Olin Partnership

Aquatic plants in the pond, above, will play a crucial role in cleansing stormwater, which will be used for landscape irrigation and toilets.

Kroon Hall's Rainwater Harvesting System to Save Half-Million Gallons a Year

By Alan Bisbort

When ground was broken on May 3 for Kroon Hall, Edward Bass – a major donor whose generosity helped make the school's landmark building a reality – pointed skyward and said, "We can only go up from here."

Bass' enthusiasm notwithstanding, the architects and engineers had other ideas. Indeed, in order to meet the specifications for a Leadership in Energy and Environmental Design (LEED)-certified platinum building, the construction team had to go down from there – as in underground.

To qualify for a platinum rating – the highest set by the U.S. Green Building Council – Kroon Hall must produce nearly as much energy as it consumes through features such as solar panels, solar water heaters, natural light and ventilation. Of the underground features, the most exciting may be a rainwater harvesting system that will provide water for flushing toilets, as well as for irrigating the native fauna in the two courtyards on the 3.5-acre site. And, thanks to a recent $1.5 million donation from the Mars family, this feature will be made possible.

"The rainwater harvesting system will conserve water, contribute to better water quality and control the rate of runoff during a storm by detaining and slowly releasing excess stormwater," said Nicole Holmes, the project manager for Boston-based Nitsch Engineering. "That will be beneficial to the city and the environment, because the school will be drawing less water from the city's aquifer and not be using any drinking water for irrigation or toilets."

The rainwater harvesting system, collaboratively designed by Nitsch Engineering, Philadelphia-based Olin Partnership and Arup, an engineering firm with offices in the United States and Europe, will allow all rainwater that falls on Kroon Hall's roof and grounds to enter into a 24-hour-a-day recycling process that will take place in a pond and subterranean tanks. Together, Nitsch and Olin transformed the current patchwork of above-ground service roads into "watering holes," figuratively and literally – gathering places for students, as well as for the reuse of harvested rainwater.

The rainwater harvesting system is expected to save approximately 500,000 gallons of potable water annually, and will satisfy at least six LEED credits, including two points for stormwater management and four points for water efficiency. LEED platinum buildings must achieve 52 to 69 credit points.

> "This system will pay for itself, with savings from the potable water that would have been used, within 10 years or so."
>
> *Nicole Holmes*

"The biggest challenge was the steep terrain of the site, with its 20-foot slope from north to south," said Holmes. "We had to look to the lower [south] end of the site for the treatment aspect of the rainwater collection system. However, the south side of the site sits just above an underground service node. For treating

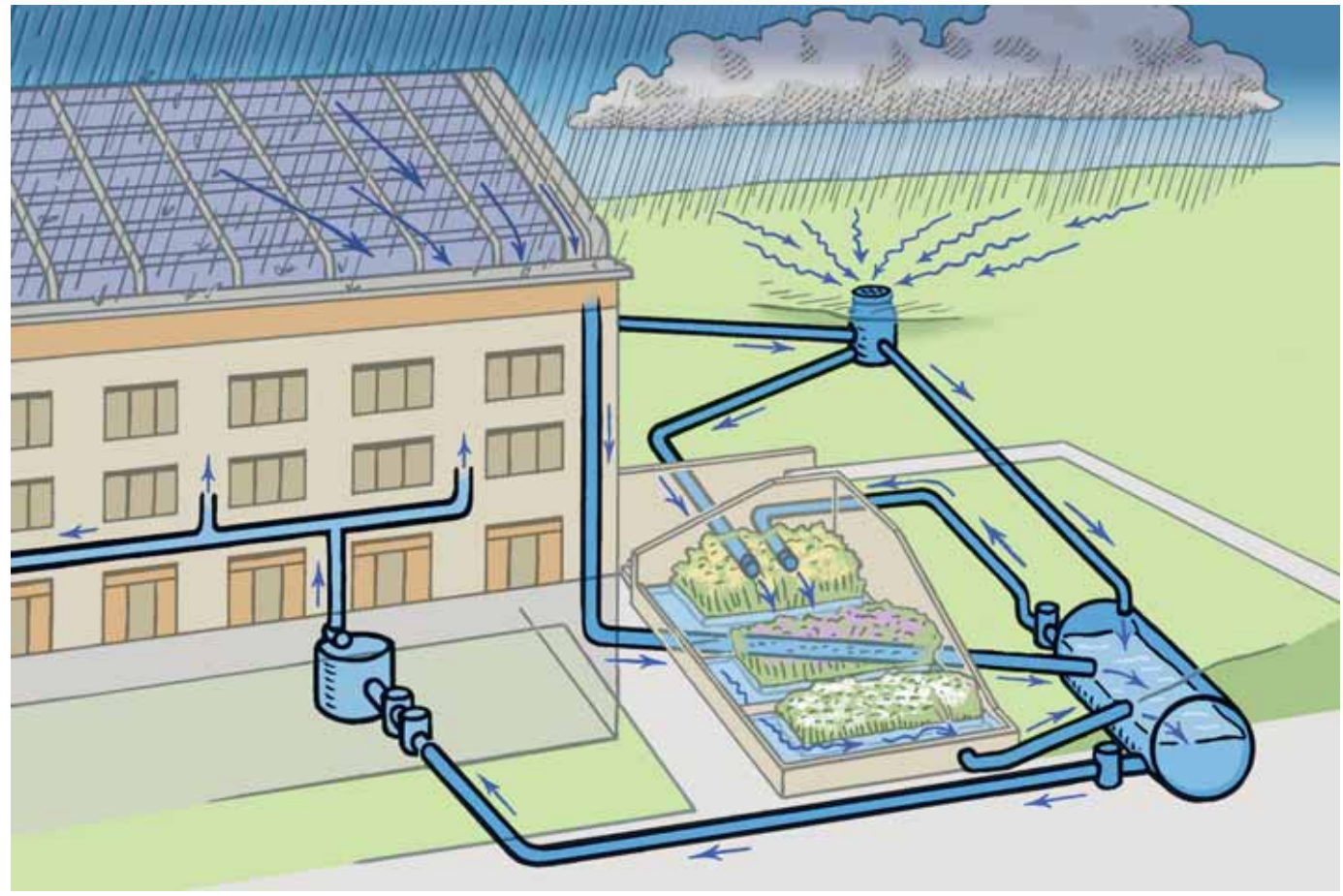

Illustration by Gregory Nemec

The first inch of stormwater from the north side of Kroon Hall's roof and the ground that collects in the tank at upper right will empty into the pond, where it will be cleansed and diverted into the larger harvesting tank. The water in the harvesting tank will be pumped to another tank for use inside Kroon Hall and back into the pond for additional cleansing.

water, this allows very little ground space within which to work."

Holmes said the goal will be to get the dirty water treated quickly. "The dirtiest portion of storm-generated water is the first inch that runs off of impervious surfaces. To catch this, we had to have a diversion structure upstream, at the north end. All of the water that falls on the northern part of the site and through the rooftop drainage system goes through this diversion system."

The diversion system will consist of an underground manhole-type structure that will pipe the first inch of stormwater to a pond created by Olin that will feature specially selected aquatic plants, such as iris, cattails, arrowheads and lotuses, serving as biofilters to clean the water.

"We first thought that the best way to clean the water was to pull it through soil," said Cricket Brien, an Olin associate. "But we had only one foot of space above the service node to work with. We had to think of another way. We consulted pond scientists who had devised rafts of plants specifically designed to clean water. We discovered that mats of trailing roots in a pond are more effective at cleaning runoff water than soil. They not only take the nitrogen and phosphates out of the water, they trap fine particles, too."

Any flows greater than an inch will be carried by a separate pipe to a 20,000-gallon fiberglass-reinforced underground harvesting tank, which will also collect overflow from the pond and rainwater from the Kroon Hall roof. That mix will then be circulated through the pond for additional cleansing. The water stored in the harvesting tank will also be used for landscape irrigation and be diverted to a separate 940-gallon "day" tank located in Kroon Hall's basement, where it will be filtered and disinfected for use in toilets. A hookup to a city line will provide water for drinking and washing.

"Part of what is unique about this project is that Yale, as an institution, has looked at the long-range impact," said Holmes. "This system will pay for itself, with savings from the potable water that would have been used, within 10 years or so." ■