

Gray's Landing (Block 49) Ecoroof Report

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Block 49 Ecoroof (aka Gray's Landing Apartments) Portland, Oregon

Project Summary

Project Type:	Multi-family Apartments
Technologies:	Green roof (ecoroof); 29,088 square feet; 4-in. deep growing media
Major Benefits:	<ul style="list-style-type: none"> • Roof longevity – the ecoroof should double the life of the roof. • Stormwater management – a substantial reduction in runoff from the roof with improvements in the quality of the runoff water that include reduced pollution loads and lower water temperatures. • Reduced heat gain for the building. • Reduced heat island effect for neighborhood. • Visual relief for neighbors in taller buildings. • Airborne dust (particulate) reduction. • Provides some foraging for insects.
Cost:	<ul style="list-style-type: none"> • Total Project Cost is \$50.5 million; construction cost is \$35 million • Ecoroof Construction Cost is \$368,518 (\$12.67 per sq. ft.) • Bureau of Environmental Services grant is \$145,440
Constructed:	Construction completed November, 2012

Introduction

This is a report for the new construction of the Block 49 apartment building on Portland's South Waterfront. The project includes 209 apartments, 17,000 square feet of commercial space, 160 parking stalls and bicycle storage within a 245,000 square foot, six story building. Atop the structure is a 29,088 square foot ecoroof.

Overview of the Stormwater System

Approximately 70% of the rain falling on the Block 49 site will be captured and treated by the ecoroof. The remaining area is primarily the courtyard where rainwater will be cleaned by means of stormwater planters and 6" of sand under a raised concrete paver system. All of the cleansed stormwater enters a water tower and is dispersed into a large street side planter by means of decorative runnels (see photograph).



Stormwater Capacity and System Components

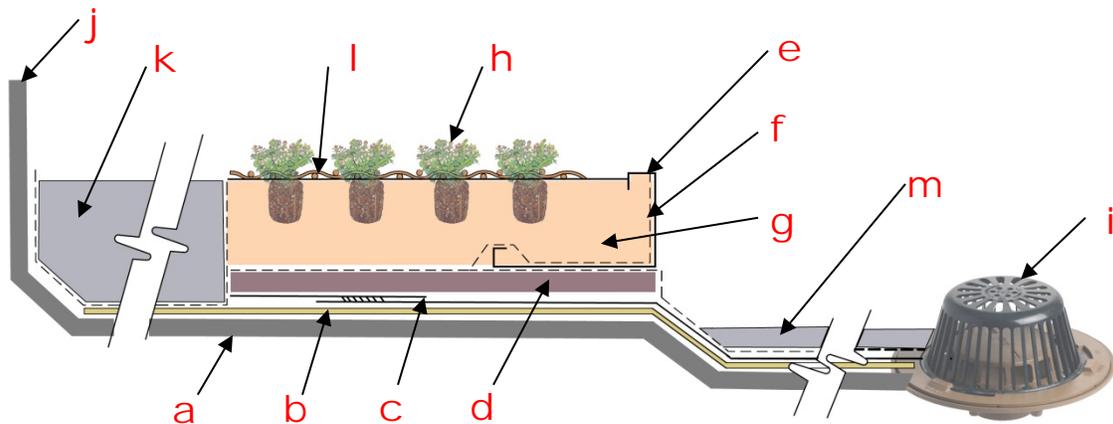
Stormwater Management Goal

The overall stormwater management goal is to reduce peak runoff volumes that contribute to stormwater system overflow events as well as providing a filtration medium to ensure good water quality. The system design utilized the Portland Stormwater Management Manual.

System Components

Planted Roof Portion

The planted Ecoroof area is approximately 29,088 square feet with a total catchment area of 29,360 square feet. The growing media is 4 inches deep with 3-1/2 inches of planting media and 1/2 inch of cinder mulch. The planting media is formulated specifically for ecoroof plant material requirements and will not exceed 4.4 lbs. saturated weight per inch of depth per square foot (52.8 pcf). The cinder mulch will not exceed 4.3 lbs. saturated weight per inch of depth per square foot (51.9 pcf). The total combined saturated weight will not exceed 17.55 lbs. per square foot.



- a. – Roofing System: SBS-Modified Bituminous Membrane roofing with leak detection system.
- b. – Protection Board over existing roof: Provide protection to building roof and additional root barrier protection.
- c. – Root Barrier: Prevents plant roots from penetrating roof protection board and roof system.
- d.– Drainage Composite Board: Allows water to pass through while restricting movement of soil.
- e. – Stainless Steel Edging: 4” height “L” shaped stainless steel sheet metal edger at edge of sump pit prevents the soil from entering roof drains.
- f. – Filter Fabric: Prevents or slows down penetration of soil into drainage mat and gravel ballast areas.
- g. – Growing Medium: Three and one-half inch depth lightweight soil medium.
- h. – Green Roof Vegetation: Sedums, succulents, and grasses selected for ability to absorb water and withstand drought.
- i. – Roof Drain: 4” Cast iron roof drain and adjacent overflow with cast iron strainers on each.
- j. – Roof Parapet: Self-adhered roofing membrane with granulated cap sheet for UV protection.
- k. – Gravel Ballast and Maintenance Access Paths : ¼-minus crushed rock ballast
- l. – Jute Mesh Fabric with 4” staple, 6’ o.c.: Plants are installed through jute netting to help prevent soil and plant loss due to wind uplift.

m. – Coated cap sheet: UV resistant cap sheet secures protection board, filter fabric and root barrier at sump pit to allow free movement of runoff around the roof drains.

Water moves down from the roof, is daylighted in the courtyard, deposited into drain rock and then into a sloped sand bed. From the sand bed, the stormwater moves into a 810 gallon concrete detention chamber which slowly releases the water over a number of hours. Interpretive signage describes storm flow events on the exterior of the concrete detention chamber for visitors and residents. Overflow for the system is released to the municipal storm system in Bancroft Street.

Landscaping

The growth medium (soil) is a proprietary aggregate from a local company. The 3 1/2-in. deep soil is comprised of pumice, perlite, digested fiber, and paper pulp (reclaimed); it has a higher proportion of mineral content than organic content. The composition meets the structural requirements of the roof, and is free draining to promote plant growth.

The selection criteria included adaptability to roof conditions, ecological function, local availability, drought tolerance, seasonal interest, aesthetics, and maintenance requirements.

The ecoroof is comprised of 57,869 plants including:

- 26,604 Sedum Mix I
- 14,664 Sedum Mix II
- 4,652 Sedum Mix III
- 11,949 Blue Fescue

The courtyard plantings include 26 trees, 155 shrubs and 605 groundcover plants.

Irrigation

The irrigation system is designed to maximize both water efficiency and ease of maintenance. The ecoroof is watered using low-flow rotary nozzles which provide uniform coverage and perform well in windy conditions. (Drip irrigation was not used on the ecoroof or the courtyard because the high porosity of the light-weight soil mix doesn't facilitate even moisture distribution). Spray heads are installed in the courtyard planters to allow a high level of control to minimize overspray in confined spaces. Drip irrigation is installed at the street-level planters. Water usage for the entire system is monitored and managed with a state-of-the-art electronic controller that adjusts water delivery based on weather conditions. The ecoroof comprises 90% of the irrigation system's total square foot area.



Irrigation in use

Budget

I. Budget Elements

Non-Construction Activities

The original project was not designed for an ecoroof. Therefore there are costs associated with the structural upgrade to the building, landscape design of the ecoroof plantings, and specifications written to explain the installation of all roof components. These costs are listed in the following cost summary. In addition, there was contract administration and management of the installation: the costs associated with these functions are included in the labor columns of the individual construction tasks. The 09/14/2011 construction bid was \$368,518.32 for the ecoroof components of this project not including the design and engineering upgrades to the structure.

Construction

Activities necessary to install the ecoroof include utilization of a crane for the time period in which the ecoroof is being installed, filter fabric, drain rock, growing media, plants, irrigation, walkways and edging. The cost of the crane use is not included in the above budget (the crane was onsite during the entire ecoroof installation and was utilized to bring the materials to the roof during down times of other tasks).

II. Cost Components

	Material	Labor	Total
Cover Board	\$ 26,581.00	\$7,536.00	\$ 34,117.00
Root Barrier	\$ 22,060.00	\$6,078.00	\$ 28,138.00
Drain Board/Filter Fabric	\$ 40,670.00	\$6,078.00	\$ 46,748.00
Soils	\$ 16,000.00	\$131,583.32	\$ 147,583.32
Plants	\$ 38,804.00		\$ 38,804.00
Irrigation	\$ 46,388.00		\$ 46,388.00
Cinder Walking Paths	\$ 525.00		\$ 525.00
Irrigation Main to Roof	\$ 4,410.00	\$520.00	\$ 4,930.00
Misc. Materials	\$ 15,781.00	\$5,504.00	\$ 21,285.00
	\$211,219.00	\$157,299.32	\$368,518.32
structural upgrade to building frame			\$ 104,790.00
engineering/design	n/a	\$ 41,500.00	\$ 41,500.00
EcoRoof Cost Totals	\$211,219.00	\$198,799.32	\$514,808.32
Total Planted Area	29,088	s.f.	
Square Foot Cost	\$12.97	not including design and structural upgrade	

Design and Administration

Since the original building design did not include an EcoRoof, the structural elements had to be redesigned to accommodate the additional weight and lateral load resistance. Both the Architect and Landscape Architect were involved in the design of the softscape and roof membrane components. The total engineering and design was approximately 8% of the overall roof design.

Construction

The ecoroof installation comprises approximately 1% of the total construction budget (\$35 million) and 1.4% including the required structural upgrades.

Labor vs. Materials

Labor accounts for approximately 43% of the total ecoroof installation or 39% when including the design work.

Walkway

The walkways were constructed of crushed granite and are acting as an additional growing medium. Therefore, their area is included in the total ecoroof square footage.

Photos



Drainage mat



First of the planting medium



Plants awaiting planting





Plants without jute netting



Plants with jute netting

Maintenance and Monitoring

Portland Housing Bureau selected REACH Community Development to own, develop and manage the Gray's Landing project. REACH will enter into a maintenance agreement with a qualified ecoroof landscaping firm to monitor and maintain the plants and medium.

Successes and Lessons Learned

Designing the ecoroof after the building has been permitted is an added cost both from an engineering standpoint and because of re-bidding for the structural work and materials

Plants that come in pots from the nursery contain insects that are attractive to birds which dig put the plants to get to the roots. Some plant loss must be accounted for.

Jute netting to hold down the plant starts is necessary when the roof is in a location subject to high winds.

Coordination with the construction crane is key to getting the large quantities of soil to the roof. Usually, by the time the ecoroof is to be installed, the crane is at the end of its usefulness at the site therefore the schedule needs to be carefully considered in advance to insure that the crane can be efficiently utilized up to the time of the soil transport.

Multiple Benefits - The project is a great example of how an ecoroof can be a central feature in the urban environment, with multiple benefits:

- Many nearby residences enjoy views of the green roof.
- The roof will provide ongoing benefits for REACH and the City in terms of stormwater management, moderating temperatures on the roof (including reductions in heating and cooling costs for the building), and increased roof life.
- The roof provides habitat for urban life – birds, butterflies, etc.