

Designing Green Roof Irrigation

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Source: www.TurfMagazine.com

Green roofs are hot. Planted rooftops continue to be a trend that is growing across the country – and the world. As urban centers strive to reduce stormwater runoff, the trend only promises to get hotter.

Speaking of heat, is there any place hotter than a rooftop on a summer's day? While plants offer natural air conditioning, keeping them irrigated and thriving can be a huge challenge. Full sun and scorching temperatures combined with exposure to wind, rain and snow create a challenge for the toughest plants.

Green roofs can be as simple as a swath of grass or as complicated as a full-on landscape with all the amenities. The style of the design will dictate the best way to irrigate.



PHOTO: Jeffrey L. Bruce LLC

Extensive versus intensive

Green roofs are classified as either extensive or intensive. “The terminology comes from Germany,” says Jeffrey Bruce.

Bruce’s company, [Jeffrey L. Bruce LLC](#), is a landscape architecture, planning and urban design firm celebrating its 30th anniversary in North Kansas City, Missouri. Bruce is not only chairman of [Green Roofs for Healthy Cities](#), but past president of the [American Society of Irrigation Consultants](#) (ASIC).

“Germany has a much longer history with green roofs, so a lot of our terminology is adapted from German,” Bruce explains. “Extensive essentially meant no maintenance; you wouldn’t water it, you wouldn’t fertilize it. It has a narrow profile. You basically get what you got. It was ‘ex-ing’ out maintenance.

“Intensive gardens have plants over 6 inches. It’s more garden-esque, so you would have to intensively maintain it,” Bruce concludes.

When irrigating intensive gardens, standard irrigation practices are generally used. “When you have a depth starting at 6 inches or going up to 30 inches or even 3 feet in some cases, you can almost go with traditional irrigation,” Bruce says. “You have the depth and you can get equipment in. You can use standard valves and sprays and rotors and all the other components.”



PHOTO: Jeffrey L. Bruce LLC

Although you'd think an extensive rooftop would be easier because of the low-maintenance model, that's not the case when it comes to irrigation. "The more difficult side of the equation is the extensive, when you're talking about a 6-inch profile or less... even a 3- or 4-inch profile," Bruce says. "There's not really an ideal way to deal with that right now.

"Because of the depth, it's very difficult to put in traditional equipment. A 4-inch pop-up requires about 8 inches of height," Bruce details. "At 6 inches, you're cutting valve boxes and trying to get it into the narrow profile."

Besides the lack of depth for irrigation infrastructure, one of the main challenges is the soil. "Those lightweight soils are extremely granular. They have virtually no capillary water movement. So you can't pull moisture from the bottom of the profile to the surface," Bruce says.

"If you use a drip emitter, the media is even more porous than sand, so the water falls straight through and doesn't have significant lateral movement," he adds.

The granular soil calls for a bit of ingenuity. "What a lot of people are doing is using a combination of materials," Bruce explains. "You can use what they call a moisture retention mat, or egg crates, so you capture moisture in the bottom of the profile. That way the plants will venture down to access the moisture."

Down with drip

In spite of the challenges drip irrigation might entail, it is the delivery

system of choice. "We use HDPE pipe, which is pretty durable in those conditions. We prefer the microsprays," he says. "We spray the surface; a lot of that moves vertically very fast. Then at the bottom of the profile we have a moisture retention layer or egg crate, which will harvest some of that water and provide it backup to the profile."



PHOTO: Jeffrey L. Bruce LLC

Bruce recalls working on [Millennium Park in Chicago](#), one of the largest green roofs in the world. "We've done some creative things to meet the challenge. We had a natural grassland type of landscape. If you go with traditional drip, you end up with miles and miles of tubing. If you use a spray head, you have to keep the nozzle above the plant material," Bruce recalls. However, since grass grows and gains height, the spray heads would need to be lifted.

"We put out a grid of quick couplers," Bruce recalls. "We had spray nozzles on different heights of risers – we had 12-, 18-, 24- and 36-inch risers. They were concerned with the aesthetics of all these risers showing when the grasses were small. So you would pop in a short riser to water it and water for a couple or three weeks until the grass got taller, then you would pop in a taller riser. We had a series of risers so they could easily change the height."

Still, with all the technology available, Bruce admits, "probably one of the hardest things we try to irrigate is narrow-profile roofs."



Even though green roofs are meant to be self-sustaining, proper irrigation is vital for successful projects. PHOTO: Jeffrey L. Bruce LLC

Taking advantage of stormwater retention

On the other hand, in many areas of the country enough water falls out of the sky to keep a roof irrigated. "There's been a number of good projects that take advantage of stormwater retention," says Bruce. "We worked with Paul Mankiewicz in New York City and he actually created a treatment wetland on top of one of the roofs. We took all the water from an adjacent natatorium at the Einstein Institute next door and cascaded it along the roof and essentially create a saltwater marsh."

As chair for Green Roofs for Healthy Cities, one of his jobs is judging submissions for the awards program. "There was one a few years ago with a sloped roof, they used a flexible membrane and put 4-inch pipe underneath it. It acted as a seep, so you would collect, or bird bath, water coming down the slope behind the 4-inch pipe. It acted as passive rainwater harvesting or storm detention," Bruce says. "The water hit the roof and it would continue down until it hit what were essentially little artificial underground ponds. That was a pretty cool solution."

Other sources of water are available in some locations. "There's lot of examples where you're harvesting water from condensate, or from cooling tower blowdown. Or harvesting rainwater," Bruce says. "Our goal nowadays is trying to get the roof net zero in terms of its water footprint. I would say we're successful about 50 percent of the time."

While green roofs are designed to be sustainable features in the urban landscape, it takes a little ingenuity, a bit of imagination and a lot of product and plant knowledge to make the whole project come together. Irrigation is a key component to a successful project.