RIVER VOICES

GREEN INFRASTRUCTURE AND URBAN RIVERS

Turning Our Cities Blue

July 2015 Issue

A RIVER NETWORK PUBLICATION

CLICK THE BLUE LINKS ON EACH PAGE TO ACCESS HELPFUL RESOURCES

river NETWORK
connecting people · saving rivers

HEADQUARTERS
434 NW Sixth Avenue
Suite 304
Portland, OR 97209
503.241.3506
info@rivernetwork.org
www.rivernetwork.org

TABLE OF CONTENTS

MISSION, VISION, AND FOCUS

River Network empowers and unites people and communities to protect and restore rivers and other waters that sustain all life. We envision a future of clean and ample water for people and nature, where local caretakers are well-equipped, effective and courageous champions for our rivers. Our three strategies for focused investment are strong champions, clean water, and ample water.

IN THIS ISSUE

Many of us meet our first river in a city, either because of our curiosity about the water that flows through our faucets and backyards or because the city happens to be located adjacent to a major river.

What we find when we look closer at our urban areas are rivers that are overworked and often overlooked, places that we have turned our back on, or manipulated and engineered to make way for buildings and industry.

What would happen if we tried a different approach with the waters that pass through our cities? What if instead of turning our back on these waters and managing them for fast exit from our urban areas, we turned toward them? What if instead of pushing them underground and into pipes and concrete, we brought them out into the open? Could we bring back their ecological function while also delivering benefit to our communities?

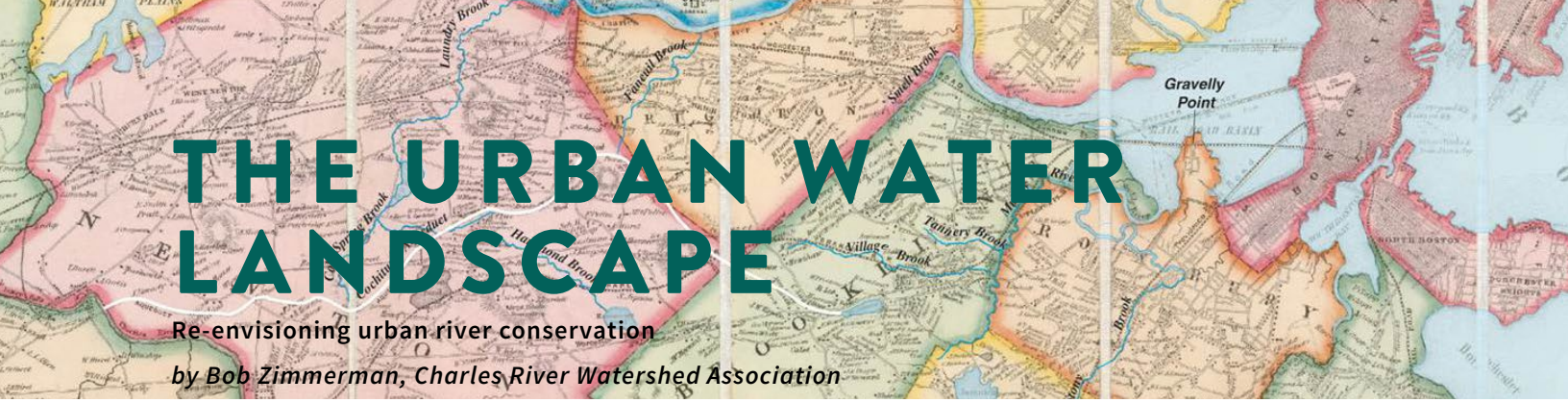
This issue of *River Voices* explores the topic of turning our cities blue, of moving from gray to green infrastructure, and the related benefits to our communities of restoring the health of our urban waters. We encourage you to explore the perspectives and experiences from efforts in cities across the country, where actions are transforming our relationship with water in urban landscapes. As with all issues of *River Voices*, we hope to pique your interest, ignite your curiosity, and connect you with others who inspire you to do more. **Thank you contributors!**

OTHER IMPORTANT ANNOUNCEMENTS FROM YOUR FRIENDS AT RIVER NETWORK:

- The ***call for workshops*** for River Rally 2016 in Mobile, AL is now open!
- Register for the ***new ideas and innovations forum*** on green infrastructure coming up on September 23rd, 2015.
- Support us through your ***donations*** and ***Partner dues***.
- Get ready for a new River Network website soon!

And stay tuned for the the next quarterly issue of *River Voices*, which will focus on diversity and inclusive conversation!

Nicole Silk, President
River Network



THE URBAN WATER LANDSCAPE

Re-envisioning urban river conservation

by Bob Zimmerman, Charles River Watershed Association

Rivers weave a tapestry across our landscape, connecting mountains with valleys, farms with cities, and industry with markets. They serve our needs for drinking water, crop irrigation, electric generation, and transport of goods and services. They carry our waste, and fuel our recreation. Those of us in the river and watershed conservation community work hard to understand our rivers, their unique characteristics, the laws and regulatory framework we can use to protect them, and engage the public and decision makers in pursuit of their protection.

Urban river conservation is unique. Urban rivers, their tributaries, and how they connect to groundwater, often have been rerouted, thier channels armored, and entire streams pushed into pipes, or simply buried, to allow for streets and buildings. Add city wastewater systems, pipes for drinking water, and all other infrastructure, and it becomes clear that what we have created is very different from what nature intended. Efforts in cities often focus on complying with regulatory mandates, reducing pollution and bringing more people to neighborhood waterways, but given the issues we face, these efforts can be made more effective by taking a comprehensive approach.

At Charles River Watershed Association (CRWA), we have concluded a wholesale re-envisioning of our urban landscapes is necessary if we are to truly protect, restore, and sustain our rivers, and ourselves.

The Charles River flows 80 miles through eastern Massachusetts, collecting water from 308 square miles and flowing through 23 towns and cities on its journey to the Atlantic Ocean at Boston Harbor. CRWA was formed in 1965 in response to public concern about the abysmal condition of the Charles. Beginning in 1994, with the addition of research science and engineering capabilities, CRWA became, in effect, a small consulting firm whose only client was the Charles and its greater metropolitan environs.

Over the past 20 years, a critical take-away from CRWA's research science and engineering has been the realization that our entire perspective on pollution issues, climate change, and sustainability is based on the wrong premise. Since 1972, with the passage of the Clean Water Act, the premise in both regulation and design engineering has been that by adding to or subtracting from existing urban water infrastructure we can clean up and restore the waters of the United States.

We have certainly improved the waters of the United States since 1972 by eliminating or severely curtailing the most egregious polluted discharges. The bottom line, however, is this: if every surface water body in the United States currently met the requirements of the Act, rivers in the United States would remain in big trouble. From instream flow and groundwater hydrology, to flooding, drought, habitat, and climate change, the regulatory framework on which we rely is simply inadequate.

CRWA's research clearly indicates that water sustainability must begin with understanding and restoring historic natural hydrology. If we begin with the premise that our water use must serve and restore nature, then how we design and engineer infrastructure for water supply, stormwater capture, and wastewater collection and treatment must change.

CRWA is challenging the 19th century technology and concepts that underpin our relationship to water in urban areas. We have identified five principles of infrastructure design to inform our work moving forward, principles that offer guidance for others ready to re-envision rivers and water in urban landscapes.

RESTORE NATURE

Restoring nature sounds like a tall order, when in fact it is pretty straightforward. For any urban area, the process requires mapping regional hydrology dating to before and during early settlement. CRWA staff regularly reference maps that are nearly 300 years old and then consider land development and alteration patterns to better understand how the Charles River and Boston Harbor have been filled and changed to create half of Boston. Over time, tidal estuaries and wetlands, creeks and tributary streams, and canals have disappeared. Using GIS mapping, we then overlay existing water infrastructure on the historic maps, focusing particularly on stormwater and wastewater collection systems.

In any investigation of how to restore nature with modern water infrastructure, the mapping process is the first step. It shows quite graphically how our systems have changed and impacted natural hydrology, often at our own expense. For example, rainwater continues to behave as if the streams long buried were still there, causing localized flooding during rainstorms as a consequence.

Nature, with millions of years of land and water evolution, is far more efficient than we are at creating storage and conveyance for flood-water, and storage and long-term resilience to drought. By replicating her design, we enlist her aid in confronting and adapting to flood, drought, and climate change.

As a practical application, CRWA's landscape-wide mapping process informs the siting and design of blue/green infrastructure to integrate with and restore aspects of the area's historic natural hydrology, effectively making it more blue.

Also critical to this approach is the reintroduction of streams and tributaries to the urban environment, including those that have been pushed underground or buried. By "daylighting" them, flood storage and conveyance, as well as riparian zone stormwater treatment and infiltration, can be dramatically increased. Daylighted streams can also become the central element in economic redevelopment.

RESOURCE TO WASTE TO RESOURCE

Current water/wastewater systems throw away a tremendous amount of value. First, there is the fresh water. In Boston's case, we collect, treat, and discharge approximately 300 million gallons of water a day into the Atlantic Ocean. Forty percent of that 300 million gallons is otherwise clean groundwater leaking into our wastewater collection system pipes, or rainwater.

The pressure in the ground, where groundwater travels a little over a foot a day, is much higher than the pressure inside collection pipes, where water travels miles in a day. Therefore, as collection systems develop leaks, and they all do, groundwater is collected and transported away as if it were wastewater. Groundwater losses in these volumes seriously impact instream flow, particularly in tributary streams, but also river flow in the summer months and during drought.

The organics in wastewater can be gathered and used to generate electricity. Wastewater is warm; it takes about 2,250 kilowatts of energy to treat one million gallons of wastewater. That same million gallons contains about 36,500 kilowatts of thermal energy we could and should be using to heat and cool our homes and businesses.

SMART SEWERING

CRWA's Urban Smart Sewering project examines the economic and environmental benefits of breaking up Boston's large centralized wastewater infrastrucutre in favor of a series of distributed treatment plants, each generating electric and thermal energy, and utilizing reclaimed water. Conceptual designs are underway for treatment facilities that can treat approximately 1.10 million gallons of wastewater a day while also producing energy and non-potable water. Effluent from the facilities will then be introduced to restored urban streams, acting as permanent baseflow to those streams. To find out more, visit CRWA's blog series available at www.charlesriver.org under the ***Water Transformation*** banner.

KEEP WATER LOCAL

Nature does an exceptional job of slowing water down, infiltrating it, storing it in groundwater aquifers, wetlands, vernal pools, ponds, lakes, intermittent streams, tributaries, plants, and rivers. All are interconnected. Conversely, most engineered systems do a very good job of throwing lots of water away, often quite polluted, from pavement and compacted soils, by filling in wetlands, streams, vernal pools, and by cutting off rainwater infiltration to the ground. We take our drinking water from somewhere upstream of our homes and businesses, and then once used throw it away someplace far downstream.

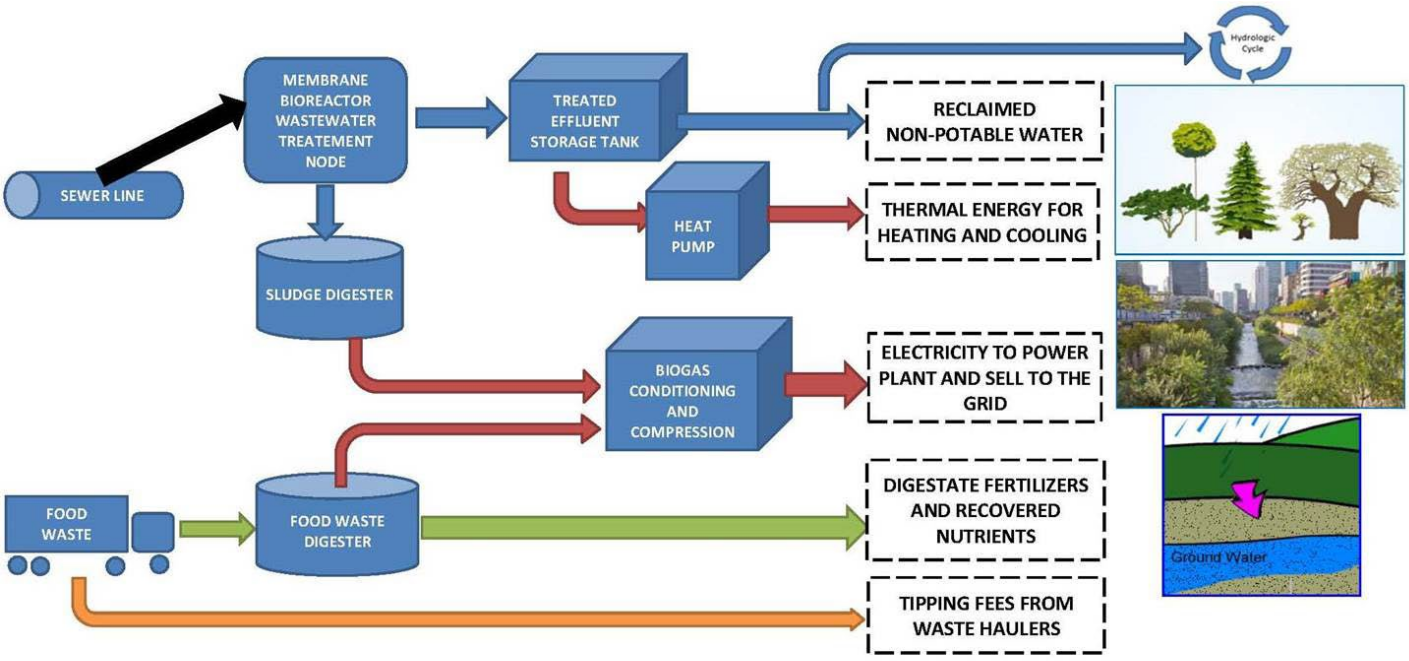
If we are serious about confronting both flooding and drought, and the vagaries of climate change, as well as finally achieving the water quality requirements of the Clean Water Act, nature can help us. That is the premise of blue/green infrastructure. The catch is that to succeed and be most effective, blue/green infrastructure must be designed to respect and replicate landscape-wide historic natural hydrology. In this way, as each blue/green infrastructure project comes on line, the net effect will be the restoration of the natural hydrology so badly damaged over large landscapes and watersheds, bringing significant benefits for infiltration, filtration, storage, and conveyance.

FLEXIBILITY, ADAPTABILITY, INTERCONNECTEDNESS

Unlike in a natural setting, where each different aspect lends its capacity to all others during and after significant events, most of our urban water infrastructure is rigid, inflexible, and separate by design. Using technology and science, we can restore urban natural hydrology, but we should make sure to also reintroduce natural flexibility and interconnectedness to the systems we build.

Blue/green infrastructure should be intentionally constructed to connect with groundwater and surface waterways. Restored streams must be able to handle flooding, make use of existing open spaces in cities for overflow storage, or recreate flood plains through development retreat over time.

As distributed wastewater treatment plants are engineered, freeing up capacity in our large urban wastewater sewer interceptors and ultimately eliminating combined sewer overflows, pipes should be repurposed for flood control. In Boston, for example, interceptors have an upper capacity to move 1.2 billion gallons daily. Once wastewater is no longer collected in them, perhaps they might be used to help keep flood water out of Boston's subway system.



Plant schematic by Natural Systems Utilities.

PROMOTE AND SUPPORT RICH DIVERSITY

The systems and facilities that we rely on for power generation, water treatment, trash disposal and waste incineration, and road maintenance, have historically been placed in and near places with few local residents or where those residents are least represented in our political process. These necessary but often nuisance services and operations are disproportionately sited in economically and otherwise disadvantaged communities, or conversely, such areas effectively become “affordable housing” magnets.

We can do much better. As we design to restore urban nature and diversity, these systems and facilities deserve our attention. Restored streams, blue/green infrastructure, community gardens, job opportunities associated with the construction and maintenance of green technologies, all can and should serve to enhance disadvantaged areas in our cities, as well as protect them.

The flooding in Arizona and California last summer and fall, and in Texas this spring, the drought in the west, the increased power and size of storms, none of these are aberrations. Talk of adaptation and sustainability in the face of rapid and sometimes catastrophic climate change is good, but if all we do is make existing, inherently environmentally damaging systems bigger, we will miss a tremendous opportunity to both adapt and restore. The key to adaptation in the face of climate change lies with restoration. Billions of years of land and water evolution trump 170 years of water engineering. Every time.

RESOURCES

- CWRA blog series on water transformation: ***http://www.crwa.org/water-transformation-series***
- ***Integrating Water Infrastructure in a New Paradigm for Sustainable, Resilient Communities*** from Cities of the Future 2010 by Clements et. al.
- ***Charting New Waters: Optimizing the Structure and Scale of Urban Water Infrastructure*** by the Johnson Foundation

Map image credit: ***David Rumsey Map Collection***

RIVER NETWORK LEARNING SPOTLIGHT

CLEAN WATER WEBINARS

Intro Session: Monitoring That Guarantees Measurable Results

August 18th, 2015 at 9am PST/11am EST

NEW! Monitoring That Guarantees Measurable Results
Five-part webinar series

Begins November 9th, 2015 at 9am PST/11am EST

LEADERSHIP DEVELOPMENT WEBINARS

NEW! The Building Blocks of an Exceptional Board
Five-part webinar series

Begins August 13th, 2015 at 11am PST/1pm EST

-- Scholarships are available for this webinar series. Please inquire via email: Mary Ellen Olcese, Leadership Development Manager, meolcese@rivernetwork.org --

SIGN UP NOW!

For more information and to register for a webinar or webinar series, please visit River Network’s website:
www.rivernetwork.org/river-network-webinars

FROM GRAY TO GREEN

Stormwater Trading in Washington D.C.

by Evan Branosky, District Department of the Environment

A single storm in the District of Columbia can generate over 500 million gallons of stormwater runoff, carrying pollution and causing erosion as it rushes into local rivers and streams. This problem begins simply, with rain falling in a city where 43 percent of the land is covered by impervious surfaces. Curbing runoff requires regulation for construction projects and funding for green infrastructure. However, most impervious surfaces are not subject to retrofit requirements and lack financing to support voluntary retrofits.

BOX 1: IN-LIEU FEE OFFERS ANOTHER COMPLIANCE OPTION

Instead of buying and using SRCs, sites may pay in-lieu fee to achieve off-site retention obligations. The in-lieu fee rate is $3.57 per gallon per year of required off-site retention. DDOE deposits in-lieu fee payments into a spcial purpose revenue fund and uses the revenue to install green infrastructure projects that retain stormwater runoff.

To address these challenges, the District Department of the Environment (DDOE) adopted local stormwater regulations with an innovative trading program that catalyzes green infrastructure retrofits and maximizes cost-effective clean water benefits. Published in 2013, the regulations require major land-disturbing projects[1] and major substantial improvement projects[2] to retain the volume from the respective 1.2- or 0.8-inch storm. The 1.2-inch storm is the 90th percentile storm in the District (i.e., an event that is greater than or equal to 90 percent of all 24-hour storms on an annual basis), while the 0.8-inch storm is the 80th percentile event. Once these regulated projects retain 50 percent of their Stormwater Retention Volume onsite, they may meet the remaining volume by purchasing privately-traded Stormwater Retention Credits (SRCs) from other sites or paying an in-lieu fee to DDOE (see BOX 1). Each SRC achieves one gallon of retention for one year. Sites generate SRCs by installing voluntary green infrastructure or by exceeding their regulatory requirements. Because off-site retention is an ongoing obligation that must be met on an annual basis, sales of SRCs can provide a reliable revenue stream to finance green infrastructure and may turn a profit over time.

PROGRAM BENEFITS

DDOE's program is designed to provide flexibility for regulated sites while maximizing the benefit to District waterbodies. Two hypothetical scenarios illustrate the potential for cost savings and flexibility from SRC trading. In Scenario A, a single site that is 5,000 ft^2 and 100 percent impervious controls the entire 1.2-inch storm volume onsite through relatively high-cost green infrastructure ($3.25 per gallon or $11,547). In Scenario B, there are two sites that are both 5,000 ft^2 and 100 percent impervious. Site 1 retains 0.75 inches onsite (at $3.25 per gallon) and achieves the remaining 0.45 inches using SRCs generated at Site 2, which is located in an area where it is less costly to install green infrastructure ($0.65 per gallon). The combined retention cost for Sites 1 and 2 is $8,084. Compared to Scenario A, Scenario B results in a 30 percent cost savings to provide the same amount of runoff retention.

[1] Major land disturbing projects are development projects that disturb 5,000 ft2 or more of land area.
[2] Major substantial improvement projects are development projects where the cost of improvement equals at least 50 percent of the assessed value of the structure prior to improvement and the combined footprint of the improved structure(s) and land disturbance is ≥5,000 ft2.

On an annual basis, Scenario B may also provide increased benefits to District waterbodies because two smaller practices can receive runoff from more area than one larger practice. Based on 2009 annual rainfall data, many of the storms that occur in the District are smaller than the 1.2-inch retention requirement. Consequently, Scenario B's two green infrastructure practices fill to their capacity more frequently than the single practice in Scenario A, resulting in a comparative 53-percent increase in annual stormwater retention for Scenario B.

Beyond the financial and environmental benefits of increasing retention, SRC trading should also help to drive installation of green infrastructure to areas outside of the downtown core where there is more open space and land values are relatively low. This driver can help to catalyze "greening" of areas that are in most need of social and economic benefits. Additionally, increasing green infrastructure outside of the downtown core provides enhanced protection to sensitive non-tidal streams and accrues benefits to the downstream tidal waters of the Anacostia and Potomac Rivers (Figure 1).

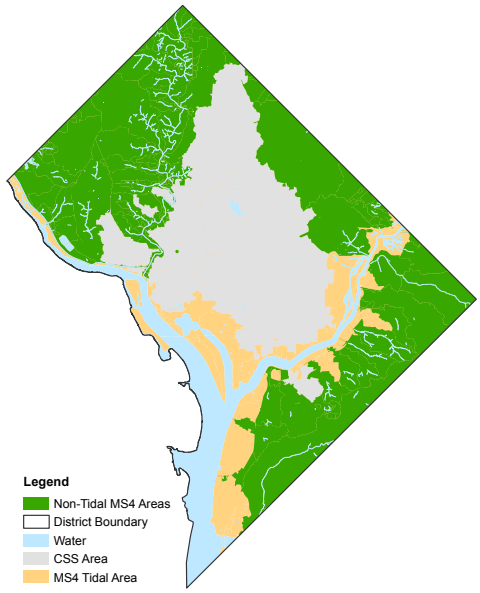


Figure 1: Green infrastructure in areas draining to small streams benefits those streams and downstream tidal rivers. Source: DDOE

CREDIT CERTIFICATION AND MAINTENANCE REQUIREMENTS

DDOE is the sole SRC-certifying authority. To be eligible, projects must exceed existing retention requirements, be designed in accordance with an approved stormwater management plan, complete a final construction inspection and ongoing maintenance inspections, and document the ability to maintain the green infrastructure over the certification period. DDOE certifies up to three years' worth of SRCs at one time and will re-certify every three years as long as eligibility requirements are met.

A unique feature of the SRC trading program is that one SRC equals one gallon of runoff retention for one year. Likewise, the in-lieu fee corresponds to one gallon of runoff retention for one year. The one-year lifespan of an SRC and the three-year certification cycle provide incentives for continued maintenance and provide flexibility for SRC generators who decide to leave the market and use their land in other ways.

COMBINED INCENTIVES MAXIMIZE RETURNS FOR PARTICIPATING SITES

The SRC trading program complements DDOE's other financial incentive programs to provide maximum financial support to sites that install voluntary green infrastructure. For example, through the RiverSmart Rewards program, sites that retain the volume from the 1.2-inch storm can receive a 55 percent discount on their water bill, while smaller amounts of retention receive less of a discount. The volume retained for RiverSmart Rewards may also be eligible to generate SRCs, so sites that participate in both programs can "stack" the financial benefits.

INITIAL ACTIVITY

DDOE certified the first SRCs in April 2014 and approved the first trade in September 2014. As regulated projects finish their construction phases and more people learn about SRC trading opportunities, DDOE expects trading activity to increase. As of April 2015, several projects are in the process of applying for SRC certification and two have used SRCs or in-lieu fee to meet their retention requirements. Potential traders and the general public can view the SRC trading registry in real time at ddoe.dc.gov/src.

RESOURCES

- DDOE SRC Trading Program: ***ddoe.dc.gov/src***
- DDOE River Smart Homes: ***http://green.dc.gov/riversmarthomes***

GETTING RAINREADY℠

Helping communities prepare for urban flooding

by Harriet Festing, Center for Neighborhood Technology

Elizabeth Rafferty's South Side Chicago home flooded four times in two years, causing an estimated $75,000 in damage. At one point, her basement filled with five feet of murky sewage water in less than an hour. That was the day Rafferty found the family's large oak dining room table crashing into the basement walls and the clothes dryer bobbing upside down in the water.

The losses have grown with every flood. Carpets and tiling have needed replacement, as did the entire basement bathroom. The clothes washer and dryer and water heater had to be replaced. The furnace has been replaced twice. After one flood, larvae in the sewage hatched, and thousands of enormous horseflies swarmed through her basement. Bad luck sometimes creates bad luck - Rafferty's flood insurance was canceled after her third flood.

URBAN FLOODING IN OUR CITIES

Rafferty is one of millions of homeowners across America affected by urban flooding; defined as the inundation of property in a built environment caused by rain overwhelming the capacity of drainage systems, such as storm sewers. Flooding in cities like Chicago can affect neighborhoods and homes in several ways that stormwater can:

- Backup through property floor drains, tubs, toilets, and sinks
- Seep through foundation walls and basement floors
- Enter buildings through windows, doors, or other openings
- Overflow from rivers, streams, and coastal areas

As cities, towns, and suburbs have developed to accommodate increasing population, more impervious surfaces (roads, roofs, parking lots, driveways, alleys, sidewalks, and patios) have led to increased stormwater runoff, and natural drainage systems have been replaced with man-made sewer and stormwater infrastructure. In many cities, this infrastructure is aging, poorly maintained, and undersized. As a result, even after modest events, stormwater can overflow with devastating flood effects.

There's a clear link between the solutions to Elizabeth's misery, and goals to enhance the vitality and health of rivers and watersheds – the stormwater runoff that causes billions of dollars of flood damage to homes and businesses is also a major pollutant of rivers and streams.

COMBINING FORCES

So imagine the power of bringing together flood victims and healthy river campaigners around a coordinated program of action and advocacy both locally and nationally. This is the essence of RainReady, a national program launched in 2014 by the Chicago-based nonprofit, the Center for Neighborhood Technology (CNT). RainReady helps individuals and communities find solutions to the problems of too much and too little water. Participating communities and residents are provided with planning and implementation services to improve stormwater management in ways that bring wider benefits to the community. Strategies adopted include:

- **Coordinated landscaping, plumbing and building improvements to homes and businesses** complete with a property assessment, construction oversight and upfront financing. Improvements can include downspout disconnection, re-grading, foundation crack sealing, porous paving, rain gardens, and backwater valves.
- **Deploying green infrastructure in public rights-of-way**, including projects that infiltrate, intercept, delay, and detain rainwater before it can reach stormwater drains and pipes.
- **Restoring wetlands, riparian corridors, and forested areas** in areas where they can best alleviate vulnerability to flooding.
- **Buyouts of properties** that have been repeatedly flooded or substantially flooded, with the land converted into wetlands
- **Restoring tree canopy and urban forests** for urban communities with little or no tree canopy, planting trees enhances the capacity of urban soils to retain stormwater and decreases the quantity of excess runoff through transpiration and evaporation.

RainReady is currently being piloted in two communities in the Chicago region, with expansion already planned to an additional 16 communities in the region. CNT hopes to expand the program to other cities in 2016.

THE CASE OF MIDLOTHIAN, IL

Midlothian, IL, located in Chicago's south suburbs, is one example. The village's 14,000 inhabitants suffered from occasional flooding for decades, but residents have noticed that the episodes are more frequent and severe in recent years, with even small rain events resulting in severe flooding of homes, garages, yards, and streets.

After a particularly severe flood in 2013, five hard-hit families banded together as the "Floodlothian 5" and began meeting regularly, and utilizing social media to post various updates for their community.

Floodlothian Midlothian has now expanded to represent hundreds of affected residents. In 2014, the Village partnered with CNT and the US Army Corps of Engineers to complete an assessment of the source and severity of flooding in the town, using information gathered via resident survey, historic maps, public meetings, and a newly installed USGS streamflow.

A RainReady Steering Committee made up of flood victims, residents and Village administration is now working with CNT to draft a set of solutions and strategies to reduce the risk of damaging floods. Improvements are likely to include natural and recreational enhancements to Natalie Creek, the incorporation of green infrastructure, stormwater management practices as part of a comprehensive "Complete Streets" policy, and building, plumbing, and landscaping improvements to individual properties. The RainReady Plan will be completed by September 2015. Meanwhile, homeowners in the village are receiving free home assessments that offer expert guidance on how to keep their homes dry during the rainy season.

TEN CORE PRINCIPLES

Several core principles underpin the program and distinguish it from traditional stormwater master planning:

1. Nationally replicable: The tools and services that underpin RainReady have been designed so that they can be easily adopted by any American town or city.

2. Market-based: RainReady helps coordinate existing private sector companies – whether engineering firms, or plumbing and landscaping services – across private and public property within a community. This aggregation of market-based services reduces costs and speeds up delivery.

3. Community-wide: Rainready brings efficiency savings by serving the whole community and addressing the multifaceted mix of flooding problems that residents face.

4. Evidence-based: The recommended investments are prioritized based on a robust analysis of the risks property owners face.

5. Affordable and fair: RainReady prioritizes affordable solutions that can be installed quickly.

6. No negative downstream impacts: Solutions are designed to avoid pushing stormwater runoff into neighboring homes.

7. Nature-based: RainReady advocates using green infrastructure as often as possible, as it brings wider benefits to the community than large-scale, engineered fixes.

8. Fiscal fairness and transparency: All property owners generate stormwater runoff, and RainReady makes the case that everyone should help pay for the services managing it.

9. Preventative: Promotion of the adoption of zoning ordinances, permits, and incentives to encourage development consistent with RainReady practices.

10. Multi-tiered: Flooding problems occur at many levels, and thus action is needed at all levels – from individual residents to municipalities, regions, states and the nation.

While much of this work is on the ground, there are also policy strategies at the state and federal levels. Legislation such as the Urban Flooding Awareness Act, passed in Illinois last summer and currently being introduced at the federal level, demonstrate the potential for change when flood victims are engaged and coordinated.

Using these strategies can make communities more resilient to urban flooding while also reducing polluted stormwater runoff, creating benefits for people and rivers.

RESOURCES

- Midlothian flooding stories: ***http://rainready.org/videos-urban-flooding-and-activism***
- *The Prevalence and Cost of Urban Flooding* by Harriet Festing: ***http://www.cnt.org/publications/the-prevalence-and-cost-of-urban-flooding***

CNT staff members are available for presentations and technical assistance if your community is interested in adopting a ***RainReady*** plan!

Photo credit: Center for Neighborhood Technology

SIDEBAR: EPA'S GREEN INFRASTRUCTURE PROGRAM FOCUSES ON COMMUNITIES

In the past 10 years, green infrastructure has grown from a seemingly niche stormwater management practice to a well-accepted community development and water infrastructure improvement strategy. Once dominated by mostly pilot and demonstration projects, multi-million dollar municipal investments in green water projects are now common.

During this time, the Environmental Protection Agency's (EPA) Green Infrastructure Program has focused on supporting community efforts to use green infrastructure to reduce stormwater pollution and sewer overflows. The Agency's early work describing green infrastructure practices and how they operate has evolved into a multifaceted program dealing with financing, evaluating the multiple benefits of greening cities, and integrating stormwater management into broader planning and capital improvement efforts.

Much of the Agency's most recent work has centered on how green infrastructure can complement and enhance existing gray infrastructure to improve environmental performance and provide the best investments for communities. This also includes evaluating how green infrastructure can be a strategy for improving community and infrastructure resiliency to climate change. Many of the additional benefits of green infrastructure, such as recharging local groundwater supplies, decreasing energy use, addressing urban heat islands, and improving air quality, are important components of an overall resiliency plan.

A key element of EPA's work on green infrastructure has been the community technical assistance program, which has provided more than $2.2 million to 39 communities since 2012. The program has helped address local needs to more easily use green infrastructure, but just as importantly, has also built 39 specific case studies that can serve as models for the growing number of communities around the nation interested in investing in more green.

For more information about EPA's green infrastructure program, check out:

- ***EPA's Green Infrastructure Webpage***
- ***Green Infrastructure for Climate Resiliency***
- ***Green Infrastructure Technical Assistance Program***
- ***Green Infrastructure Collaborative***
- ***Green Infrastructure Policy and Permitting Information***

URBAN GREEN INFRASTRUCTURE

Conducting A Retrofit Analysis for Ellerbe Creek

by Chris Dreps, Ellerbe Creek Watershed Association

In North Carolina's thriving Triangle Region, the 37 square-mile Ellerbe Creek watershed offers a refuge for people and wildlife in Durham's urban core. Since 1999, the Ellerbe Creek Watershed Association (ECWA) has worked to make the creek an asset to Durham through protection, restoration and connecting the community to the creek. This is no small challenge, as Ellerbe is the most urban and degraded stream in the entire Upper Neuse River Basin, a regional drinking water source.

Ellerbe Creek receives almost half of downtown Durham's stormwater runoff, and the creek is on the list of NC's most polluted water bodies because it does not meet Clean Water Act standards for aquatic life. Urban stormwater runoff is the primary source of stream impairment, and regionally, Ellerbe Creek is the greatest contributor of stormwater pollutants to the downstream and eutrophic Falls Lake Reservoir, a State Recreational Area and the drinking water source for more than 500,000 people in and around Raleigh.

Luckily for Ellerbe Creek, clean-up goals for the downstream reservoir are in place and call for a 40% reduction in nitrogen and a 77% reduction in phosphorus, driving the City to identify best management practices to improve water quality as part of its Ellerbe Creek Watershed Management Improvement Plan.

PLANNING FOR A DIFFERENT SOLUTION

To restore clean water to the creek using traditional stormwater management practices, Durham would need to spend hundreds of millions of dollars. ECWA saw an opportunity to evaluate an alternative, innovative approach to address these problems relying on integrating green infrastructure (e.g. rain gardens, green roofs, permeable pavement) into the city's most urban landscape, South Ellerbe Creek. Green infrastructure mimics nature by absorbing and filtering polluted stormwater and slowly releasing the cleaned, cooled water into the creek.

In a built-out watershed like South Ellerbe Creek, one first step is to identify the potential locations where green infrastructure can be retrofitted into the landscape. In 2012, ECWA, the City of Durham, American Rivers, NC Cooperative Extension, and other partners developed the Ellerbe Creek Green Infrastructure Partnership to pursue these approaches and identify the best opportunities for installing green infrastructure and to model the water quality and quantity benefits. With support from an EPA Urban Waters grant, the partners developed a detailed plan for the South Ellerbe Creek. This drainage area flows primarily through pipes from an area of downtown Durham that is roughly 60% impervious cover. This catchment was selected because it contains a good mix of both residential and commercial land uses, has a high percentage of impervious area, has significant traditional stormwater infrastructure and is the headwaters of the creek.

PROCESS

The Green Infrastructure Partners conducted a Geographic Information Systems (GIS) analysis and field verification using methodologies adapted from the Center for Watershed Protection's Urban Subwatershed Restoration Manual Series. Field teams using iPads with GPS and Google Maps and Fusion Table technology searched for opportunities for significant sized stormwater retrofits on commercial sites (Winter, 2012), residential sites (Spring, 2013), and for green street retrofit opportunities in the street rights-of-way (Summer, 2013). The fieldwork identified over 550 stormwater retrofit opportunities treating 173 acres of this 467-acre catchment including:

- 279 bioretention/rain gardens (show as green circles in Figure 1)
- 246 rainwater harvesters (blue circles)
- 40 green roofs (green squares)
- 3.7 acres of permeable pavement (orange cross hatches)

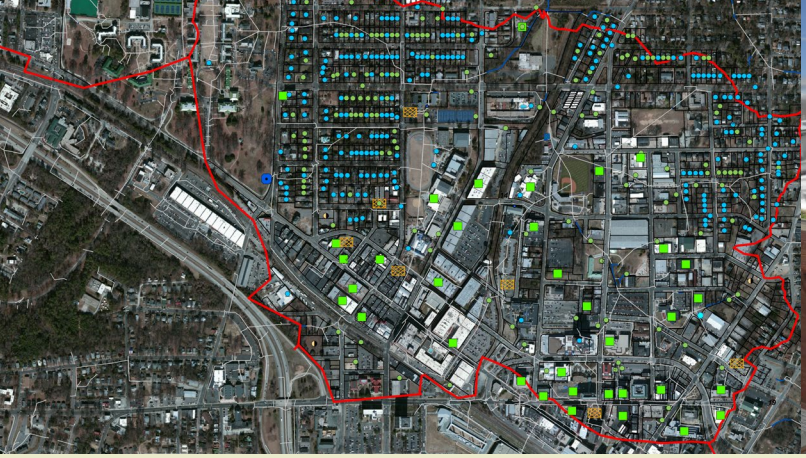


Figure 1: GIS map of green infrastructure opportunities. Source: Ellerbe Creek Watershed Association

Figure 2: Green infrastructure envisioned for Chapel Hill Street. Source: American Rivers

- One dry pond (large blue circle)
- 2.08 million square feet of street rights-of-way; and
- 2 wetlands (not shown in map).

Once the partners had identified all practices, Triangle J Council of Governments water resources staff modeled the potential nutrient and stormwater volume reductions using a state-approved regulatory spreadsheet tool for the Falls and Jordan Reservoirs. The results show that, once implemented, these identified Green Infrastructure projects will treat 173 acres of mostly impervious area, managing 57 million gallons of stormwater annually, and reducing nitrogen loading by 38% and phosphorus loading by 43% in South Ellerbe Creek. These reductions represent a significant pollutant reduction to the creek.

NEXT STEPS

Since the release of the project's technical report in 2014, ECWA and American Rivers have been sharing the results of the project with local governments, state agencies, business organizations, neighborhoods, scientific and professional conferences, and at *River Rally* (2014). We believe that the future success of implementing these green infrastructure practices depends on:

1. Public participation in advancing this vision and implementing the projects;

2. Adoption of city and county policies to integrate green infrastructure into future public works projects and local codes and ordinances;

3. Identifying detailed costs and funding sources for the implementation of green infrastructure practices; and

4. Additional study to document the scope of the green infrastructure benefits (e.g. reduced flooding, energy use, etc.).

To this end, ECWA and partners have been applying for state and federal grants for implementation. With funding support from Durham's stormwater utility, the Partners have been installing a limited number of residential practices to kick start implementation. The City of Raleigh, the largest downstream water user, has begun supporting the project through its Watershed Protection Program.

Because many of the practices identified were on residential property, ECWA has begun offering guidance for Durham citizens who want to make their properties Creek Smart (www.creeksmart.org) With this strong green infrastructure analysis in place showing the real clean water benefits to Durham and downstream communities, ECWA believes in a bright future for Ellerbe Creek using these practices that provide multiple benefits.

FOR MORE INFORMATION:

Ellerbe Creek Green Infrastructure Technical Report: ***www.ellerbecreek.org/green-infrastructure.***

Article header image credit: Xero Flor America

TRANSFORMATIVE CHANGE

Renewing the Buffalo and Niagara Rivers

by Jill Jedlicka and Susan Kornacki, Buffalo Niagara Riverkeeper

The Niagara River watershed includes 1,400 square miles, 3,250 miles of waterways, and two of the Great Lakes (Lake Erie and Lake Ontario). The Niagara and its main tributary, the Buffalo River, have been impacted by pollutants and the lasting effects of industrial development, resulting in their designation as toxic hotspots by the International Joint Commission in 1987. The Buffalo River was even declared ecologically dead in 1967. With 95% of North America's freshwater flowing through the region, impaired waterways are in critical need of restoration, protection and stewardship. Fortunately, the future looks bright, and community-led restoration is part of the reason why.

Buffalo Niagara Riverkeeper (BNR) envisions a future where the waters that flow within this community become a priority in the region's economic revitalization and identity. BNR has engaged with a wide range of public and private partners to leverage funding, capacity, and engagement to begin making this vision a reality. Although each river is unique, perhaps some ideas and examples can be replicated:

- **Work with your local sewer authority to make green infrastructure a reality:** BNR helped secure a $92 million commitment by the Buffalo Sewer Authority so homes, schools and businesses can actively collect stormwater and provide useful solutions to reduce combined sewer overflows.

- **Partner on workforce development to operate and maintain green infrastructure:** BNR is partnering with local and national organizations to develop an innovative workforce training and development, and social enterprise solutions to operate and maintain green infrastructure systems.

- **Become a conduit for river restoration investment:** BNR coordinated the Buffalo River Restoration Partnership, a seven year partnership which leveraged $50 million from the US Environmental Protection Agency (USEPA) and private funds from Honeywell, to remediate contaminated sediment from the Buffalo River in collaboration with the US Army Corps of Engineers, New York State Department of Environmental Conservation, County of Erie and City of Buffalo.

- **Work with others to protect your region's "living infrastructure":** A novel collaboration between NGOs on both sides of the U.S. border contributing to the Niagara River Habitat Conservation Strategy (e.g., Niagara Peninsula

Jill Jedlicka and Chris Murawski (BNR) accept the 2015 North American RiverPrize at River Rally in Santa Ana, New Mexico in May 2015.

Conservation Authority, Environment Canada, The Nature Conservancy, US Fish and Wildlife Service, Sierra Club, Buffalo Audubon Society, the Western New York Environmental Alliance, and others) is helping raise awareness about ecological resources throughout the watershed and their valuable role in the region's health and vitality.

- **Plan and act for the long-term:** BNR coordinates the Niagara Relicensing Environmental Coalition (NREC) which engages fourteen municipalities, two counties, four different standing committees, and the Niagara River Greenway Commission in a 50 year commitment to establish the Niagara River Greenway, a 40-mile interconnected system of parks, trails and conservation areas. This effort is supported by a $450 million settlement from the Federal Energy Regulatory Commission.

- **Keep expanding the discussion:** Using an economic perspective to understanding the watershed, BNR recently launched the Rust to Blue Initiative® to support the emerging blue economy in Western New York. This initiative has produced non-traditional collaborations with the private sector, including the global HSBC Water Programme, Riverworks LLC, WNED- Public Television, State University of New York at Buffalo's Regional Institute, and New York State Governor Cuomo's Regional Economic Development Council. The overarching goal of this initiative is to create a culture and paradigm shift that values clean and accessible water as a catalyst for economic revitalization.

BNR will have achieved their goals when community and economic development policies integrate seamlessly with the social and ecological values of this globally significant freshwater resource.

RESOURCES

- Buffalo Niagara Riverkeeper: ***www.bnriverkeeper.org*** and ***www.facebook.com/bnriverkeeper***

- North American River*prize*: ***http://www.riverfoundation.org.au/riverprize_north_american.php***

SIDEBAR: PARTNERING TO SUSTAIN GREEN INFRASTRUCTURE PROJECTS

Green infrastructure projects are often great in concept but need ongoing maintenance and support to succeed over the long-term. The Huron River Watershed Council (HRWC) in southeast Michigan installed three different green infrastructure projects in Millers Creek in 2009 in an effort to reduce high flows and phosphorus.

At a local elementary school, the parent-teacher association was willing to take on the responsibility of one raingarden's long-term maintenance and still continues this six years later. At a local business, the business owner decided that he was not interested in the maintenance of a restored detention basin and hence mowed down the riparian plantings next to a detention basin in a year's time. At a city-owned piece of property, HRWC assumed maintenance responsibility for a large raingarden for five years before turning over responsibility to the City's natural areas department. In all three cases, HRWC was interested in passing on the maintenance responsibility to limit financial obligation and to encourage stewardship among the property owners.

What is your plan for sustaining your green infrastructure projects?

Photo credit: Huron River Watershed Council

SOLUTIONS TO DROUGHT

Replenishing water supplies with green infrastructure
by Tree People

THE STORY OF ELMER AVENUE

For decades, rain storms in Los Angeles turned Elmer Avenue, a residential street in Sun Valley, into a flood zone. In a region of the city built without storm drains, the rainy season often forced Elmer Avenue residents to wade through water simply to cross their street. In a project led by the Council for Watershed Health, Tree People participated with residents and other partners in transforming Elmer Avenue from a flood hazard zone to a street that's a model of sustainability.

A typical approach to solving urban flooding has been to install storm drains to channel rainwater to the ocean. However, as rain runs off streets and sidewalks it collects pollution and trash, which storm drains sweep out to rivers and the ocean, along with valuable water that could replenish groundwater supplies. Elmer Avenue demonstrates an alternative approach to dealing with flooding, related pollution, and water shortages common in Los Angeles and other locations.

The street, part of the Los Angeles River Watershed, has been retrofitted with a variety of rainwater harvesting techniques that filter water back into the ground. It conserves water with the use of climate appropriate landscaping and native trees. This one city block now catches, cleans, and reuses rain and stormwater from a 40-acre area upstream.

Infiltration galleries beneath the street are designed to provide 16 acre-feet of groundwater recharge annually, which is about the same amount of water used by 30 households in a year. The project increases wildlife habitat and community access to greenspace, and new sidewalks and solar powered street lights make the neighborhood safer and more walkable.

"The residents of Elmer Avenue are now watershed managers," says Rebecca Drayse, former Director of TreePeople's Natural Urban Systems Group. "Their properties and the street are literally interconnected – mimicking the natural hydrology of the Los Angeles River Watershed that's been so greatly impacted by development for the past century."

Neighbors have also experienced an increased sense of community and place as they've gathered to plant trees and care for their new landscape. Residents, most of whom own their homes, received bilingual maintenance manuals and training in the maintenance and care of their new landscapes over the course of the project. While the project has run into long-term maintenance issues, this neighborhood-scale project provides a real-world model of sustainable design and has served as inspiration for many efforts in the region to simultaneously address flood management, water quality, local supplies, and environmental restoration.

Local tree planting event. Source: Tree People.

"Save the Drop " bilingual campaign. Source: Tree People.

The project depended on diverse partners and funding. In addition to Tree People, who coordinated public outreach and assisted in surveying to identify a suitable street to undergo this transformation, partners include the Council for Watershed Health, which managed the project, and the City of Los Angeles, which constructed the major components of the street and parkway. Project funding was provided by the U.S. Bureau of Reclamation, California Department of Water Resources, County of Los Angeles Department of Public Works, Metropolitan Water District of California, Water Replenishment District of Southern California, Los Angeles Department of Water and Power, and the City of Santa Monica.

SCALING UP FOR IMPACT

More recently, Tree People has been working with the City to make green infrastructure solutions, like what was used in Elmer Avenue, the norm rather than the exception. The Los Angeles City Council passed a motion approving a change in stormwater management guidelines for public street construction and reconstruction that will require incorporation of green infrastructure elements, and the Los Angeles Department of Water and Power is working on a stormwater capture master plan. By failing to capture the rain, Tree People estimates that the city lost 28 billion gallons of water, or 6,500 gallons per L.A. resident, in 2013, one of the driest years in Los Angeles history. Instead of sending it out to the sea, new models estimate that rainwater capture could equal billions of gallons of water and meet between 30 and 45 percent of current water demand by recharging aquifers.

RESOURCES

- Capturing Stormwater for Water Supply Reliability blog by NRDC: ***http://switchboard.nrdc.org/blogs/ngarrison/making_the_most_of_californias.html***

- Stormwater Capture: California's Untapped Supply by Capital Public Radio: ***http://www.capradio.org/articles/2015/06/23/stormwater-capture-californias-untapped-supply/***

- Tree People website: ***https://www.treepeople.org/***

Photo credit: Tree People

river NETWORK
connecting people · saving rivers

MISSION, VISION, AND FOCUS

River Network empowers and unites people and communities to protect and restore rivers and other waters that sustain all life. We envision a future of clean and ample water for people and nature, where local caretakers are well-equipped, effective and courageous champions for our rivers. Our three strategies for focused investment are strong champions, clean water, and ample water.

HEADQUARTERS 434 NW Sixth Avenue, Suite 304, Portland, OR 97209
503.241.3506 | info@rivernetwork.org

www.rivernetwork.org