Leading the Way With Rainwater Reuse

By Robyn Albaum

System helps school become South Carolina's first LEED-certified educational facility

In the words of Alexandra Cousteau, "Water will be the defining crisis of our century." Essentially, water is running out. Population is constantly growing, and water and storm water management costs are skyrocketing across the U.S., increasing by up to 8% per year. Without a sustainable water management plan that includes rainwater harvesting, both people and businesses will suffer.

The beauty of rainwater harvesting lies in its ability to positively affect the triple bottom line for any commercial or industrial building with social, economic and environmental benefits realized in a relatively short time frame. Typical uses for treated rainwater include water for cooling tower makeup, flushing toilets, irrigation and other non-potable applications.

Green Initiative

Keeping in line with its mission to educate students to become more environmentally conscious, Ashley Hall, an independent girl's preparatory school in Charleston, S.C., constructed a 30,000-sq-ft Ashley Hall Media and Science Center, the first U.S. Green Building Council Leadership in Energy and Environmental Design (LEED)-certified school facility in the state. Design characteristics that contributed to the certification include daylighting, lighting controls, energy-efficient mechanical systems and a rainwater harvesting system that utilizes an underground cistern to store rainwater for site irrigation and flushing toilets.

A significant contributor to the "greening" of the new building is the turnkey water conservation solution designed to capture, measure, control and deliver harvested rainwater. Created by Elm Engineering of Charlotte, N.C., in conjunction with Aquanomix of Davidson, N.C., the system is designed to meet two distinct goals: to serve as an example of the school's dedication to developing the first green school facility in South Carolina, and to provide an interactive tool to help students learn and understand the importance of reducing carbon footprint through green building concepts.

Rainwater harvesting is not a complicated concept, but systems must be carefully designed and managed to produce ideal results. The Aquanomix AX-CTI Water Management Center provides a technologically sophisticated, turnkey approach that harvests and manages water for cooling tower makeup, flushing toilets or irrigation in one integrated system.

Once in use, it provides numerous benefits, including an attractive return on investment; a redundant water supply; the ability to view water usage, savings and quality in real time; decreased utility operating expenses; offset utility fees; and reduction in storm water management impact to the environment and its associated costs.

Utilizing the synergy of mechanical, electrical and chemical technologies, the AX Rainwater Management Center captures, measures, controls and delivers clean, harvested rainwater and condensate that can also impact storm water management. Most projects that use the system are eligible for up to 14 LEED points.

A Flood of Challenges

Designing the rainwater harvesting system for the center presented several unique challenges, most of which revolved around the building's close proximity to the waterfront in a historic section of Charleston.

Because the area often deals with flooding, the 8- to 10-ft flood plain and impervious soil prevented any structures from being located above grade. With a high water table and no basement available for equipment

Top: Ashley Hall's Media and Science Center is the first LEED-certified educational facility in South Carolina.

Below: The AX-CTI Water Management Center captures and treats rainwater for reuse in a variety of applications.

storage, the project required an underground cistern. In order to maintain stability, buoyancy was an important factor in the design of the cistern and the materials used to build it.

System Solutions

The rainwater harvesting system was designed to substantially reduce the school's dependence on municipal water by delivering non-potable water to toilets and an irrigation system for the rooftop patio garden and botanical studies and research. The solution, customized for the center, includes an underground 30,000-gal-total-capacity, 30-ft-by-15-ft cistern; a level control for the holding tank; a bag filter to remove impurities; and a dye pack to indicate that reclaimed water is being used for the toilets.

Due to buoyancy concerns, the cistern was constructed using cement. Substantial excavation was required to bury the tank, as well as keep it secure and well hidden. Additional landscaping was included in the project to match the area to the existing grounds for beautification purposes.

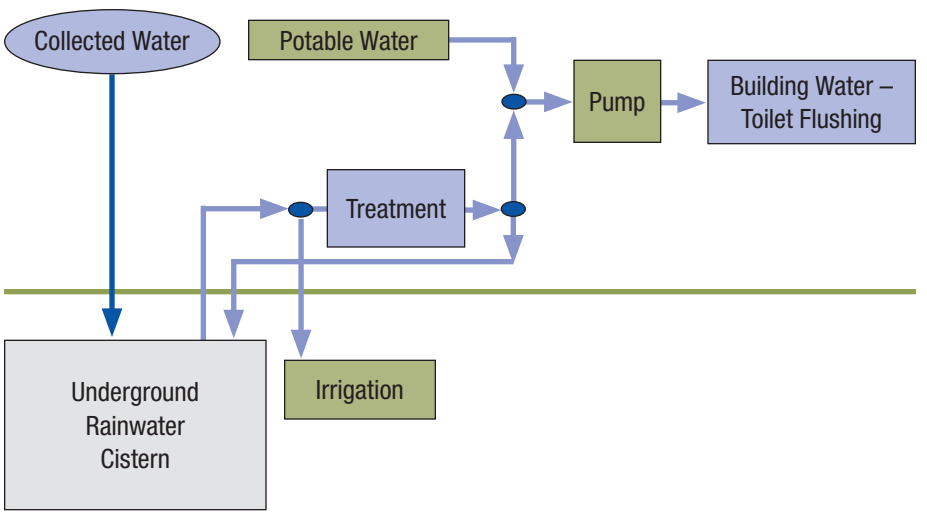
The harvesting process itself is simple. Rainwater is collected from the gutter system and flat roofing areas, where much of the equipment is located. The captured water then flows into a prefilter to remove large debris such as leaves, branches and dead birds before being pumped into the underground cistern. When the day tank calls for water, it is sent through a bag filter for treatment and dyed before it is delivered to the building for reuse in toilets and irrigation.

Water usage for the building's toilets is estimated at 148,800 gal per year, while irrigation utilizes an additional 171,200 gal per year for a total annual demand of 320,000 gal. The goal of the Ashley Hall project is to use rainwater to meet this demand year round.

A Success Story

Today, the Ashley Hall Media and Science Center at Ashley Hall has benefited from using an alternative source to satisfy virtually 100% of its water demand, representing a total savings of approximately $4,100 to supply 320,000 gal of water per year. This equates to an approximate five-year return on investment. In the future, if rainfall is not significant enough to meet demand, the system is intelligent and will pump city water to make up the difference.

Figure 1. Diagram of the Ashley Hall Rainwater Harvesting System



Because almost all of the center's annual water needs are being supplied by the rainwater system, there is an almost zero impact on wastewater back into the Charleston storm water and wastewater system. Results also have shown a positive impact on the school's storm water problem: Since installation, flooding on campus has been significantly reduced. *wqp*

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