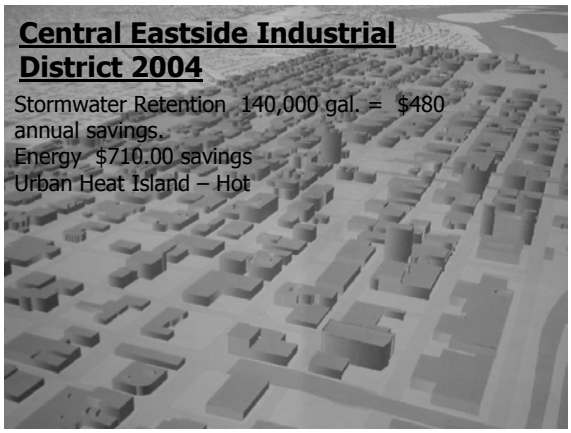
Multnomah Building Ecoroof July 2003



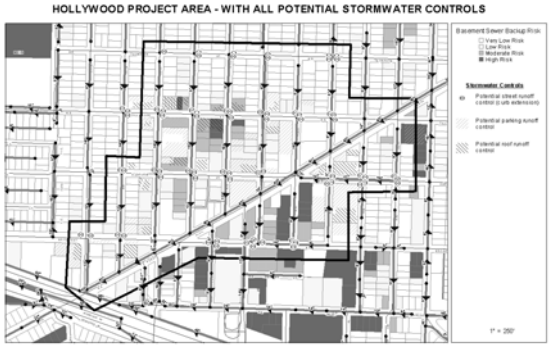
Stormwater Retention



Central Eastside Industrial District Ecoroof Study



Hollywood District: Can we fix undersized systems without replacing them…



Hollywood District: Pipe and Landscape

Pipe Replacement Approach:
CIP project in this 20+ block area to eliminate basement sewer back ups. The current plan would replace existing pipe, upsizing from 8" to 12".

Preliminary pipe costs are $4.5 million

Landscape Approach: $2.55 million

Smart Business ?