

PLANNING BY DESIGN

Montgomery County Planning Commission

Green Roofs

Green roofs can transform traditional roofs into attractive green spaces that provide environmental and economic benefits. They date back thousands of years and have been used successfully in Europe for over 40 years. Sometimes called vegetated roofs, eco-roofs, or living roofs, green roofs offer a unique opportunity to manage stormwater while adding beauty and greening our communities. Green roofs, which can be completely or partially covered by vegetation, mimic nature by capturing, delaying, and evaporating rainwater. They filter pollutants and reduce the amount, temperature, and speed of runoff, helping protect our streams and rivers. Green roofs improve air quality by absorbing carbon dioxide, neutralizing acid rain, and reducing air temperatures, cooling our cities and reducing the urban heat island effect. They offer educational opportunities, create wildlife habitat, and may grow food. Green roofs can double the life span of roofs, save energy by insulating buildings, reduce heating and cooling costs, buffer noise, and increase property values.



Photo: Horticulture Center at the Morris Arboretum of the University of Pennsylvania, Bloomfield Farm, Springfield, PA



*Top photo: PECO Headquarters, Philadelphia, PA
Credit: Margaret Funderburg, Philadelphia Horticultural Society*

Middle photo: Dansko USA Headquarters, West Grove, PA

*Bottom photo: Colorcon Global Headquarters & Technology Center,
Harleysville, PA
Credit: McCloskey & Faber, P.C.*

Green Roof Systems

Green roofs are a multilayered roofing system. They are comprised of components that typically include a waterproof membrane/root barrier, drainage layer, a filter fabric, a lightweight engineered growing medium (soil), and specialized plantings that are placed on top of a conventional roof. They can be installed or retrofitted on all types of buildings with sloping or flat roofs. In this region, a green roof can capture and retain 50 to 60 percent of the annual precipitation.

There are two basic types of green roofs—intensive and extensive. An intensive green roof is designed with a deeper soil layer (usually greater than 6 inches) and supports a wider variety of plants including shrubs and trees. It is usually accessible and typically used as recreational space. An extensive green roof is designed with a shallow, lightweight soil layer (usually less than 5 inches) and planted predominantly with drought-tolerant plants, such as sedums, which are adapted to the harsh conditions of a roof environment. The load capacity and structural integrity of the roof must be considered before installing any green roof. Extensive green roofs, which can weigh 15–30 pounds per square foot, require less structural support and maintenance and are less expensive than intensive roofs, which can weigh over 36 pounds per square foot.

Designing a Green Roof

Green roofs need a medium (soil) to grow plants. Unlike garden soil, which is heavy and high in organic material, green roofs require a specifically engineered lightweight medium consisting of inorganic (minerals) and organic materials. This porous material is able to retain, as well as drain, excess water while providing nutrients for plant growth. Selecting the right plants is also crucial to the long-term success of green roofs. Plants selected for an extensive roof are usually perennial with a low-growing and spreading habit and a tolerance for drought, such as sedums, grasses, or hardy perennials. All green roof plants should be low maintenance and able to withstand heat, cold, and high winds. They should be self-sustaining without fertilizers or pesticides and only require minimum irrigation. All green roofs need an effective waterproof membrane to maintain the structural



*Top photo: Swarthmore College, Swarthmore, PA
Credit: Se Eun Gong, The Daily Gazette*

Middle photo: The Court at Upper Providence, Upper Providence, PA

*Bottom photo: PECO Headquarters, Philadelphia, PA
Credit: Margaret Funderburg, Philadelphia Horticultural Society*

integrity of the roof surface. Membranes are made of asphalts, rubber, or reinforced PVC and have different strengths and functions. A root barrier to prevent root penetration may also be needed depending on the type of membrane installed.

Installation and Maintenance

Green roof systems can be installed as modular units with the drainage layer, filter fabric, growing media, and plants already prepared in a pre-grown vegetative mat or tray or built in place with each component of the system installed separately. A green roof initially costs more than a conventional roof but typically lasts twice as long. Green roof costs are higher because they require more materials and labor for installation. Long-term savings from reduced maintenance and replacement costs and lower heating and cooling costs help offset the short-term capital costs. As the green roof industry develops, overall costs may decrease. In successful green roofs, maintenance is a critical component. Initial maintenance includes supplemental watering and weeding and fertilizing, particularly during the plant establishment period. Periodic inspection (usually twice a year) is encouraged to ensure the green roof is functioning properly. This includes inspecting all roof components, such as the roof membrane, drainage layer, growing medium, and plant material. After the plants are established, occasional replacement and weeding are needed.

How Are Communities Promoting Green Roofs?

Green roofs have been successfully built in this region as well as in other cities throughout our country and Canada. Chicago, Portland, and Toronto have long been leaders in promoting green roofs. Communities use various incentives to encourage green roofs, including grants, loans, tax credits, density bonuses, fast-track permitting, fee reductions, and utility rebates. Toronto is the first city in North America to require the construction of green roofs on new buildings. In the downtown, buildings with a gross floor area over 21,530 square feet are required to have a roof cover requirement ranging from 20–60 percent of the roof



Top photo: 125 East Elm Street, Conshohocken, PA

Bottom photo: Elmwood Park Zoo, Norristown, PA

area. Many communities, such as the District of Columbia, Portland, and Toronto, all offer grant programs to help reduce the cost of green roof construction. Portland and Chicago provide a floor area bonus for installing green roofs in their business districts. Locally, Philadelphia provides a credit against the business privilege tax, for the year the roof was constructed, of 25 percent of the cost (up to \$100,000). Many urban areas use green roofs as a best management practice to divert stormwater from their combined sewer systems to improve and protect the water quality of their streams and rivers. Green roofs offer an excellent opportunity to create more sustainable and greener communities.

Resources

Portland Bureau of Environmental Services
www.portlandonline.com/bes/index.cfm?c=44422

City of Chicago
www.artic.edu/webspaces/greeninitiatives/greenroofs/main.htm

District of Columbia, Department of Environment
ddoe.dc.gov/ddoe/cwp/view,A,1209,Q,499460.asp

Green Roofs for Healthy Cities
www.greenroofs.org

Center for Green Roof Research,
Penn State University
<http://horticulture.pus.edu/cms/greenroofcenter>

City of Toronto
www.toronto.ca/greenroofs/index.htm



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