

Green Roof Research – A Growing Trend

One of the most interesting stormwater control systems under evaluation by EPA are “green roofs”. Green roofs are vegetative covers applied to building roofs to slow, or totally absorb, rainfall runoff during storms. While the concept of over-planted roofs is very ancient, the goals of modern green roof technology are to replace the benefits of vegetative cover on land which are lost when a building is erected. Research into this approach has been growing steadily since the 1980s, especially in Europe. In the United States, EPA is cooperating in several projects testing green roof technologies; in one of these, created in partnership with Penn State University, researchers are evaluating performance data that could be used to enhance municipal stormwater management planning. The cooperative agreement is being managed by the EPA, ORD, National Risk Management Research Laboratory, Urban Watershed Management Branch in Edison, NJ, to demonstrate and promote green-roof research, education, and technology transfer in the Northeastern U.S. Initial results have been presented at several conferences. A final EPA report on the research results is anticipated in late 2006.

Green roofs contain vegetated plantings about 4-6 inches deep applied over waterproofed roofs of concrete, wood or metal. Plant size and selection depend on the depth of the growing medium and on local climate. Green roofs offer a practical alternative for new roof construction and for retrofitting existing roofs. They are designed to slow rainfall runoff primarily from larger storms; smaller storms often have no runoff from a green roof.

Germany, a leader in green-roof technology; now has an estimated 800 green roof projects in place. In European countries, many communities have mandated the implementation of green roofs on new buildings. With municipalities in the U.S. looking for flexible ways to control stormwater, including the use of stormwater credits or watershed-based trading, the development of new stormwater controls such as urban green roofs is a vital initiative for EPA.

The EPA-Penn State project is investigating the effectiveness of green roofs in limiting stormwater volume discharge and reducing pollutant runoff content. The main research facility consists of six small buildings. Three buildings have traditional asphalt shingle roofs and three have green roofs. All building gutters are connected to runoff barrels fitted with pressure transducers to measure runoff. The field tests include real-time continuous runoff, storage, and runoff quantity and quality monitoring to compare green roofs to non-green roofs in the field. In addition to stormwater runoff, energy data from the test buildings in the field is being recorded. Buildings are insulated, equipped with heaters and air conditioning, and are instrumented to collect data on heat flux, energy use, and roof-top surface temperature. Preliminary results from spring 2005 indicate that green roofs effectively buffer acid rain. During the summer of 2005, runoff from many rainfall events of less than 1-inch was entirely contained by the green roofs. Research on design and performance will help municipalities and private entities make decisions associated with green roof technology and assist in matching this technology with other technologies as part of an overall stormwater management plan.