Barrington Square Apartments

7123 SE Powell Boulevard, Portland

Project Summary

Project Type:	Commercial stormwater retrofit – demonstration project
Technologies:	Landscape infiltration basin; mini soakage trenches; simple downspout disconnections (to splash blocks).
Major Benefits:	• Runoff from more than 16,500 sq. ft. of roof (5 apartment buildings) has been removed from the combined sewer. • The stormwater facilities remove more than 350,000 gallons of runoff from the sewer in a typical year, with corresponding reductions in runoff pollutants. • Approximately 5,600 sq. ft. of native landscaping was added, improving the urban environment and the aesthetic appeal of the property.
Cost:	$71,200 (unit cost of $4.30/sq. ft. of impervious area managed). Adjusting for a project component that was not essential – replacement of the entire gutter and downspout system - the estimated total cost was $54,200 or $3.25/sq. ft. BES provided a $30,000 grant for the project.
Constructed:	Spring 2002

Project Background

The owner of the Barrington Square Apartments was making plans to replace the gutters and downspouts at the complex when he received a brochure regarding the Willamette Stormwater Control Program[1]. He subsequently hired a landscape architect to develop a proposal to disconnect the apartment roofs from the combined sewer. He viewed the project as an opportunity to increase the aesthetic appeal and commercial value of his property while reducing impacts on the combined sewer system. He also anticipated potential savings on his stormwater rates. BES accepted his project proposal in May 2001.

Barrington Apartment Complex, 2001

[1] 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 July 1, 2003.

Project Scope

- Replaced all of the gutters and downspouts.
- Disconnected the downspouts from the combined sewer system.
- Hand dug approximately 350 linear ft. of mini soakage trench (this eliminated potential damage to the property by heavy equipment).
- Constructed 3 landscaped infiltration basins.
- Installed 13 subsurface mini catch basins.
- Installed subsurface ABS pipes to link all of the stormwater management facilities.

Mini soakage trench surrounding the pool (note plantings along edge); 2004

Notable Features

- The designer did an excellent job of integrating the landscape facilities into the existing layout of the property, taking advantage of the space around the pool deck and stairwells.
- The design successfully provides complete on-site disposal (infiltration) of runoff by linking a number of stormwater facilities, some of which are too small by themselves to serve the area that drains to them.

Landscape infiltration basin under stairs; 2004

Project Design

The property owner hired Landesign Associates, a local landscape architecture firm, to design the project. The firm was responsible for all phases of the project including design, layout, and construction management.

Courtyard with landscape infiltration basins around edges and under stairs; 2004

<u>Overview of the Stormwater System</u>

(See site plan for drainage details, page 10)

- Approximately 6,780 sq. ft. of roof surface from buildings on the north half of the property drain to a system of mini soakage trenches surrounding the swimming pool (Area I).
- Runoff from an estimated 4,700 sq. ft. from buildings on the south side of the courtyard drain to two linked landscape infiltration basins (Area II).
- The southern halves of the two buildings along Powell Boulevard, approximately 2,300 sq. ft. of roof, drain to mini soakage trenches in the landscape (Area III).
- Runoff from over 2,700 sq. ft. of roof area drains to a combination infiltration basin/trench on the east side of the property (Area IV). This area also serves as the terminus for the entire linked system around the courtyard and pool.

Capacity and System Components

I. Introduction

The overall stormwater management goal was to meet the Bureau of Development Services (BDS)[2] standards for stormwater disposal. When BDS approved the project in 2002, the disposal standard was to infiltrate at least 3 in. of runoff in 24 hours (approximately the size of the 10 year design storm). All design standards cited in in this report were current in the year 2002.

A site-specific infiltration test was not required for this particular project; local drainage characteristics had already been documented by other projects in the vicinity[3]. The Natural Resource Conservation Service (NRCS) Soil Survey for Multnomah County classifies the local soils as moderately well-draining silty loams (type B hydrologic group). The Survey lists an expected infiltration range of 0.6 – 2.0 in. per hour.

City staff collaborated with the designer to develop a stormwater management system that would meet capacity standards. At one point the designer considered adding drywells in order to extend the capacity of the system. However, installing drywells would have required heavy equipment with a substantial risk of damage to the walkways and other structures. To avoid this risk and provide adequate capacity, the designer successfully modified the configurations of the soakage trenches and landscape infiltration basins (from the 2002 Stormwater Management Manual) to fit the space constraints of the site.

East side of the pool deck prior to to construction of the project; 2001

Installation of Mini soakage trench next to the pool.

II. Facility Components

Gutter System

The property owner replaced all of the gutters with a covered gutter system which should substantially reduce the amount of debris entering the mini-soakage trenches and landscape infiltration basins.

East side of the pool deck just after construction of soakage trench; 2002

[2] BDS is responsible for developing standards for stormwater disposal and inspecting projects to

[3] It is common for the Bureau of Development Services to require infiltration tests prior to approving plans for infiltration facilities. Designers should contact the Bureau prior to submitting plans in order to determine the type of documentation required.

Linked Soakage Trenches and Infiltration Basins (manages runoff from all roof surfaces except those along Powell Blvd.)

(See Site Plan for drainage details, pg.10)

Catchment Area: 16,585 sq. ft. of roof

Facility footprint[4]*:* 282 sq. ft.

Estimated Internal Volume: 395 cu. ft.

Overflow: The linked stormwater system - excluding the soakage trenches along Powell Boulevard (Area III) - overflows to a landscape infiltration basin on the east side of the property. There is no pipe overflow for this landscape basin; if the system ever crests it will flow overland to Powell Boulevard.

Capacity: The measured volume of the facility)to the elevation of the pipes linking the different sections) is about 40% of the volume of the standard eastside soakage trench[5] that would be required (the trench would have a footprint of 995 sq. ft. and an internal volume of 1045 cu. ft.). In larger storms, this capacity would be substantially augmented by the "freeboard" on the facilities, which would allow them to fill well above the level of the pipes. The freeboard is the vertical distance between the surface grade and the overflow pipe elevations (that link the facilities). The volume of that additional capacity is unknown.

Excavation of mini soakage trench along SE edge of property; 2002

The trench filled with gravel and planted along the edges; 2002

Additional Information:

Mini Soakage Trenches

- The bottoms of the trenches are 8 to 15 in. wide, widening at ground level (see drawing). They average 22 in. deep.
- They are filled with 3-in. diameter river rock.
- Roof runoff enters via subsurface downspout extension pipes.
- There is a 4-in. perforated pipe that travels the length of the bottom of each trench to distribute flows.
- The trenches are linked by 3-in. ABS pipes. The pipes are approximately 6 in. below grade, allowing up to fourteen inches of ponding within the trenches.

Landscape Infiltration Basins

- The two basins under the stairs are each approximately 50 sq. ft. in area, with a ponding depth of 14 in. and 2:1 side slopes.
- The basin on the southeast edge of the property is approximately 65 sq. ft. in area with a ponding depth of 12 in. and 2:1 side slopes.
- They receive runoff from adjacent roofs and overflows from the soakage trenches.
- Runoff enters approximately 12 to 14 in. below grade through 3-in. ABS pipes.

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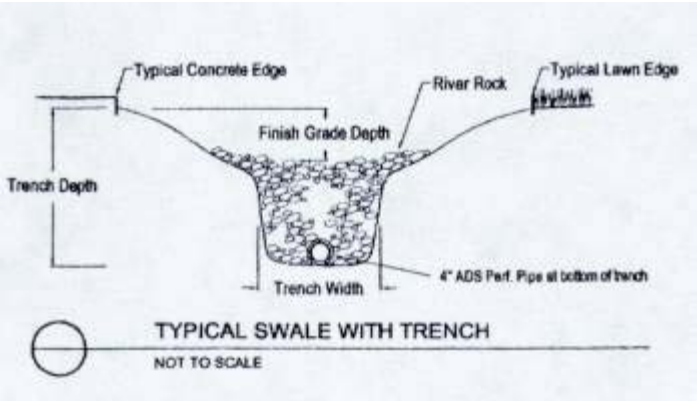
[4]For the purpose of comparing the capacity of the facility with the standard eastside soakage trench, the footprint has been calculated as the wetted (ponded) surface area when the facility reaches maximum capacity.

[5] The standard eastside soakage trench meets the City's standard for complete stormwater disposal in soils which infiltrate at least 2 inches per hour. The City requires 24 feet of trench per 1000 ft^2 of impervious area (drainage catchment). The trench is 3 feet deep, 2.5 feet 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 cubic feet per 1000 ft^2 of catchment.

- The basins are lined with 3-in. diameter river rock.
- Filter fabric was not installed in order to create better rooting conditions for the plants.

Mini Catch Basins

- Mini catch basins were installed at points where the subsurface downspout extensions enter the stormwater facilities.
- City plumbing code requires the catch basins to prevent the passage of debris and sediment.
- A removable screen captures debris and allows easy cleaning.



Cross section for mini soakage trench

Emergency Overflow Point

The linked stormwater system serving most of the roofs - excluding the south side of the roofs along Powell Boulevard - flows to a landscape infiltration basin on the east side of the property. There is no piped overflow for this landscape basin; if the system ever crests it will flow overland to Powell Boulevard.

DEQ requires simple registration of all subsurface stormwater disposal systems. See the following web-site for current information: :http://www.deq.state.or.us/wq/groundwa/uichome.htm
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Landscaping

- Approximately 5,600 sq. ft. of landscaping was added, more than half of which was previously turf grass.
- Plants are native species selected from the plant list in the BES 2002 Stormwater Management Manual (SWMM). The plants also include flowering perennials.
- The planting plan for the landscape infiltration basins does not fully meet BES' standards for inclusion of trees and grass or grass-like plants. The project did not formally trigger the requirements of the SWMM - it did not create or redevelop impervious surface.
- River rock was used as a mulch to suppress weeds, reduce erosion, and diminish the slope of the sides. The river rock also creates a more formal appearance (drawing on the aesthetic appeal of the Buckman Heights Apartment courtyard in NE Portland).

Irrigation

The project expanded the existing irrigation system to serve the newly planted areas.

Budget

The total budget for the project was $71,200 including design and construction. BES contributed $30,000 in grant funding from the Willamette Stormwater Control Program; the owner contributed the remaining amount. The following table lists the budget elements.

Task Item	Cost	Total Cost
Design		**$7,600.00**
Construction Management		**$5,600.00**
Excavation		**$19,600.00**
Landscaping		**$19,000.00**
Plant material	$7,700.00	
Plant installation	$4,300.00	
River rock	$4,600.00	
Irrigation	$2,400.00	
Miscellaneous		**$19,400.00**
Permitting	$100.00	
New gutters and downspouts	$17,000.00	
Small catch basin	$2,300.00	
Total		**$71,200.00**

I. Budget Elements

Non-Construction Activities
The total estimated cost for management, design, and permitting was $13,300, comprising approximately 19% of the total budget.

- **Management**
  The total for construction management was $5,600, comprising 8% of the total budget. The overall project management effort is incorporated into this figure.

- **Design**
  The landscape architect's cost for designing the project was $7,600, comprising 11% of the total budget. Although the design costs are not out-of-scale with the total project costs, they reflect the complex design process for retrofitting an existing developed site with stormwater management facilities.

- **Permitting**
  The cost of permitting was reported as just $100, the cost of the plumbing permit. However, this is not representative of typical costs for permits; the City will ordinarily require a site development permit.

Construction Activities
Excavation, construction, and landscaping costs totaled $57,900, comprising 81% of the total budget.

Excavation of mini soakage trench along south side of the property; 2002

- **Grading and Construction**
  The cost of construction (including grading) was $38,900 comprising 57% of the total budget. Components included:
  - Replacement of the gutter and downspout system, which was about 41% of total construction costs.
  - Installation of the 13 small catch basins, which were integral components of the management system (cost: $2,300).
  - Excavation of the site, which was performed manually (with shovels) to reduce damage to existing structures and to reduce disruption for the residents.

The same trench in 2004

- **Landscaping**
  The cost to landscape approximately 5,600 sq. ft. was $19,000, comprising 27% of the total budget.
  - The total unit cost for landscaping was approximately $4.22 per sq ft.
  - Installation costs ranged from $2.75 to $ 3.00 per sq. ft., reflecting a relatively intensive planting of larger plants.
  - Installing river rock in the landscape facilities added approximately $1.00 per sq. ft..

II. Cost Efficiencies

Demolition
Many retrofit projects incur substantial costs for removing or modifying existing structures such as pavement or walkways. The designer of the Barrington Project avoided substantial demolition costs by minimizing alterations to existing structures in the courtyard. This benefit may have been offset by the cost of some of the subsurface piping required, particularly in the case of installing downspout extensions under the walkways.

III. Cost Comparisons with Other Projects

The project is a great example of what it takes to retrofit an existing apartment complex with landscape facilities that have sub-surface downspout connections. The project is fairly complex relative to some other roof disconnection projects because of the replacement of the gutter and downspout systems as well as the extensive sub-surface piping.

It is important to note that the cost for this type of project could be substantially reduced if replacement of the gutters and downspouts was not a component – in this case the cost would be reduced by almost

25% (to approximately $54,200). While many similar projects would require re-locating some downspouts, completely replacing the gutter and downspout systems would probably not be required.

Beginning hand excavation of landscape infiltration basin - east side of property

One of 13 cleanouts installed where subsurface downspout extensions enter the trenches and basins

Bidding and Permitting

I. Bidding

The landscape architect contracted directly with Seven Dees Landscaping for all phases of construction.

II. Permits

Plumbing Permit
A plumbing permit was required for replacement of the downspouts, installation of the sub-surface piping, and expansion of the existing irrigation system.

Building Permit
The City did not require a building permit project since the project did not create or alter any structures.

Site Development Permit (SD) Permit
The City typically requires a site development permit for any stormwater project entailing excavation. The process includes three reviews: for the adequacy of erosion control and grading plans; for compliance with the BES Stormwater Management Manual (for water quality and flow control requirements); and for the capacity of the system if the goal is to provide complete on-site disposal.

Planning and Zoning Review
The project did not trigger any requirements related to conditional uses, non-conforming uses, or overlay districts (trails, e-zones, plan districts, etc.). No reviews were required for transportation or pedestrian issues, ADA, or seismic issues.

III. Permitting Issues

Setbacks – The City normally requires that infiltration facilities be at last 10 feet from foundations and 5 ft. from property lines ("safety setbacks"). Along the SE edge of the property, where there is just 10 ft. between the apartment and the property edge, the project designer filed a permit appeal to construct the trench closer to the building and property line than allowed by code. The City accepted the designer's appeal based on the low risk associated with the project - the building does not have a basement, the grades are flat, and the soils drain well.

Construction

Seven Dees Landscaping constructed the project in May and June of 2002. The landscape architect provided oversight during construction. Construction proceeded on schedule with no significant issues to report. Minimizing disruption to the residents was a primary concern during construction; excavating the facilities by hand (with shovels) helped reduce construction disturbance. The workers used part of the parking lot as a staging area for excavated soil and construction materials.

Maintenance and Monitoring

The property owner is responsible for all maintenance activities. BES will monitor the performance of the facilities at Barrington Square for at least five years, and perhaps longer. Confirming the hydraulic performance of the facility will be a primary focus; BES will also regularly evaluate the level of effort required for maintenance, the success of the planting regime, and the comments of the owner.

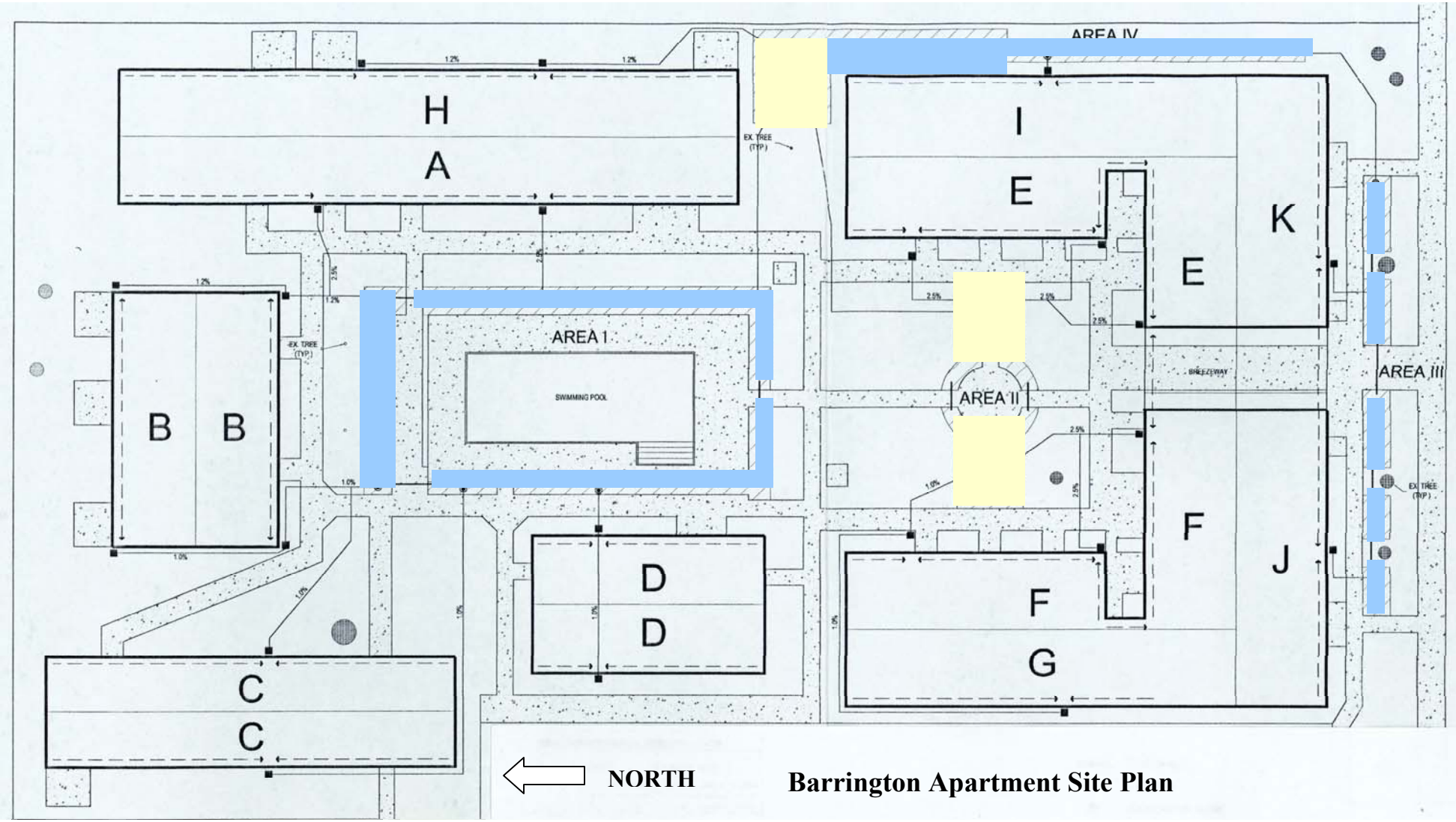
Successes and Lessons Learned

Good Design – The design process started with an intensive evaluation of the existing functions and uses of the property. The designer integrated the new stormwater systems into areas surrounding existing structures such as the pool deck and the outdoor stairways. The result is a visual enhancement of the existing landscape that does not impact usable space in the courtyard commons.

Stormwater Capacity – The linked stormwater system is key to providing substantial on-site capacity. The additional capacity provided by the landscape infiltration areas, coupled with the capacity of the mini soakage trenches, proved adequate to handle runoff from the north side of the property.

Landscaping – The project is a great example of how landscape stormwater systems can be incorporated into more formal (manicured) settings.

Owner Motivation – The fact that the gutters were old and needed replacement was a factor in the owner's willingness to undertake the project – he already needed to replace a part of the existing stormwater system. The project also afforded the property owner an opportunity to aesthetically upgrade the courtyard.



Barrington Apartment Site Plan

Mini Soakage Trench

Landscape Infiltration Basin

Drainage from Downspout