Greening Correctional Facilities: Water Efficiency & Conservation

By Bryna Cosgriff Dunn

Efficient use of water and the integration of conservation measures have come to form central elements of green building, and in no sector are the potential efficiencies and benefits greater or more readily realizable than in the corrections market.

Correctional facilities are particularly good candidates for the integration of water conservation concepts and efficiency measures. Due to the number of plumbing fixtures per facility, the large number of building occupants, the heavy system load and 24-hour operations, correctional facilities consume millions of gallons of water annually.

As the volume of water used and wasted at correctional continues to increase in lockstep with growth in inmate populations, so does the imperative of integrating comprehensive conservation strategies and efficiency measures into the design and operations of our prisons and jails.

Plumbing

One of the greatest opportunities to improve water efficiency at correctional facilities is to install low-flow plumbing fixtures that use less water.

Conventional showers and lavatories have a flow rate of 2.5 gallons per minute. Urinals release 1 gallon and water closets release 1.6 gallons of water down the drain with each flush. These fixtures have become standard in the design and construction of correctional facilities, many options on the market should be considered in order to maximize water efficiency.

Alternatives to conventional fixtures include showerheads that use between 0.5 and 1.8 gallons per minute. Lavatories can also be reduced up to 0.5 gallons per minute. Alternatives to traditional water closets include 1.1 and 1.3 gallon-per-flush models, as well as dual-flush toilets that use 1.1 gallons per low flush and 1.6 gallons per full flush.

With urinals, project owners and designers have the option of installing fixtures that use 0.5 gallons of water or less per flush, and some models don't use any water at all. There are security-grade fixtures that function at these reduced flow rates.

The design team should conduct comparative analyses to estimate the water savings that may result from different design decisions and determine which fixtures will result in the greatest water savings and are most appropriate for a project. These analyses should compare the planned design to a baseline, which is a comparable facility without water efficiency strategies.

While a baseline comparison will give designers and owners an idea of the water efficiency strategies available to them and their impacts on the design, it's important to realize that this comparison is between two theoretical conditions. Results should not be interpreted as a predictor of actual performance since the factors used to estimate water use, such as occupancy and frequency of fixture use, may differ in reality.

A comparative analysis conducted during the design of the Federal Correctional Institution #3, in Butner, N.C., illustrated the predicted savings resulting from water efficiency strategies amount to more than 5 million gallons annually — a 34 percent reduction in water use compared to the baseline case. Modeling predicted Butner would use 21 gallons per square foot annually compared to 32 gallons per square foot for the baseline case. The design team selected 0.5 gallon-per-


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flush urinals, 0.5 gallon-per-minute lavatories and 1.5 gallon-per-minute showers and sinks to meet the established water efficiency goals.

Stormwater

Stormwater runoff is an often-overlooked element of water conservation. However, water leaving the facility site is no less important a consideration than the water going down the drain.

Many correctional facilities are constructed on previously undeveloped greenfield sites. Development of such sites increases the area of impervious surfaces through the addition of sidewalks, paved parking and roofing. Stormwater cannot penetrate, and therefore, cannot replenish groundwater.

Correctional facilities located in previously developed urban areas may be connected to already overburdened stormwater or combined sewer infrastructure. Furthermore, stormwater runoff from all building sites is often polluted, which is an additional strain on our clean water supply.

Many on-site strategies can be applied to combat the stormwater-related effects associated with increased development and imperviousness, and it's important that these strategies address both the amount and the quality of runoff. Cost-effective solutions, such as rain gardens and constructed wetlands that collect runoff and remove pollutants through a biofiltration process, are becoming more common in green building. Pervious paving, whether asphalt, concrete or vegetated, allows stormwater to penetrate surfaces and reach the ground beneath. These strategies and technologies are especially helpful for addressing runoff from parking, driving and walking surfaces.

One of the best technologies for addressing roof runoff — a major component of total runoff volumes — is a living or vegetated roof. Green roofs act a lot like vegetation on the ground: Plants and soil hold the stormwater, thereby reducing the amount that leaves the building site and also helping to cleanse runoff.

Stormwater management and treatment strategies — detention basins, wetland planting areas, and sediment forebays at storm drain outfalls — reduced stormwater runoff at Butner by 7 cubic feet per second, a 13 percent reduction in peak stormwater runoff.

Closing the Loop

The integration of low-flow plumbing fixtures and stormwater management measures are excellent resource usage and conservation strategies for improving water efficiency, reducing waste and protecting quality.

Connecting stormwater management and plumbing systems to create a closed loop reinforces and augments the gains generated from efficiency measures in individual systems by utilizing gray water instead of treated water. Gray water stored in stormwater collection tanks or cisterns can be redirected to supply facility functions that do not require potable water, such as in-grounds irrigation, HVAC cooling and toilet flushing.

The size of cistern to be used on a project depends on that project's size, occupancy and intended uses of collected water. Plumbing engineers should be consulted during the initial stages of the design process to ensure that cisterns are correctly sized and configured for the project.

An inappropriately sized cistern could result in excessive or insufficient stormwater collection, threatening the efficiency, performance or functionality of the closed-loop system and its component subsystems.

Thousands of gallons of stormwater can run off a facility's roof in a year. Collecting and diverting stormwater for facility functions conventionally supplied by potable water reduces the volume of water flowing through the storm drain system and the amount of water that needs to be treated to potable standards.

Whether you are in the early planning and design phases of a new project or evaluating the performance of an existing facility, incorporating strategies to reduce water usage and waste is one of the easiest steps to improved efficiency and enhanced operations.

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