

Drought or Not, Water Conservation Makes Sense at NC State

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Author: R. Allen Boyette, P.E., Director, Building Maintenance and Operations, NC State University

Contact: Tracy Dixon, Sustainability Director, NC State University, tracy_dixon@ncsu.edu, 919.513.0122

History

In early 2008, as central North Carolina experienced the most severe drought in a century, North Carolina State University was at the center of attention. As the largest single water user in the City of Raleigh and a leader in conservation in the nation, the community looked to NC State to lead the way in meeting the pressing needs of the area. NC State accepted the challenge and committed to water conservation actions exceeding those of the local community. Through aggressive conservation efforts, NC State has always been a leader in water conservation and reduced water usage in 2007 by 29 percent per gross square foot over the baseline year of 2001-2002.

Project description

To meet the environmental challenge caused by the 2007-2008 drought, additional innovation came from the operations side of the University. Taking one of Chancellor James Oblinger's focus areas of "driving innovation in energy and the environment" to heart, the Building Maintenance and Operations (BM&O) department within Facilities Operations evaluated uses of water in classrooms, research, and office buildings. Basic projects such as installing low-flow aerators on faucets and low-flow toilet flush valves were completed and effective, but not enough to significantly reduce water consumption. To further reduce water usage, BM&O looked to technicians and supervisors within the department for innovations. The Team quickly developed three basic criteria for a water reuse project to be feasible. These criteria were:

1. a source of water
2. an economical method to collect and store the water
3. a use for the water near the collection source

When an effective method to collect, store, and use the water within close proximity to the generation source existed, the economics of the reuse alternative were much more appealing.

Several conceptual projects and ideas were generated. Models were developed to estimate the amount of water that could be collected or saved with each alternative and life-cycle cost analysis were performed to prioritize the work effort. Campus awareness was an additional consideration when evaluating projects.

Costs and savings

As a result of the evaluation, ten projects were initiated and completed in a five-month period. The capital cost of the ten projects was approximately \$264,000 and resulted in over 9,983,400 gallons of water saved per year. The innovative projects not only demonstrate the potential for increased water savings in similar areas on campus, but also equate to a reduction in over three percent of the total water usage for the University. Using a simple payback, the projects will pay for themselves in approximately six years. Assuming the water rates increase 10 percent per year as proposed by the City of Raleigh, the payback period reduces to five years. Drought or not, saving water at NC State makes sense. The projects are summarized and shown in Table 1.

Table 1 – Summary of Building Maintenance and Operations water conservation projects

Building	Project Description	Capital Cost (\$)	Water Saved (Gallons/year)	Water Saved (\$/year)
College of Veterinary Medicine, Main Building	Replaced vacuum and medical air pumps ¹	\$54,670	1,180,000	\$5,332
Campus Wide Fixture and/or valve Replacement	Replaced 86 toilets with low-flow toilets and replaced 157 flush valves on toilets and urinals with lower flow valves at College of Veterinary Medicine, Harrelson, DH Hill, Holladay, Poe, College of Textiles, and Carmichael	\$20,890	1,510,720	\$6,826
Campus Wide Aerators	Install low-flow aerators all public sinks	\$8,000	694,000	\$3,136
Fox Labs	Condensate Recovery - reuse as makeup water for Greenhouse swamp coolers	\$3,000	470,300	\$2,125
Monteith Research Center	Condensate Recovery - reuse as makeup water for cooling towers ³	\$4,800	845,800	\$3,822
Pulp & Paper	Condensate Recovery - reuse as makeup water for cooling towers ³	\$13,500	168,000	\$759
Mann Hall	Add process chill water loop to replace once through water for cooling hydraulic accumulators ²	\$70,000	1,382,400	\$6,246
Williams Hall	Growth Chamber Room - replace water cooled condenser	\$11,347	490,600	\$2,217
Gardner Hall	Cooling for microscopes - replaced water cooled unit ⁴	\$24,892	2,600,000	\$11,871
Jordan Hall / Biltmore Hall	Condensate recovery reuse as irrigation water for upper Miller recreation field	\$53,398	641,600	\$2,899
TOTALS		\$264,497	9,983,400	\$43,451

¹The replacement of the vacuum pumps at College of Veterinary Medicine saved not only water but also electricity. Replacing the old and failing pumps also significantly increased reliability and reduced overall maintenance costs, in addition to water savings.

²The Mann Hall Process-cooling loop will not only save water, but also provide future expansion for the departments.

³Reusing condensate water for cooling tower makeup has the added benefit of saving electricity since the water is cooler than potable water.

⁴Water savings included replacing two water-cooled unit with air-cooled units and changing the operational process on another unit to reduce water usage.