GREEN ROOF

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GREEN ROOF:
consist of plants in a growing medium (soil mix) installed over a building’s waterproofing membrane. Green roof is also referred to as eco-roof, vegetated roof, living roof or greenroof.

Three Topics:
1) General information
2) Benefits of having a Green Roof
3) Maintenance issues/challenges

General information

First recorded green roof can be traced back to the Hanging Gardens of Babylon around 600 BCE.

Villa of the Mysteries, Pompeii

Oldest building with green roof that is still standing. Dates to before the eruption of Mount Vesuvius in A.D. 79

Northern Europeans have utilized sod roofs (green roof) for centuries
Sod houses (Soddies) were built by early Pioneers on the Great Plains

Sod House, near Chadron, Neb.

One of the first large commercial bldg. w/green roof in USA was installed at Rockefeller Center in NYC in the 1930’s.

Gardens on the roofs of Rockefeller Plaza buildings

Union Square Plaza, San Francisco

It was the world’s first underground parking garage and was designed by Timothy Pflueger in 1939. First Garage with a Green Roof.

Modern Green Roof Movement started in Germany in early 1970’s

A meadow-like roof on top of a commercial building in Kassel, Germany

Two examples of Seattle’s Green Roofs that were built in the mid-1970’s: Harborview Parking Garage and Freeway Park

Seattle Justice Center Green Roof was installed in Oct. 2002

One of the earliest Commercial Bldg. in Seattle with a Green Roof
Green roofs can facilitate a significant improvement in the LEED rating of a building, contributing as many as **15 credits** under the system, depending on design and level of integration with other building systems. In some instances, while green roofs may not contribute directly to achieving points under the system, they contribute to earning LEED credits when used with other sustainable building elements. For example, green roofs can earn direct credits under the following:

- Reduced Site Disturbance, Protect or Restore Open Space
- Landscape Design That Reduces Urban Heat Islands, Roof
- Storm Water Management
- Water Efficient Landscaping
- Innovative Wastewater Technologies
- Innovation in Design

(Th above is an excerpt from Green Roofs and Maximizing Credits under the LEED Green Building System, by Richard Kula in The Green Roof Infrastructure Monitor, Spring 2005)
3 Types of Green Roofs

**Extensive Green Roof:**
- Light weight design
- Saturated weight of 15-30 lb/sq.ft.
- Maximize performance and environment benefits
- Growing medium of 1 – 6 inches
- Generally planted with sedums and drought tolerant plants
- Generally not accessible to the public i.e. Seattle City Hall and Ballard Library

**Semi-Intensive Green Roof:**
- More maintenance, higher costs and more weight than Extensive Green Roof
- Saturated weight of 30-50 lb/sq.ft.
- Growing medium 6 – 12 inches
- More maintenance, higher costs and more weight than Extensive Green Roof
- Deeper substrate allows herbaceous perennials and smaller shrubs
Semi-Intensive Green Roof

Vancouver (B.C.) Public Library

Intensive Green Roof:
- Design to be accessible to public
- “Park-like setting”
- Saturated weight is 70 lb/sq.ft.
- **Deeper layer of medium; 1 - 4 ft.**
- Wider variety of plants (trees & shrubs)
- Greater need for irrigation and maintenance
  i.e. Seattle Freeway Park, and Hundertwasserhaus

Intensive Green Roofs

Kensington Roof Gardens

Hundertwasserhaus

Seattle Freeway Park

Green roofs around Puget Sound area (next several slides)

Zoomazium at Woodland Park Zoo

Seattle Ballard Library

Washington Park Arboretum Pavilion
Harborview Medical Center Parking Garage

Russell Investments Center (WaMu Center)

Hyatt at Olive 8

Seattle Center 5th Avenue North Garage

Seattle’s Largest Extensive Green Roof (60,000 square feet)

Freeway Park
5-acre Intensive Green Roof

5th and Madison Condominiums
M-Street Apartments

Ronald Bog Park (Shoreline)

Cedar River Watershed Education Center

Reservoirs with Lids (Green Roofs)
Cal Anderson Park (Lincoln Reservoir)
Jefferson Reservoir

Reservoirs with Lids (Green Roofs)
Westcrest Reservoir
Myrtle Reservoir

Bannan Biology Building (Seattle U)
Snohomish County Parking Garage

Bertschi School
Mukilteo City Hall
11/5/2010

Famous Green Roofs

- UW Merrill Hall
- Seattle Tilth shed
- Ross Park Shelterhouse
- Victor Steinbrueck Park

Photos by P.Jeu

Famous Green Roofs

- Chicago City Hall
- The California Academy of Sciences, San Francisco
- ACROS Fukuoka building, Japan
- Art and Exhibition Hall in Bonn, Germany
- School of Art, Design and Media in Singapore
- Space Needle, Seattle

Photos by Tim Griffith

New trend in Green Bldg. design:
Green Wall (aka living walls, biowalls, or vertical gardens)

- Caixaforum Museum vertical garden in Madrid, Spain
- Musee du quai Branly in Paris, France

Photos from Greenroofs.com

Seattle’s Green Wall on 4th Ave S.

Photos by P. Jeu

Next trend in Green Bldg. design:
(Locavore Movement)
Sky Farm and Vertical Farm

- Proposed Sky Farm in Toronto
- Proposed Sky Farm in Las Vegas

Pictures by environmentalgraffiti.com
Benefits of having a Green Roof:

- Stormwater runoff reduction: and delay peak flows during storms
- Quality control: filter pollutants and heavy metals from entering our waterway system

Benefits of having a Green Roof:

- Improved Air Quality
  Carbon dioxide and other airborne toxins from the city air are absorbed through the foliage, naturally cleansing the air.

Benefits of having a Green Roof:

- Heat reduction: moderation of Urban Heat Island effects

Benefits of having a Green Roof:

- Energy conservation: better insulator than conventional roof thus reducing heating and cooling cost
- Cost savings: reduces cost of roof maintenance and repair

Benefits of having a Green Roof:

- Sound Insulation
  A green roof with 5 inches substrate layer can reduce sound by 40 decibels; 8 inches substrate layer can reduce by 46-50 decibels.
Benefits of having a Green Roof:
• Aesthetic Benefits
• Better work environment

Benefits of having a Green Roof:
• Food Production

Herb Garden on Vancouver’s Fairmount Waterfront Hotel

Benefits of having a Green Roof:
• Wildlife Habitat: create habitat for birds and invertebrates

Benefits of having a Green Roof:
• Create ‘Green’ Jobs

Benefits of having a Green Roof:
• Storm Water runoff reduction
• Filter Pollutants
• Improved Air Quality
• Mitigate Urban Heat Island effects
• Energy Conservation
• Cost savings in Roof Maintenance
• Sound Insulation
• Aesthetic Benefits
• Food Production
• Wildlife Habitat
• Create ‘Green’ Jobs

Maintenance issues/challenges
**Maintenance issues/challenges:**

**Irrigation**

*Must* irrigate the first 2 years of planting and thereafter irrigate as needed. Otherwise expect high plant mortality rate and/or live with ‘Brown’ Roof during the summer months.

**Inadequate Irrigation System**

Example: Micro-sprayer sprinkler system in a windy location where most of the water mists are blown away before landing on plants.

**Fire Hazard**

Weeds

- Dandelion
- Thistle
- Alder
- Blackberry
- Scotch Broom
- Pearly Everlasting
- Grasses
- Clover

**Weeds with Long Tap Roots**

Weeds with deep tap roots such as Alder, Scotch Broom, English Holly, Blackberry must be removed right away to prevent damages to roof membranes or structures.

- Dispersed by wind (alder, grasses)
- Dispersed by bird droppings (blackberry, English holly)
- Brought in with new plant materials
Maintenance issues/challenges: Grass Weed Domination

Wind-blown grass weeds are dominate plants on many green roofs around Puget Sound area. Tall Grasses smother and kills desirable plants.

Maintenance issues/challenges: Poor plant selections

Fescue plants are very drought tolerant in normal settings but not on Extensive Green Roof.

Plants that have done well

Maintenance issues/challenges: Birds

Crows
Crosses like to pull out newly planted plants thus making the roots dry out.

Seagulls
During nesting season, Seagull Parents are very aggressive and territorial.

Maintenance issues/challenges: Difficult Access

Must design for easy access to Green Roof for maintenance workers. Many Green Roofs do not have easy access with the concept of 'Low/No Maintenance' Green Roof.

Roof damages from Seagulls repeatedly using Green Roof plants for their nesting material and in the process removing 'soil' and exposing roofing materials.
Maintenance issues/challenges: Maintenance Plan
Lack of or conflicting policy in regards to Green Roof Maintenance Plan may create Maintenance issues.

Maintenance issues/challenges: Regional Differences
(Green Roof Designers not familiar with Seattle’s climate)
- Irrigation
- Maintenance
- Plant Selections

Maintenance issues/challenges
- Questions about the Green Roof
  Why is the Green roof Brown?

Green Roof Q/A
End

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