BY WINSTON HUFF, CPD, LEED AP

Using Water Reuse Systems to Obtain LEED Credits

Many sewer systems in the United States were constructed in the late 1800s and early 1900s. Back then municipal sewers were combination storm water and sewer systems. The basic idea behind these systems was to keep storm water and sewage out of the public's sight. However, as populations grew, these combined systems could not handle the increased sewage deposits.

Also affecting sewer demand was the development of hard surfaces such as parking lots over large areas, which decreased the space available for water to absorb naturally into the ground and ultimately into the groundwater system. Over time these trends have altered the quality of the fresh water source on which the municipal water systems rely.

To compound the problem, facilities are using more potable water than ever before. In the late 1800s potable water was used primarily for drinking and washing. Now potable water systems supply water for other uses such as air-conditioning cooling towers, fire protection systems, decorative water features, and irrigation systems. Modern buildings use large amounts of water and discharge it into old, inadequate municipal sewer systems, resulting in manhole sewer discharges and flooding in low-lying areas.

To respond to these issues many state and local governments are requiring retention of storm water on site to reduce the amount of runoff. To meet such mandates, plumbing engineers now are responsible for designing storm water systems that decrease the amount of storm water leaving a site.

To help plumbing engineers deal with these changing needs and requirements, the Leadership in Energy and Environmental Design (LEED) guidelines, developed by the U.S. Green Building Council (www.usgbc.org), and other sustainable programs are promoting methods to reduce the amount of storm water that runs off a site and the amount of potable water used by facilities. Such measures result in buildings and municipal water systems that run more efficiently, reducing energy consumption and expensive upgrades.

By coordinating with the landscape architect, civil engineer, and architect, a plumbing engineer can design a storm water system that reuses storm water on site to decrease potable water use and storm water runoff. In addition to the environmental benefits, such a system can help a building obtain several LEED points.

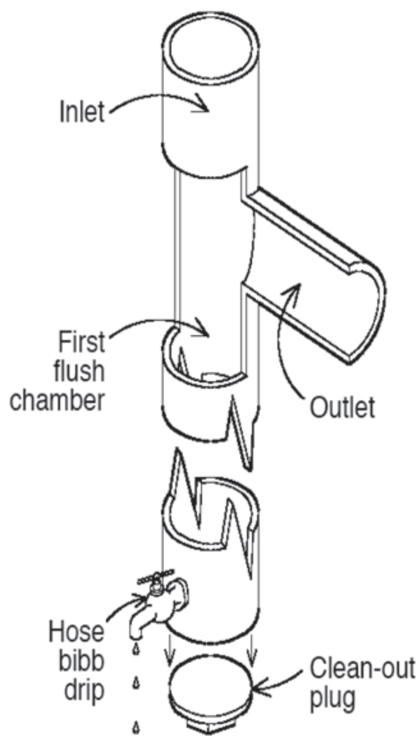
A BRIEF OVERVIEW OF WATER REUSE SYSTEMS

When designing a water reuse system it is important to first verify local storm water quality. In some areas the level of fecal chloroform (FC) and other contaminants in storm water is so high that the water requires treatment.[1]

With reuse systems that gather storm water from the roof, most of the pollutants are twigs, leaves, and bird droppings. The first inch of rain, sometimes called the first flush, typically contains these contaminants, so after the first flush is separated out the remainder of the water is relatively clear. Dust also can become an issue in the collection system. In dry areas dust can gather on the roof and enter the storm water system. As much as 66 pounds of dirt can be collected in one year from a roof on a typical house.[2]

First flush diverters are used to collect the contaminants from the first inch of rain. A simple way to make a first flush diverter is to connect the downspout to a 6-inch-diameter PVC pipe with a cleanout cap on one end (see Figure 1). The intent is to collect the first few gallons of rainwater from the roof in the riser. The riser that collects contaminants will require regular maintenance to clean out debris.[3]

Figure 1 Standpipe First Flush Diverter



Source: *Texas Manual on Rainwater Harvesting*, Texas Water Development Board

Another device to filter small debris is called a box roof washer. The box roof washer is installed downstream of the first flush diverter. On a system the size of a house a 30- to 50-gallon drum can be used. A baffle should be installed inside the drum to reduce the turbulence in the water as it flows into the washer. A 30-micron removable filter can be installed on the washer discharge to further clean the water.

Downstream of the roof washer is the storage tank. To size the storage tank the designer first must determine the rainwater supply (local precipitation), system demand, dry periods during the year, and the roof area. Storage tanks can be made of a wide variety of materials including concrete, steel, and PVC. They can be installed underground or aboveground to add to the aesthetic features of the building. The system can use one common tank or several tanks in different locations on the site. The tanks should be opaque or covered to reduce the amount of sunlight on the stored water to prevent algae growth. Tanks must be covered and their vents screened to discourage mosquito breeding.

A pumping system usually is needed on the discharge side of the tank to pressurize the irrigation or the flushing water supply system to the building. If flush meters are used it is important to maintain a minimum 30 pounds per square inch of pressure (or the manufacturer's minimum required pressure for operation) to all flush meters. Using low-flow plumbing fixtures will reduce the amount of needed storage capacity. Many reliable packaged systems are available from a wide variety of pump manufacturers.

A filtration and disinfection system usually is required as well. The type, size, and complexity of the filtration system depend on the size of the reuse system. Smaller systems can use a 5-micron filter system followed by a 3-micron filter followed by an ultraviolet light. Most storm water is clear; however, leaves can discolor the water, and as a result ultraviolet systems may not be practical.

With every storm water collection system, the owner will need to adhere to a regular maintenance routine. If you notice that an owner is not ready to make this commitment, a water reuse system may not be appropriate for that particular application.

The plumbing engineer also will need to coordinate with the local code officials and water/sewer system administrators to fulfill the requirements of the project. Most states have regulations and guidelines for sizing and installing these systems. In some areas water reuse systems are not allowed because of the concern that a potable water fixture such as a drinking fountain could be connected mistakenly to the reuse system. The pipes in these systems should be marked clearly both during and after construction to reduce this risk.

In some facilities the reuse water piping in the finished toilet rooms is exposed to the fixture and is marked clearly. This is done to demonstrate to the public that the owner is concerned about saving valuable potable water. This design also helps show future maintenance personnel that this water is not potable water and must be treated differently.

Some of these systems will require a potable water backup connection and a backflow preventer. If the owner is applying for LEED Existing Building (LEED-EB) certification, a water meter should be installed. Some municipalities will reduce the building's sewer bill if the owner can meter water that is not returned into the municipal sewer system.

LEED CREDITS FOR WATER REUSE SYSTEMS

Installing a storm water reuse system can help a building qualify for several LEED credits. To obtain these credits the plumbing engineer would use the letter templates and calculation spreadsheets provided by the USGBC when registering the building.

One credit is Sustainable Site Credit 6.1, which requires "No net increase in the rate and quantity of storm water runoff from existing to developed conditions; OR, if existing imperviousness is greater than 50%, implement a storm water management plan that results in a 25% decrease in the rate and quantity of storm water runoff," according to LEED Version 2.0.

It is possible to obtain this point if the facility captures the storm water and reuses it in the building as process water, landscape irrigation, or for flushing. The LEED guidelines provide a calculation for comparing the base storm water runoff rate before and after the water reuse system is installed. To obtain the credit the storm water containment system must reduce the amount of runoff by 25 percent.

Many states have additional calculations to determine storm water runoff rates. A storm water reuse system also can reduce the size of the storm water retention area that typically is required by local storm water code officials.

This same storm water containment system can help a facility obtain Water Efficiency Credit 1.1, which states, "Use high efficiency irrigation technology, OR, use captured rain or recycled site water, to reduce potable water consumption for irrigation by 50% over conventional means," according to LEED Version 2.0. To obtain this point the captured storm water would need to replace the amount of potable water used in an irrigation system by 50 percent.

An additional point could be obtained from Water Efficiency Credit 1.2: "Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems." To obtain this additional point the irrigation system could not be connected to the potable water system. Careful planning between the landscape architect and the plumbing engineer is required to obtain these water efficiency credits. Hose bibbs can be provided in areas that will require temporary irrigation to help plants get established. Such water use is not included in the LEED potable water calculation.

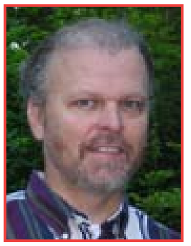
In some cases the design team may decide to use the storm water for the building's flush fixtures to obtain Water Efficiency Credit 2.0, which states: "Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, treat 100% of wastewater on site to tertiary standards," according to LEED Version 2.0.

A good source for designing water reuse systems is the U.S. Environmental Protection Agency's Low Impact Development (LID) program. Its downloadable design guide can be found at www.epa.gov/owow/nps/lid/lid_hydr.pdf.

This column is not intended to be a complete design guide for water reuse systems. I want to show readers that many economical ways to reuse storm water and save potable water in buildings are available. In the end the owner benefits from reduced utility bills, and the public benefits from high-quality natural water sources and reduced flow into municipal storm water systems. PSD

REFERENCES

1. Wisconsin Plumbing Code, Table 2: Sources of Pollutants in Wisconsin Storm Water, Geometric Mean Concentrations of Contaminants in Runoff From Source-area and Storm-sewer Outfalls.
2. Docken, Lynita. "Storm Water Detention and Reuse Design." ASPE 2005 Technical Symposium. Oct. 28, 2005.
3. *Texas Manual on Rainwater Harvesting,* Third Edition. Texas Water Development Board.



WINSTON HUFF, CPD, LEED AP, is a project manager, plumbing fire protection designer, and LEED facilitator with Smith Seckman Reid Consulting Engineers in Nashville, Tenn. He received the 2005 Apex award for Technical Writing for the article "Sustainable Plumbing System Technologies for Space and Earth" printed in the September/October 2004 issue of *Plumbing Systems & Design*. He was the founding editor of *Life Support and Biosphere Science* and has served as its editor-in-chief. He is president of Science Interactive, an organization promoting biosphere science. For more information or to comment on this article, e-mail **articles@psdmagazine.org.**