WATER PAGES

Produced by the
Rutgers Cooperative Extension
Water Resources Program

Creating solutions for water quality issues in New Jersey

MARCH 2012

I HOPE YOU HAVEN'T MISSED US . . .

It has been a year since our last newsletter, so we have a lot of catching up to do. The Rutgers Cooperative Extension Water Resources Program continues to expand our network of partners and stakeholders as well as our staff. This past year we have added Sara Mellor, Hae-An Chyun, and Jessica Brown to our team.

Sara Mellor graduated in May 2010 from Rutgers University with a B.S. in Environmental Policy, Institutions, and Behaviors. Sara interned with the Water Resources Program from May 2009 to May 2010 and has worked part time as a Program Coordinator with the Water Resources Program from May 2010 to May 2011. Sara will be coordinating and presenting rain barrel workshops, designing, constructing, and coordinating the installation of rain gardens and natural landscaped systems , and participating in community and youth outreach projects pertaining to water resources throughout New Jersey.

Sara and Amy building rain gardens at a school in Haddonfield

Hae-An working with Jillian on the Parkside rain garden in Camden

Hae-An Chyun is a LEED® Green Associate with a background in architecture, sustainable and graphic design, and stormwater best management practice design. Hae-An received a Master of Architecture degree from the New Jersey Institute of Technology and a Bachelor of Arts in Art & Art History from Colgate University. Hae-An will be providing technical support for the design of stormwater best management practices, ecological restoration projects, and LEED site planning efforts.

Jessica is very excited to be a Jersey Girl!

Jessica Brown has a bachelor's degree from North Carolina State University in Biological and Agricultural Engineering with concentrations in the Environment and Agriculture. Jessica also has a master's degree from North Carolina State University in Biological and Agricultural Engineering with a focus on Watershed and Stream Assessment and Restoration and a graduate certificate for the Design and Analysis of Environmental Systems. She has a background in ecological restoration, watershed assessment and planning, stormwater best management practice design, stream restoration, and data management. Although much of her work centers around the design and assessment of environmental projects, Jessica will also spend a portion of her time obtaining grant funding and developing and delivering educational programs focused primarily on stormwater management.

For more information, check out our web site at www.water.rutgers.edu.

CLIMATE RESILIENT RAIN GARDENS FOR NJ

Christopher C. Obropta, Ph.D., P.E. and Jessica Brown

"Humans experience climate as weather (Liebl, 2011)." Precipitation, flooding, and temperature are some of the weather station characteristics used in climate models to simulate the effects of climate change (Liebl, 2011). Groisman et al. (2005) examined data for over half the global land area, including the United States, and found "an increasing probability of intense precipitation events." Karl and Knight (1998) found a 10% increase in total annual precipitation since 1910 across the United States.

New Jersey is "the nation's most densely populated [state], and 60% of its residents live in coastal communities (NECIA, 2007)." Increases in the extent and frequency of flooding, sea level rise, erosion and property damage pose significant impacts on communities, human health, agriculture, and forests. New Jersey's ability to manage water and mitigate for climate change will determine the extent of these impacts.

According to the IPCC Climate Change Report, the Northeast United

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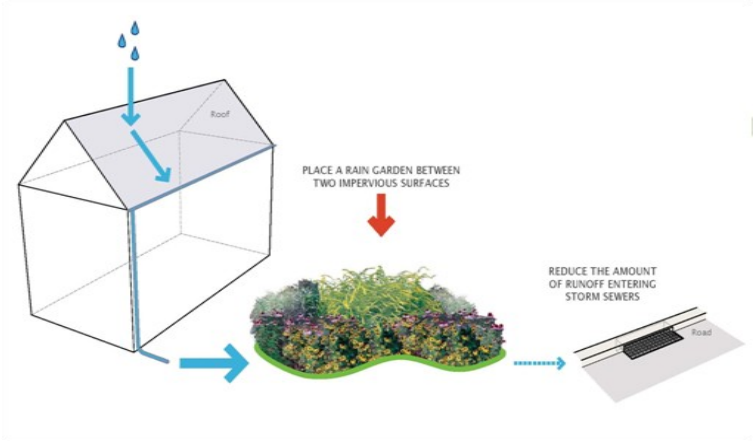
States will expect to have more intense storm events. Presently, New Jersey designs stormwater best management practices (BMPs) for the water quality design storm of 1.25 inches of rain over two hours.

This rainfall distribution and amount was specifically developed for New Jersey based upon past historical rainfall data (see NJDEP Stormwater BMP Manual) with approximately 90% of New Jersey's rainfall events occurring in precipitation events of less than 1.25 inches. "Nonetheless, the evidence suggests that drainage infrastructure designed using mid-20th century rainfall records may be subject to a future rainfall regime that differs from current design standards (Rosenberg et al., 2009)." "The Northeast is projected to see an increase in winter precipitation on the order of 20 to 30 percent (NECIA, 2007)." As the climate continues to change, it is expected that the intensity of rainfall will increase. This rainfall amount and potentially this rainfall distribution will no longer be suitable for best management practice design. It is expected that 90% of the storms will not be less than 1.25 inches, but rather some greater amount.

The Rutgers Cooperative Extension (RCE) Water Resources Program is presently working with communities throughout New Jersey to help them address their stormwater issues. The RCE Water Resources Program staff of engineers, scientists, and landscape architects has been designing and implementing stormwater BMPs to address the water quality problems in these communities. To meet the growing climate challenge, the RCE Water Resources Program has taken a unique approach in designing these BMPs to ensure they are resilient to climate change.

A typical rain garden is designed by the RCE Water Resources Program to capture the entire runoff from the water quality design storm. For example, the stormwater runoff volume from a 1,000 square feet rooftop for the water quality storm would be:



1,000 sq. ft. x 1.25 inches of rain x 1 feet/12 inches = 104 cubic feet of water.

A rain garden would be sized with a depth of 0.52 feet and be 200 square feet in size. Although a rain garden is designed to infiltrate at a rate of at least one inch per hour, the system is designed to capture and hold the entire runoff volume from the rainfall event, assuming no infiltration during the storm. If infiltration during the storm was considered in the design, the rain garden will only need to be 0.39 feet deep to capture, treat, and infiltrate the runoff from the water quality design storm (1.25 inches of rain over two-hours). By designing the rain garden without considering infiltration, a safety factor has been incorporated into the rain garden design. In actuality, the rain garden is deep enough to capture, treat and infiltrate a water quality design storm of 1.60 inches of rain over two-hours when an infiltration rate of one inch per hour is considered in the design, which is approximately 28% greater than New Jersey's existing water quality design storm.

Rain Garden Design Example for Treating the Two-Year Design Storm

In many areas of New Jersey, in addition to water quality issues, localized flooding is also a concern. The RCE Water Resources Program has been designing water quality BMPs such as rain gardens, to capture, treat and infiltrate the two-year design storm, which is approximately 3.5 inches of rain over 24-hours, making these systems more capable of capturing and storing the rainfall anticipated for the future. The duration of the two-year storm is 24 hours, and runoff will infiltrate during the storm. It was discovered that the system does not have to be dramatically larger than those systems designed for the existing two-hour water quality storm.

Now looking back at the original example, if the system is designed for the same rooftop but designed to manage the two-year storm, the system can have the same footprint (200 sq. ft.) but must increase in depth. The increase in depth is a function of the infiltration rate. Using an infiltration rate of 1.0 inches per hour, the depth increases from 0.39 feet to 0.60 feet. Since the original design of the rain garden was 0.52 feet deep because infiltration was not being considered, the increase in depth is only 0.08 feet to capture, treat and infiltrate the two-year design storm of 3.5 inches

Design Storm	Rain Garden Footprint (square feet)	Rain Garden Depth (feet)	Infiltration Rate (inches/ hour)
Water Quality (1.25 in.)	200	0.52	0
Water Quality (1.25 in.)	200	0.39	1.0
Two-year (3.5 in.)	200	0.60	1.0

With a depth of 0.60 feet, the rain garden can now handle a two-hour water quality storm of 1.78 inches of rain, which is approximately 42% greater than New Jersey's existing water quality design storm.

Conclusion

Engineers and professional designers need design standards (e.g., the water quality design storm of 1.25 inches of rain over two-hours or the two-year storm of 3.5 inches of rain over 24-hours). As climate continues to change, the Northeast United States will expect to have more intense storm events, thereby increasing the rainfall amount in the water quality storm to something greater than 1.25 inches of rain. Since the exact amount of this increase cannot yet be predicted by the climate change experts, engineers are reluctant to change their design standards. As an alternative, by simply designing to an existing standard like the two-year design storm instead of the water quality design storm, engineers can make their stormwater management systems, like the rain garden, resilient to climate change, additionally reducing localized flooding during the two-year storm. The best part is that this change in design standard will not substantially increase the design or construction cost of the rain garden. These slight changes in design can result in a 42% increase in the ability to capture, treat and infiltrate runoff from a two-hour storm event. This is an economical decision to not only treat localized flooding resulting from the two-year storm, but increase the capacity of a rain garden to be resilient to the increases in rainfall intensities resulting from climate change.

YOUTH AND WATER EDUCATIONAL PROGRAMS

Amy Boyajian and Elaine Rossi-Griffin

The Rutgers Cooperative Extension (RCE) Water Resources Program engages youth audiences through innovative programs such as *Stormwater Management in Your Schoolyard* and Water Champions. These programs are targeted at increasing youth's knowledge and awareness, changing their behaviors, and engaging them to take action to initiate changes in our society. The result of these programs is youth who care deeply about water and are empowered to take action to necessitate changes to preserve, protect and restore water resources.

The Stormwater Management in Your Schoolyard

The *Stormwater Management in Your Schoolyard* program was developed by the RCE Water Resources Program in collaboration with the Northeast States & Caribbean Islands Regional Water Center and the New Jersey Sea Grant Consortium. The program provides educational lectures, hands-on activities, and community level outreach for students on the topics of water quality issues and stormwater management practices such as rain gardens and rain barrels.

Kids jumping for joy after building their rain garden.

Building upon this successful program, we are expanding our reach into technical high schools. Technical high schools (a.k.a. vocational technical schools) are in need of real world applications to their classroom material. To address this issue, the *Stormwater Management in Your Schoolyard* program would like to expand its reach by involving technical high schools in a "green collar" job training program. Career programs offered at the technical high schools, such as ornamental horticulture, green technology, and drafting, can be tailored to provide students with practical applications for their studies. After the students learn about innovative "green" interior and exterior practices that are currently being used in the industry, they can be involved in the design and installation of practices in their surrounding community. These experiential learning experiences will help empower these students. For example, students can take their knowledge about bioretention systems (i.e., rain gardens) and put it into practice by designing a rain garden for their community. The students will not only be involved with the installation of the rain garden, but they will be instrumental in working with community members to design a garden that will fit the members' needs. Therefore, through applied learning as well as service learning, technical high school students will be prepared for the workforce and/or secondary education upon graduation from high school. These students will be the future "green collar" workforce of our country.

We are about to pilot the technical high school program at Penn Tech in Pennsauken, New Jersey and are hoping to expand it throughout the state.

Water Champions

In 2009 USEPA Region 2 approached New Jersey Water Savers, a partnership between NJDEP, EPA and the RCE Water Resources Program, to participate in the Water Champions Program in one high school in the State. Rahway High School was selected for this

initial pilot program. The Water Champions Program was designed to engage high school students to develop a promotional campaign on water conservation within their school and their surrounding community. It is through these efforts that we are able to create the conditions that allow for behavior changes such as smarter purchasing decisions and proactive public participation in water conservation. The RCE Water Resources Program staff helped students tailor the program to local needs to provide an environmentally-oriented community service and learning effort.

In 2011 Rutgers University received a grant from USEPA Region 2 to continue their work with the Water Champions Program and expand the program to two additional high schools. The participating students first learn how to conduct a water audit in their school. Students then provide a numeric estimate of waste. The students work in groups to develop a plan for conserving water at their school. Funding is provided to implement parts of these plans, and the students monitor the water savings that are being achieved. Students then have the opportunity to request a school retrofit. These retrofits typically involve removing old plumbing fixtures and replacing them with water saving fixtures. Students evaluate the results of the retrofit by conducting a post-audit, providing a numeric estimate of savings. By participating with this task of the project, students gain the ability to visualize barriers to change, find opportunities to foster change, and achieve measurable results. Students then share their experiences by working with their parents to conduct a water conservation audit of their home. The students are encouraged to implement their home plans and evaluate the effectiveness.

Next the RCE Water Resources Program works with the students to help promote the results of each of the participating school's project within the community. The students deliver educational programs to younger students. These peer-to-peer teaching experiences help the students master the material and give them experiences at teaching. These students may be the next generation of science teachers. The students also inform the community about the importance of water conservation. These community programs focus on promoting cost-saving/water reducing technologies and encourage participation in USEPA's Watersense® Program. The students ultimately gather data on the purchase of water-efficient technologies, calculate the reduced volume of water used and cost savings associated with these purchases, and share the project outcomes with the community.

The Water Champions program would like to expand its reach by offering this program to additional high schools in New Jersey. By 2015, we hope to bring this program to all 21 of New Jersey's counties. Resources will be used to expand this program at all grade levels via peer-to-peer learning. This experience will allow the high school students an opportunity to teach a modified water conservation program to middle school and elementary school students. It is through this opportunity that high school students will be able to have teaching experiences, but experiences with addressing environmental issues within their community as well. In addition, the project partners plan to develop additional educational curriculum that satisfy the New Jersey State Core Curriculum Standards for the subjects of Math, Science, Communications, English, and Social Studies. Each of these disciplines will provide students with real world opportunities to make a difference in the community where they live.

UPDATE ON THE COMMUNITY-BASED GREEN INFRASTRUCTURE INITIATIVE FOR CAMDEN CITY

Jeremiah Bergstrom and Caitrin Higgins

In July 2010 the Rutgers Cooperative Extension (RCE) Water Resources Program entered into a partnership with the Camden County Municipal Utilities Authority (CCMUA) to pilot a community-based initiative implementing green infrastructure projects throughout the City of Camden to help in managing combined sewer overflows throughout the City.

Engaging the Public

During winter and spring 2011, a series of public meetings were held in the City of Camden. Five individual evening meetings were scheduled in various locations throughout the City. Each meeting targeted residents within four or five of the City's 20 unique neighborhoods. Our local partner, the New Jersey Tree Foundation (NJTF) helped to facilitate and organize the meetings. The purpose of the meetings was to educate residents about the issues of combined sewer systems and the benefits and opportunities of green infrastructure. In addition, residents were asked to provide information on localized flooding and sewer backups in their

Engaging stakeholders in the Cramer Hill section of Camden

neighborhoods. Information was gathered during these meetings on local neighborhood groups, organizations, community gardens, and civic buildings and activities. This information provided insight into potential community partners and sites for demonstration green infrastructure projects.

A locally driven partnership was established through the Camden SMART Initiative to coordinate and expand upon green infrastructure efforts within the City of Camden. The future of Camden is inextricably tied to the environmental and economic health of the region. A green stormwater infrastructure approach is the most environmentally beneficial and economically favorable way to remediate the effects of urbanization on the region's waterways. Sustainability needs to be a fundamental component of the revitalization strategy for the City of Camden. A holistic, sustainable approach can generate economic development, improve the lives and health of Camden residents, and improve the quality of the water and air. The Camden SMART Initiative will benefit the City of Camden by:

- Preventing neighborhood flooding
- Reducing combined sewer overflows
- Creating sustainable green jobs
- Improving air, water and climate quality
- Developing environmental policy
- Increasing property values
- Providing economic development opportunities
- Adding recreational amenities and open space
- Beautifying neighborhoods

Ferry Avenue rain garden in Camden

Partnering with local community-based organizations is critical to establishing lasting relationships in the City. Each of the City's 20 neighborhoods is unique. A successful city-wide program for green infrastructure that is embraced by the community will be dependent upon strong local relationships with multiple community -based organizations and activist groups. Through local partners, the effort will be able to effectively engage residents by providing the necessary education and programming that outlines 1) the need for green infrastructure, 2) the many benefits it can provide to the community at the lot, block, and neighborhood scales, and 3) the opportunities for improvements and changes in future planning, redevelopment and reinvestment projects.

The Community-Based Green Infrastructure for the City of Camden Feasibility Study, November 2011 is available on our web site at www.water.rutgers.edu under Projects & Programs, Camden Green Infrastructure Initiative.

Over the past year, multiple demonstration projects have been identified that will provide the foundation for a city-wide green infrastructure program. The RCE Water Resources Program staff, with assistance from NJTF and numerous local organizations and residents, visited each of the City's 20 unique neighborhoods to evaluate the need and opportunities for green infrastructure. In total, over 40 projects were selected, incorporating every one of the City's neighborhoods. Implementation of these efforts will be a priority to accomplish the first steps of a city-wide program. Eight of the demonstration projects were constructed this past year, which include 11 rain gardens designed to capture, treat, and infiltrate over 800,000 gallons of stormwater each year. The RCE Water Resources Program is eager to continue to lead the people of Camden with in-the-ground green infrastructure projects that beautify the City as well as mitigate environmental concerns.

ARTIST APPLICATION FOR THE ONE BARREL AT A TIME CO-OP 2012

The Rutgers Cooperative Extension Water Resources Program is coordinating the "One Barrel at a Time Co-op," where artists beautify rain barrels to be auctioned off to the public. If you are an artist and interested in participating, please check out our web site at www.water.rutgers.edu. **Hurry! Time is running out.**

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MARCH 2012

Applying knowledge to improve water quality
National Water Program
A Partnership of USDA NIFA & Land Grant Colleges and Universities

2012 LAND GRANT AND SEA GRANT
NATIONAL WATER CONFERENCE ▪ MAY 20-24, 2012
PORTLAND MARRIOTT DOWNTOWN WATERFRONT HOTEL
PORTLAND, OREGON

Sea Grant
National Sea Grant College Program

Early Registration Fee Deadline: April 22, 2012
Hotel Room Block Cut Off: April 26, 2012

Conference Highlights

- 140 Presentations addressing current and future water resource management issues
- 21 Workshops addressing critical national issues in water quality and quantity
- 4 Off-site tours exploring the Tualatin Basin, Portland Urban Sustainability, Coastal Oregon, and Columbia River Gorge
- Large poster and exhibit hall featuring 160 water quality and quantity projects at the local, regional, and national levels
- Network with Land Grant, Sea Grant, and NIFA National Water Program partners
- Student poster competition

Conference participants will include:

- University researchers and educators who lead water quality and quantity programs
- Land Grant and Sea Grant Extension professionals working on water quality and quantity education
- USDA NIFA program leaders
- Federal partners including USEPA, NOAA, NSGO, NRCS, USGS, and other water agencies
- State and local water agencies and organizations
- Private organizations interested in water management research and education

The RCE Water Resources Program Staff are giving two oral presentation and will be presenting four posters at the National Water Conference. We hope you will join us in Portland, Oregon.

FINAL THOUGHTS . . .

Christopher C. Obropta, Ph.D., P.E.

For over nine years, the RCE Water Resources Program has been identifying and addressing community-based water resources issues using sustainable and practical science-based solutions. We have worked with our partners to help develop three Regional Stormwater Management Plans and nine Watershed Restoration Plans. We have been working with stakeholder groups to implement the stormwater best management practices that have been identified in these plans. We have developed and delivered a wide-range of outreach programs targeted at diverse audiences including farmers, homeowners, municipal officials, State officials and youth.

Since its inception, the RCE Water Resources Program received funding from the USDA National Water Program to support our outreach efforts. This funding has made it possible to deliver successful programs in places where no other funding was available. Many of our rain barrel and rain garden workshops have been subsidized by this USDA National Water Program funding. Unfortunately, this funding is coming to an end on August 31, 2012. We are currently seeking a new funding source so we can continue to deliver our programs throughout the entire State. We are grateful for all the support from our partners over the years. Our hope is to continue to work closely with all of you to keep delivering our successful programming so together we can address New Jersey's water resources issues.

Please remember what Dr. Seuss wrote in The Lorax: "Unless someone like you cares a whole awful lot, nothing is going to get better. It's not." We hope you will continue to care with us and work to make things better.

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