

# Portland Parks & Recreation (PP&R)

## Natural Resource Program

### Eastside Field Office

5701 SE 86<sup>th</sup> Street at Foster Road

#### Project Summary

<b>Project Type:</b>	Commercial/residential stormwater retrofit - demonstration project
<b>Technologies:</b>	Landscape swales, landscape infiltration basin, vegetated filter, and downspout disconnections
<b>Major Benefits:</b>	<ul style="list-style-type: none"> <li>Runoff from 14,000 sq. ft. of impervious roof and parking lot surface has been removed from the combined sewer.</li> <li>The stormwater facilities remove more than 314,000 gallons of runoff from the sewer in a typical rain year, with corresponding reductions in runoff pollutants.</li> <li>More than 6,200 sq. ft. of native landscaping was added, improving the urban environment and the aesthetic appeal of the property.</li> </ul>
<b>Cost:</b>	\$55,183 (unit cost of \$ 3.94 per sq. ft. of impervious area managed). Environmental Services granted \$30,000 for the project through the Willamette Stormwater Control Program <sup>1</sup> .
<b>Constructed:</b>	Summer 2002

#### Overview of the Stormwater System

- Runoff from the 4,200 sq. ft. warehouse roof discharges to a landscape infiltration basin on the west side of the property.
- Runoff from 2,000 sq. ft. of parking area (and brick patio) also drains to the landscape infiltration basin on the west side of the property.
- Three downspouts drain runoff from the 1,015 sq. ft. residential office roof to shallow landscape basins. There are two basins in front of the building and one in the back.
- Runoff from 1,000 sq. ft. of re-graded asphalt on the east side of the property drains to shallow landscape basins at the front of the office and warehouse.
- Almost 6,000 sq. ft. of asphalt was replaced with pervious surface areas (landscape and gravel).



**Aerial view of the PP&R field office, 2002, prior to project construction.**

<sup>1</sup> Portland's Bureau of Environmental Services implemented the Willamette Stormwater Control Program in 2001. The Program offered financial grants and technical support for a series of projects to retrofit existing commercial properties with stormwater controls incorporating green technologies. The Program recruited these demonstration projects in order to research the feasibility, cost and performance of commercial stormwater retrofits in the area served by the combined sewer. The Program provided grant funds for a total of eleven projects. The projects were completed by July 1, 2003.

## Stormwater Capacity and System Components

### Stormwater Management Goal

The stormwater management goal was to meet the Bureau of Development Services (BDS)<sup>2</sup> standards for stormwater disposal. In 2002 the disposal standard was to infiltrate at least 3 in. of runoff in 24 hours (the size of the 10 year design storm). All design standards cited in this report were current in 2002.

### Geotechnical Evaluation/Infiltration Test

City staff did not require site-specific infiltration tests - local drainage characteristics had been adequately documented by other projects in the vicinity. The Natural Resources Conservation Service (NRCS) soil survey for Multnomah County classifies the soils as 50A - Urban Land/Multnomah Complex. The survey indicates the soils typically have been disturbed and mixed with fill material. The predicted infiltration range is 0.6 – 2.0 in. per hour.

### System Components

#### **Landscaped Infiltration Basin**

(See [Site Plan](#) for details; Figure 1, pg. 9)

*Catchment Area:* 6,500 sq. ft. (warehouse roof and asphalt)

*Facility footprint*<sup>3</sup>: 630 sq. ft.

*Internal Volume:* 850 cu. ft.

*Overflow:* The facility does not have a piped overflow; it will fill to a depth of approximately 3 ft. before overflowing to a gravel area in the southwest corner of the property (formerly the site of the demolished garage).

*Capacity:* The facility is larger and provides substantially more capacity than the eastside soakage trench<sup>4</sup> required by the Stormwater Management Manual for a similar catchment (the soakage trench would have a footprint of 360 sq. ft. and a volume of 378 cu. ft.).

*Additional Information:*

- The basin is 45 ft. long, 14 ft. wide, and 3 ft. deep.
- It is located behind the office along the west side of the property. A 5-ft. buffer separates the facility from the property line.



Street-front view of the Parks Eastside Field Office - just after planting; 2002



Prior to the project - view from the back of the property toward the entrance; warehouse is on left; 2002



Prior to the project - entrance view of the warehouse; 2002

<sup>2</sup> BDS is responsible for developing standards for stormwater disposal and inspecting projects to confirm compliance with those standards.

<sup>3</sup> For the purpose of comparing the capacity of the facility with the standard eastside soakage trench, the footprint has been calculated as the wetted (ponded) surface area when the facility reaches maximum capacity.

<sup>4</sup> The standard eastside soakage trench meets the City's standard for complete stormwater disposal in soils, which infiltrate at least 2 in. per hour. The City requires 24 ft. of trench per 1000 sq. ft. of impervious area (drainage catchment). The trench is 3 ft. deep, 2.5 ft. wide, and filled with drainage rock. Flow enters the trench through a pervious pipe that travels the length of the top of the trench. Assuming a porosity of 35%, the trench provides an internal volume of approximately 63 cu. ft. per 1000 sq. ft. of catchment.

### Shallow Landscape Infiltration Basins

- There are 4 shallow landscape depressions that capture and infiltrate runoff. They are typically 6 inches deep.
- The areas occupy a total of 1,500 sq. ft. of landscape.
- The three shallow landscape areas along the east side of the property together manage runoff from 750 sq. ft. of office roof and approximately 1,000 sq. ft. of adjacent asphalt.

### Warehouse Rain Drains

- Fifty lineal ft. of ABS pipe (4 in. diameter) was installed along the ceiling of the warehouse. The new pipe collects runoff from the warehouse roof and conveys it to the south wall of the building.
- Runoff is piped through the south wall of the building and down the exterior, discharging to the landscape infiltration basin.

### Office Downspout Disconnections

- Three simple downspout disconnections drain 1,500 sq. ft. of office roof.
- Simple residential-type drain rock helps convey roof runoff to 3 shallow landscape infiltration areas, one behind the office and 2 in front.

### Removal and Replacement of Asphalt

A contractor removed all of the existing asphalt (8,500 sq. ft.). Part of the asphalt was replaced – a total of 2,500 sq. ft. – and graded to direct runoff into the landscape infiltration areas.

### General Landscaping

- The landscaping includes mostly native plants - trees, shrubs, grasses, and wildflowers selected for their tolerance to dry and moist soil conditions.
- In some upland areas - outside the facilities in front of the office building - prairie grass plugs and seed were planted as an alternative to a standard lawn.
- Trees and shrubs were placed in strategic locations to help reduce the seasonal heating and cooling needs for the building.
- All of the soils in the landscaped areas were ripped to a depth of 2 ft. using a standard soil tiller.
- Over 75 cu. yd. of clean fill was imported to grade the landscape areas as basins. The imported soil consisted of a blend of composted (weed free) yard debris and soil.
- Immediately after excavating the large infiltration basin, standard turf sod was installed on the floor of the facility as a substrate for seeding wetland plants. A herbicide, glyphosate, was applied to kill the grass before seeding.



Prior to planting - landscape infiltration area on the NE corner of the property; 2002



Graded landscape infiltration basin - west side of property; 2002



Construction of lined swale draining runoff from warehouse downspout to infiltration basin; 2002



Preparing landscape in front of the offices for planting; 2002

### **Vegetated Filter Strip**

The east side of the main landscape infiltration basin was designed as an evenly-sloped filter strip with the purpose of filtering and slowing runoff (as sheet flow) from the parking lot. The area has not functioned as designed: runoff from the parking lot concentrates into a couple of flow paths rather than spreading throughout the strip.

### **Emergency Overflow**

There are no emergency overflow pipes. If the landscape facilities reach capacity, they will safely overflow into adjacent landscaped or paved areas.

### **Irrigation**

Temporary soaker hoses will be used to irrigate the plants during the two-year establishment period. Because the landscape is comprised of native plant species adapted to regional climate conditions, supplemental summer irrigation will typically not be required after they are established.



The landscape infiltration basin on the west side of the property just after planting; 2002



Another shot of the basin just after planting - note that the side of the basin next to the pavement was designed as a filter strip for pavement runoff



The basin after rain; 2003



The basin in October 2004; Lupin has become the dominant plant species

## Budget

Portland Parks and Recreation (PP&R) submitted a total budget of \$55,183 including management, design, and construction. The final budget is shown below.

<b>Portland Parks and Recreation Budget Summary</b>			
<b>Item</b>	<b>Item Cost</b>	<b>Volunteer Effort</b>	<b>Total Cost</b>
<b>Project Design, Project Management &amp; Construction Management (unpaid labor)</b>		\$6,951.00	<b>\$6,951.00</b>
<b>Demolition, excavation, grading:</b>			<b>\$ 13,800.00</b>
Remove asphalt & partially remove sub-base (8,300 sq.ft.)	\$ 13,000.00		
Excavate stormwater management facilities	\$ 600.00		
Demolish structure (500 sq.ft.)	\$ 200.00		
<b>Construction</b>			<b>\$ 11,842.83</b>
Asphalt re-surface [2,500 sq.ft.]	\$ 7,912.00		
Re-plumb warehouse roof drains	\$ 3,000.00		
Modify office downspouts (downspout disconnect)	\$ 642.40		
Misc.hardscaping (lumber, pavers, etc.)	\$ 288.43		
<b>Landscaping (6,200 s.f.) :</b>			<b>\$ 21,510.95</b>
Plant material (trees, shrubs, seed, groundcover)	\$ 4,823.00		
1 cu. yd. 1/4 in. minus gravel & bark mulch	\$ 34.50		
Misc. planting material (sod, fabric, etc.)	\$ 157.35		
Drain rock (downspout disconnect)	\$ 54.20		
10 cubic units (75 cu. yds.) Compost/soil blend	\$ 1,352.25		
Erosion control (straw, plastic, etc)	\$ 550.00		
Irrigation (hose bibs & soaker hoses)	\$ 1,132.41		
<b>Subtotal</b>	<b>\$ 8,103.71</b>		
<b>Unpaid Volunteer Labor</b>			
Installation - volunteers (\$10/ hr)		\$ 1,206.00	
Installation - PP&R staff (\$49/hr)		\$10,995.24	
<b>Subtotal</b>		<b>\$ 12,201.24</b>	
<b>Permitting:</b>			
Permit - Planning/Zoning/Landuse	\$ 1,077.84		<b>\$ 1,077.84</b>
<b>TOTAL</b>	<b>\$ 34,824.38</b>	<b>\$ 19,152.24</b>	<b>\$55,182.62</b>

### I. Budget Elements

#### **Non-Construction Activities**

The cost for management, design, and permitting was \$8,029, comprising or about 15% of the budget. PP&R staff provided 140 hours of unpaid volunteer services for design, project and construction management, as well as permit submittals.

- **Management and Design**

Management (for the overall project as well as construction) and design was \$6,951, comprising 12% of the budget.

- **Permitting**

The Site Development Permit cost \$1,077, comprising 2% of the total budget. The staff cost for coordinating the submittal and resolving permitting issues is included in the management costs.

### **Construction Activities**

Demolition, excavation, construction, and landscaping costs were \$47,154, comprising 85 % of the budget.

- **Demolition, Excavation, and Grading**

The activities cost \$13,800 (25% of the budget), including removal of 8,500 sq. ft. of asphalt. Also included was the removal and re-grading of the 6-in. sub grade. A licensed contractor removed the asphalt; Parks staff did all other demolition work, including removal of a 500 sq. ft. garage on the southwest corner of the property.

- **Construction**

Construction cost \$11,843, comprising 21% of the budget. The work included disconnection of three office downspouts, re-plumbing the internal rain drains of the warehouse, installation of walkways (flagstone pavers and brick paths), and asphalt re-paving. A contractor did the asphalt work.

- **Landscaping**

The project added 6,200 sq. ft. of new landscaping (about 40% of the surface area of the site). The cost for landscaping was \$21,511, including plant material, imported clean soil, and over 300 hours of volunteer labor valued at \$13,407. The average unit cost for landscaping was \$3.59 per sq. ft. including the volunteer labor and temporary irrigation materials.



Disconnected downspout on the front of the office building; spring 2004



Wildflowers in bloom; 2004

## **II. Cost Components**

### **Pavement**

- Asphalt removal and re-grading was the largest single cost, comprising almost 40% of the budget.
- The unit cost of removing and exporting asphalt was \$1.50 per sq. ft., including removal and some re-grading of the 6 in. gravel sub-base.
- The unit cost to install 2,500 sq. ft. of asphalt was \$3.16 per sq. ft. (not including sub grade)

### **Landscaping**

- Many trees were larger than required by the City (in 2002 the City required minimum diameters of 1.5 in. to 3 in.).
- One-third of the new landscape was not associated with the stormwater facilities.

- Over 75 cu. yds. of clean topsoil was imported to re-grade the site. The clean soil was more costly than recycled topsoil, but the designer specified it to help minimize the introduction of undesirable invasive weed species.
- Native grasslands were selected for the upland areas because they are deep rooted, require no supplemental irrigation, and provide habitat for a variety of insects including pollinators. PP&R installed plugs of three native perennial bunchgrasses as well as seeds and plugs of 14 species of native wildflowers. Plugs are typically more expensive and require more labor to plant than seeds, but they tend to have a higher success rate than many seeds and produce a high quality cover of diverse species.
- Although installation costs were relatively high, the planting approach for the upland areas should require less maintenance and watering than other landscapes, and be aesthetically pleasing quickly.



Recently planted landscape infiltration area in front of the office building - note flow path on asphalt driveway.

### Design

Design costs were relatively low in part because engineering services were not required. The project did not include structural elements; it was designed by a PP&R staff person with a landscaping contractors license.

### Plumbing

There were few plumbing modifications with the exception of re-directing the warehouse roof drains to the landscape infiltration basin. No overflow pipes were required for the basin system: it is large enough to capture and infiltrate all of the runoff from the warehouse roof and the adjacent parking lot.

## **III. Cost Comparisons**

This project is an example of a fairly complex retrofit project. While adequate space existed for landscape infiltration areas, creating the areas and delivering runoff to them required some substantial modifications. The most significant changes were re-grading and removing existing pavement.

Similar private sector projects might cost less. Although a private contractor installed the new pavement, all other construction and planting was performed by City staff. The staff provided much of their work free of charge, but the project budget includes their effort at almost \$50 per hour (their normal billable rate). The residential portion of the work – simple downspout disconnections to landscape infiltration areas – was inexpensive when compared to other project components.

## **Maintenance and Monitoring**

PP&R is responsible for the facility and its maintenance. Environmental Services and PP&R will monitor the performance of the facilities at the PP&R field office for at least five years. Confirming the hydraulic performance of the facility will be a primary focus. Environmental Services will also regularly evaluate the effort required to maintain the facility and the success of the planting regime.

## Successes and Lessons Learned

Design - This project is a good example of a site retrofit with a mix of simple components (downspout disconnections, excavated shallow landscape depressions) and more complex components (re-plumbing of roof drains, asphalt re-contouring). The components clearly demonstrate to both the residential homeowner and commercial property owner the different ways a site may be assessed and retrofitted for stormwater management.

Oversight of Asphalt Work – The project manager suggested that the project might not have been successful had he not provided extensive oversight during installation of the asphalt. His chief concern was producing the relatively subtle slope needed to convey runoff into the landscape facilities. The success of similar projects is expected to require the same degree of oversight.

Vegetated Filter Strip– The vegetated filter strip along the edge of the parking lot (west side of property) was designed to slow and filter sheet-flow entering the landscape infiltration basin from the adjacent parking lot. In practice the runoff concentrates into one or two flow paths; the result illustrates the challenges associated with achieving the grades required for filter strips in similar situations.

### Landscaping

In 2004 the PP&R staff observed that the landscape facilities are less frequently ponded with runoff – monitoring is needed to confirm if infiltration rates have improved.



