

## CONTROLLING STORMWATER TO IMPROVE THE WATER WE DRINK

In spring 2014, the Villanova Urban Stormwater Partnership (VUSP)—part of the Villanova Center for the Advancement of Sustainability in Engineering (VCASE)—was awarded a three-year \$565,000 grant by the William Penn Foundation to model and monitor stormwater control measures (SCM) and develop outreach programs in the Philadelphia suburbs. The grant is a part of a \$35 million Delaware River Watershed Initiative to restore drinking water quality in the region. Under project leader Andrea L. Welker, PhD, PE, professor of Civil and Environmental Engineering, VUSP researchers, including one doctoral candidate and two master's degree students, are determining the effectiveness of SCM in a select cluster of micro-watersheds.

The William Penn Foundation's strategy is to begin restoration efforts in the headwaters of tributaries to the Delaware. It is anticipated that as restoration efforts continue downstream toward the Delaware, water quality will improve in the many creeks and streams that form the watershed. Proper management of urban stormwater leads to cleaner watersheds, which ultimately will result in improved drinking water quality, as well as fewer flash floods, less erosion and the return of fish species. A major question that remains is when will enough SCM be installed to “move the needle” on water quality? As an expert in soils and unsaturated flow, Dr. Welker is ideally suited for the work at hand.

The process of testing SCM begins with the collection of pre-construction data from which mathematical models are built to predict SCM effectiveness. Because SCM are tested on a site-by-site basis, Dr. Welker plans to monitor different combinations at each micro-watershed. She explains, “SCM must be designed to meet site-specific constraints and needs; there are many available, and they all have their places.” These include rain gardens, rain water collection systems, constructed stormwater wetlands, permeable pavements, green roofs and swales. Two SCM were completed this past summer, and it is estimated that they will need to be in place for a year or two before their effectiveness can be determined.

by Hanna Quinn '16 ChE

In addition to building and monitoring SCM sites, Dr. Welker points out another critical piece of the project.

“The education and training of contractors, municipal officials and citizen scientists is crucial to the success of the research since SCM require careful implementation, inspection and maintenance.” Because training is so important, VUSP has developed an education and outreach program with other institutions, helping to organize stormwater workshops, and teaching those responsible how to visually inspect SCM.

“The work and mission of the Delaware River Watershed Initiative is a definite game-changer for stormwater control,” says Dr. Welker. “To have this many organizations working together toward the restoration and maintenance of the watershed is amazing. Despite a lot of different project roles and personalities—from activists to academics—we've found a way to work together to get things done.”

Graduate students Samantha Butwill '15 CE, Civil Engineering, and Sarah Rife, Water Resources and Environmental Engineering, install a stand-alone weather station on the roof of Abington Friends School in Jenkintown, Pa.



### VCASE Highlights

- VCASE held its inaugural research symposium in April 2015, bringing faculty, students and industry representatives together to discuss the integration of sustainability and engineering.
- Eleven speakers representing academia, industry and government, took part in the 2014-15 VCASE lecture series.
- This past fiscal year, VCASE received five new grants and an extension on a continuing grant totaling \$1.3 million.
- VUSP, represented by Dr. Wadzuk, was among a number of public and private sector organizations invited to the White House for a one-day forum with the federal Council on Environmental Quality.