



Ladd Tower Eco-Roof
 1300 SW Park Ave.
 Portland, Oregon

Project Summary

Project Type	<ul style="list-style-type: none"> • Hi-Rise Apartment Building
Eco-Roof System	<ul style="list-style-type: none"> • American Hydrotech Garden Roof over structural post-tensioned concrete decks • 6,803-sf of Garden Roof type Eco-Roof
Major Benefits¹	<ul style="list-style-type: none"> • Enhances the building's aesthetic appeal. • Stormwater management – reduction in rainwater runoff from the roof by retaining 50%-90% of a typical rain fall on the roof. • Improves building's energy efficiency. • Processes airborne toxins and re-oxygenates the air.
Cost	<ul style="list-style-type: none"> • Garden Roof construction cost: \$261,556 (\$39 per sq-ft) • Portland BES grant amount: \$34,015
Construction	<ul style="list-style-type: none"> • Dec-2008 thru Feb-2009
Developer	Opus Northwest, LLC
Architect	Ankrom Moisan Associated Architects
Design Build GC	Opus NWR Construction, LLC

Project Introduction

Ladd Tower is a mixed-use urban hi-rise apartment project comprised of six different uses:

- A twenty-three story apartment building with 332 residential units,
- Four ground level retail spaces,
- Approximately 20,000-sf office space for the adjoining First Christian Church,
- Underground public parking garage,
- Underground private parking garage, and
- Fully renovated three-story Ladd Carriage House suspended over the underground parking garage.

The design of Ladd Tower incorporates 6,803-sf of Eco-Roof constructed on four separate floors. This includes roof & patio levels at floor 3, floor 4, floor 5, and the main roof above floor 23. Additionally, the project is currently anticipating achieving a Gold LEED-NC certification, as well as a Platinum LEED-ND certification.

Key Design & Construction Dates

- Construction began in May of 2007
- 100% Construction Documents completed February of 2008
- Eco-Roof construction: November of 2008 thru February of 2009
- Occupancy attained in February of 2009

Recitals

The City of Portland's Bureau of Environmental Services (BES) manages stormwater as a resource under the Portland Watershed Management Plan (PWMP). In November of 2007 the Grey to Green (G2G) Initiative was launched to accelerate some principal elements of the PWMP implementation. The G2G Initiative will expand the existing eco-roof program by providing grants to individuals for eco-roof projects.

Overview of the Stormwater System

Rain falls on either Eco-Roof surfaces or non-Eco-Roof surfaces. The non-Eco-Roof surfaces immediately direct water to roof drains which lead directly to the building storm water system. Eco-Roof surfaces absorb rainfall that falls directly on it by absorbing and retaining the rainfall water within the growth medium (soil) and the water retainage/drainage panels. In effect, the Eco-Roof suspends a percentage of the rainfall within the Eco-Roof assembly for continued use by the vegetation after the rain storm. The Eco-Roof also receives runoff from pavers along the perimeter of the roof. Rainwater in excess of that which can be suspended by the system components is allowed to pass through a filtering medium (filter fabric) in order to retain soil, and then on to the roof drains whereby entering the building's storm water system. From here, the building's storm water system collects and combines storm water from the numerous decks, patios, Eco-roofs, standard roofs, and courtyards, and then filters the water through StormFilter Cartridges before connecting to the public storm water piping network.

Stormwater Management Goal

The overall stormwater management goal was to reduce the peak runoff and volume that would otherwise contribute to combined sewer overflow (CSO) events in the adjacent Willamette River. Although the project did not trigger the requirements of the City's Stormwater Management Manual (SWMM), it meets the general standards for eco-roofs.

Eco-Roof System Components

Planted Roof portion

The planted portion of the eco-roof is a combination of multiple components manufactured and provided by American Hydrotech, Inc. The eco-roof occurs on three different floors of the building; the Fourth Level, Fifth Level, and 24th Level all receiving eco-roof installation.

The below image is a very close representation of the eco-roof assembly installed at all floors of Ladd, with the addition of a wind erosion mat on top. A wind erosion mat was added to the top layer to assist in keeping the growing media and the vegetation from blowing away in high winds typical of high rooftops. The mat, called GardMat P, is also manufactured and provided by American Hydrotech, Inc. as a component of their Garden Roof system.

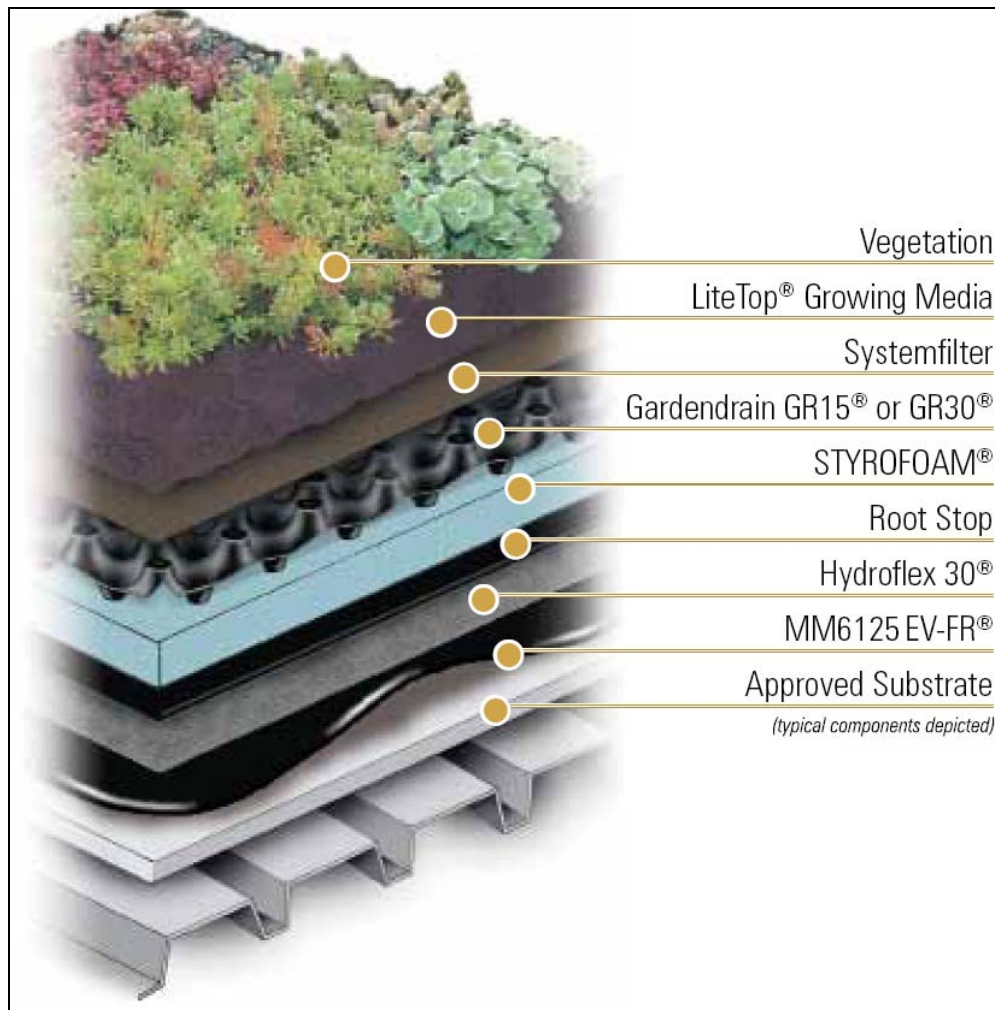


Image shows typical components within the American Hydrotech, Inc Eco-Roof²

WIND EROSION CONTROL (24th Level Only) - Polypropylene netting called GardMat P. by American Hydrotech Inc.

VEGETATION – Sedum Sexangulare, Sedum Spurium “Summer Glory”, Sedum Spurium “Roseum”, Sedum Oreganum, Sedum Album.

EROSION CONTROL - GardNet by American Hydrotech Inc. is an expandable polyethylene sheet strip assembly for soil confinement.

GROWING MEDIA – LiteTop® - Extensive and Lite Top® - Semi Intensive mix available through American Hydrotech Inc.

FILTER FABRIC – Non-woven, polymeric, geotextile fabric called Systemfilter SF. Made by American Hydrotech, Inc.

WATER RETAINAGE/DRAINAGE – Three-dimensional, molded panels of recycled polyethylene with drainage channels top and bottom sides and water retention reservoirs top side known as Gardendrain GR 15 Drain mat. Made by American Hydrotech, Inc

R-10 BD INSULATION – Extruded polystyrene board with either natural skin or cut cell surfaces called STYROFOAM. Made by American Hydrotech, Inc

DRAINAGE COMPOSITE – Composite drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric called Hydrodrain 300. Made by American Hydrotech, Inc

ROOT BARRIER – Polyethylene root barrier made by American Hydrotech, Inc. known as Root Stop WSF 40.

PROTECTION SHEET – Fiberglass reinforced rubberized asphalt sheet called Hydroflex 30. Made by American Hydrotech, Inc.

FLUID APPLIED MEMBRANE – Hot, fluid applied, rubberized asphalt membrane classified as Monolithic Membrane 6125EV-FR. Made by American Hydrotech, Inc.

CONCRETE SUBSTRATE – Cast-in-place concrete slab.



Level 24 Eco-Roof - March 2009



Placing LiteTop® - Dec. 2008



Membrane Install L24 – Nov. 2008

Landscaping

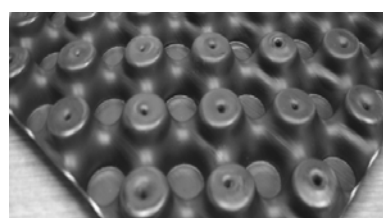
LiteTop® - Extensive and LiteTop® - Semi Intensive mix, available through American Hydrotech Inc., was used as the growing medium. Over 2500 each of six different types of sedums were planted in a minimum of 4-inches of the LiteTop® mix. The sedums were planted at a spacing of 8-inches on center to ensure proper root and plant development.



Irrigation

Portland's extensive summer dry periods made an irrigation system a requirement. The system includes:

- A permanent water retention system known as Gardendrain Drain Mat. The Gardendrain is a drain mat with three-dimensional, molded panels of recycled polyethylene with drainage channels top and bottom, and water retention reservoirs on the top side.³



- A permanent drip-line irrigation system is installed just below the surface. The frequency of watering is weather related with the first season watering occurring everyday during the summer establishment period. Once the sedums reach full coverage, watering is reduced to occur only during extreme summer drought conditions.

Budget

Roofing/Membrane Components:		Amount
Membrane	\$	29,865
Root Barrier	\$	7,075
Drain mat	\$	19,388
Subtotal:	\$	56,328
Eco-Roof Components		
Protection board if needed	\$	5,782
Growing media	\$	20,681
Paver paths	\$	28,380
Gard Mat P	\$	3,365
Gard Mat ET	\$	1,128
Gard Net	\$	15,192
Irrigation system	\$	26,860
Subtotal:	\$	101,388
Plantings/Sedum		
Sedum kamtschaticum Weihenstephaner Gold	\$	20,768
Sedum reflexum ' Blue Spruce'	\$	20,768
Sedum acre 'Aurea'	\$	20,768

Sedum acre ‘Gold Moss’	\$	20,768
Sedum rupestre ‘ Angelina’	\$	20,768
Subtotal:	\$	103,840
TOTAL:	\$	261,556

Maintenance and Monitoring

Maintenance will be performed by Teufel Landscaping in accordance with American Hydrotech’s maintenance procedures. Maintenance is fairly minimal and includes regular inspections of the irrigation system, drainage, plants, growing media, weeding, plant replacement, soil testing, fertilization, and a warranty walk through. A copy of the Garden Roof Maintenance Specifications has been included in this report.

Successes and Lessons Learned

- Success: Opus successfully constructed 6,803-sf of eco roof installed on four different levels on Ladd Tower. A significant portion of the eco roof is installed on the top of the building which is over 250-ft in the air. Significant challenges were meeting the wind uplift requirements, coordinating layout with other rooftop items such as window washing davits, mechanical equipment, and safe maintenance access.
- Lesson Learned: After the completion of the eco-roof, there has been an infestation of clover weeds throughout the garden roof on all levels which has resulted in a poor environment for the sedums to grow properly. This situation has not resulted in a decreased quality of storm water filtration as intended, but is rather unsightly. It has been discovered that the seeds were actually present in the special light weight soil prior to it arriving on site. A process has been determined for moving forward with eradication of the clover, however, it is a daunting task. Next time there will be testing performed on the soil to ensure no foreign seeds are present prior to and after arriving on site.

Attachments

Project Documents:

- Ecoroof Technical Detail Sheet
- Garden Roof Construction Specifications, AMAA
- Garden Roof Maintenance Specifications, Hydrotech.
- L4.05 – IRRIGATION PLAN – LEVEL 04
- L4.05 – IRRIGATION PLAN – LEVEL 05
- L4.24 – IRRIGATION PLAN - LEVEL 24
- L5.04 – PLANTING PLAN - LEVEL 04
- L5.05 – PLANTING PLAN - LEVEL 05
- L5.24 – PLANTING PLAN - LEVEL 24
- S1.01 – Structural Load Maps
- S1.02 – Structural Load Maps

¹ <http://www.hydrotechusa.com/garden-roof.htm>

² <http://www.hydrotechusa.com/brochures/GardenRoof.pdf>

³ <http://www.hydrotechusa.com/components.htm>