

EFFORTS TO ADDRESS URBAN STORMWATER RUNOFF

(111-15)

HEARING
BEFORE THE
SUBCOMMITTEE ON
WATER RESOURCES AND ENVIRONMENT
OF THE
COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES
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March 18, 2009

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SUMMARY OF SUBJECT MATTER

TO: Members of the Subcommittee on Water Resources and Environment
FROM: Subcommittee on Water Resources and Environment Staff
SUBJECT: Hearing on Efforts to Address Urban Stormwater Runoff

PURPOSE OF HEARING

On Thursday, March 19, 2009, at 10:00 a.m., in Room 2167 Rayburn House Office Building, the Subcommittee on Water Resources and Environment will receive testimony from: the National Research Council; the United States Environmental Protection Agency; Dallas, Texas; Kansas City, Missouri; Milwaukee, Wisconsin; Philadelphia, Pennsylvania; Portland, Oregon; the National Association of Clean Water Agencies; the National Association of Flood and Stormwater Management Agencies; and the Natural Resources Defense Council. The purpose of this hearing is to gather information on the utility of green infrastructure and low impact development technologies and approaches in addressing urban stormwater runoff, as well as barriers towards implementing these technologies and approaches.

BACKGROUND

This memorandum summarizes stormwater, its impacts on water quality, and traditional regulatory and technological approaches for addressing stormwater discharges. It also introduces technologies and approaches that encourage stormwater infiltration and evapotranspiration – commonly known as green infrastructure or low impact development technologies or approaches. These approaches can assist in the reduction of overall volumes of stormwater in sewer systems, thereby limiting the potential for the discharge of untreated stormwater and lessening conventional infrastructure construction and maintenance costs for municipalities.

Urban Stormwater Runoff

Stormwater: From a hydrologic perspective, stormwater runoff is the water associated with a rain or snow event that flows off the surface and can be measured in a downstream river, stream, ditch, gutter, or pipe shortly after the precipitation has reached the ground.¹ From a regulatory perspective, stormwater can impair water quality and is subject to water quality regulations when it is discharged from a point source, such as a gutter, pipe, or concrete canal. Precipitation that runs as sheet flow over the ground surface directly into a water body is not regulated stormwater. Nevertheless, non-point source surface runoff can impair water quality as well.

In terms of impacts on water quality, stormwater can be characterized along at least three dimensions: volume; rate of flow; and constituents carried in it.

Urbanization and Stormwater: The creation of impervious surfaces through urbanization has significant effects on the manner in which water moves both above and below ground during and after wet weather events. Urbanization is the transformation of land use from a natural, forested, or agricultural use to suburban or urban areas. The impervious surfaces associated with urban areas include roofs, streets, and other hardened surfaces that do not allow for infiltration of precipitation into the soil. In 2002, the Pew Ocean Commission and the National Oceanic and Atmospheric Administration (NOAA) estimated that there are 25 million acres of impervious surfaces across the continental United States. This represents nearly one quarter of the 107 million acres of developed land across the nation.

Natural landscape features help to mitigate the impacts of stormwater – in terms of both flow and constituents contained within it. Trees, vegetation, and open space capture or slow-down the flow of rain and snowmelt. This facilitates the infiltration of water into the ground. Infiltrated water enters groundwater or can reconnect with nearby surface waters after seeping through the ground. Because the time lag is greater in the latter case, the flow volumes, at any one point in time, into these nearby waters are considerably lower. The U.S. Environmental Protection Agency (EPA) has found that under natural conditions the amount of rain that is converted to runoff is less than 10 percent of the rainfall volume.²

In 2007, the U.S. Census Bureau determined the population of the United States was growing at an annual rate of 0.9 percent. The patterns of population growth across the country are weighted towards urban and suburban areas. Therefore, the influences resulting from urban and suburban land use are growing at a faster rate than the overall population rate. In addition, the urban environment is in constant transformation. A 2004 Brookings Institute analysis found that 42 percent of urban lands will be redeveloped by 2030. Dr. Arthur Nelson, at the University of Utah, determined in a 2007 study that, by 2050, 89 million new or replaced homes and 190 billion square feet of new offices, institutions, stores, and other non-residential buildings will be constructed. In other words, two thirds of the development on the ground in 2050 will be built between 2007 and then. These figures indicate both challenges and opportunities. Increased population growth and an increased proportion of urban land use will result in greater volumes of stormwater entering the

¹ The National Research Council notes that what constitutes ‘shortly’ depends on the size of the watershed and the efficiency of the drainage system. In a small and highly urban watershed, the temporal interval between rainfall and measured stormwater discharge may be very short, a matter of minutes. For large and undeveloped watersheds, the temporal lag may be multiple hours. (National Research Council. 2008. *Urban Stormwater Management in the United States*)

² U.S. EPA, 2003. *Protecting Water Quality from Urban Runoff*. EPA 841-F-03-003.

nation's waters. However, the redevelopment that is anticipated to occur offers opportunities to mitigate the harmful impacts of stormwater.

Stormwater runoff that is carried across impervious surfaces can impair water bodies along three dimensions: volume; rate of flow; and constituents. First, impervious surfaces do not allow infiltration to occur. Therefore, the volumes of water entering a given water body will be greater than when the land is in a natural state. Increased volume can result in localized flooding and erosion of stream banks. Second, the flow of stormwater along impervious surfaces and gutters or pipes is faster than if stormwater was running across open, undeveloped ground. When this higher rate of flow enters a water body it can result in flooding, as well as erosion, or scouring, of stream beds and banks. Third, stormwater running across an urban or suburban landscape will pick up and carry with it constituents that it encounters. These constituents are then carried into water bodies, sometimes untreated (see section below), and can result in potential water quality impairments. These constituents include: bacteria and pathogens from pet waste; metals from automobiles and roof shingles; nutrients from lawns, gardens, organic matter, trash, and atmospheric deposition³; oil and grease from vehicles; pesticides from lawns and gardens; sediment from construction sites and roads; chemicals from automobiles and industrial facilities and processes; and trash and debris from multiple sources.

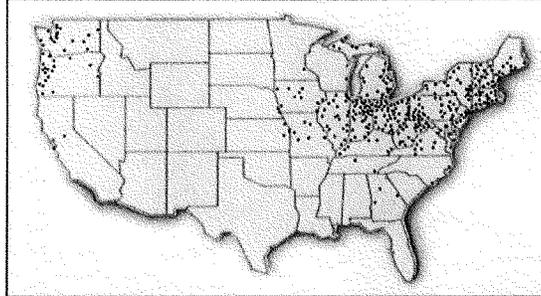
Sewer System Types & Stormwater: Stormwater runoff, in urban areas, is usually initially captured in curbside gutters and by stormwater drains.

Most U.S. cities have separate stormwater sewer systems through which stormwater flows directly into waterways. Stormwater that travels through separate stormwater sewer systems is typically not treated before discharge into a water body. As a result, any constituents picked up by the stormwater are carried into these water bodies. The water bodies are also subject to higher volumes and rates of flow, as discussed above, in cities that use separate storm sewer systems.

However, 746 other municipalities, located in 31 states and the District of Columbia, use another sewer collection configuration, commonly referred to as combined sewer systems. These municipalities are primarily located in the northeast, the Great Lakes, the Ohio River valley, and the Pacific Northwest. In these systems, stormwater flows into the same pipes as sewage. This combined wastewater (sewage and stormwater) is intended to be treated at wastewater treatment facilities. During dry weather, or small wet weather events, the system works as intended. However, during larger wet weather events, the combined sewer systems can be overwhelmed by the large volumes of stormwater in the system. As a result, the systems are designed to discharge untreated wastewater (untreated sewage and stormwater) into nearby water bodies through outlets known as combined sewer overflows (CSOs). Whether CSO events occur (i.e., the discharge of untreated wastewater through CSO outlets), is contingent on the engineering design of a given sewer system, the topography of a city, and the amount of impervious surface present in the city. Depending on these factors, a CSO event in a given city may occur in only heavy wet weather events, in other cases during light rain events, and in others, during dry weather. The age and condition of a CSO system (for example, blockages in the sewer system) may play a role in determining whether CSO events occur.

³ Car emissions and other fuel-burning processes can produce nitrous oxides that can fall-out onto the land through atmospheric deposition.

Graphic: Approximate Locations of CSO Communities in Lower 48 States



Source: US EPA (<http://cfpub.epa.gov/npdes/cso/demo.cfm>) (accessed 18 March, 2009)

CSO events pose a significant environmental and public health threat as they can include bacteria and viruses.⁴ As a result, cities with CSO outlets must often release public health advisories (for example, no swimming, no contact with the water, no fishing) after CSO events. In addition, the untreated sewage can contain nutrients and other oxygen-depleting constituents that can impair water bodies. EPA estimates that 850 billion gallons of untreated sewage and stormwater are discharged annually from CSO outlets.

Stormwater Impacts on U.S. Water Quality: Stormwater discharges – through both separate and combined sewer overflow discharges – have had a demonstrable impact on the nation's water quality. In some developing areas, like the Chesapeake Bay watershed, water quality impairments due to stormwater discharges are growing, relative to other sources.

According to EPA's 2004 National Water Quality Inventory, stormwater is a major source of water quality impairment, of those areas sampled for the report.⁵ Urban runoff, including discharges from separate stormwater sewer systems, is responsible for:

- 9 percent of impaired rivers and streams (in terms of miles);
- 7 percent of impaired lakes, ponds, and reservoirs (in terms of acres);
- 12 percent of impaired bays and estuaries (in terms of acres).

Sewage discharges, including CSO discharges, are responsible for:

- 6 percent of impaired lakes, ponds, and reservoirs (in terms of acres);

⁴ EPA has found that the median concentration of fecal coliform in untreated CSO discharges is 215,000 colonies per 100ml, compared to less than 200 colonies per 100ml in treated wastewater. (EPA, 2004. *Report to Congress: Impacts and Control of CSOs and SSOs*. EPA-388-R-04-001).

⁵ In its 2004 National Water Quality Inventory, EPA reported that the primary source of pollution of assessed Great Lakes shorelines which were impaired was contaminated sediment from historical, or legacy, toxic pollution. EPA also reported that sewage discharges, including those from CSO events, was the next leading source of impairment.

- 15 percent of impaired rivers and streams (in terms of miles);
- 32 percent of impaired bays and estuaries (in terms of acres).

In 2006, EPA reported that during 2002, 49 percent of all beach advisories and closings that had known sources of impairment were a result of stormwater runoff, and CSO and sanitary sewer overflow events.⁶

Approaches to Controlling Urban Stormwater Runoff

Regulatory: Most municipal stormwater discharges from engineered conveyances, such as gutters, pipes, or concrete canals are regulated as point sources under the Clean Water Act (CWA). As such, they require a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permitting program for separate stormwater sewer systems is the Municipal Separate Storm Sewer System (MS4) program. It includes Phase I (1990) and Phase II (1999) stormwater regulations that stipulate requirements for separate stormwater sewer systems and industrial activities, including construction. The MS4 permit system typically requires municipalities to develop a stormwater management plan, and to implement best practices. Traditional, end-of-pipe treatment technologies (that might be found at a wastewater treatment facility or with an industrial discharger) are usually not applied because of the large volumes of stormwater involved, because of the complex and decentralized nature of many municipal stormwater conveyance systems, and because of the space constraints associated with urban areas.

Municipalities that have CSO outlets are required to develop and implement short- and long-term strategies to reduce CSO overflows during wet weather events. Long-term CSO control plans must detail procedures and the infrastructure modifications necessary to minimize CSO overflows during wet weather events, and necessary to meet water quality standards. Associated with this, the CWA directs states to develop Total Maximum Daily Load (TMDL) plans for water bodies that are impaired. These should include the pollutant-load reduction measures necessary to meet water quality requirements.

Traditional Infrastructure Methods for Combined Sewer Stormwater Control: The two primary, traditional approaches for addressing CSO discharges involve separating combined sewers (into lines separated and dedicated for sewage and stormwater, respectively) and building deep storage tunnels. Both are very expensive approaches. EPA's 2004 Clean Water Needs Survey estimated that \$54.8 billion would be required in capital investment for CSO controls. In its 2004 report to Congress on *Impacts and Controls of CSOs and SSOs*, EPA reported expenditure information from 48 communities that had installed new infrastructure and technologies to control CSO events. These communities spent approximately \$6 billion in total, ranging from \$134,000 to \$2.2 billion per community.

Separating combined sewers involves disconnecting stormwater inlets from the combined sewer system and directing them to a newly installed separate storm sewer system. While this

⁶ 43 percent of all beach closings or advisories were a result of pollution with unknown sources. If these unknown closings and advisories are included, stormwater, CSO events, and sanitary sewer overflow events account for 28 percent of all closings and advisories.

approach eliminates untreated sewage entering water bodies through CSO discharge events, it does increase the total volume of untreated stormwater entering water bodies.

Deep storage tunnels are very large underground storage tunnels that are designed to store the large volumes of combined sewer wastewater that occur during wet weather events. As the wet weather event subsides, wastewater can be slowly released from the tunnel back into the sewer system, ultimately ending at the waste water treatment facility. Deep tunnels, if designed and operated correctly, can significantly reduce CSO discharges. However, constructing deep tunnels is very expensive and can take many years. The table below illustrates examples of cities that have either constructed, or are constructing deep storage tunnels, as well as associated costs.

City	Project Duration	Expected Completion Date	Storage Capacity (gallons)	Cost
Chicago, Illinois	40+ years	2019	18 billion	\$3.4 billion
Milwaukee, Wisconsin (Phase 1)	17 years	1994	405 million	\$2.3 billion
Milwaukee, Wisconsin (Phase 2)	8 years	2005	88 million	\$130 million
Portland, Oregon	20 years	2011	123 million	\$1.4 billion
Washington, DC	20 years (after construction begins)	(20 years after construction begins)	193.5 million (proposed)	\$1.9 billion (projected)

Green Infrastructure and Stormwater Control: A 'green infrastructure,' or low impact development (LID), approach for stormwater mitigation is premised on the notion that the volume of stormwater should be reduced before entering into stormwater and/or sewage conveyance systems. Green infrastructure approaches for stormwater mitigation provide more opportunities for infiltration or evapotranspiration to occur in a developed landscape – thereby lessening the amount of runoff. Green infrastructure approaches are a proactive response to the problem of impervious surfaces by addressing runoff at the source, as opposed to a reactive response to large volumes of stormwater within the stormwater system.

Green infrastructure can take a variety of forms. Central to all technologies and approaches is the use of the natural environment to manage stormwater naturally by capturing and retaining water, infiltrating runoff, and trapping and filtering constituent pollutants. Examples of green infrastructure include:

- Green Roofs: Outfitting buildings with soil and vegetation on the roof can nullify the impervious nature of most roofs. Instead of immediately washing off a building's roof and into the stormwater system, precipitation is absorbed into the soil where it is absorbed by the vegetation or released slowly into the stormwater system. Precipitation is also evapotranspired from the vegetation back into the atmosphere;

- **Permeable Pavement:** Road or alleys can be designed and constructed with materials that allow for increased infiltration of water into the ground;
- **Curb Cut-outs:** Curb cut-outs are constructed gaps in street curbs that allow for some of the stormwater making its way along street gutters to enter into median strips where it can infiltrate into the ground;
- **Rain Swales and Gardens:** Rain swales and rain gardens are designed ditches or depressions that contain stormwater during wet weather events. These can hold larger volumes of stormwater than traditional street gutters, slow down the flow of stormwater, and promote infiltration;
- **Increased Tree Cover:** Planting street trees can reduce stormwater runoff because urban tree canopies intercept rainfall before it hits an impervious surface below (a sidewalk or road). This lessens the volume and rate of flow of stormwater entering the stormwater conveyance system. Trees with mature canopies can absorb the first half-inch of rainfall. Researchers at the University of California-Davis have estimated that for every 1,000 deciduous trees in California's Central Valley, stormwater runoff is reduced by one million gallons;
- **Green Space and Buffer Zones:** Urban parks and the expansion of green space provide more opportunities for infiltration to occur. This reduces the volume and flow of stormwater entering into the sewer system. Planting vegetation by urban and suburban water bodies can also help to slow stormwater runoff, and capture constituent pollutants contained within the stormwater.

The cost-effectiveness and technical feasibility of incorporating these green infrastructure, or low impact development, approaches can vary. However, in particular circumstances, the incorporation of green infrastructure technologies may offer advantages to municipalities. These approaches reduce the volume of stormwater in the system. Improved infiltration can also help to remove pollutants that had been carried in the stormwater. Green infrastructure approaches can also provide a municipality with site-specific solutions. The nature of the technologies and approaches result in decentralized solutions, as opposed to a traditional, centralized stormwater infrastructure approach, like deep storage tunnels. Decentralized mitigation options, like green infrastructure, can provide city planners with options that may work in constrained urban spaces.

Green infrastructure approaches can also be used in the context of reducing stormwater runoff from highways. For example, in 2008, the California Department of Transportation began installing best management practice technologies along thousands of miles of highways in Los Angeles and Ventura Counties.⁷ This is expected to keep more than six million pounds of pollution out of area waters every year.

⁷ Examples of best management practice technologies used by the California Department of Transportation include infiltration basins and trenches (technologies that encourage infiltration), biofiltration swales and strips (technologies that slow the flow of stormwater and capture pollutants using vegetation, and also encourage infiltration), and sand filters (two-chambered stormwater treatment practices; the first chamber is for settling, and the second is a filter bed filled with sand or another filtering media).

Green infrastructure approaches can also offer a number of non-stormwater related ancillary benefits. Some technologies, like green roofs, can help to mitigate urban heat island effects. The placement of vegetation on a roof can help to insulate the building – thereby lowering heating and cooling costs. This can result in significant savings for building managers. The vegetation can also result in significantly cooler temperatures at the top of buildings. Increased vegetation can also help to filter air pollutants. Finally, green infrastructure can yield aesthetic improvements that can increase property values, as well as, in some forms, provide additional recreational space.

The experiences of those cities that have experimented with these approaches have shown that these technologies can be cost-competitive with conventional, ‘hard’ infrastructure approaches for controlling stormwater. Studies in Maryland and Illinois have shown that new residential developments that use green infrastructure technologies saved \$3,500 to \$4,500 per lot (quarter- to half-acre lots), compared to new developments with conventional stormwater controls. In addition to lowering these immediate costs, these developments discharged less stormwater. Retrofitting existing buildings and communities with green infrastructure can be expensive, however. For example, adding a green roof to an existing building can be very expensive because structural changes may be necessary. However, taking into account heat savings and insulation that could accrue from the application of this technology can make it more cost attractive.

WITNESSES

Panel I

The Honorable Tom Leppert
Mayor of Dallas, Texas

The Honorable Mark Funkhouser
Mayor of Kansas City, Missouri

The Honorable Tom Barrett
Mayor of Milwaukee, Wisconsin

Panel II

Mr. Mike Shapiro
Acting Assistant Administrator, Office of Water
United States Environmental Protection Agency
Washington, D.C.

Dr. Robert Traver

Professor, Civil and Environmental Engineering
Villanova University
Villanova, Pennsylvania

Testifying on behalf of the National Research Council

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Director, Office of Watersheds
Philadelphia Water Department
Philadelphia, Pennsylvania

Testifying on behalf of the National Association for Clean Water Agencies

Mr. Timothy Richards, P.E.

NAFSMA Director and Stormwater Committee Chair
Deputy City Engineer
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Testifying on behalf of the National Association for Flood and Stormwater Management Agencies

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Director, Office of Watersheds
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Portland, Oregon

Ms. Nancy Stoner

Co-Director, Clean Water Program
Natural Resources Defense Council
Washington, D.C.

HEARING ON EFFORTS TO ADDRESS URBAN STORMWATER RUNOFF

Thursday, March 19, 2009

HOUSE OF REPRESENTATIVES
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
SUBCOMMITTEE ON WATER RESOURCES AND ENVIRONMENT,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in Room 2167, Rayburn House Office Building, the Honorable Eddie Bernice Johnson [Chairwoman of the Subcommittee] presiding.

Ms. JOHNSON. Good morning. The Committee will come to order.

Today's hearing examines efforts to control urban stormwater runoff. In many parts of the country, stormwater is a growing problem that impairs both city budgets, as well as nearby waters. Arresting the urban runoff problem will result in significant and immediate improvements to public health and the environment.

Stormwater runoff is the water associated with a rain or snow event that runs over the ground and eventually enters into a water body.

In a natural environment, most precipitation is absorbed into the ground before it enters streams and rivers. However, in urban environments it is a very different matter. The large amounts of impervious surfaces in city's results in significant quantities of stormwater entering stormwater and sewer systems. Running across streets, urban runoff picks up sediment, oils, grease, and a host of toxic pollutants. As cities grow, these surfaces become larger. This results in greater flows and volumes of stormwater, as well as increased pollutant loadings.

These large flows of stormwater are usually dealt with in one of two ways. In some communities, they are discharged directly into water bodies, without the benefit of treatment. As a result, streams and rivers are continuously buffeted by whatever pollutants happened to lay on the city streets at the time.

In other cities, the stormwater is added to wastewater and should ultimately be treated by a wastewater treatment facility. However, during many wet weather events, raw sewage and stormwater are intentionally discharged directly into local waters before treatment so as to not overwhelm the system. These are known as Combined Sewer Overflow events, and, as might be expected, they represent serious threats to public health and water quality.

In order to mitigate the impacts of stormwater and CSO events, cities across the Country have chosen a variety of different approaches. Some cities have reengineered their sewers into separate

pipes that carry sewage and pipes that contain stormwater. Other approaches, used by some of the cities represented here today, involve building giant tunnels that will temporarily store combined sewage and wastewater, rather than discharging it untreated into the water bodies. Both of these engineering-based approaches are very expensive and can be long-term propositions.

In this time of economic uncertainty and tight municipal budgets, it may behoove city planners to look in other directions for ways to deal with the impacts of urban stormwater runoff. Among these alternate approaches is the incorporation of green infrastructure or low impact development approaches.

Green infrastructure approaches take a very different view of stormwater control. Instead of engineering the stormwater system to deal with increasingly large amounts of stormwater, these low impact development approaches utilize technologies that aim to reduce the amount of stormwater that even enters the system. This is achieved through processes that encourage enhanced infiltration and evaporation processes. Simple approaches such as green roofs, increased tree cover, disconnecting downspouts, and adding more green space can go a long way to reducing the amount of stormwater that enters into sewers. And, in some circumstances, these technologies can realize significant cost savings for municipalities and building owners.

Nevertheless, many of these technologies are new and have not been applied in all conditions and cities. I hope to hear testimony today that will answer a few key questions:

First, what barriers exist in regards to the increased adoption of green infrastructure technologies and approaches?

Second, what can the Federal Government—both EPA and the Congress—do to reduce those barriers?

And, third, what process does EPA use, and should EPA use, in balancing the need to promote promising new technologies, while at the same time protecting water quality?

I look forward to this morning's testimony from our two panels of excellent witnesses, and I would like to extend a special welcome to my mayor from the city of Dallas, Mayor Leppert.

Thank-you for appearing here today, and sharing with us the experiences of Dallas.

I now yield to Mr. Boozman, the Ranking Member.

Mr. BOOZMAN. Thank you, Madam Chair.

Today, the Subcommittee begins to explore another important topic, urban stormwater runoff. Ignored in the past, more public attention is slowly being paid to the deteriorating impacts of urban stormwater runoff.

Our Nation's health, quality of life, and economic well-being rely on an adequate supply of clean water. Industries that rely on clean water, like farming, fishing, and manufacturing, contribute over \$300 billion a year to our gross domestic product.

In the past three decades, this Nation has made significant progress in cleaning up our rivers and lakes, but there is still much to be done; and, in these economically challenging times, we must be sure that, with the limited funds that we have, we are getting the most clean water for our dollar.

One of the many factors that affect the water quality of our lakes, rivers, bays, and estuaries is urban stormwater. The impervious surfaces found in the urban environment accelerate drainage through curb gutters and drains to nearby natural streams and water bodies. As it flows through the urban landscape, the water picks up contaminants and sediment, and dumps them into the receiving waters.

In a more naturally vegetated landscape, the water moves more slowly, much of it is soaked up by the soil, and plants, contaminants and sediments tend to be filtered out.

Cities and towns face the challenge of providing drainage without exacerbating flooding or diminishing water quality in local streams. This is accomplished through a host of traditional measures, including underground conveyances and catch basins.

Some have suggested that urban areas need to employ more green technologies or limited impact designs to reduce the quantity and rate of flow of stormwater, and thereby reduce the impacts of stormwater on the environment. These measures include green roofs, permeable pavement, curb cutouts, rain barrels, and buffer zones. These approaches have been introduced in areas where runoff is especially prevalent.

These measures can be expensive, and their effectiveness will vary depending on the characteristics of the areas where they are used. For example, permeable pavement will not have much effect on slowing runoff in areas where the natural soil is relatively impervious to begin with.

Nevertheless, where the right conditions exist, new technologies and designs can be cost-efficient and effective in managing stormwater. Where they work, these innovative features reduce the need for traditional stormwater infrastructure. Municipalities need a variety of tools in their toolbox to address stormwater management. Entities need to stay educated on all the options, both traditional measures, as well as new or green designs. Nongovernmental organizations, such as the National Association of Flood and Stormwater Management, agencies and certain environmental organizations can be very helpful in educating local officials about the various tools that are available and under what conditions they have proven to be useful.

But, in the end, it is the local officials, both elected and professional, who must decide what is the best solution for their specific circumstance. We all want the same goal, which is clean water. As we at the Federal level look at the Nation's stormwater policy, we must be careful that we don't impose solutions on municipalities that may not be the best fit, either technically or economically.

I think that we can accomplish a lot with education outreach to help local officials consider all options. Additional research and development of innovative technologies and designs would help identify the most efficient and effective measures, and add to the tools available to local officials. We should consider what would be the appropriate Federal role in bringing such technologies and designs to the marketplace.

Urban runoff accounts for 9 percent of impaired rivers and streams, and 12 percent of impaired bays and estuaries. However, in our efforts to be more conscious of our environment, we must not

lose sight of the cost of implementing new technologies and designs.

Also, one-size-fits-all solutions or regulatory schemes to deal with impairments will not work for water quality improvement. Soil hydrology, topography, weather, climate, and other conditions vary widely from site to site, region to region, and over time.

Future solutions need to be science-based, economically feasible, and compatible with regional and site-specific conditions. Where appropriate, green infrastructure should be considered as part of the strategy in managing stormwater runoff, but by no means should it be a requirement. These new practices and technologies could result in numerous economic and environmental benefits. However, communities need to do a rigorous analysis of the costs and benefits of installing these technologies and decide for themselves the most appropriate course of action.

I hope to learn more from the hearing today, from the panels of expert witnesses, and look forward to your testimony, and I appreciate your being here.

I yield back, Madam Chair.

Ms. JOHNSON. Thank you very much for your statement.

I understand we have no opening statements, so we will go right to the first panel.

We are pleased to have three distinguished mayors here to testify on our first panel. The first one is my own mayor, Mayor Tom Leppert, from Dallas, Texas. He will testify first and will be followed by Mayor Mark Funkhouser from Kansas City, Missouri. Our final witness on this panel is Mayor Tom Barrett from Milwaukee, Wisconsin. I am certain he will be recognized by many of the people here; he is a former House Member, and we want to welcome you back.

Your full statements will be placed in the record, and we ask that you try to limit your testimony, if possible, to five minutes. We will make sure that your full statements are in the record.

Mayor Leppert, you may begin.

TESTIMONY OF THE HONORABLE TOM LEPPERT, MAYOR OF DALLAS, TEXAS; THE HONORABLE MARK FUNKHOUSER, MAYOR OF KANSAS CITY, MISSOURI; AND THE HONORABLE TOM BARRETT, MAYOR OF MILWAUKEE, WISCONSIN

Mr. LEPPERT. Thank you. Chairman Johnson, Ranking Member Boozman, and Members of the Subcommittee, thank you for this opportunity to provide testimony regarding efforts to assist urban stormwater runoff.

I am Mayor Tom Leppert, and I have the privilege of serving as the mayor of the city of Dallas, Texas. I am here to share some of our experiences in the management of stormwater runoff.

Not too many years ago, you would not have found the city of Dallas included on the list of what we now commonly refer to as green cities. However, today, I am convinced that Dallas is at the forefront of leading the Nation in environmental issues.

The city of Dallas, like many other cities, is extremely interested in expanding our use of green infrastructure and low impact development to manage the quality of stormwater runoff. Stormwater

runoff is best treated as close to its source as possible, rather than using the “end of the pipe” structural control solutions.

Dallas has utilized several green infrastructure techniques and tools to treat stormwater runoff at its source. At various city facilities, we have used rooftop and ground-level cisterns for collection of rainwater for use in irrigation; permeable paving to reduce runoff and increase both infiltration and pollution removal; bio-retention for onsite stormwater treatment to its discharge offsite; and in our fire stations we use separators to divert fire engine and apparatus wash water from the stormwater drainage system.

We have also adopted a strategy to require more sustainable and greener buildings. We are probably one of the first cities in the Nation that now has standards in place to require all buildings—public, private, large, small, residential, commercial—all to be green buildings. We are achieving this in a two-phased implementation. The first implementation phase is this year and the second will be in 2011. In addition to that, we have 27 buildings that have already maintained and achieved green building standards.

In Dallas, we are also updating our development code to incorporate the concept of integrating stormwater management in terms of drainage planning and post-construction control of urban runoff into the early stages of site development.

One of the obstacles that all cities are facing is obtaining the buy-in of developers and their engineers. It is a myth that is commonly perpetuated that developers think that green infrastructure will add additional costs. I can tell you that, as a former CEO of a major international construction company, I can tell you unequivocally that building and developing green does not—does not—automatically mean higher construction costs. And it is also my personal belief that it is imperative for the sake of our future generations that everybody begins to move in this direction.

The first step, of course, is education and training. We are utilizing a phased approach in which integrated design and planning is optional during the first phase. Phase 2, we believe, will include incentives for developers who adopt these practices. For example, if certain levels of green infrastructure and low impact development techniques are used, we may very well reduce parking requirements, reduce the right-of-way with requirements, both of which would put money into the pockets of the developers. We believe we will be the first city in Texas to do this.

In Phase 3, we also assess effectiveness and consider making the use of green infrastructure tools mandatory. One of those that is an interesting example may be pervious concrete. We have had some specific examples with this in our South Central Police Station. Initially, we wanted to use this application for all paved areas, as it both treats stormwater runoff and also reflects heat, which, of course, lowers the ambient temperature, and that is a big plus in Texas, as it is throughout the South.

Unfortunately, we were only able to use it in our overflow parking lot. The reason is very simple: traditional strength tests used for regular concrete don't work with pervious concrete due to its porous nature. Engineers have traditionally relied upon compressive strength as a key design element. Determining the structural strength is crucial because it drives the decision of whether it can

only be used for sidewalks or light vehicles, as opposed to neighborhood streets. Perhaps this is an area which Congress can direct the National Institute of Standards and Technology to work on.

In addition, I would like to touch briefly on the great progress that we have made in stormwater management systems. Back in 2006, the city entered into a consent decree with the EPA, Department of Justice, and State of Texas to address issues with our stormwater management program, particularly in the areas of staffing and housekeeping practices.

I am pleased to tell you that, two and a half years later, we are exceeding the requirements. We maintain compliance with required inspections; we have modified our supplemental environmental wetland project to make it greener by incorporating a pretreatment cell to remove pollutants; and we are also implementing an environmental management system with third party evaluation under the International Standards Organization.

Dallas is the first city to get certified across all major operations, including feet, large facilities, a regional airport, and water utility.

In conclusion, I want to commend the House of Representatives for the recently passed Water Quality Investment Act of 2009, particularly the better position that it affords us. I would also like to thank the Subcommittee for taking up the issue of urban stormwater runoff. Despite the current obstacles, cities across the Nation, like Dallas, are implementing and supporting the expanded use of green infrastructure and low impact development tools and techniques. These tools are needed to address the overarching challenges of urban stormwater runoff and the urban heat island effect. The reauthorization of the Clean Water State Revolving Fund Grant program is vital to expanding the use of these tools, and your continued support is appreciated.

Madam Chairman, thank you for this opportunity.

Ms. JOHNSON. Thank you very much.

Mr. FUNKHOUSER.

Mr. FUNKHOUSER. Madam Chairwoman and Ranking Member, thank you for this opportunity to address your Subcommittee on water resources and the environment regarding Kansas City, Missouri's efforts to address urban stormwater runoff. I also want to thank you again for visiting Kansas City last year to review our stormwater facilities and our related efforts.

We also appreciate the support you provided to our Congressman, Representative Emanuel Cleaver, in his effort to secure a 20 percent designation for green strategies as an amendment to H.R. 1262, the Water Quality Investment Act of 2009, which passed out of the House of Representatives just last week. As deliberations on this measure and related measures proceed, we look forward to working with you to ensure the provision of enhanced Federal resources, including direct grants to communities with sewer control plans, which are needed to assist communities such as Kansas City. Truly, and without equivocation, your commitment to improving our Nation's water infrastructure is commended and appreciated.

In terms of today's hearing, I am pleased to report that our community's vision for Kansas City is to become America's Green Region. As you know from your visit to our city, Madam Chairwoman,

we have a seriously outdated system that was built over 100 years ago. Moreover, we face the dual challenges of meeting modern-day demand and investing in strategies required by the future. In this regard, our region is committed to investing in green infrastructure not only to address our water quality issues, but also to create jobs and enhance our citizens' quality of life.

Kansas City is so committed to this vision, we have developed, through a five-year community driven process, a Green Solutions Position Paper, which is attached and hereby incorporated into this testimony by reference. This paper was endorsed by city council resolution and embraced by our city staff through various implementation initiatives. This document provides the foundation for our recent submittal of Kansas City's Overflow Control Plan to the U.S. Environmental Protection Agency. This plan includes a significant investment in green infrastructure and green initiatives to help address our combined sewer overflow problem.

Kansas City also adopted a cutting-edge stream setback ordinance, which is the backbone to our green infrastructure program. We also changed our development codes to encourage low impact design approaches. These green initiatives will help us prevent problems in the future, but they will not address the massive flooding issues that we have in our already developed areas, which is estimated at \$2.1 billion. This also does not include the \$2.4 billion we need to invest in our sewer plan.

In Kansas City, there are three issues associated with green infrastructure:

Green solutions are a relatively new technology in Kansas City. We need to better understand the true costs and benefits of the long-term impacts of this approach. The two biggest barriers to success are time and money. We will need time to innovate, and a significant investment to realize and evaluate the actual impacts to water quality. We look forward to a partnership with the Federal Government to move ahead with green solutions on the scale needed in Kansas City.

Two, green solutions are only one part of the overall strategy. We will need to replace our gray infrastructure, such as pipes, storage facilities and plant upgrades. They will enhance our neighborhoods, and we hope they will reduce the level of investment we need to make in gray, traditional infrastructure.

Third, stormwater management, in most cities across the Country, is typically underfunded. These facilities are out-of-sight, out-of-mind. Green infrastructure is not out-of-sight. The plant materials of green infrastructure create a visual presence above ground and not only require more frequent attention, but a different type of maintenance. On-going maintenance of green infrastructure is typically left to the local government and, in any economic situation, is difficult to fund. State and Federal funding for green infrastructure is very limited. There are some funds available for research. The U.S. Environmental Protection Agency is monitoring the impact of a green infrastructure project Kansas City is building on a 100-acre pilot project. The Federal Government has invested in Kansas City's major flood control system, but that has barely scratched the surface in terms of addressing our overall flooding issue. State and Federal funds are not as readily available for tra-

ditional stormwater capital investments. Cities don't typically invest until after a major flood has occurred.

Kansas Citians value natural resources. Protecting water as a valuable resource is a top priority for us. Kansas City is embracing green solutions while recognizing the risks associated with this strategy. The level of investment needed and risks are great. It is our hope that Congress and the Administration will work hand-in-hand with local governments to explore and implement the green infrastructure approach.

I want to thank you again for allowing me to testify. I would be happy to answer any questions.

Ms. JOHNSON. Thank you very much, Mr. Mayor.

Now we will have Mr. Barrett.

Mr. BARRETT. Thank you very much, Madam Chairwoman and Mr. Ranking Member and Members of the Committee. I appreciate the opportunity to be here today to talk about Milwaukee's experience.

Today, urban areas face a far different threat to water quality than existed in 1972, when the Clean Water Act was passed. In Milwaukee, for example, the latest data shows that 89 percent of the bacteria pollution entering our major rivers and Lake Michigan comes from urban and rural runoff. Sewer overflows and wastewater treatment plants comprise the other 11 percent.

The science is clearly telling us that, to make real progress toward achieving swimmable and fishable waterways, a water policy in the future has to address both point and non-point pollution.

According to the EPA, the Nation faces a \$300 billion to \$500 billion water infrastructure funding gap for what needs to be spent on water-related infrastructure over the next 20 years. Federal assistance has declined more than 70 percent, and now local communities shoulder more than 95 percent of the cost of clean water.

Sewer pipes in older cities leak. Fixing those leaks in the nearly 6,000 miles of sewers in the Milwaukee region is a huge financial strain on local budgets. But Milwaukee has not been shirking its responsibility on stormwater. We have a stormwater fee that is based on impervious surface area. We use that funding source to help meet the backlog in sewer line repairs.

But, due to a lack of funding, our current replacement cycle for our local sewers is 140 years. That hard reality poses a significant threat to the great progress we have made over the years to reduce combined sewer overflows from 60 per year to an average of two just year.

I stand with my fellow mayors in the Great Lakes region in strong support of Congress to establish a Clean Water Trust Fund to rebuild our Nation's water infrastructure. Our Nation's cities need the Federal Government to help close the water infrastructure funding gap that has grown over the years.

To ensure that future investments result in clean water, we need to think like a watershed. We must integrate our efforts to reduce pollution from our factories and wastewater treatment plants with efforts to reduce stormwater pollution. This integration could start with the EPA helping the Milwaukee region move to a watershed permit and to help us to pilot a water quality trading system that could be model for the rest of the Country.

Milwaukee has attacked polluted runoff with a variety of green infrastructure approaches, including green roofs, such as the one on the City Hall Municipal Building, rain gardens and green roofs at our public housing developments, as well as porous pavement.

One experience with green infrastructure in particular that I would like to share with you was recognized with a national award from the Sierra Club and has turned out to be quite popular with the public.

We had a brownfield in the Menomonee River Valley that used to be a former rail yard and manufacturing center. It is 1200 acres.

When looking at how to deal with the water that would run off the site after it was redeveloped, there were two paths to consider. One choice would have been to build a big pipe in the ground to collect the polluted water and send it to our treatment plants. The problem with traditional pipes is that the public doesn't get any direct enjoyment with this type of hidden infrastructure. You can't hold a picnic or a tailgate party in a deep tunnel.

Instead, we decided to keep the water out of the sewer system by using green infrastructure on the surface of the land to capture and clean every drop of rain that falls on the business park before being slowly released into the river.

We created a beautiful stormwater park where people use the Hank Aaron Trail to hike and bike and walk to Miller Stadium, where the Milwaukee Brewers play baseball. There is easy public access to the Menomonee River, where visitors can hike or fish. Youth workers have planted prairies and hundreds of stormwater trees to restore habitat.

The businesses that locate there benefit financially because they can rely, to a great extent, on the regional stormwater system that was created, rather than bearing the cost on their own. They also benefit from the enhanced green space and aesthetics. Using green infrastructure made it possible to connect people and jobs and recreation at a formerly blighted area in the heart of Milwaukee.

Some of you are from the Gulf Coast, some of you are from the East Coast, some of you are from the West Coast. I am proud to be from America's "Fresh Coast" because we have a huge body of fresh water right at our front door, and this will become increasingly important in the next decades. 1.2 billion people worldwide suffer from lack of clean water. 2.6 billion people lack adequate sanitation, primarily due to water conditions.

As mayor, growing our water economy is central to my vision for Milwaukee. I am not talking about selling our water. I am talking about growing and selling our technology and expertise with treating freshwater. If we can figure out how to cost-effectively manage polluted runoff, our Country will lead this sector of the emerging global green jobs economy.

Lake Michigan is a tremendous asset for Milwaukee. The cities around the lake do not want to see us backslide. That is why we need the Federal Government's help.

I am not asking the Federal Government to do it all. But with this type of help, with a trust fund, we believe that we could make a lot of progress. Thank you very much.

Ms. JOHNSON. Thank you very much.

We will now begin our first round of questions.

My first question is to you, Mr. Barrett. Could you elaborate just a little bit on the aesthetic and financial benefits that you related to in your testimony of Milwaukee Stormwater Park?

Mr. BARRETT. Well, when I discuss the Menomonee River area, if you haven't been to Milwaukee, it was an area that for many, many years was the center of the Milwaukee Road. It was a tremendous hub of activity. It then became essentially the armpit of the city. It was a place that people didn't go to. You literally needed an all-terrain vehicle to get from one area, one part of the valley to the other area, and we took a massive cleanup attempt and it was successful.

Now we have literally thousands of jobs there, which is great. It connects Miller Park with the Harley Davidson Museum, which has been a huge attraction as well. But, really, the part that people get excited about is the Hank Aaron Trail. Menomonee River is a place where you can go and you can be in a canoe, you can fish, you can hike in the area. So it has become really a gem. And when it was recognized by the Sierra Club, it wasn't just one of the 25 in the Nation, it was one of the 25 worldwide that they saw us using these sustainable techniques to really turn around this area.

Ms. JOHNSON. And you mentioned the vision for Milwaukee and growing the city's water economy. Give me just a little bit more description of what you have in mind.

Mr. BARRETT. Well, the history of Milwaukee is intertwined with beer, with tanneries, a lot of water-related industries, and that has changed over time. What hasn't changed is the expertise that we have in our community for water technology. We have over 120 companies that are involved in water technology. Just earlier this week, the governor of the State of Wisconsin announced \$240 million in building construction, including an institute for fresh water research at the University of Wisconsin-Milwaukee. So we see it as a real economic hub and economic engine for the future.

As I said, we think that fresh water is going to be vital in the coming decades, and we couldn't be positioned in a better place. Again, we are right on the Fresh Coast. We think that that is going to put us in a very, very good spot in the future.

Ms. JOHNSON. Thank you very much.

Mr. Leppert, you go into some detail about the green building program that was adopted by the city of Dallas last year. Highlight that a little bit more for us, if you will.

Mr. LEPPERT. We believe it is an important issue if you look at the building process in total. If you look at it on a national basis, over a third of the waste that goes into landfills comes from building. Approximately a third to 40 percent of the greenhouse gases that are emitted come from that building process, so it becomes a very important part of the overall environmental.

We believed it was important, as some cities have, to not only take steps to address the public buildings, but we wanted to go further than that. We wanted to adopt policies that encompassed all of the buildings that are built in the city of Dallas. We adopted that as a policy, but then we took a very different route. We then, instead of just leaving it as a policy, we then engaged industry with a number of different task forces that came in to identify what was the proper standards, using leads, National Home-

builders Association, etc., because we wanted to incorporate both commercial and residential. But then we also worked with them on what the implementation schedule should be to ensure that there was a very sound understanding of the education that needed to take place, especially with the smaller construction firms that were involved in our community.

I can say that we have not only got to that point, we got to that point in a way that has really brought the community together. There was very little dispute because we brought industry in. In fact, I would tell you that this was actually approved on a consent agenda with absolutely no discussion, I think, again, because of the process.

So we believe, as I said, we were one of the first two cities in the Nation that adopted green building that encompasses all the buildings that will be built in the city of Dallas, and we are just excited for what it does for the city of Dallas not only from an environmental standpoint, but also positioning us to attract business, attract business knowing that more and more businesses, as well as individuals, are going to make the selection based on the type of environment. We think Dallas is positioned very well.

Ms. JOHNSON. Thank you very much.

Mr. Funkhouser, in one piece of your testimony you mentioned that the infrastructure is not out-of-sight. Could you give us a little bit more elaboration on that?

Mr. FUNKHOUSER. When you do the green infrastructure, you are planting plants, you are creating these swales. In the 100-acre that we are working on, Marlboro, one of the neighborhoods in Kansas City, it is one of the neighborhoods that is low income, right on the edge, and this is a major investment for us to help bring that neighborhood back. And they were willing to, and wanted to be, the sort of guinea pig for this.

It has to do with creating, instead of a normal catch basin that you see at the end of a street, it is one of these depressions, a swale that is engineered so that the water goes in there and stays there; it doesn't go into the sewer system, it doesn't go into the pipes. But that has to be maintained.

There is a whole lot of work that has to go on to maintain this stuff, which is above ground, which you can see, in terms of taking care of the vegetation and making sure that the thing continues to work well. But when you do that, you get the benefits that Mayor Barrett was talking about. It actually can enhance the attractiveness of the neighborhood; it can enhance the economic value of the homes that are built there.

But it requires effort; whereas, if you put a big pipe in the ground, nobody knows it is there, and, if it is well built, it will 30, 40 years before you ever have to do anything about it. This stuff you are going to have to take care of at a certain level every year.

Ms. JOHNSON. Thank you very much.

The Chair now recognizes the presence of our Full Committee Chair and call on him.

Mr. OBERSTAR. Thank you, Madam Chair. This is a very, very important hearing, and I am delighted that you and the staff have undertaken to do this. I thank Mr. Boozman as well for his participation, as always.

This issue of combined sewer overflows is one that has long been neglected, but one that was foreseen in the Clean Water Act of 1972, and before that. My predecessor, John Blatnik, former Chairman of this Committee, was the author of the Federal Water Pollution Control Act of 1956, the foundational legislation that established today's program of clean water. Then, he knew, we knew that—by we I mean the scientific community, the practitioners on the front line, mayors, township officers, county commissioners who were out there on the front lines knew that we had to deal with this problem of combined storm and sanitary sewers, that we also had to deal with storm sewers and the overflow as the urbanization of America accelerated.

In the mid-1960s, the U.S. Geological Survey sent a team to California to evaluate a phenomenon, that there was a huge amount of runoff. Ditches and drainage areas, as well as receiving creeks and streams, were getting higher levels of water than they had ever experienced. The USGS team reviewed the geography, reviewed the runoff areas, measured rainfall for that particular year, then went back through all the records.

Rainfall hadn't changed, but the runoff had changed. Runoff had changed because more areas paved over for parking lots of shopping centers, for city streets, for other paved areas of urban sprawl. So the runoff was twice what it had been a decade, two decades, three decades earlier, going back into the 1930s, where they had records.

So we have now not only the phenomenon of combined storm and sanitary sewers, increased runoff, continuing urban sprawl, and climate change that is now beginning in certain areas of the United States to produce more precipitation. So separating combined sewers, some of the approaches taken have great promise, deep underground tunnels. They are expensive, take a long time to complete.

I went to Atlanta to travel their sewer with Mayor Jackson. It was wonderful to see this brave lady in a yellow construction rubber suit, wetsuit, boots up to her hips, the two of us slogging through the tunnel. It is going to take them years to do this, but it will provide a means, as it will in Chicago, for underground treatment before the water runs off. Retention basins are another option. But all of those cost a good deal.

The stimulus provides an opportunity for us. We had \$14 billion in this Committee in the stimulus. Mr. Mica and I and Members on the Republican side and the Democratic side agreed that was what we needed to do. And if our Committee's plan had passed, it would have been really good for America. Better for America than the one we have now. We got cut back, unfortunately, to \$4.6 billion, and half of it in loans and half in grant money.

We passed the legislation under the leadership of Chairwoman Johnson, with Mr. Boozman's participation, Mr. Mica, to replenish State revolving loan funds. But that is a fallback position. The Clean Water Act of 1972 provided grant money, up to \$6 billion for wastewater treatment facilities, for interceptor sewers, storm sewers, and separating combined storm and sanitary sewers; and most of those funds, that is, 60 percent, were dedicated in the first six years of the program to the major metropolitan areas where the

largest waste streams occurred and where we needed to invest the greatest proportion of funds.

Then, in the early 1980s, the agreed upon plan—though not specified in law, but agreed upon plan—was to shift 60 percent to commit in these under 25,000 population, 40 percent to the major areas. But that was the time that Ronald Reagan was elected president, changed the shape of government. The grant funds were eliminated, converted to State revolving loan funds.

I sat on the House Senate Conference Committee when all that occurred and pleaded with the Senate to accept the House position. I will never forget the Senator from Vermont saying, well, the vote is 5 to 4 against the House position. I said, but, forgive me, you didn't ask Jennings Randolph or Senator Moynihan. He said, I could, but the vote will still be 5 to 4. And like that the switch was flipped and \$6 billion disappeared. We had a \$2 billion a year loan program, and then over time that diminished to less than \$600 million in the last year of the Bush Administration.

On a bipartisan basis, our Committee has upped the ante again. We want to replenish those funds, but it is still going to be a loan program. The stimulus gives an opportunity to make some really significant changes and to do so in a very short period of time.

We also, in that bill that passed the House, Chairwoman Johnson's water bill, included funding for separation of storm and sanitary sewers.

Now, you can perform a great service for us, mayors. You go tell your senators that they need to act like senators, and not like squabbling children, and pass something over there. We are tired of passing legislation that goes to the dead letter office 200 yards away.

Thank you for your contribution this morning.

Ms. JOHNSON. Thank you very much, Mr. Chairman.

The Chair recognizes Mr. Boozman.

Mr. BOOZMAN. Thank you, Madam Chair. I would like to defer my questioning until later and recognize Mr. Westmoreland in my stead, with your permission.

Ms. JOHNSON. Yes.

Mr. WESTMORELAND. Thank you for yielding.

Mayor Leppert, let me congratulate you on working with, it sounds like, the industry that is in Dallas that is in the building industry. I am a former builder and it is a breath of fresh air to hear of the government working with an industry to make life better for all citizens, so I do want to thank you for that.

I do want to ask one question, though. You mentioned that you had been in the building business, I guess through development, and that the cost was no higher for these energy conservation jobs. That is not true where I am from, and I didn't know how you equated that, if you were doing some cost benefit analysis.

Mr. LEPPERT. On a personal basis, I am convinced that if it is done in the right way, which means that you bring the green building concept in at the very outset, that you do it literally when you start thinking about the project, when you first started that design. I can tell you from personal experience, having been involved in about \$13 billion worth of green buildings, be it small projects, large projects, I think that you can bring in a green building within

a percent or less of traditional building if you do that planning up front.

Clearly, as we move forward with it in Dallas, one of the great advantages that we had is usually industry will raise their hand and say, hold it, more cost. I brought such a large base of experience from the private side into it that I could talk about how you accomplish that cost reduction and how you accomplished it in ways that, again, brought green building in, even at gold standard levels, within a percent; and I am convinced that at silver level and below that you can do that with almost no differential, and, again, to give concrete examples of buildings that have been built across this Nation, literally across the Nation where that is the case.

Mr. WESTMORELAND. I hope that you will share that, wherever you go, with your other mayors and county commissioners and others.

This question would be for any of the mayors there. Have you all changed any of your building ordinances or codes to development codes to allow for narrow streets, less curb and gutter, more open ditch, runoff, less impervious surface. I know that in a lot of my business, you know if you built a building that had X number of square feet, then you had to have so many parking spaces that were paved. I am glad to read in some of the testimony that you are going away from the impervious surface for these overflow parking lots. These are some very cost-effective things that we can do that helps our environment.

To talk about them is one thing, but have you actually gone in and changed your ordinances and your development rules and regs to put into place what you are talking about?

Mr. BARRETT. If I may, our State has provided leadership on that as well and requires us to make sure that the runoff from sites over a given size stays on the site. So, for example, when we have a developer come in who wants to do a new store, a big box store, for example, we move away from the discussion that they have to have enough parking for Christmas Eve, which is always sort of the standard they come in with, and use a lower parking per square foot measure, but also require them to have right on that plot either some sort of pool to keep it there or to work with us to pay for it.

We also have found this impervious surface. The more impervious surface you want to have, the more it is going to cost you and, quite honestly, that has worked quite well also.

Mr. WESTMORELAND. Okay, but have you really put in an ordinance that—

Mr. BARRETT. Yes. We have to comply with a State law. To answer your question, yes, we have. So by working with the State, we have to do it. There is also a new subdivision in the southern part of our community where we have smaller streets or more narrow streets and areas for runoff right in that subdivision as well.

Mr. WESTMORELAND. Okay.

Mr. FUNKHOUSER. We have also put those kinds of things into ordinance. We have put particularly stream setback we have moved, I think it is, 300 feet for certain kinds of streams and 150 feet for others, certain kinds of development.

Kansas City straddles the Missouri River, so it has the Little Blue River and two or three others that flow into it, and we are at the bottom, so to speak, of a whole metropolitan area, and we have streams coming in from everywhere. So the whole stream set-back issue, it was not on the consent agenda for us, but it was very cutting-edge when we finally adopted it. And I would say that on the development code issues our council is pretty unified on this and the community, particularly the chamber of commerce and folks like that, the business community, has really kind of got the green region bug and they are with us on all this stuff. Now, there is debate and there is discussion, but the general direction is absolutely to put this stuff in ordinance to control development in a way—because we know that is what really, ultimately has the most impact on these issues, is having it from the beginning and catching it at the source. Doing the green buildings, which we are saying every city building will be at least leed silver. That kind of thing we know has the most impact.

Mr. WESTMORELAND. Well, I just think it is important that these things be in the ordinances so these builders and developers, and whoever is coming in, knows up front what they are doing and what to expect, because it goes back to what Mayor Leppert said about if you get this in on the planning stage, you might work your cost down. So I think it is very important that you all do this and don't just do it on a case-by-case basis, but let it be for the entire thing.

Ms. EDWARDS. [Presiding.] Thank you, Mr. Westmoreland.

Mr. Ortiz?

Mr. ORTIZ. Thank you, mayors, for joining us today. I am happy that you are here.

In the Gulf Coast, we have clean water, fresh water. In Dallas we have the Dallas Cowboys. Thank you for joining us today.

You know, I was a county commissioner at one time, and I was just wondering what is the biggest impediment that you have when you try to initiate these programs? Is it funding, environmental studies, the community who might be for or against the project? Could you elaborate a little bit on that?

Mr. LEPPERT. I think in some cases it could be all of the above, and it probably depends project by project. Clearly, when we are looking at, as we have in Dallas—and I think with the other mayors that are here with me today—some infrastructure that literally goes back 100 years. Then it becomes a cost issue, just the significance of going in, renovating or replacing large infrastructure within some of the older cities across the Nation. I would point that out.

I would also point out too—and you touched on another one, too—just the regulatory process of going through things. Clearly, we at the cities put some of that in place too, but it comes from other places, and sometimes what we do is we layer upon layer upon layer, which then increases the cost, and from a timing standpoint pushes it so far out that it is very difficult to deal with.

So I think, depending on the project, it is a combination of all of the above. But sometimes what we do is we put regulation on top of regulation on top of other regulations and, unfortunately, we create disincentives for people, and even cities, to make the nec-

essary changes that are going to be in the interest of their taxpayers and their citizens.

Mr. ORTIZ. Anybody else like to elaborate?

My next question would be some of the cities are impacted because when you have large fields, most of the time that is the water that drains out first, whether they are cotton fields or raising cattle fields, and that water washes into the city and then you have flooding. This is the case that we have where I come from. We are a large agricultural community and most of the water comes from thousands and thousands and thousands of acres of land, and it goes right through the city and it impacts sewers, dirty water, and it does a lot of damage. So I sympathize with all three of you because you do have serious problems.

I am a new Member on this Committee and I am trying to learn from my colleagues here. We have got great Members. We have a great Chairman, great co-chairman. But it is good that you are here and maybe elaborate a little bit on the cost.

Now, elaborate a little bit on the cost now. Your project, mayor, that you were talking—mayor from Dallas—how much is that cost for your project?

Mr. LEPPERT. Well, it literally depends on the project. In fact, in Dallas—and I am sure in the other cities—it is broken up into many different projects, so you would almost have to ask which project are we talking about.

Mr. ORTIZ. So it takes several steps before you get to the end of the project that you are working on, right?

Mr. LEPPERT. Yes, and depending on which project that we are talking about. The other thing that we have had done, which I think has produced some positive elements, is we have tried to develop many programs and broke our city up into 38 sub-watersheds, as a way to refer to it, and then in each one of those try to develop specific plans, specific projects within each one of those to try to address the stormwater drainage issue, too.

Mr. BARRETT. One of the things that we are trying to do in Wisconsin is move to a watershed permit approach, so that you are not dealing with the finger pointing that results when you have different jurisdictions, some urban, some suburban, some rural. But if you go with the land and recognize the watershed approach, then you can come together in a much more effective fashion.

For literally decades we had sewer wars in Southeastern Wisconsin and a lot of finger pointing. Now, the executive director of our sewage district has worked much, much more closely both with the urban leaders and with the suburban and rural leaders in the watershed to try to say, hey, we have to work together; and the more that we can work with EPA to go to that approach, the better job we think we can do.

Mr. FUNKHOUSER. You asked specifically, Mr. Ortiz, about cost. For us, the combined sewer overflow program that we have agreed with the EPA to implement is \$2.4 billion. Now, that pushes us right to the outer edge of what the EPA says is affordable. My city has lower median household income than the surrounding suburban cities. That is going to really be difficult for us. That is one of the reasons why we are looking for help and one of the reasons why we want to have as long as possible to do that, and we want

to be able to amortize that cost over the maximum number of years so that we can phase in the rate increases.

One of the things that Mayor Barrett said was about the impervious surface fee. That is one of the things that we have done too. We have a fee that you have to pay, a stormwater utility fee, as part of your monthly bill, and it is based on the amount of impervious surface, rooftop and driveway and parking lot and so forth. But we are trying to keep those costs such that they don't pose an undue burden on development.

We have these other issues that we are doing with stream setbacks and so forth, so we are on a very precarious tightrope. We want to be green. We have to clean up the water. We are putting 6.3 billion gallons of basically diluted sewage into our waterways every year because of the combined sewer overflow. I remind my citizens of that all the time when we talk about the cost. This \$2.4 billion is a lot of money and they are worried about it, appropriately. But, on the other hand, while we need help, somehow we are going to pay this. Either we are going to pay it through our Federal tax bill or our State tax bill or the city water and sewer rates. But we can't leave this go for our children to deal with; we have got to stop putting this water out.

Mr. ORTIZ. Let me just say thank you for caring and thank you for the great job that you all do.

Ms. EDWARDS. Thank you, Mayor Funkhouser.

Dr. Ehlers?

Mr. EHLERS. Thank you, Madam Chair. I will be brief.

I just want to thank all three of you for the work you have done. I have a great familiarity with this because I am from Grand Rapids, Michigan, across the lake from Milwaukee. We live on the good side, but we faced this problem some years ago and I recall I personally met with the city commission because they were resistant to doing what had to be done, and I persuaded them in rather vivid language of what would happen to the river if they didn't. They took it upon themselves. I am very proud of my city. They solved the overflow problem, the combined sewer problem, and paid for most of it themselves, as you are doing.

I must confess I get a little tired sitting on this Committee and having people come here from around the Country and saying, oh, we need money from you, we can't do this, we can't do this. And I remind them that their parents, who were far poorer than they are, put in the initial systems, sewer systems, and were proud to do it. I think that the citizens today should be proud to maintain the system and improve it and be proud to spend their own money doing it.

So I just want to commend all three of you. You have done exactly what should be done. You have done it right. You have taken the responsibility upon yourself and I believe the rest of the communities across the Country are going to have to do that.

I will add I have no problem with revolving loan funds and using the Federal borrowing power to help communities like yours. But I think every community has to face it themselves, and I think this is especially true because, if they don't, I don't want Federal program mandating to every little city just exactly how they are going to do it. You have designed programs that fit your community, your

cities; you have arranged the financing; and I commend you for that and thank you for doing it.

With that, I yield back.

Ms. EDWARDS. Thank you.

Mr. Baird?

Mr. BAIRD. Thank, Madam Chairman. It is great to see our colleague again.

Tom, good to see you again, and the other witnesses.

Our Subcommittee has done great work, as always, our staff has, but when they list the various approaches to dealing with stormwater runoff, it is regulatory, technological. There is nothing in there about behavioral. And, as I walked to work this morning, I look at all the garbage along the street, the trash and cigarette butts, etc. My kids and I were in the arboretum here recently and scrambled over a bank and went down the river, and every tree had plastic trash bags attached to it.

I am wondering what are you doing to try to make people aware—and this is really for this next panel as well, so I can get this on the record. What are we doing behaviorally to help people understand that what goes off our streets ends up in our water and has real consequences?

Mr. BARRETT. Well, I will say that that is actually one of the more challenging aspects, and we have had, at best, mixed success with, for example, the downspout issue, encouraging people, paying them, in essence, to disconnect their downspouts and have rain barrels or to have it runoff naturally. That has been the biggest challenge that we have had.

So, at the micro level, convincing people that even though we have spent all this money on a deep tunnel, even though we have made progress, we have more progress we have to make. But I would be lying to you if I said that that is something we have been successful in. So it is a challenge.

Mr. FUNKHOUSER. I would say we have spent a lot of time and effort to try to do that, but, as Mayor Barrett said, it is a challenge. This is the kind of thing that is a cultural shift, it is an attitude shift, and it is going to take a long time. My predecessor, Mayor Barnes, launched a program, 10,000 Rain Gardens. It is going to take something like 260,000 rain gardens to solve our problem, but the message was out there that we needed to change what we are doing.

My city, particularly, has put a lot of money and effort, and we have been criticized, by the way, for putting money into PR and so forth, but I call it education; trying to help people understand the consequences of all of our behavior.

Mr. LEPPERT. Simply to build on my colleagues, as I mentioned in the testimony, we have also tried to use some incentives, especially when you get to the development side. The second thing is we have invested very aggressively, and I think with good success, in a website, a website that not only talks about what the city is doing, but also gives an awful lot of ideas on an individual basis of what people can do in this category of green in total. It is greendallas.net. It has received an awful lot of awards, but the basic premise of it is try to provide an awful lot of ideas, concepts,

actions that can be taken at the individual level; and, again, we think that we have had pretty good success with it.

Mr. BAIRD. I applaud you for that. I am very concerned about the health of our oceans and our waterways. We had a big controversy in Washington State about stormwater runoff and there was a proposal that you can't necessarily wash your car in your driveway, and the uproar over this was vast. It was, sort of, I have a divine right to wash my car in front of my house or to drain my radiator, etc., etc., regardless of the downstream consequences. And the irony of this is, if you ask people, do you like clean water? Do you like fishing? Do you think the oceans ought to be healthy? Yes. Ask them to change their behavior; well, that is an outrage. And I just encourage us to try to get responsibility back into this equation.

I was in Israel about three or four weeks ago, and they have got a big drought happening there, and they have run an ad campaign where a beautiful, young Israeli girl's face in the ad campaign dries up and becomes a desiccated face like the soil gets cracks in it. They tell me that that ad is credited with a 20 percent reduction in water consumption, which is equivalent of an entire desalinization plant. I just want us to add that to our repertoire of interventions.

It is a whole lot cheaper to get people to quit throwing, for the record, into our system than it is to clean it up, and I applaud you with that and yield back the balance of my time.

Thanks, Madam Chair.

Ms. EDWARDS. Thank you.

Mr. Cao?

Mr. CAO. Thank you, Madam Chair. I just have a couple of questions I might have missed. Was there a question concerning cost benefit analysis of these green infrastructures that you all mentioned?

Mr. FUNKHOUSER. A major part of the \$2.4 billion that we are going to spend is pilot programs designed to assess in scales large enough to matter, the 100-acre Marlboro project, for example, the cost benefit. We think it works. The EPA scientists think it works. But it depends on the geographic, the soil conditions, so on and so forth. So, I would say, right now what we are doing is we are taking a risk on whether or not it works, whether or not, doing the green part decreases the investment in the gray part; and we are going to build the data. We are kind of being, in some respects, we are one of the lead cities to try to do this, to take the risk to see what the cost benefit is.

Mr. CAO. And I appreciate your efforts in trying to promote these green infrastructures. Was there a study that has been done, for example, to see whether or not these systems would work under severe conditions like floodings from a hurricane or something along that line? I come from New Orleans, and we do flood quite often. Has there been any studies that would somehow show that these infrastructures would hold up under those conditions?

Mr. FUNKHOUSER. In Kansas City, we have severe storms; we have tornadoes and we have lots of water at short periods of time. This is not going to work for that. We are pretty clear, the bulk of our investment, the vast majority of our investment is going to be big pipes and reservoirs. We are talking about if you take the

green solution part from, say, 5 to 10 to 15 to 20 percent, you are being pretty aggressive. What we are talking about with green solutions is small storms; we are not talking about the kinds of things that you are talking about, huge weather events.

Mr. CAO. And I just have one last question. In your report you stated that rainwater is being collected underground in cisterns. I am just thinking about if we have all houses doing that, has there been a study that would see how much energy it would cost to pump the water from the cistern to use it in irrigation and in those other projects?

Mr. BARRETT. I don't know that any of us talked about cisterns. What we have in Milwaukee—and I think it sounds like Kansas City has it too—we have a very large deep tunnel that holds hundreds of millions of gallons of water, so it stays there or comes there during a heavy rainfall. Then it goes to the sewage plant, where we do the work at the sewage plant; then it gets released into Lake Michigan. So at least in my community we don't have any of the cisterns, underground cisterns.

Mr. CAO. I think this is the one with Mr. Leppert.

Mr. LEPPERT. I don't know of any study that would go at what you are talking about.

Mr. CAO. Thank you very much.

Ms. EDWARDS. Thank you.

Mr. Boozman.

Oh, I think I may have messed up. The Chair made a mistake.
Mr. Hall.

Mr. HALL. Thank you, Madam Chair.

Mr. BOOZMAN. We don't slight Mr. Hall.

Mr. HALL. I will make it short.

We in the Hudson Valley, I represent both the good side and the good side of the Hudson River, and we have had three 50-year floods in the last five years. We don't make the news because it is not as calamitous as Cedar Rapids or Galveston or New Orleans and some other really major weather events, but there has been a lot of discussion in the five counties that I represent in the 19th Congressional District about how much of this is attributable to climate changes, the computer models showing more precipitation in the Northeast and stronger storms and more frequent storms; how much of it is due to increased development and more impervious surfaces.

And I would say that all of our county and local and State officials are educating themselves and becoming experts on this, and we are working very well across political aisles. There are issues with how to pay for these things, but we are pretty much in agreement that we need to recreate more natural absorbent and retentive systems to prevent the fast runoff from those small to medium size storms. Obviously, if you get a nor'easter where it just rains like crazy for three days, which is what we tend to see as an extreme event so far in our part of the Country, you are going to overflow even those things.

But congratulations and thank you for the work that you are all doing in your cities. Mayor Bloomberg, in New York City, which is just to the south of my district, has been talking about a sustain-

able New York plan. One of the components is green rooftops and similar water management, runoff management.

You know, we had a decline in funding over the eight years of the previous administration, as Chairman Oberstar mentioned, and I was happy that this Committee took the first step in reporting out and getting through the full House the Water Quality Financing Act, and I too hope the Senate will take it up and pass it soon. Meanwhile, many of your communities and your cities are grappling with the CSOs and other water infrastructure needs, and it seems that the burden of complying with Federal mandates has been transferred to local property taxpayers and utility ratepayers.

So the question, I guess, to each of you is can you speak about how the decline in funding for water infrastructure has impacted your efforts to improve and clean up CSOs and SSOs, but also how it has impacted your local ratepayers and taxpayers?

Mr. FUNKHOUSER. As I said, for us, the models that EPA has are of affordability, how much can you afford. We have worked and worked to try to get our CSO plan down to their highest levels, and we can only do that if we take it out more years than they normally allow cities to do. And, again, I would say again that my city is the largest city in the metropolitan area; we have decline. For example, in 1970, we had 40 percent of all the income. Today, my residents have 18 percent of all the income in the metropolitan area. We are a high-taxed separate city. The point was made earlier by Mr. Ehlers about cities ought to take care of themselves. However this shakes out, we are going to pay a whole lot of money, and we are right at the edge of what my citizens can afford.

Mr. BARRETT. If I can piggyback on that, the way I analyze it is we made great progress because of the Clean Water Act in 1972, and we really have come a long way. The challenge, looking to the future, for a lot of cities—and I talking about cities in the Northeast or the Midwest—older cities where the pipes are literally over a 100 years old, and what has happened is those, at one point, were the centers of wealth. Many of those people have left and you have far more low income people who now live in cities, and the question that this Nation has to face is what are we going to do with—I call it the hidden infrastructure of this Country, and that is the issue that I face and I think many, many local representatives are concerned about, is how do we replace these sewers once they reach their life expectancy. That is where we want to have a partnership with the Federal Government.

Mr. HALL. My time has expired.

Ms. EDWARDS. Thank you, Mr. Hall.

Mr. HALL. Thank you. Thank you, Madam Chair.

Ms. EDWARDS. Mr. Boozman.

Mr. BOOZMAN. Thank you, Madam Chair.

Recently, we had a hearing on wastewater treatment plants and how they could be more energy efficient, and they indicated that there was some low hanging fruit with the pumps that had been there for a long time, and those could be replaced. I guess what I would like to know is where do you all think the low hanging fruit is with stormwater runoff? What are you doing now that you weren't doing 10 years ago that has been very cost-effective, that if you walked around and you were in a different community, or

maybe even your own community, that you saw that you could do that perhaps has been very cost-effective in trying to accomplish what we are trying to get done?

The other question I am going to ask—let me do them both at the same time, in the interest of time—is Mr. Barrett mentioned the Federal water trust fund. I guess we have a gasoline, a highway trust fund that is paid for out of the tax on gasoline, tax on diesel, tires, and things like that. Where would you envision the money coming to fund the Federal water trust fund?

Mr. BARRETT. Well, that would obviously be something we open, and I don't have a magic wand answer for that. I know it is going to be an expensive program. I don't know if you would have a comparable tax on bottled water, just like you have a tax on gasoline. That would be something that would certainly generate a lot of conversation. But I think that there are ways to deal with it. But my point, again, as I said to Mr. Hall, is this is an issue that we have to grapple with, and we are going to do it. We are doing 95 percent of it now at the local level. Our concern is whether we can continue to do it. So I am open to suggestions, quite honestly.

Mr. LEPPERT. In regard to part of your question, again, I think where some of the low hanging fruit—and probably to give an example is try to deal with it broadly—is in terms of the surfaces, of working with the various surfaces and trying to deal with those as you have got more urbanization. I think, again, that is a great opportunity and, as I mentioned in my testimony, trying to use that in as many different ways as we can. Now, clearly, some of that is going to have to be, as I mentioned, changing of standards, doing more research, those sorts of things, but I think that is a great opportunity; and, again, we have seen it in a couple of specific examples, as I related. My sense is there are great opportunities there, especially on the surface side.

Mr. FUNKHOUSER. I think, going forward, changing the behavior. I said before we were criticized for spending money on PR, but, actually, that, I think, the example that was given about Israel, I think that while I don't have evidence to support this, it seems to me that changing behavior is going to be a significantly cost-effective way to do this. And I think it is a generational thing. I think it is going to be easier to get younger folks as each generation comes along. I think those of us my age, our habits are pretty ingrained, but I think younger folks are going to get it.

I would say this, finally, that I told a group I talked to yesterday, environmentalism is very big in my region right now, and I told this group of college students, I said, if you are an environmentalist, you are an urbanist. We need urban density again. We need to stop with the sprawl. Mayor Barrett and I have been talking about struggles with regard to transit. We need good cost-effective, multimodal transit which will help with development patterns and ultimately really have a significant impact on water quality.

Mr. BOOZMAN. Thank you very much. I agree. I think Congressman Baird really made a good point, and you followed upon that, with changing behavior, and I think we can do that without forcing behavior from Government. That is so important. One of my friends, the Congressman from Montana here, when he brushes his teeth, he will turn the water on, he will stick his brush in there,

turn it off, brush. We in Arkansas, where we have a lot of water, the water runs, this and that, the shower is running, warming up at the same time. I grew up at a time where you just didn't leave the room if you didn't turn the light off, and the enforcer was not the governor, it was my dad, you know. So I think that is a very, very good point and yield back the balance of my time.

Ms. EDWARDS. Thank you.

Mr. Kagen?

Mr. KAGEN. Thank you, Madam Chairwoman, and thank you to our Chairman of the Transportation and Infrastructure Committee, Chairman Oberstar, for oftentimes bringing us a historical framework. But, really, what we are doing is repeating history, as human beings, over and over again. It was several centuries ago, and I am sure all of you studied it in school somewhere along the way, it was Samuel Taylor Coleridge who wrote *The Rime of the Ancient Mariner*. I am going to use just 30 seconds of my time to quote this old man of the sea, who might have been someone sitting behind me.

[Laughter.]

Mr. KAGEN. And it reads, in part: "Down dropt the breeze, the sails dropt down. 'Twas sad as sad could be; and we did speak only to break the silence of the sea! All in a hot and copper sky, the bloody Sun at noon. Right up above the mast did stand, no bigger than the Moon. Day after day, day after day, we stuck, nor breath nor motion; as idle as a painted ship upon a painted ocean. Water, water, every where, and all the boards did shrink; water, water every where, nor any drop to drink. The very deep did rot, oh Christ! That ever this should be! Yea, slimy things did crawl with legs upon the slimy sea."

We are repeating history as it may have been predicted by Samuel Taylor Coleridge.

I have to express my great admiration not only for the Chairman, but also for Mayor Barrett for his service to our Nation and now to the city of Milwaukee, where I used to live just before we raised a family. I lived on the lake, Summit Avenue; not quite on the lake, above MacArthur Park, and I got to see that city transform its waterfront, and I got also to witness the Milwaukee River come back to life.

As an allergy specialist, I used to study water quality and air quality in Northeast Wisconsin, and the best way to monitor water quality in any stream is its aquatic insect life; and I got to see the midges come back to life in the Milwaukee River, in large part because of your great efforts to protect the waterways.

Water does not recognize county lines, and that is one of the problems that was approached by the State of Wisconsin, by the region of the Great Lakes and helped to bring about the Great Lakes Compact; and I would applaud the efforts of everyone everywhere in the Country to respect the watershed, to understand that, yes, this is our water, but we are really drinking 10,000-year-old water, and thank God they don't charge you on the age of the product that you are drinking.

But it comes down to money and funding and also Federal regulation, and time will not permit the three of you today to respond to my question, but it has to do with what are the three greatest

obstacles that you face with regard to Federal regulations? If we could just erase them or modify them in such a degree to make your life much easier, what would those three recommendations be?

I have been hearing from my constituents that it happens to be unfunded mandates; that a small community without the tax base necessary to build a retention pond or water retention area, is forced to do it. So I would ask for those recommendations and I will pose that question to you briefly and add an editorial comment: Really, if you need money, you are coming to the wrong place. Ben Bernanke, at the Federal Reserve, can print you a trillion dollars if you need it.

So, Mayor Barrett, if I ask you to come up with three responses. Not necessary right now, but just on the spot and the time remaining.

Mr. BARRETT. We would love to have a very close relationship with Ben Bernanke. That would be the first one. It really, I think, comes down to the partnership, because I have served at the Federal level, I have served at the State level, I have served at the local level. All of us want to have clean water. Every one of us wants to have clean water. It looks good. Every one of us wants to have our campaign commercials or brochures saying that we are fighting for a clean environment. It sells. The difficulty is who pays for it, and that is the big difficulty. It is always easy to say I am fighting for it and then let him pick up the tab.

So I think that there has to be, more than anything, a recognition that this is something that has to be a joint effort by all of us at all units of government.

Mr. FUNKHOUSER. I would just point out, since I get a lot of my stormwater from Kansas, that it doesn't recognize State lines either.

Mr. LEPPERT. And I would just concur with my colleagues.

Mr. KAGEN. Thank you all very much, and I will expect your responses not at government speed, but at the speed of business. How is that?

Thank you very much. I yield back.

Ms. EDWARDS. Thank you.

Mr. Carnahan?

Mr. CARNAHAN. Thank you, Madam Chair. Welcome to the panel. I apologize for getting here late, but I want to give a special welcome to Mayor Funkhouser, our friends from the other side of the State of Missouri. I had a great opportunity to visit with Councilwoman Marcason, who was in my office a few days ago, catch up with her. We share your pain in St. Louis, having, I am sad to say, some fine sewer infrastructure from the Abraham Lincoln Administration. So we look forward to partnering with you and also learning from some of the creative things that you have done.

In St. Louis, we have some initiatives underway for green absorbent alleys, parking lots, roofs, but I can see that Kansas City is ahead of us on these matters. So, again, we look forward to working with you on this.

I was really interested in the description of your efforts for the public-private collaborative and the many stakeholders that you have brought to the table, especially the public schools. I think that

is brilliant to get those young people involved early on. But I wanted to ask about the question of cost. That obviously is what vexes policymakers and appropriators and leaders in communities, how to pay for this infrastructure.

Tell me what your strategy is in terms of passing cost on to ratepayers using the State revolving funds; other ideas in terms of cost sharing and really addressing some of the cost involved with these transitions.

Mr. FUNKHOUSER. First of all, just a plaudit to Councilwoman Marcason. She has led the effort on this. She has been dubbed on our council the Sewer Queen and she has done a marvelous job.

We have had a huge community involvement. In my testimony, attached is the report put out by our Wet Weather Solutions Panel. This is a big group of citizens, including a lot of experts, who have been meeting over about five years to develop our sort of overall strategy on this. Then, about a year and a half ago or a year ago, when we began to see the outlines of the bill that we were going to have to pay, we created a mayor's utility funding task force and we put together a group of people who would design the way that we were going to pay for this. We are going to do it primarily through rates, sewer rates; some of it will be straight-up sewer rates, some of it will be the impervious surface fee that we have. We had to try and design this in such a way that certain geographic areas in our city that are the lowest income would be not negatively impacted.

So we don't have the complete package together yet. We considered various tax sources—property tax, sales tax, and so forth—found very little support for that. It is going to be almost entirely fees of one kind or another that are going to be balanced in such a way as to not unfairly impact the poorest in our city.

Mr. CARNAHAN. Mayor, again, thank you for your leadership role, especially Councilwoman Marcason. She is very impressive, and we are glad someone is the queen of the sewers there in leading this effort. But thank you for being here in DC.

Mr. FUNKHOUSER. Thank you.

Ms. EDWARDS. Thank you.

The Chair recognizes our Chairman, Mr. Oberstar.

Mr. OBERSTAR. Thank you, Madam Chair. I do want to intercede. I think Mr. Hare is yet to be recognized, but I have another transportation issue awaiting me in the conference room.

I want to compliment the three mayors on their concerted effort on green solutions. The recommendations made and the practices adopted by Mayor Leppert, Mayor Funkhouser, Mayor Barrett all point to the direction in which Federal policy needs to move and needs to stimulate State policy as well.

Your comment, Mayor Leppert, about previous concrete, more research needed, perhaps by the National Institute of Standards and Technology, I wish we had that testimony about six weeks ago; we would have included it in our bill. But we can still do that. The bill has passed the House. We can still do that with the conference support, if the Senate is ever able to move anything other than the prayer. We will do that.

You also talked about North Central Texas Council of Governments and an integrated stormwater management guidance. I would like to have a copy of that document.

Mr. LEPPERT. Sure.

Mr. OBERSTAR. I think that is a valuable concept, resource. You are saying few developers are using it. We ought to find ways to inspire them to do that, and there are ways that we can do that in Federal law.

Mr. LEPPERT. I will make sure that you get that. Again, I think it is an example of a theme that you have heard—although you are visiting with given municipalities today, the reality of it is a lot of these issues that we are dealing with are clearly ones that go much more broadly to your Committee even than what is being addressed by this Subcommittee—is that we are dealing with regional issues, and the interaction between counties, between other cities, other entities becomes paramount in trying to deal with these issues.

Mr. OBERSTAR. Mayor Funkhouser, your green solutions, overflow control plan, your Wet Weather Community Panel, how did you come about to establish this Wet Weather Community Panel?

Mr. FUNKHOUSER. That was done by my predecessor, Mayor Barnes, and it was done in 2003, when we first began to see that we were going to have to deal with the combined sewer program. Again, there are a lot of people in my community who are very concerned about the environment, and have been. So as soon as the outlines, so to speak, of the sewer problem began to be apparent to the community, there were people who were concerned about climate change, concerned about the environment, and took it upon themselves, came to the mayor, said we want to put something together to look at how to use this in a transformational way to improve property values and protect the environment, as well as deal with the sewage overflow.

I can't take any credit for that, that was well under way by the time I came into office.

Mr. OBERSTAR. Well, I have championed for many years non-point source legislation requiring management by watershed and requiring the practitioners—farmers individually, the State Departments of Natural Resources, Fish and Wildlife Service, a host of other Federal agencies—to combine efforts, develop a management plan for the watershed, and previous administrations have resisted it. We have just not gotten anywhere with it. Some more far right-thinking farm group have opposed it as Federal control. I am saying, no, you design the plan, you tell us how you want to manage it; we will support it. But if you don't, someone will, because we must. But we also must have urban runoff plans, and they can't all be widening the stream, creating more capacity to flow the water, polluted as it is, to receiving streams and lakes and estuaries.

Now, Mayor Barrett, you have had some experience with the cryptosporidium problem in Lake Michigan. It turned out it was not from runoff, it was from the inadequacy of the wastewater treatment plan itself, and needed more funds to upgrade the treatment. But you have done some remarkable things: rain gardens, green roofs, neighborhood-wide downspout disconnection.

All my youthful years we had a rain barrel at home. We saved that water and put it on our garden out back. It was a big garden, 200 feet by 50 feet. We grew everything and fed the family all during the winter. That rainwater was there in the barrel when it didn't come down from the skies. That makes such good sense.

And your point about tunnels, you can't hold a picnic or a tailgate party in a deep tunnel, that is for sure. My predecessor, John Blatnik, once said we ought to require all sewer and water pipes be built above ground so people could stumble into them and see that we are really doing something for them. Now, that was said with tongue in cheek and a good sense of humor, but you are right about it. We bury these contributions to urban improvements and people don't see them until they break.

Mr. BARRETT. That is what makes it much more difficult to fix them, because people see a road or a pothole, and they want that fixed immediately. But you have a street collapse because the pipe broke; that is obviously much more expensive to fix than a pothole.

Mr. OBERSTAR. But all of these are contributions to a new way of thinking about cleaning up our wastewater systems, improving our wastewater treatment, combine storm and sanitary sewer overflow, and perhaps the practices that you are talking about are those that we should incorporate into our loan programs or grant programs or Federal assistance as a condition of receiving those funds. Employ these practices that reduce the runoff so you have less to treat in the end.

I will conclude by complimenting Mr. Kagen, our poet laureate. Coleridge went on to describe the oceans as dark, heaving, mysterious, and endless. We know they are dark. Heaving they certainly are. We are unlocking the mystery of the ocean. But endless they are not. Nor is our supply of fresh water. All we ever had or ever will have is with us today. Of the 42 trillion gallons of moisture that passes over the Continental United States everyday, only 675 billion gallons of that everyday is available to us in moisture that reaches and remains on the ground. That is what we have to preserve and protect.

Thank you very much for your contributions, mayors.

Ms. EDWARDS. Thank you, Mr. Chairman.

Mr. Kagen, I had to reach back to my lit class at Wake Forest University for that moment.

We thank you very much, to the panel. You are dismissed.

We will recess and then reconvene after our votes, which will probably be at noon. Until then, the Subcommittee stands in recess.

[Recess.]

A F T E R N O O N S E S S I O N

[12:18 p.m.]

Ms. EDWARDS. The Subcommittee will come back to order.

Will the witnesses from panel two take your seats?

The Ranking Member, Mr. Boozman, has another markup right now, but he will be returning shortly. But we will go ahead and start with our second panel of witnesses, comprising and welcome EPA's Acting Assistant Administrator for Water, Michael Shapiro. We will then hear from Dr. Robert Traver from Villanova University. Next, Mr. Howard Neukrug from Philadelphia's Water Depart-

ment will testify. He is also testifying on behalf of the National Association for Clean Water Agencies. Then Mr. Timothy Richards, from Charlotte, North Carolina will testify next. Mr. Richards is the Deputy City Engineer for Charlotte and will also be testifying on behalf of the National Association for Flood and Stormwater Management Agencies. I love doing the double-duty. Then we will hear from Ms. Mary Wahl. Ms. Wahl is Director of the Office of Watersheds for the City of Portland, Oregon. And our final witness on our second panel is Ms. Nancy Stoner from the Natural Resources Defense Council.

Ms. Stoner, you have testified in front of this Committee before, and we welcome you back.

Your full statements will be placed into the record and we ask that you try to limit your testimony to about five minutes as a courtesy to other witnesses and so that we can get on with questioning. Again, we will proceed in the order in which the witnesses were listed in the beginning.

Mr. Shapiro.

TESTIMONY OF MIKE SHAPIRO, ACTING ASSISTANT ADMINISTRATOR, OFFICE OF WATER, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.; ROBERT TRAVER, PROFESSOR, CIVIL AND ENVIRONMENTAL ENGINEERING, VILLANOVA UNIVERSITY, VILLANOVA, PENNSYLVANIA; HOWARD NEUKRUG, P.E., DIRECTOR, OFFICE OF WATERSHEDS, PHILADELPHIA WATER DEPARTMENT, PHILADELPHIA, PENNSYLVANIA; TIMOTHY RICHARDS, P.E., NAFSMA DIRECTOR AND STORMWATER COMMITTEE CHAIR, DEPUTY CITY ENGINEER, CITY OF CHARLOTTE, NORTH CAROLINA; MARY WAHL, DIRECTOR, OFFICE OF WATERSHEDS, PORTLAND BUREAU OF ENVIRONMENTAL SERVICES, PORTLAND, OREGON; AND NANCY STONER, CO-DIRECTOR, CLEAN WATER PROGRAM, NATURAL RESOURCES DEFENSE COUNCIL, WASHINGTON, DC.

Mr. SHAPIRO. Madam Chair and Members of the Subcommittee, I appreciate the opportunity to provide EPA's perspectives on the important issues associated with urban stormwater and green infrastructure.

Stormwater pollution, as we have heard, is one of our Nation's most challenging water quality problems. Rainwater and snowmelt run off of our urban and suburban landscape, picking up fertilizers, soil and sediments, pathogens and many other pollutants on the way to our rivers, lakes, and coastal waters. The impermeable surfaces and traditional drainage designs also result in increased stormwater volume and peak flow rates.

Small tributaries and even larger streams cannot accommodate the increased water volume and flow, leading to eroded streambanks, streams choked with sediment, destroyed aquatic life, and increased flooding.

In addition to these problems, many older cities, including many of the largest cities in the U.S., have combined sewage and stormwater pipes which periodically overflow due to precipitation events.

The 1987 amendments to the Clean Water Act required EPA to establish a program to regulate stormwater. To date, approximately 7,000 municipal permittees and hundreds of thousands of industrial permittees have been regulated.

EPA published its combined sewer overflow policy in 1994, requiring communities to develop long-term control plans to address their combined sewer overflows. Our initial implementation of these programs focused on adding on to the existing gray infrastructure, one that had been designed to move stormwater as rapidly as possible off of the landscape and onto our surface waters.

In recent years, we have increasingly recognized the multiple benefits that green infrastructure approaches offer when integrated into stormwater and combined sewer overflow management programs. A green infrastructure provides multiple beneficial outcomes, including improved water quality and stream condition, reduced flooding, recharge of groundwater and surface water supplies, reduced urban temperatures and energy demand, carbon sequestration, improved aesthetics, and additional recreational and wildlife values. Moreover, case studies published by EPA demonstrate that these approaches frequently cost less than conventional approaches.

Two years ago, EPA embarked on an enhanced effort to promote green infrastructure through all of our water programs, in conjunction with several partners, including American Rivers, the National Association of Clean Water Agencies, the Natural Resources Defense Council, the Low Impact Development Center, and the Association of State and Interstate Water Pollution Control Administrators.

In January of 2008, this collaborative effort produced the Green Infrastructure Action Strategy. The Strategy is an action plan of several dozen activities and initiatives to overcome barriers to green infrastructure implementation. Since then, we have moved forward with implementing many aspects of this strategy together with our partners.

In order to assist the stormwater management community, we have provided a variety of outreach and assistance activities: training, workshops, webcasts. And we have published documents on critical topics necessary for the design and selection of green infrastructure approaches. We are working with a variety of sectors, such as Federal highways, and modifying and developing models to make design work and life cycle costing analyses easier. Much of this material is now available on our website and more will be coming.

In August 2007, our permits and enforcement programs issued a joint memo indicating that green infrastructure approaches are consistent with national pollutant discharge elimination system requirements and should be encouraged in CSO and stormwater programs. We have also clarified that our underground injection control permitting requirements do not generally apply to most green infrastructure approaches.

We have increased our emphasis on outreach to State and EPA regulatory programs to assist them in specific permitting and enforcement cases, and also to provide general guidance on incorporating green infrastructure into their programs. We have devel-

oped a helpful series of guidebooks on managing wet weather with green infrastructure for municipal utilities and their stormwater management officials, and that series of guidebooks to date has addressed financing, retrofitting green infrastructure, green streets, and water harvesting policies. Again, more documents will be on the way.

We are trying to provide as much information as possible to allow municipal officials to select green infrastructure approaches with confidence that they will work.

The American Recovery and Reinvestment Act set-aside for green projects through the Clean Water State Revolving Fund provides an outstanding opportunity to accelerate the integration of green infrastructure into our stormwater management programs. EPA is working with States to ensure that projects funded through this set-aside represent good examples of green infrastructure approaches.

There are also unanswered questions. We understand performance of green infrastructure practices very well in some cases, reasonably well in others. However, we need better tools for estimating collective performance at regional scales. And there are still questions about long-term performance of some practices under various maintenance regimes. There are questions regarding the maintenance of green infrastructure projects which are frequently located on private property.

EPA and our national local partners are helping to change the way our Nation views and manages stormwater. We look forward to working with the Committee and our partners in order to achieve mutual water quality goals, as well as to promote more livable communities. Thank you.

Ms. EDWARDS. Thank you, Mr. Shapiro.

Dr. Traver?

Mr. TRAVER. Good morning. Or I should say good afternoon, Madam Chair and Members of the Committee. My name is Rob Traver. I am a Professor of Civil Engineering at Villanova University, and I was on the NRC Committee on reducing stormwater discharge contributions to water pollution.

To protect our waters, our expectations of stormwater management have recently shifted away from a purely flood control perspective to one addressing water quantity, quality, erosion, stream bank protection. In addition thereto, of course, our original flood control mandate. We have moved from detention strategies to natural control measures, addressing both the frequent, smaller storms and the big ones.

If you take a look up here—I was asked to show a few pictures of some green infrastructure—on the upper left is a 319 project of Jordan Cove up in Connecticut. Notice the houses are closer to the street to cut down the amount of the impervious surface, and the traffic island is a treatment mechanism. On the right is a retrofit of a street in Seattle. The center one at the top is basically showing how we can slip these in to our infrastructure, showing this is a bioswale between a pavement and a street.

The bottom three practices are all projects at Villanova University: a green roof paid for by the University, and a pervious concrete, and a bioinfiltration site paid through the 319 program.

To me, I look at these as engineered approaches that are really targeted to paved areas to first reduce and then employ nature to treat the stormwater runoff.

Next slide, please.

[Slide.]

My last slide is just a picture a little bit more in depth of our bioinfiltration site.

I have heard a lot of talk about maintenance. We don't find that to be a problem on this particular site. It was designed and built in 2001 for about one inch of runoff; it takes about 80 to 90 percent of the rainfall each year, infiltrating it through the soil, through a chemical and biologically active matrix to provide treatment. We have three or four overflows a year, and we expected that, and, really, we have seen no change in performance over the last seven or eight years on this particular site. And my belief is if we had built this as part of the original construction, instead of a retrofit, it would have paid for itself, as it requires less piping and culverts than a traditional design.

Our NRC report does recognize some barriers. It recommends a systems approach tailored to the watershed and implemented at the municipal level, incorporating land use and all stressors. A primary barrier to us is the separation of stormwater quantity and quality that has occurred in both the regulatory and scientific arenas. Standards should be based on science, and that includes the role of flow as a pollutant. The real or perceived inability to not address and not target flow as a pollutant simply does not allow us to meet the full goals of the Clean Water Act.

Another barrier that we have actually already heard about today is sometimes some of the older laws are in conflict with the newer laws trying to implement green infrastructure. The simplest example are ordinances that mandate required curbing or oversized parking areas. A more insidious problem is newer design codes that underestimate the performance of green infrastructures requiring very large footprints and pushing builders and developers to more expensive and less sustainable solutions.

Another barrier that we have is more in the technology. Implementation has proceeded faster than our ability to predict the outcomes of the many processes involved. We know that they work and they are tremendously more effective than what we did in the past, but we aren't able yet to predict a unique outcome from a unique storm on these sites. We feel that a broad-based research effort is needed to develop this ability and then apply it to the larger watershed.

Because of the inherent variability of the natural processes, we really feel this research needs to include laboratory, field, model development, and long-term continuously monitored sites, so we understand more about the design capabilities, the maintenance, the longevity, and to really lower the cost to the homeowner and community and avoid wasting millions of dollars on ineffective practices like we have done in the past.

The perception barrier is the easiest one. At Villanova, we have had thousands of people come to visit our research sites, and seeing that a rain garden or a stormwater wetlands or pervious concrete site is a good neighbor, there is no swamp monster coming out of

them, there are no mosquitos, maintenance, talking about those issues with our facilities staff, learning that we can actually reduce the number of people we have mowing our sites by simply ceasing to mow a retention basin are all positive answers that we put across. And we feel, or I feel, I should say, that this concept could be exported to our township buildings, supermarkets, or school districts to engage the public in these particular sites. We really looked at redevelopment as an opportunity to incorporate green infrastructure in areas that it never existed.

And from an engineering perspective, in summary, green infrastructure is really the most cost-effective and sustainable approach that we have in mitigating the effects of urban stormwater and to reintroduce the hydrologic processes lost during urbanization.

Thank you for the opportunity to testify.

Ms. EDWARDS. Thank you, Dr. Traver.

Mr. Neukrug, I apologize if I have completely botched your name.

Mr. NEUKRUG. No, you did not; you did very well. Thank you very much.

Good afternoon, Madam Chair and Members of the Subcommittee. I am Howard Neukrug, Director of the Office of Watersheds for the City of Philadelphia Water Department. It is an honor to testify today on behalf of my utility, the city of Philadelphia, and the National Association of Clean Water Agencies.

Our mayor, Michael Nutter, is committed to making Philadelphia the greenest city in America. He is about to launch an ambitious plan which will make Philadelphia sustainable through the 21st century and beyond. We fully expect that this effort will actually strengthen our economy, while reducing our environmental footprint.

The pictures that are shown on the screens on the sides represent a future vision for Philadelphia. It is a vision that is endorsed and supported by the mayor and the Philadelphia Water Department. From the perspective of the city, the city responsible for meeting Clean Water Act requirements, the mayor's vision is energizing. But to make this vision reality, we must change how we think about the management of urban stormwater runoff. In the context of sustainable cities, our primary focus must shift from controlling discharges into our rivers and streams to stopping the rainwater from becoming a pollutant in the first place.

We believe we can do this by changing the relationship between land and water from an aggressive 19th century approach of building pipes and other barriers to one where we welcome the rainwater as a local asset. Instead of building new sewer pipes, we can plant trees and rain gardens and other aboveground amenities that provide multiple benefits of economy, sense of place, ecology, and the environment.

Green cities can address water resource and quality concerns, while also tackling the sustainability goals of air quality, waste produce reuse, urban heat island mitigation, carbon sequestration, energy conservation, environmental justice, and quality of urban life.

The U.S. EPA has been a great supporter of these concepts, as has environmental organizations such as NRDC and American Rivers and many Members of Congress, but we have a problem. While

many at the highest levels of the EPA and elsewhere support the green city clean water initiatives, EPA has yet to find the means to incorporate these ideas into its regulatory policy and enforcement framework.

What we need is a 21st century sustainable city's interpretation of the Clean Water Act. Without this, all the good wishes from our many friends at the U.S. EPA, State regulators, mayors, governors, Congress, environmental advocacy groups, and the public may have been wasted. We will remain burdened with doubt about the future of our programs by sometimes myopic interpretation of how we are to achieve the goals of the Clean Water Act.

Simply put, expanding the traditional systems of gray infrastructure is not a sustainable approach. Yesterday's sewer systems are not designed to handle today's challenges, nor are they equipped to mimic natural stormwater management principles essential for restoring our rivers and streams to not just fishable and swimmable, but to accessible, safe, and attractive. And isn't this what this is all about, caring for our streams so that they are clean and thriving and beautiful again?

NACWA has been working in support of this effort for a more holistic approach that embraces these technologies to help solve our water quality challenges. NACWA has also recently founded the Clean Water America Alliance, of which I am a board member. The Alliance seeks to promote an integrated national water policy that advances environmental, sustainable communities.

In summary, I am here today on behalf of the city of Philadelphia, its water utility, and NACWA to call on Congress to recognize that there has been a fundamental shift in how we manage and view the urban landscape, and support us, the water sector, in our efforts to implement sustainable solutions to stormwater management.

Help us direct EPA to revise the CSO policy to allow and encourage green, sustainable approaches to overflow controls. And help us by supporting legislation which establishes green infrastructure pilot programs, creating set-asides in legislation such transportation bill, and finding a long-term sustainable funding source for clean water infrastructure through a clean water trust fund.

In conclusion, the opportunities and the benefits of green stormwater programs are just too great and the potential for failure and an unsustainable future for our urban centers is just too unacceptable for us to fail. We need your help to frame policy and enforcement strategies that meet the goals of the Clean Water Act through implementation of green and sustainable cities.

Madam Chair, we look forward to working with you and other Members of Congress on accomplishing these important goals, and thank you very much. I would be happy to answer questions.

Ms. EDWARDS. Thank you, Mr. Neukrug.

Mr. Richards?

Mr. RICHARDS. Madam Chair and Committee Members, thank you for the invitation to speak on green infrastructure and low impact design approaches. I represent NAFSMA, the National Association of Flood and Stormwater Management Agencies. We are a 30-year-old national organization representing approximately 100 local and State jurisdictions. We represent mostly large urban

areas, focusing on stormwater and floodplain management and flood safety. We often work closely with EPA, Corps of Engineers, and FEMA on water policies.

First, we offer these general comments. NAFSMA supports the Clean Water Act and tools like the NPDES Permit Program. Our members primarily deal with non-point source pollution and stormwater. Today, I will not be addressing wastewater, industrial, or combined sewer systems, which have their own set of limitations and issues.

We agree with the EPA description of green infrastructure that it involves systems that mimic natural processes. It involves infiltration and evapor-transportation and recycling of runoff; it uses tools like green roofs, porous pavements, and rain gardens, vegetated swales, and that they provide a variety of environmental benefits. But most importantly, we agree that it accomplishes this as a component of a holistic stormwater management system.

For testimony purposes, we consider a low impact design or LID to be a component of green infrastructure and may use the terms interchangeably, depending on the context.

We encourage green infrastructure where conditions are suitable. However, we do not believe it is a sole solution. We offer, as requested, a few barriers to implementing green infrastructure.

Number one, green infrastructure is more appropriate for some parts of the Country than others. Some areas have soils that simply do not infiltrate well, a key component of green infrastructure. With limited infiltration, more conventional detention techniques may provide additional protection for sensitive streambanks by lowering the peak runoff rates.

Number two, green infrastructure can be problematic for higher density development. We have experienced that in ultra urban density land is at a premium, if available at all, for areas of vegetation and infiltration. It may be more viable to allow options for higher density development to participate in funding other techniques and measures like extended dry detention basins further down in the watershed.

Number three, the development marketplace in some areas has not shown broad support of green infrastructure. Many green infrastructure measures are natural, requiring ongoing routine maintenance by private property owners. Not all markets appreciate the benefit of nature up close and personal. Many markets want a cleaner, more well defined streetscape and lawn area that offers close to maintenance-free assurance.

Number four, green infrastructure could mean a huge increase in the number of measures being constructed, operated, and maintained in a city. Green infrastructure seeks to mimic predeveloped hydrology. This means collection and treatment of runoff in relatively small amounts close to where it starts becoming runoff. Studies have shown that this results often in large increases in a number of these small measures, and maintaining or providing administration for their maintenance could become a large financial burden.

Number five, this financial burden could be much larger with green infrastructure, as compared to conventional management measures. For instance, we have a study from Denver, Colorado

that showed total cost for construction, administration, maintenance, and eventual rehabilitation of a green site to cost over six times the cost of the conventional management technique. Now, this was for a 100-acre multifamily development, resulting in, for over 50 years, \$38 million versus \$6 million.

That said, we also agree that there are valid studies that showed cost savings using green infrastructure. However, we want to just recognize that it depends on the sites and it also depends on whether you are including costs for addressing runoff volumes that produce street, business, and home flooding.

Number six, LID needs to complement and support smart growth concepts. Recent draft stormwater permits have moved towards strong encouragement or even mandating LID through the use of limiting impervious areas. This can actually increase sprawl.

So we offer some recommendations for overcoming these barriers.

Number one, Congress should encourage, rather than mandate, green infrastructure when and where it is feasible and economically sustainable. This direction from the Federal Government will go a long way in promoting what EPA has stated as their goal of using an adaptive management philosophy of managing stormwater. It is this adaptive management process that will enable us to scientifically and procedurally remove ineffective methods that may be too costly or infeasible.

Number two, increase funding for research and science for stormwater management. We need to be able to fund pilot programs and extensive monitoring at both the site level and the watershed level to determine the effectiveness of different techniques. Federally-funded grants and support programs are needed to supplement what many of our members are trying to do on their own already.

And, number three, continue to educate and involve leaders, municipal officials, developers, and the public on stormwater management issues. One of the useful best management practices for protecting and improving water quality is public education and involvement. Each person, whether property owner or regulator, developer or policymaker, has a role in making the best decision.

Again, Madam Chair and Committee Members, thank you for your time.

Ms. EDWARDS. Thank you, Mr. Richards.

Ms. Wahl?

Ms. WAHL. Madam Chair, Members of the Committee, thank you for the chance to speak to you today on this subject. I am Mary Wahl. I manage watershed services for the city of Portland, Oregon.

First, to your primary question about whether these green infrastructure facilities work and there is utility for them in the urban area. The answer is yes, absolutely they do work. They work for the environment, clearly, but also for the economy and the rate-payers as well. They don't work everywhere, but they do work, and we are expanding their use across the city.

Two examples I have on the boards down here. One is the pipe. The one on the right is the pipe. We are one of the cities building the 10-mile tunnel that is 100 feet underground, big enough to be a subway. We look at that as an important part of our Clean Water

Act response, but part of the past. We are not planning on that response anymore. For the future, we plan to rely on the green infrastructure to manage stormwater from development and infill. As more and more people move in, if there is more stormwater, we will use the facilities on the right.

An example of how much we are relying on those and why is that in one 2.5 square mile area of Portland, we are putting 600 of these facilities, primarily the curb extensions that you see on the bottom picture of the board over here. Clearly, those are critical for the environmental pieces, but environment alone wouldn't have brought the funds to put 600 of these in one area. That resulted from a rigorous analysis by the engineers of alternatives and costs. The original pipe design for that 2.5 square foot mile area was \$144 million. The current design with green—see what the green can do—and then do the rest of the work with gray is \$86 million. So the difference is \$58 million by doing the green first and then the gray.

So we are expanding these where they work.

I will skip right to some of the solutions. You have heard some great ones today. I would like to mention just a few others.

The first one is implement green infrastructure when the Federal Government funds roads, buildings, and development. If you want to know where these work and under what conditions, the way to do that is to put them on the ground. That is what worked for us, and I think it can work just as well for the Federal Government as well.

The second is to capitalize green infrastructure. The pipes are capitalized. People look at trees and know that those are important assets, but, because they aren't described as an asset, they don't get the same kind of funding. So, when the call comes down, the call goes to pipes, typically, because we don't have the ability to capitalize these.

The third one that I would mention is to change the regulatory framework. Two parts of that. Cities like Portland and Philadelphia and others across the Country that are doing these shouldn't get a regulatory hall pass, but the reverse is often the case, where pipes are favored rather than the green infrastructure; and it should at least be neutral, so that if the green infrastructure can work, then that gets the regulatory compliance blessing, if you will.

The second one, and this might be the most important thing I say to you today, that is, that the water law needs to change. Until now it has been focused primarily on water quality, and that is absolutely critical. It is what people think about when they think about all of the water work we do. But the watershed science requires us to expand that focus to hydrology. We need to worry about where the water is, how much of it is, what time of the year. Water needs to be in the watershed at the right time of the year if we are going to have a chance to restore these watersheds. Green infrastructure really speaks to hydrology or flow, and that needs to get recognized in the law as well.

One other point I would like to make is that incentives are important. We have had EPA Wet Weather Grants. Over the past several years they have helped immensely to subsidize, if you will, some of the innovations and these green infrastructure demonstra-

tion projects. A lot of this ends up on private property. We need the grants to help subsidize that and get it started.

The other is that—and I will just mention this very quickly. The first billion gallons a year of water off our CSO system comes from people disconnecting their downspouts right off the roof, and it goes onto the ground instead of into the pipe. That is a billion gallons a year just for that. It costs us \$53 a house to get the 50,000 houses in Portland to take that water off the sewer system and put it on their yard. So incentives can make a huge difference.

I will stop there. I, like several other of the Members who have mentioned this, would appreciate a chance to help you work on the solutions as follow-up. I appreciate the chance to be here. Thank you.

Ms. EDWARDS. Thank you.

Ms. Stoner?

Ms. STONER. Thank you. Good afternoon, Madam Chair and Members of the Subcommittee. It is a pleasure to appear before you today on behalf of the Natural Resources Defense Council to discuss the role of green infrastructure in revitalizing our waterways and our cities.

First, I want to thank you for the Committee's leadership already on these issues and the House's leadership on both the economic recovery legislation and the reauthorization of the Clean Water State Revolving Fund. We appreciate the recognition that green infrastructure got in both of those pieces of legislation already this year.

Interest in green infrastructure is skyrocketing among Members of Congress, the sewage treatment industry, State and local governments, and the public. I think you can tell that from the witnesses you are hearing from today. This is an opportune moment to discuss the barriers to full, effective implementation of green infrastructure as an integral part of water and wastewater resource management in communities across the Country.

My written testimony discusses a number of benefits of green infrastructure. In my oral remarks I will focus on just a few.

First, investment in green infrastructure creates jobs. Designing, installing, and maintaining green infrastructure creates new jobs for architects, designers, engineers, construction workers, plumbers, maintenance workers, landscapers, and many more. For example, a recent study by the D.C. Office of Planning found that investment of \$900 million in retrofitting green roofs in D.C. would produce more than 17,000 full-time annual jobs. Those are real jobs that we need in our economy today.

Second, as many of the witnesses have indicated, investment in green infrastructure saves money. It saves developers money associated with paving, putting in curb and gutter, building piping systems, and digging centralized stormwater ponds. These types of developments also sell faster and bring in higher prices. EPA issued a report last year quantifying those cost savings for developers. It also requires lower operations and maintenance expenses, such as energy cost for pumping water around and cost of treatment during wet weather, when compared with storage tunnels and other hard infrastructure solutions.

Third, I want to tell you about a new study that NRDC has conducted in cooperation with leading academics in California examining the potential for use of green infrastructure practices to augment water supplies and reduce energy use in California. Our analysis revealed that through implementing green infrastructure practices at new and redeveloped residential and commercial properties, 400,000-acre feet of water could be saved, or enough water for about 400,000 families to meet their annual water supply needs. This water is desperately needed in California right now, and some of the water needed can be obtained through using green infrastructure.

The California study also looked at using green infrastructure to save energy. In areas such as Southern California that are dependent on distant or energy-intensive sources of water, practices that augment local water sources such as groundwater or captured rainwater can be used to reduce energy use and its attendant greenhouse gas emissions. NRDC's study found that the 400,000-acre feet of water I mentioned corresponds with potential savings of over 1 million megawatt hours of electricity, avoiding the release of over 340,000 metric tons of carbon dioxide per year, which is the same amount of greenhouse gas reduction that is achieved by taking more than 60,000 cars off the roadways.

So even though we are primarily talking about water pollution today, it is really important to keep in mind these other benefits of green infrastructure.

Given all of the benefits, lots of communities are interested in investing in green infrastructure and an increasing number are doing so despite the barriers. But there are several major reasons why others haven't done so. Today I will highlight three.

Lack of familiarity with green infrastructure approaches. While knowledge of green infrastructure is spreading among utilities, States, cities, citizen groups, and many others, lots of people have never heard of it and many people, even those directly involved in infrastructure decisions, have misconceptions about it. So Congress can assist that effort by creating a green infrastructure program at EPA to provide technical and compliance assistance, and also set up regional centers of excellence to work with governmental authorities to fill these information and communication gaps.

Second, there is a lack of effective integration of green infrastructure into the regulatory scheme. Several witnesses today have mentioned that. It should be the centerpiece of Clean Water Act permitting for stormwater and for combined sewer systems. Now it is not only not required, it is often actively discouraged by decision-makers. It should be the principal strategy employed.

And, third, technical and information needs. Green infrastructure approaches have been demonstrated to be effective at the site and development level, but monitoring data on a watershed or sewershed level is very sparse, and that is one of the barriers that prevents this technology from being recognized by regulators. Congress should fund research and demonstration projects to fill these knowledge gaps.

Thank you.

Ms. EDWARDS. Thank you, and thank you to all our panel.

I sit here with great interest and intrigue. I actually cut my political teeth doing work around water, impervious surfaces in my local community, and I want to share this with you because I think it is one of the challenges that we have to recognize. In my community, which is just outside of Washington, D.C., we had a little road, it is about a two-mile road, and we have spent years in our community really battling with our local transportation authorities, with our local environmental authorities about how to redo this road. At first the local authorities, because of traffic problems, wanted to widen the road to four lanes; it was a two-lane road, two-lane winding road.

So after many years of this Congresswoman standing on the side of the road with signs and protesting and testifying, at last the planning authorities heard from the community and said, okay, we will try to make a two-lane road. The problem with that, though, is that the folks at our local department of transportation—you know, we are really working with some older ideas, belief that a two-lane road had to be 12 feet, each lane had to be 12 feet wide; that in order to accommodate fire trucks and emergency vehicles, they were dealing with using materials that actually were not contributing at all to mitigating damage from runoff.

So multiple layers of problems actually internal to the agencies, and I think not because they are not good people and not because they are not smart and great engineers, but because there was a lack of knowledge about how they could do things differently, both in the planning process and in its implementation and in the contracting and purchasing. What designer will you hire? Do you bring on somebody who really understands walkable and livable communities, and who is committed to that; who understands not just the language of smart growth, but the implementation of smart growth?

So I am really delighted to be here to hear your testimony today and I will begin by asking Mr. Shapiro and other Members of the panel who would care to comment, do you think that there are ways that the Federal and State governments can encourage local ordinance and zoning changes that will allow for better incorporation of green infrastructure technologies and approaches? We have heard that some municipalities have rules on the books that require local roads, as I said, to be wide, and those things interpret AASHTO requirements in a way that doesn't actually contribute to a more green and a more environmentally friendly design. So I wonder what the role of our Federal agencies, and particularly EPA, is in trying to come up with some recommendations and guidelines for the process that will really enable local planning authorities to move in the right direction.

Mr. SHAPIRO. Thank you. Well, I think there are several things we can be doing, some of which we are doing now, but we could be doing more of. Partially recognizing these are largely local and county decisions; providing the tools and information and education about green infrastructure techniques to officials and to engineers and others who are writing the city codes, passing the ordinances; demonstrating that we have an alternative that will work better for the community that can be put in place without hampering any of the other values that led to the designs.

People have certain street designs, as was mentioned, because they believe it is necessary for fire protection. I think there is enough experience now that has been developed that shows you can still maintain the original goals, the protection, public safety goals, but at the same time develop in a smarter, more efficient way. As a number of panelists have said, it saves money; it is better for the environment; it provides a much more pleasing urban landscape. And as community leaders learn this and as the tools and techniques become more accessible to the local officials and their engineers, I think we will continue to see movement in the direction of green infrastructure.

I think, as has also been mentioned, there are probably things we can do with our Federal permitting programs that at least remove any impediments that we are inadvertently creating, and we will be looking at that as well.

Ms. EDWARDS. Mr. Stoner or Mr. Shapiro? Ms. Stoner. I apologize.

Ms. STONER. No problem. Well, I would like to pick up on the idea that Mr. Shapiro suggested at the end, which is one of the ways to remove those local impediments to green infrastructure is to have that be part of the municipal permitting process, and it actually works that way in Maryland, as you may know. There is a State law that requires local ordinances that conflict with the low impact development law there be removed. And I think that if we were to follow up on Dr. Traver's suggestions and directly address the issues of hydrology and flow, and also Ms. Wahl's suggestion that we directly address hydrology and flow, which is essential to actually achieving our water resource goals, then we could couple that with requirements everywhere to remove the impediments that would interfere with that goal, and I think that would be a great way to move.

Ms. EDWARDS. Mr. Neukrug?

Mr. NEUKRUG. Thank you, Madam Chair. I was listening to the responses from Mr. Shapiro and Ms. Stoner. I go back to what Ms. Stoner had called the centerpiece of the Clean Water Act, green infrastructure, and recognizing how important it is to make that connection between water and land. And you can start with the utilities, but once you start with the utilities on this, it quickly evolves to counties and townships and many, many others; street departments. Everyone starts to get involved. So it is a good way to get things started.

And even on the Safe Drinking Water Act there is source water protection, which again is an issue about watersheds, land-based practices versus water practices; and anything that can be done in the Clean Water Act, Safe Drinking Water Act to bring those two issues together will help this cause.

In addition to that, requiring stormwater management and stormwater phase two regulations. But something that is really needed in this Country is to have mandatory stormwater ordinances for every township in the Country of the United States, and to have those reflect and have some sense of improvements if you have green infrastructure as part of your results. Watershed base permitting is something that the State of Pennsylvania and EPA

has been working towards but have not really gotten successful implementation of yet, and that should move forward.

I would just like to point out in Southeastern Pennsylvania, EPA, the State and the Delaware River Basin Commission and the Philadelphia Water Department are working together on something called the Schuylkill Action Network, which brings together hundreds of partners to deal with drinking water source protection and other issues.

So there are a whole bunch of different ways to bring regional partnerships together on the water side, the wastewater side, and the land-based side.

Ms. EDWARDS. Ms. Wahl?

Ms. WAHL. Madam Chairwoman, back to your question about streets and how to get these things done on streets, the question in my mind isn't so much what can the Federal Government do immediately, but with green infrastructure, the way to get them done is to look at the other urban need and then meet the watershed purpose in that action. So, for instance, this one, the one on the bottom, the curb extension, some people see that as a stormwater facility. Most people in that area see it as traffic calming, because in that neighborhood there has been a speeding problem. So those curb extensions are not always seen as stormwater.

In other areas they are safe routes to school because if you put the curb extensions in to get the intersection smaller and you also make it into a curb extension for stormwater management, then it doesn't have to cost more, and you are getting the things done at the same time.

So I would go back to my request to the Federal Government in these kinds of facilities is to make sure that when you are constructing these for stormwater purposes, they get recognized for that and you get compliance for that, because these are contributing to the watershed needs; they are just getting done under the auspices of all kinds of urban needs at the same time.

Ms. EDWARDS. Thank you very much. I appreciate your mentioning that, and I am reminded that it was many pictures of Portland streets that we presented before our local county council that helped us move forward in our decision-making, so thank you very much.

I have a question for Mr. Shapiro. Some of the green infrastructure technologies are really promising, but they are new; they really haven't been tested yet in a lot of regions around the Country. At the same time, you have a commitment to protect water quality. So I wonder if you can describe the process or framework by which the agency balances the need to protect water quality, while also encouraging the adoption of some of the new approaches and in ways that may be environmentally and cost-effective. And, again, wondering your thoughts about the EPA's work with communities to put some of these new technologies into place while also ensuring that water quality protections will be achieved.

Mr. SHAPIRO. Thank you. Of course, maintaining or restoring water quality obviously is our primary mission under the Clean Water Act, and I think the way we go about doing this is really by building a body of experience that allows us to understand how these technologies work and develop models or rules that help us

establish expected performance. It is more difficult, historically, with green infrastructure because the decisions that have to be made are very site-specific and involve the soils and suitable greenery and hydrology of a particular area.

But EPA and other partners have supported research and monitoring that is accumulating that body of evidence, and then we, as an agency that oversees the national permitting program—most of the permits are issued by States, but as we look at those programs, build that experience into the toolkits of permit writers so that they know that, as they review permit applications, the technologies are demonstrated and they work.

In some cases, we are pretty far along in developing that knowledge base, and we have a number of tools on our website. We have a series of best practices; we have some design tools that are accessible. In other cases—and I think one was mentioned this morning in Kansas City—we are continuing to support municipal activities and partnering with them in terms of putting a research component in so that we can gather the data and continue to build our experience base.

Another point I think that was made earlier is that we very much support adaptive approaches, meaning if we think something will work, we should be willing to go ahead and allow it to be used under the permit, but make sure that as we review progress, as monitoring data become available, as permits come up for renewal, which they do on a five-year basis, if we find out it isn't working, we can make changes based on our understanding of what can work.

So it is a learning process as we introduce the new technology, but we first have to establish a groundwork, which I think now exists, demonstrating that the technology can work, and then gain experience in applying it in specific locations.

Ms. EDWARDS. Do other panelists—Dr. Traver?

Mr. TRAVER. Yes, just for a moment here. I have heard a lot today about how sometimes it works, sometimes it doesn't work in different areas. One of the strengths of green infrastructure is you can really focus it on the problems that you are trying to address. An example I use in my classes a lot of times, in Austin, apparently they have all their rains in big heavy clumps a few times a year. A green roof isn't going to help you very much. Maryland, Pennsylvania, this area, it is very helpful because most of our rain is in small, little amounts. And it doesn't matter what the soil condition is underneath a green roof; it is evaporative type plants.

I know a lot of work has been done all over the Country on bio-retention, including your area in Maryland, where they do not infiltrate and they use evaporative type procedures.

So, you know, I kind of, I guess, get a little upset when I hear that this one-size-fits-all doesn't really work. It is an engineering process and you need to take a look at what are your goals for your watershed, what are you trying to do, and which ones will work in your area.

Ms. EDWARDS. This sort of goes along the same line, but Mr. Neukrug and maybe Ms. Stoner, do you have an idea when and whether communities have been blocked from incorporating green

infrastructure approaches and technologies in their long-term control plans? Is this a problem?

Mr. NEUKRUG. That is a very good question, and I think blocked is the wrong word. I think there is an issue of risk aversion, and the risk aversion is happening both from the perspective of the environmental agencies and the utilities. It is how do you put into place this adaptive management that Mr. Shapiro talked about and do it in a way that allows everyone to innovate and try new things and move this process forward so that we can evolve our cities into a sustainable future. And that is going to take time and it is going to take trust.

We can't take our eyes off the ball, which is, as Mr. Shapiro also said, we have got to stop having sewage go into our rivers; and that is clearly what the Clean Water Act is about. But, at the same time, there are newer ways of doing these things, and at some point we all have to get together and, either through legislation or regulation or policy or just plain old trust, agree that this is something we should be trying.

Ms. EDWARDS. Ms. Stoner, I believe that was in your testimony.

Ms. STONER. Yes, it was. I appreciate your asking about it. I agree with Mr. Neukrug. Again, it is not so much that it has been blocked as that there have been pieces missing; and sometimes it is the comfort of the engineers with it, sometimes it is the comfort of the regulators and so forth. I think a big piece is this piece about actually implementing intensively and monitoring; and that is what we really need to get over the hurdle of the uncertainties that sometimes prevent this from moving forward.

But I also want to mention, with respect to the issue that Dr. Traver was talking about, another benefit of green infrastructure is its flexibility. You know, one of the things that is true, I believe, about climate change and the impacts on water is that we will see different rain patterns in the future than we have seen in the past. Most people predict more extreme storm events. But it varies somewhat in different parts of the Country and, again, the models aren't perfect, so the information isn't perfect. But we do know that things will be different in the future than they are now.

A green infrastructure kind of approach is one that is very flexible. You can add in more trees, more rain gardens, more green roofs, more street edge alternatives as the need arises; whereas, pipes don't grow. You put in a pipe, a big underground pipe like the one shown up here, and that is what you are going to have, whether that is what you need in the future or not. So I think sometimes uncertainty helps us in terms of the flexibility to look at solutions that are adaptive over time.

Ms. EDWARDS. Thank you.

One question for Mr. Richards. You seem to suggest in your testimony that there was some inconsistency between the idea of low impact development and smart growth. Did I mishear you or misread you?

Mr. RICHARDS. You heard me correctly in that sometimes, if you are using the idea or focusing in the idea that less impervious is what you have got to do, then sometimes that can encourage the development to sprawl a little bit, rather than to tighten up and look more like what I would consider to be smart growth as associ-

ated with maybe transit-oriented developments or developments that are higher in density and more urban. If you are pushing people to focus on less impervious, that is hard to do in those areas.

So my point was there should be options associated with that. If you can use things like green roofs or if you can use permeable pavements and things like that in those situations, those are great, and we should be doing that. If those options aren't available for some reason or another, there should just be other options.

Ms. EDWARDS. Do other panelists have a comment on this? Ms. Wahl?

Ms. WAHL. Madam Chair, I think there are times when people want density and want green, and think that they can't work together, but that has not been our experience so far. They are harder to do in already developed areas and most of the urban areas are built out, but they can be done in those areas as well, especially at redevelopment time. Our approach was to put a stormwater management manual in place that required, whenever you develop 500 square feet or more, you have to try to manage the stormwater onsite, on the surface, in vegetated facilities; and it unleashed thousands of these across the city, so people are learning how to do it.

Again, it is just important that—I would echo what Dr. Traver said, that different ones work in different places for different conditions, and it is not that we are all looking, if you will, for guidance from EPA on that as compiling what all of the cities and entities around the Country are doing, compile that, prove it up or disprove it, and put that information back out, because I think that is where all of the innovation is happening.

Ms. EDWARDS. Thank you.

Mr. Shapiro, just on this, is the EPA proactively presenting options to permit applicants regarding the proper mix of green and gray infrastructure for given areas? And, if not, do you intend to?

Mr. SHAPIRO. Well, again, in most cases EPA isn't the direct permit writer; in some States we are. I think 46 States manage the permitting program themselves, so we are working with the State programs to help them improve their permitting. So, typically, we are not engaged directly with the community in writing the permits. There are some cases where, as in the case of Kansas City, Portland, I believe, as well as Cincinnati, we have been working with the communities directly in helping them introduce green infrastructure approaches; but we are more involved and engaged in trying to get the tools and the information out so that the bulk of the permitting work and the local permitting work that is done is able to go forward incorporating green infrastructure approaches. Again, where we get involved is usually a pilot type of activity or one where we are engaged in sort of a research collaboration in addition to developing a specific permit.

Ms. EDWARDS. Mr. Shapiro, has the agency considered being more proactively involved in providing guidance even in those instances where you are not sort of the first up for the purposes of permitting?

Mr. SHAPIRO. Yes, we have, and I think in my testimony I mentioned that in a couple of cases we have already sent out national memos where we have directed our regional staff to consider very

strongly green infrastructure approaches. We made it very clear that, as far as we are concerned—and this includes not just the Office of Water, but the Water Office of Enforcement as well—green infrastructure approaches are perfectly appropriate for incorporation into NPDES permits, and we have other documents that encourage their use.

So we have taken that approach. We can certainly do more, and should be doing more, but we created a green infrastructure initiative specifically to promote the idea and to work with partner to motivate a much greater use of the approach.

Ms. EDWARDS. And do you have any results that this Subcommittee could take a look at?

Mr. SHAPIRO. In terms of increase in the actual application of green infrastructures or greater numbers of permits that reflect green infrastructure approaches, I don't think we have results that we can demonstrate today. There are case studies, as I said, which we have identified. There are products that our program has produced. Again, I mentioned some of those. But in terms of actual numbers of permits and amount of stormwater control through green approaches, we don't have results that I can report to you right now.

Ms. EDWARDS. And is this an appropriate area—and perhaps any of you could comment on this—where you would need more guidance, more authority from the Congress to be more affirmative and deliberate in working with State authorities?

Mr. SHAPIRO. Not necessarily, although there are some issues that go beyond some of the work we have done to date that have been raised, for example, by the National Research Council study and recommendations, where we are looking very closely at our existing authorities, for example, on the issue of managing the hydrology as opposed to the quality aspects of runoff that we are still looking at. But at this point I can't point to a specific authority that we are lacking that would prevent us from moving forward.

Ms. EDWARDS. Ms. Stoner?

Ms. STONER. Yes, thanks, Madam Chair. I would say that the agency has quite a bit of authority that it has not yet used. One example I would give is setting technology-based standards based on maintaining predevelopment hydrology, which is the basis principle here for green infrastructure, for the construction and development industry, which is something that NRDC has been promoting for a while. That is the most effective time to put in green infrastructure, as several of the panelists have mentioned. So that should be the first step, is to make sure we start building things right the first time. The retrofitting sometimes is more difficult and more expensive. So I think that is one step.

One thing that the Congress will be looking at later this year that would be a good time to think about green infrastructure is the surface transportation bill. Of course, roads are huge source of stormwater pollution, which is one of the reasons why I actually think that this work is very compatible with smart growth. We definitely want to see compact cities to protect water resources, and I view myself as a smart growth advocate as well as a green infrastructure advocate in working to revive cities. But in that surface transportation bill, it would be great if the Congress could look at

ensuring that there are funds and that there are standards to prevent stormwater pollution from those federally-funded roads.

Ms. EDWARDS. Thank you for that recommendation. As you probably know, there are some of us who share that view.

We don't have any further questions, so I would like to thank the panel, thank our witnesses. We really appreciate your testimony today and look forward to continuing to hear from you and to work with you. Thank you.

[Whereupon, at 1:19 p.m., the Subcommittee was adjourned.]

**OPENING STATEMENT OF
THE HONORABLE RUSS CARNAHAN (MO-03)
HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
WATER RESOURCES AND ENVIRONMENT SUBCOMMITTEE**

Hearing on

Efforts to Address Urban Stormwater Runoff

Thursday, March 19, 2009

2167 Rayburn House Office Building

Chairwoman Johnson and Ranking Member Boozman, thank you for holding this hearing today on efforts to address urban stormwater runoff.

I believe it is critical to incentivize incorporation of green infrastructure practices in wastewater treatment facilities in urban areas. By using the natural environment to manage stormwater we can reduce its volume before it reaches stormwater or sewer conveyance systems.

In my hometown of St. Louis, Missouri we have some of the oldest water infrastructure in the country, in fact some dating back to the Civil War. Due to this aged infrastructure we have frequent overflows into one of our nation's treasures, the Mississippi River. Incorporation of green infrastructure could reduce stormwater runoff flowing into the river and bringing with it trash, soil solids, and animal waste.

It has been estimated that two thirds of the development on the ground in 2050 will be built between 2007 and then. Although this provides many challenges it also provides us with a great opportunity in that we can build this infrastructure to mitigate the harmful impacts of stormwater runoff in urban areas.

In closing, I would like to thank our witnesses for joining us today, especially Mark Funkhouser from my home state of Missouri, and I look forward to hearing their testimony.

A handwritten signature in black ink, appearing to read "Russ Carnahan". The signature is written in a cursive, flowing style.

Statement for the Record
Rep Emanuel Cleaver, II
House Committee on Transportation and Infrastructure
Subcommittee on Water Resources and Environment Hearing Thursday, March 19, 2009

Madam Chairwoman, I would like to thank you for calling a hearing on such a crucial issue for cities across the nation, including my home, Kansas City. Water issues have been central to Kansas Citizens since the city's founding more than 150 years ago, when traders recognized the Missouri River would provide ample opportunities for trade and westward expansion. However, the river that brought such opportunity has also in recent years wrought destruction for citizens of Kansas City through floodwaters and sewer overflows.

In order to comply with the Clean Water Act of 1972, the City of Kansas City has developed the largest capital project the city has ever undertaken. This Combined Sewer Overflow plan will cost \$2.5 billion over 25 years. As you know from your recent visit, Kansas City has decided as a community that green infrastructure must be a main component of its sewer overflow control strategy. To that end, Kansas City's plan allocates tens of millions of dollars toward implementing green infrastructure solutions. The plan continues and expands the City's award-winning "10,000 Rain Gardens" campaign, which educates citizens about the benefits of installing rain gardens and provides resources to residents who want to plant a rain garden. The program will be expanded to help residents disconnect their downspouts. Recognizing the economic benefits of green infrastructure to the long term local economy, Kansas City is also allocating significant resources to developing the green collar workers that are needed to build green infrastructure. In tough times, these jobs will provide an economic stimulus to distressed areas. Finally, Kansas City has kicked off the largest demonstration of green solutions for CSO control in the nation, in the Marlborough neighborhood. Covering 100 acres, the project will be designed to store 500,000 gallons of stormwater through green infrastructure. Originally, the plan called for two underground storage tanks, while the new plan will beautify the neighborhood and save money.

Last May, I was very public in urging the Mayor and City Council to adopt the "greenest plan possible." When I encouraged the City to include more 'green' solutions in its Combined Sewer Overflow Plan, I promised the City that the path to 'green' would yield more opportunities for federal funding. I said I would fight tooth-and-nail for money if the City advanced the vision of a healthier, more sustainable and greener future.

Making the first step in keeping that promise, last week, with the Chairwoman's help and support, I was able to add a provision to H.R. 1262, The Water Quality Investment Act of 2009 that designates 20 percent of the \$2.5 billion devoted to funding municipal Combined and Sanitary Sewer Overflow grants go to projects incorporating green infrastructure approaches and practices. This amendment makes Kansas City's commitment to green pay off with a greater chance at millions of federal dollars. It also strikes a reasonable balance between green infrastructure and traditional control systems, as both have a role in creating a sustainable and workable solution to sewer overflows. I would especially like to thank you, Chairwoman Johnson, and also Chairman Oberstar, for your support in advocating my amendment's inclusion in the bill.

I hope this bill and future efforts will help cities adopt these and other innovative strategies, and adhere to the New Direction this Congress has charted: one in which economic prosperity, environmental protection, and social well-being are not mutually exclusive.

STATEMENT OF
THE HONORABLE JERRY F. COSTELLO
SUBCOMMITTEE ON WATER RESOURCES
HEARING ON EFFORTS TO ADDRESS URBAN STORMWATER RUNOFF
MARCH 19, 2009

Thank you, Madame Chairwoman, for holding today's hearing on efforts to address urban stormwater runoff. This is an important issue to examine given the health and environmental impacts it has on our constituents and our communities.

Urban development has an enormous impact on the quality of our nation's waters. Development alters how rainfall and water are intercepted and absorbed which then result in stormwater runoff. There are a variety of approaches to dealing with stormwater runoff, including regulatory; combined sewer stormwater control; and new, green infrastructure for stormwater control.

I am particularly interested in hearing from our witnesses on the green infrastructure component, given studies in Maryland and Illinois have shown that new residential developments that use green infrastructure technologies saved \$3,500 to \$4,500 per lot (quarter- to half-acre lots), compared to new

developments with conventional stormwater controls. Further, the state of Illinois, and in particular, the City of Chicago, has been working on green infrastructure, including at its airports; on its roads; and with its wastewater infrastructure. I am also interested in hearing from our witnesses on how our current federal policies are addressing urban stormwater runoff and areas for improvement.

I am pleased that we are having a hearing on this to look at significant policy issues affecting our nation's ability to maintain and ensure clean water for our communities. I welcome the witnesses here today, and look forward to their testimony.



Statement of Rep. Harry Mitchell
House Transportation and Infrastructure Committee
Subcommittee on Water Resources and Environment
3/19/09

--Thank you Madame Chairwoman.

--According to the Environmental Protection Agency, nearly 30 percent of known pollution to our nation's waters is attributable to stormwater runoff.

--The question is not whether we address this issue, but rather, how.

--I am eager to hear from today's witnesses about their experience with mitigation approaches aimed at reducing the amount of pollution caused by stormwater runoff.

--Obviously, the best time to design a new mitigation system is when an area is first being developed, or when it is being redeveloped. The good news is, development happens more often than we think.

--According to one study which we will hear about this morning, when we estimate all the new or replaced homes, offices, stores and other non-residential buildings that will be built in the coming decades, nearly two thirds of development on the ground will be built between 2007 and 2050.

--There is an enormous opportunity, and that's why I am glad we are having this hearing today.

--I yield back.



Tom Barrett
Mayor, City of Milwaukee

Testimony of Mayor Tom Barrett

Good morning, Madam Chairwoman and members of the Subcommittee on Water Resources and Environment.

Thank you for the opportunity to appear before this committee and discuss Milwaukee's efforts to reduce urban stormwater runoff pollution, the largest remaining threat to water quality in our local rivers and Lake Michigan.

The Clean Water Act of 1972 resulted in unprecedented investments in wastewater infrastructure improvements across the country. The federal government led the way to cleaner water by investing more than \$72 billion to help cities construct and upgrade their sewer systems and wastewater treatment facilities.

However, today urban areas face a far different threat to water quality than existed in the 1970's. In Milwaukee, for example, the latest scientific research shows that 89% of the bacteria pollution entering our major rivers and Lake Michigan comes from urban and rural runoff. Sewer overflows and wastewater treatment plants comprise the other 11%.

The science is clearly telling us that to make real progress toward achieving swimmable and fishable waterways, a more holistic water policy in the future that addresses both point and non-point pollution will be required.

According to the Environmental Protection Agency (EPA) and other federal agencies, the nation faces a \$300-500 billion water infrastructure funding gap for what needs to be spent on water related infrastructure over the next 20 years. Federal assistance has declined more than 70 percent, and now local communities shoulder more than 95 percent of the cost of clean water.

Sewer pipes in older cities leak. Fixing those leaks in the nearly 6,000 miles of sewers in the Milwaukee region is a huge financial strain on local budgets. Milwaukee has not been shirking its responsibility on stormwater. We have a stormwater fee that is based on impervious surface area. We use that funding source to help meet the backlog in sewer line repairs.

But, due to a lack of funding, our current replacement cycle for our local sewers in the City of Milwaukee is 100 years. That hard reality poses a significant threat to the great progress we've

Mayor Tom Barrett
Testimony
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made over the years to reduce combined sewer overflows from 60 per year to an average of two each year.

I stand with my fellow mayors in the Great Lakes and St. Lawrence Cities Initiative in strong support of the effort in Congress to establish a Clean Water Trust Fund to rebuild our nation's water infrastructure. Our nation's cities need the federal government to help close the water infrastructure funding gap that has grown over the years just to prevent us from losing ground in our efforts to reduce point source pollution. At the same time, a new federal funding source is needed to construct the large-scale green infrastructure projects necessary to address polluted runoff in our cities.

To ensure that future investments result in clean water, we need to think like a watershed. We must integrate our efforts to reduce pollution from our factories and wastewater treatment plants with efforts to reduce stormwater pollution. This integration could start with the EPA helping the Milwaukee region move to a watershed permit and to help us to pilot a water quality trading system that could be model for the rest of the country.

Milwaukee has attacked polluted runoff with a variety of green infrastructure approaches, including green roofs, such as the one on the City Hall Municipal Building, rain gardens and green roofs at our public housing developments, neighborhood-wide downspout disconnection with rain barrel installation, and porous pavement.

One experience with green infrastructure in particular that I'd like to share with you was recognized with a national award from the Sierra Club and has turned out to be quite popular with the public.

We had a brownfield in the Menomonee River Valley that used to be a former rail yard and manufacturing center. It took nearly two dozen state and federal brownfield grants to clean up and redevelop this 1,200-acre space which is now home to the Harley Davidson Museum and more than a dozen other businesses. This redevelopment project has created 4,200 jobs since 1998.

When looking at the how to deal with the water that would run off the site after it was redeveloped, there were two paths to consider. One choice would have been to build a big pipe deep in the ground to collect the polluted water and send it to our treatment plants. The problem with a traditional pipes and plants approach is that the public doesn't get any direct enjoyment with this type of hidden infrastructure, as I call it. You can't hold a picnic or a tailgate party in a Deep Tunnel.

Mayor Tom Barrett
Testimony
Page 3

Instead, we decided to keep the water out of the sewer system by using green infrastructure on the surface of the land to capture and clean every drop of rain that falls on the business park before being slowly released to the river.

We created a beautiful stormwater park where people use the Hank Aaron Trail to bike and walk to Miller Stadium where the Milwaukee Brewers play baseball. There's easy public access to the Menomonee River where visitors can hike or fish for salmon and trout. Youth workers have planted prairies and hundreds of stormwater trees to restore habitat.

The businesses that locate there benefit financially because they can rely to a great extent on the regional stormwater system that was created, rather than bearing the cost on their own. They also benefit from the enhanced green space and aesthetics. Using green infrastructure made it possible to connect people and jobs and recreation at a formerly blighted area in the heart of Milwaukee.

I like to say that Milwaukee is located on the 'Fresh Coast' because we have a huge body of fresh water right at our front door. Water will be one of the largest economic growth sectors in the world over the next decades. 1.2 billion people worldwide suffer from lack of clean water. 2.6 billion people lack adequate sanitation, primarily due to water conditions.

As Mayor, growing our water economy is central to my vision for Milwaukee. I'm not talking about selling our water. I am talking about growing and selling our technology and expertise with treating freshwater. If we can figure out how to cost effectively manage polluted runoff, our country will lead this sector of the emerging global green jobs economy.

Conclusion

Lake Michigan is a tremendous economic and recreational resource for Milwaukee. The cities around the Great Lakes don't want to backslide on water quality improvements, but that may happen unless we take action.

I'm not asking the federal government to do it all. Municipalities will continue to shoulder the vast majority of the cost of clean water. According to a study by the Great Lakes and St. Lawrence Cities Initiative, local governments invest an estimated \$15 billion annually to protect the Great Lakes. But that's not nearly enough to meet the escalating threats to this resource, particularly while we're experiencing ongoing cuts to federal restoration programs.

The future drive to clean water requires integrated approaches that attack all threats to the resource with sustainable financial support from federal, state, and local governments. The federal government has historically played a leading role in protecting water resources. The time has come for Congress to reestablish that role by creating a Clean Water Trust Fund to protect the water resources and economies in urban areas. Thank you.

WRITTEN TESTIMONY

SUBMITTED BY

**THE HONORABLE MARK FUNKHOUSER
MAYOR OF KANSAS CITY
CITY HALL, 29TH FLOOR
414 E. 12TH STREET
KANSAS CITY, MISSOURI 64106
(816) 513-3500**

BEFORE

**THE SUBCOMMITTEE ON WATER RESOURCES AND THE
ENVIRONMENT REGARDING "EFFORTS TO ADDRESS URBAN
STORMWATER RUNOFF."**

**MARCH 19, 2009 AT 10:00 A.M.
ROOM 2167 OF THE RAYBURN HOUSE OFFICE BUILDING**

Madam Chairwoman and Ranking Member:

Thank you so much for this opportunity to address your subcommittee on Water Resources and the Environment regarding Kansas City, Missouri's efforts to address urban stormwater runoff. I also want to thank you again, Chairwoman Johnson, for taking time to visit our city last year to review our water facilities and related efforts.

We also appreciate the support you provided to our Congressman, Representative Emanuel Cleaver, in his effort to secure a twenty percent designation for green strategies as an amendment to H.R. 1262, the Water Quality Investment Act of 2009, which passed the House of Representatives just last week. As deliberations on this measure and related measures proceed, we look forward to working with you to ensure the provision of enhanced federal resources, including direct grants to communities with sewer control plans, which are needed to assist communities such as Kansas City. Truly and without equivocation, your commitment to improving our nation's water infrastructure is commended and appreciated.

In terms of today's hearing, I pleased to report that our community's vision for Kansas City is to become America's Green Region. As you know from your visit to our city, we have a seriously outdated system that was built over 100 years ago. Moreover, we face the dual challenges of meeting modern-day demand and investing strategies required by the future. In this regard, our region is committed to investing in green infrastructure not only to address our water quality issues but also to create jobs and enhance our citizen's quality of life.

Kansas City is so committed to this vision, we developed through a five-year community driven process, a Green Solutions Position Paper, which is attached and hereby incorporated into this testimony by reference. This paper was endorsed by City Council resolution and embraced by our City staff through various implementation initiatives. This document provides the foundation for our recent submittal of Kansas City's Overflow Control Plan to the US Environmental Protection Agency. This plan includes a significant investment in green infrastructure and green initiatives to help address our combined sewer overflow problem.

Kansas City also adopted a cutting edge stream setback ordinance, which is the backbone to our green infrastructure program. We also changed our development codes to encourage low impact design approaches. These green initiatives will help us prevent problems in the future but it will not address the massive flooding issues we have in our already developed areas, which is estimated at \$2.1 billion. This also does not include the \$2.4 billion we need to invest in our sewer plan. As our forefathers did 150 years ago, it is now our generation's time to reinvest in our aging stormwater and wastewater infrastructure using green technologies to enhance its function.

In Kansas City, there are three issues associated with green infrastructure:

1. Green solutions are a relatively new technology in Kansas City. We need to better understand the true costs and benefits and the long-term impacts of this approach. The two biggest barriers to success are time and money. We will need time to innovate and a significant investment to realize and evaluate the actual impacts to water quality. We look forward to a partnership with the federal government to move ahead with green solutions on the scale needed in Kansas City.
2. Green solutions are only one part of the overall strategy to manage Kansas City's wet weather issues. While green solutions will not completely replace the need for new gray infrastructure such as pipes, storage facilities and plant upgrades, it will enhance our neighborhoods and we hope they will reduce the level of investment we need to make in gray, traditional infrastructure. Green solutions are designed to manage small storms but don't address the heavy rains we have in Kansas City that cause loss of life and extensive property damage.
3. Stormwater management, in most cities across the country, is typically underfunded. These facilities are out-of-sight, out-of-mind. Green infrastructure is not out-of-sight. The plant materials of green infrastructure create a visual presence above ground and not only require more frequent attention but a different type of maintenance. On-going maintenance of green infrastructure is typically left to the local government and in any economic situation, is difficult to fund. State & federal funding for green

infrastructure is very limited. There are some funds available for research. The US Environmental Protection Agency is monitoring the impact of a green infrastructure project Kansas City is building in a 100-acre pilot project. The federal government has invested in Kansas City's major flood control system but that has barely scratched the surface in terms of addressing our overall flooding issue. State and federal funds are not as readily available for traditional stormwater capital investments. Cities don't typically invest until after the major flood has occurred.

Kansas Citians value natural resources. Protecting water as a valuable resource is a top priority. Kansas City is embracing green solutions while recognizing the risks associated with this strategy. The level of investment needed and risks are great. It is our hope that Congress and the Administration work hand-in-hand with local governments to explore and implement the green infrastructure approach.

I want to thank you again for allowing me to testify. I would be happy to answer any questions.

Water, A Vital & Valuable Natural Resource Green Solutions Position Paper



Executive Summary

POSITION

Kansas Citians value natural resources. We value open space, tree lined stream corridors and wildlife habitat. We value clean streams, lakes and rivers. We use and enjoy trails and eagerly pursue recreational activities that connect us to these natural areas. Surveys of Kansas Citians consistently confirm that protecting our natural resources is a top priority to a majority of our community. According to the 2006 Wet Weather Solutions Program Public Opinion Survey results, more than three-quarters (77%) of the residents surveyed thought City leaders should place a very high or high priority on maintaining and protecting streams. Ninety-two percent (92%) of those surveyed also indicated that they valued natural resources.

Historically, our most valuable natural resource – water – has often been a destructive force. Floodwaters have caused damage to structures throughout the community. Citizens have lost their lives during flood events. Our waterways are being polluted by both humans and animals. Our sewer systems can be overwhelmed by too much water, causing sanitary sewers to overflow. The methods and practices of the past clearly are not working. We need to develop new solutions that will solve these issues, or we risk destroying the very resources that we value, and jeopardizing human health and the quality of life that we enjoy in Kansas City.

Citizens know that clean water in our urban rivers and streams is a key to a healthy community with abundant recreational opportunities. The Wet Weather Community Panel strongly believes that **green solutions** must be a comprehensive and fully integrated part of Kansas City's Wet Weather Solutions Program. **Green solutions** are strategies that result in on-the-ground projects which are specifically designed to reduce stormwater runoff, reduce water pollution, create recreational amenities, and protect our natural resources through the use of "green infrastructure" (also referred to as "natural systems") such as rain gardens, bio-retention facilities, stream restoration, stream buffers and other scientifically proven methods.

RECOMMENDATIONS

The task of the City's Wet Weather Solutions Program is to find ways to address some of the concerns that our community faces in managing water. This program will be the largest public infrastructure investment in our community's history. If Kansas Citians are to support such a significant investment, then we deserve to see this investment result in the protection and enhancement of the natural resources we value so highly. Kansas City can create a city rich with natural resources by adopting the following basic philosophy, which serves as the basis for a **green solutions** approach:

**Water is a vital and valuable natural resource.
Protecting water as a valuable resource is a top priority.**

Protecting water as a valuable resource means:

- Keeping stormwater where it falls, using native landscaping to treat the pollutants and reducing the amount of stormwater that leaves the site.
- Keeping buildings away from streams and using native vegetation to filter stormwater pollutants before they enter the streams.
- Creating multiple benefits when managing stormwater; incorporating water as a design feature and amenity.

Creative partnerships, focused land conservation and restoration, community education, development incentives, regulations and sustainable infrastructure projects are all **green solutions**. All are critical if we are to succeed in protecting water as a valuable resource. Every decision should be viewed as an opportunity for a **green solutions** approach.

CONNECTIONS

The philosophy and recommendations of the Wet Weather Community Panel are consistent with existing City policy and past actions such as:

- Adoption of American Public Works Association (APWA) 5600 stormwater standards and Best Management Practice (BMP) manual which improve the design of new development.
- Adoption of Erosion and Sediment Control standards which improve the construction of new developments and protect streams from sediment.
- Adoption of Climate Protection Plan Phase I Recommendations which recognizes the multiple benefits of green solutions.

ACTIONS

This position paper sets out specific **Green Solutions Implementation Strategies** that the Wet Weather Community Panel strongly recommends in order to achieve the protection of water as a valuable resource. We believe that successfully pursuing the strategies laid out in this paper will result in measurable social, economic and environmental benefits that will enhance the quality of life for all Kansas Citizens.

Position Paper

PURPOSE

The purpose of this position paper is to advocate for adoption of a formal policy for the City of Kansas City Missouri that recognizes water as a vital and valuable natural resource, and that integrates the protection of water into every component of the City's comprehensive Wet Weather Solutions Program plan. This position paper sets out implementation strategies for developing a comprehensive approach to water protection, an approach that has been defined as "Green Solutions."¹

KANSAS CITY'S WET WEATHER SOLUTIONS PROGRAM

The Water Services Department of the City of Kansas City has been tasked, through the mandates of the federal Clean Water Act and otherwise, with developing a comprehensive solution to addressing some of the water issues faced by the City, such as flooding, deteriorating sewers, sewer overflows and pollution of our urban creeks and streams. In order to facilitate a comprehensive, holistic approach, three divisions of the Water Services Department, the Overflow Control Program (OCP), the Stormwater Utility Division, and the Waterways Division, were combined, in a comprehensive approach dubbed the Wet Weather Solutions Program.

In 2003, Mayor Barnes appointed a citizen's advisory board, known as the Wet Weather Community Panel (Panel), to provide citizen input to the City's Wet Weather Solutions Program Team. The Panel developed a set of goals, or desired outcomes, to guide their work, listed below in no particular order:

- **Goal:** Minimize loss of life and injury and reduce property damage due to flooding.
- **Goal:** Improve water quality.
- **Goal:** Maximize economic, social and environmental benefits, optimize infrastructure investment and enhance natural habitats.

A subcommittee of the Panel was formed, known as the Green Solutions Subcommittee. The Subcommittee's task was to focus on strategies that recognize the importance and role of green infrastructure – trees, vegetation, wetlands, and preserved open space – in mitigating negative environmental impacts and enhancing the quality of life for all of our citizens. The Green Solutions Subcommittee identified the need for a broad city policy, focusing on the protection of water as a vital and valuable natural resource, as critical to the integration of green infrastructure into the City's comprehensive Wet Weather Solutions Program plan. This position paper is the result of the Subcommittee's efforts.

TOWARD A STEWARDSHIP ETHIC

Kansas City, like many cities across the country, faces immense challenges in addressing issues associated with stormwater management and the control of sanitary sewer overflows. Substantial resources will be needed to adequately address these challenges and every resident will be

¹ The term "Green Solutions" was chosen, in lieu of the more traditional terminology of "green infrastructure," to denote an approach that encompasses not only the use of natural systems on the ground, but also includes changes in traditional planning and management practices that encourage and enhance the use of natural systems.

impacted. Citizens, through various public participation avenues and opinion surveys, have indicated a recognition and preference for Green Solutions as an integral element of these future investments. **(Attachment A)**

87% of those surveyed in the 2006 Wet Weather Solutions Program Public Opinion Survey indicated that they would support an ordinance that would require developers to protect streams and stream corridors when land is developed.

When the concept of Green Solutions is understood, the benefits of a Green Solutions approach to urban growth and resource management can not be ignored. An efficient, effective approach to addressing wet weather issues in Kansas City, one that works with nature and not against it, makes absolute sense. Kansas City is poised to experience an “environmental revolution”. Problems of climate change, water quality, waste management and deteriorating infrastructure demand a substantial shift in how Kansas City approaches urban growth and management of its existing resources. A new environmental ethic that values the stewardship of our natural resources and assets as an essential part of our economic and social well-being is emerging. This is what the citizens of Kansas City are demanding, to meet the high standards for the quality of life that we expect and deserve.

This does not mean that growth or redevelopment can not occur, but it needs to happen differently than the traditional approach of the last century. The goal is to ensure approaches that preserve natural resources and that maximize economic, social, and environmental benefits. Green Solutions promote sensitive development in appropriate locations while preserving existing natural attributes of the landscape, including our urban streams and rivers, so they can continue to perform their essential functions.

Recently, the City took steps to minimize the deterioration of our urban streams through the adoption of new drainage standards, a stormwater best management practices manual, and sediment and erosion control design standards. Implementation of these new criteria will begin to address decreasing water runoff by requiring the treatment of runoff from new development and significant redevelopment, and by controlling runoff from construction sites.

Implementation of the Green Solutions Strategies recommended in this position paper is the next critical step that the City must take to further reduce the negative environmental impacts of stormwater runoff and wastewater discharges to our urban rivers and streams.

EPA ENCOURAGES GREEN SOLUTIONS

The U.S. Environmental Protection Agency (EPA) is responsible for protecting human health and the environment. One of the federal laws which EPA is mandated to enforce is the Clean Water Act, the goal of which is protect our nation’s water resources, including our urban rivers and streams. The City of Kansas City must comply with the Clean Water Act requirements, and as a part of compliance the City must submit a plan to EPA and the State of Missouri detailing how it intends to meet certain of the statute’s requirements relating to sewer impacts on our urban waterways. This plan will require significant public infrastructure investment, perhaps the largest public infrastructure investment in our community’s history.

In March of this year (2007), EPA issued a policy memo by Assistant Administrator Benjamin Grumbles that encourages the use of green infrastructure as a significant and valued component of

community efforts to meet regulatory requirements related to a broad range of water quality standards (see Attachment B). The importance of this policy statement can not be overlooked as the City works toward submission of its plan, in 2008, for meeting the Clean Water Act requirements.

The EPA memo concisely outlines the numerous benefits of green infrastructure:

- Cleaner Water
- Enhanced Water Supplies
- Cleaner Air
- Reduced Urban Temperatures
- Increased Energy Efficiency
- Community Benefits
- Cost Savings

Issuance of the Grumbles policy memo by EPA gives Kansas City a unique opportunity to develop its own policy to integrate Green Solutions into its comprehensive Wet Weather Solutions Program plan. The benefits of this approach are obvious.²

While the emphasis of the work done by the Panel is water quality, the interconnected and interdisciplinary nature of environmental issues should not be overlooked. The City is currently undergoing a comprehensive climate change planning process, with the first phase recommendations unanimously approved by the City Council (April 12, 2007). That climate change planning process acknowledges the benefits of a green infrastructure approach in sequestering carbon, improving air quality, and mitigating urban heat island effects.

GREEN SOLUTIONS REDUCE COSTS AND ENHANCE QUALITY OF LIFE

The book *Green Infrastructure: Linking Landscapes and Community* (Benedict and McMahon, 2006) provides an extensive description of the many benefits of a green infrastructure approach. One paragraph that captures the essence of this states:

"By protecting key landscapes and natural systems, green infrastructure helps to reduce the cost of providing community services and building water retention, filtration, and drainage systems that are needed when natural systems cannot perform their natural functions. The cost savings realized are multiplied by the tax revenues brought about by an increase in the value of homes and the desirability of the community as a site for new commercial enterprises. Perhaps most important of all, the enhanced quality of life the green infrastructure offers communities benefits all who live there." (Page 78)

² The EPA memo also references a June 2006 document issued by the Natural Resources Defense Council entitled Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows. This document highlights the role of green infrastructure in dealing with these issues and provides a list of policy directions for local decision makers – a "top nine" list of actions communities should implement to achieve the benefits of a green solutions. This listing formed the basis for the development of the Green Solutions Implementation Strategies included as part of this paper.

One critical component of a Green Solutions approach in Kansas City is the adoption of a progressive stream buffer ordinance that will significantly protect stream integrity, improve water quality, and result in a number of "greenways" of preserved trees and vegetation. Many of these greenways will provide the basis for an extensive network of neighborhood and community trails that will be part of the regional network known as MetroGreen.

The economic value of amenities such as greenways, trails and other open space areas is documented by the preferences of home buyers and the price premiums homeowners are willing to pay to live in proximity to them. This is a real world measure of the intrinsic value people place on these attributes and their ability to enhance our quality of life.³

GREEN SOLUTIONS' SUCCESS STORIES

Several cities around the country have begun to implement green infrastructure concepts for all the reasons mentioned above. Based upon data and analysis of a number of the green infrastructure projects utilized in other communities faced with issues similar to those in Kansas City (such as Chicago, Portland, Toronto and others), Camp, Dresser and McKee, a well-known, national engineering consulting firm, identified the following attributes of a green solutions approach:

1. Green solutions primarily provide stormwater quality benefits, with combined sewer overflow (CSO) volume reduction a secondary benefit
2. Green solutions utilize a "decentralized approach" to address stormwater problems at the source throughout the watershed
3. Green solutions are important for redevelopment as well as developing areas and are key to preserving the integrity of control plans
4. Green solutions achieve multiple benefits, beyond just water quality improvements, which enhances their cost-benefit basis

CONCLUSION

The Wet Weather Community Panel strongly recommends adoption of a formal Green Solutions policy by the City Council that will focus city resources on preserving and enhancing the City's natural resources as an integral part of the City's comprehensive Wet Weather Solutions Program plan. For the reasons stated in this position paper, the Panel believes that integration of Green Solutions into the City's comprehensive Wet Weather Solutions Program plan is critical to maximizing the social, economic and environmental benefits that enhance the quality of life for all Kansas Citizens. A City policy recognizing the value of Green Solutions and directing City departments to coordinate actions to maximize the use of green infrastructure concepts is a vital, positive step to significantly improving the future of our City.

³ Kansas City's comprehensive plan known as FOCUS (Forging Our Comprehensive Urban Strategy), completed after an intensive multi-year community involvement process, lays the foundation for the future of the City. One emphasis was that "quality development" is essential to creating a place where people want to live and to avoid repeating past development patterns that create detrimental effects, increase infrastructure costs, and negatively impact quality of life. FOCUS emphasizes that if we develop with quality the first time, quantity (economic growth) will come. Kansas City is increasingly recognized as a desirable place to live, work, and play.

Green Solutions Implementation Strategies

INTRODUCTION:

Water is a vital and valuable natural resource. Protecting water as a valuable resource is a top priority. The following Implementation Strategies describe steps to be undertaken to fully integrate the multiple benefits of Green Solutions into Kansas City's comprehensive Wet Weather Solutions Program plan.

Implementation Strategy: *Educate and engage the public. Create community and regional partnerships.*

Action Steps:

- Implement a large scale, well-targeted public education campaign encouraging citizens to prevent pollution and be part of the solution.
- Develop and implement a Wet Weather Community Panel public advocacy campaign.
- Institutionalize the Wet Weather Community Panel giving it a long-term role.
- Build community and political leadership.
- Provide opportunities for citizen input and make decisions utilizing this input.
- Fund staff position(s) responsible for building internal and external partnerships and dedicated to implementing green, multi-benefit solutions.
- Support multi-jurisdictional efforts aimed at planning and implementing a green, multi-benefit solutions approach.
 - Formalize agreements with other political jurisdictions sharing watersheds with Kansas City to promote and develop projects on a regional, watershed basis.
 - Develop, fund and implement projects designed to maximize efficient use of resources from a watershed perspective.

Accomplishments:

- ✓ Formed Wet Weather Community Panel in 2003
- ✓ Formed 12 Basin Coordinating Committees
- ✓ Created 10,000 Rain Gardens Initiative
- ✓ Conducted Wet Weather Fairs
- ✓ On-going presentations to existing community groups
- ✓ Prepared websites, handout materials, videos and television programming
- ✓ Participating in regional watershed management planning and public education programs
- ✓ On-going Municipal Separate Storm Sewer System (MS4) permit compliance activities.

Implementation Strategy: *Enact regulations and create enforcement programs that protect natural resources. Modify or eliminate any ordinance provision or enforcement practice that discourages the use of green, multi-purpose solutions.*

Action Steps:

- Create procedures for City staff from different departments to work together to integrate green solutions into planned projects.
- Train City staff to better understand green solutions and to think more holistically to integrate green solutions into projects whenever feasible.
- Enact and enforce the stream setback ordinance.
- Modify design standards for streets and sidewalks to minimize impervious area and to include green solutions such as bio-filters and rain gardens.
- Work with APWA and other regional organizations to update stormwater standards, to define “low impact development” as it pertains to the Kansas City metropolitan area and incorporate those concepts into city planning and development regulations.
- Amend the development code to encourage low impact development through incentives and flexible regulations.
- Amend stormwater design regulations to further limit rates, volumes and frequencies of stormwater for redevelopment projects – using redevelopment as an opportunity to make our community better than the status quo.
- Adequately fund planning and enforcement programs and proactively enforce regulations.
- Evaluate development review procedures and capital project development procedures to ensure that they result in green, multipurpose approaches.
- Obtain dedication of easements in riparian buffer where appropriate so that future trails can connect people to the resource.
- Require city projects to meet standards and showcase best practices.
- Adopt KC-One Stormwater Management policies.

Accomplishments:

- ✓ Adopted updated stormwater design standards American Public Works Association (APWA) Section 5600 and Best Management Practices Manual as mandatory regulation.
- ✓ Adopted updated stormwater management construction standards American Public Works Association (APWA) Sections 2100 and 5100 with supplemental city criteria.

Implementation Strategy: *Create incentives to integrate green solutions into the community.*

Action Steps:

- Create incentive programs that encourage developers, neighborhood organizations and owners of industrial, commercial and residential properties to install and maintain micro Best Management Practices (BMPs) for stormwater quality and quantity management.
 - Facilitate project development
 - Provide design assistance
 - Offer a credit or fee deduction
 - Reduce development approval timeframe (e.g. move these projects to the "front of the line.")
 - Provide special recognition within the community for these entities
 - Provide matching funds or grants
- Develop standards for integrating green solutions into private projects receiving government funding or that are city funded (example Tax Increment Financing).
- Identify green solutions as a funding priority for infrastructure/capital improvements.

Accomplishments:

- ✓ Adopted Leadership in Energy Efficient Design (LEED) in city buildings by ordinance.

Implementation Strategy: *Invest public dollars in green, multi-benefit solutions.*

Action Steps:

- Set targets for percent of open space within city limits and track progress
- Incorporate green solutions into Long-Term Control Plan for the combined sewer system.
 - Require green solutions to be integrated into every basin.
 - Include green solutions in negotiations with state and federal regulatory agencies.
- Enact a comprehensive urban forestry program with the goals of increasing urban canopy by at least 10%.
- Retrofit existing stormwater management facilities (such as detention basins) to function for water quality as well as quantity.
- Install native landscaping on public right-of-ways.

- Build demonstration or “signature” projects to gather data. Analyze effectiveness and showcase proactive green solutions. Utilize data from other sources (local, state and national) to promote proactive green solutions.
- Maximize the useful life and performance of facilities by fully funding an aggressive preventative maintenance program.
- Establish a sustainable, dedicated funding source(s) for green, multi-benefit solution projects identified in KC-One report.
- Establish dedicated funding source that promotes the integration of green, multi-benefit solutions.
- Work in tandem with other jurisdictions in the metro to pursue funding and appropriate siting for green, multi-benefit solutions.
- Restore public lands to function as natural systems for stormwater management.
- Provide regional land managers with sufficient resources to protect and restore public lands.
- Research and implement new and innovative methods for natural resource protection.
- Educate public and private land managers on best practices for natural resource management.
- Consider life-cycle costs when analyzing the cost-effectiveness of green solutions.
- Consider the long-term, ancillary value of green solutions.

Accomplishments:

- ✓ Adopted Climate Protection Plan, Phase I recommending green, multi-benefit solutions.

Attachment A

**Wet Weather Solutions Program
2006 Public Opinion Survey Summary Report
Executive Summary**

*Wet Weather Solutions
Survey Summary Report
ALL BASINS*



conducted for

The City of Kansas City, Missouri
Water Services Department

by

ETC Institute

725 West Frontier
Olathe, Kansas 66061
(913) 829-1215

May 30, 2006

Wet Weather Solutions Survey Executive Summary

Methodology

ETC Institute administered a survey for the City of Kansas City, Missouri, Water Services Department during the spring of 2006. The purpose of the survey was to objectively gather input from residents in order to plan improvements related to the City's Overflow Control Program and Stormwater Management Plan.

During March 2006, ETC Institute mailed a four-page survey to a stratified random sample of more than 14,000 households in Kansas City. The sample was designed to ensure the completion of at least 400 households in each of twelve basins. Approximately seven days after the surveys were mailed, residents who received the survey were contacted by phone. Those who indicated that they had not returned the survey were given the option of completing it by phone. Of the households who received a survey, a total of 5,430 completed the survey. The results for the stratified random sample of 5,430 households have a 95% level of confidence with a precision of at least +/- 1.5%. There were no statistically significant differences in the results of the survey based on the method of administration (phone vs. mail).

All survey responses were geocoded to the parcel identification number (KPIN) for the responding households to allow the information from the survey to be integrated with geographic information systems (GIS) that are used by the City.

This report contains (1) a summary of the major findings, (2) charts depicting the overall results of the survey, (3) crosstabulations that show the results for each of the 12 basins, (4) tabular data for the overall results to each question on the survey, and (5) a copy of the survey instrument.

Major Findings

- More than half (77%) of the residents surveyed thought City leaders should place a very high or high priority on maintaining and protecting streams; 2% thought it should be a low priority, and 21% gave a medium priority rating.

Section 1: Executive Summary

- 92% of those surveyed indicated that they valued natural resources.
- 77% of those surveyed thought that the quality of local streams affects property values.
- 87% of those surveyed thought that it was important to improve water quality in streams in Kansas City.
- 85% of those surveyed thought that it is important to make improvements that would minimize sewer overflows into creeks and streams during heavy rains.
- 87% of those surveyed indicated that they would support an ordinance that would require developers to protect streams and stream corridors when land is developed.

How Residents Thought the Quality of Water in Lakes, Rivers, and Streams Is Changing

- 32% of the residents surveyed felt that the quality of water in lakes, rivers and streams in the area where they live is getting much worse or somewhat worse; 10% thought it is getting better; 25% thought it was staying about the same, and 33% did not have an opinion.

Perceived Sources of Water Pollution

- 43% of the residents surveyed thought that stormwater was the greatest contributor to pollution of local waters.
- 27% of those surveyed thought that industrial discharge was the greatest contributor to pollution of local waters.

Participation in Recreational Activities in and Around Lakes, Rivers, and Streams

- 45% of the residents surveyed indicated that they had participated in hiking and walking near lakes and streams in the City of Kansas City during the past year; 29% had participated in picnicking, and 23% had participated in fishing.
- 8% of the residents surveyed indicated that they would consider swimming in lakes and streams in the Kansas City area during or immediately after a rainstorm; 92% would not.

Actions Residents Would Be Willing to Take to Reduce Pollution in Lakes, Rivers, and Streams

- 93% of the residents surveyed indicated that they would be very or somewhat willing to dispose of hazardous waste at a collection site.

Section 1: Executive Summary

- 84% of the residents surveyed indicated that they would be very or somewhat willing to sweep excess fertilizer and grass onto the lawn.
- 83% of those surveyed indicated that they would be very or somewhat willing to landscape their yard with plants.

Opportunities to Educate Residents

- Only 8% of those surveyed knew that they lived in a watershed.

Where Residents Get Information About Sewer Overflows and Stormwater Management Issues

- 49% of the residents surveyed had seen or heard information about sewer overflows, water quality or stormwater management during the past year.
- Among those who had seen or heard information, 66% got their information from television, 54% got their information from a bill insert, and 49% got their information from newspapers.

Sources of Basement Flooding

- 33% of the residents surveyed indicated that they had water in their basement from surface flooding or sewer backups in their current neighborhood at least once.
- Of those who had water in their basement, 60% indicated that rainwater that entered through cracks in the foundation and floors was the source of the flooding; 40% indicated the source was caused by sewer backups through floor drains.

Funding Issues

- 62% of those surveyed indicated that they would be willing to pay at a sales tax increase of 1/8th cent to fund improvements to the City's stormwater and sanitary sewer system, but only 17% were willing to pay an increase of 1/2 cent or more.
- 50% of those surveyed indicated that they would be willing to pay an increase of at least \$5 per month in utility fees to fund improvements to the City's stormwater and sanitary sewer system, but only 2% were willing to pay more than \$10 per month.

Attachment B

**United States Environmental Protection Agency
Memorandum from Benjamin Grumbles, Assistant Administrator
To EPA Regional Administrators**

**“Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source
and other Water Programs”
Dated March 5, 2007**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 5 2007

OFFICE OF
WATER

MEMORANDUM

SUBJECT: Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs

FROM: Benjamin H. Grumbles
Assistant Administrator

TO: EPA Regional Administrators

Green infrastructure can be both a cost effective and an environmentally preferable approach to reduce stormwater and other excess flows entering combined or separate sewer systems in combination with, or in lieu of, centralized hard infrastructure solutions. EPA Water Programs are in a pivotal position to exert leadership in the consistent and reliable implementation of green infrastructure approaches. This memo is to highlight opportunities for the Regions, States, and Headquarters efforts to increase the development and use of green infrastructure in water program implementation.

Several cities, searching for alternatives to traditional hardscape solutions to wet weather discharge problems, have initiated some green infrastructure approaches. The Natural Resources Defense Council (NRDC) has recently published a document with information and case studies on these efforts. I strongly support the use of green infrastructure approaches described in the NRDC report and I suggest you share the report with States and promote other tools for green infrastructure. *Rooftops to Rivers: Green strategies for controlling stormwater and combined sewer overflows* (NRDC, June 2006) is available at:
<http://www.nrdc.org/water/pollution/rooftops/contents.asp>

Green infrastructure approaches essentially infiltrate, evapotranspire or reuse stormwater, with significant utilization of soils and vegetation rather than traditional hardscape collection, conveyance and storage structures. Common green infrastructure approaches include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains. Green infrastructure can be used where soil and vegetation can be worked into the landscape. It is most effective when supplemented with other decentralized storage and infiltration approaches, such as the use of permeable pavement, and rain barrels and cisterns to capture and re-use rainfall for watering plants or flushing toilets. These approaches can be used to keep rainwater out of the sewer system to reduce sewer overflows and to reduce the amount of untreated stormwater discharging to surface waters. Green infrastructure

facilitates or mimics natural processes that also recharge groundwater, preserve baseflows, moderate temperature impacts, and protect hydrologic and hydraulic stability.

Green infrastructure has a number of benefits:

- *Cleaner Water* – Vegetation and green space reduce the amount of stormwater runoff and, in combined systems, the volume of combined sewer overflows.
- *Enhanced Water Supplies* – Most green infiltration approaches result in stormwater percolation through the soil to recharge the groundwater and the base flow for streams.
- *Cleaner Air* – Trees and vegetation improve air quality by filtering many airborne pollutants and can help reduce the amount of respiratory illness.
- *Reduced Urban Temperatures* – Summer city temperatures can average 10°F higher than nearby suburban temperatures. High temperatures are linked to higher ground level ozone concentrations. Vegetation creates shade, reduces the amount of heat absorbing materials and emits water vapor – all of which cool hot air.
- *Increased Energy Efficiency* – Green space helps lower ambient temperatures and helps shade and insulate buildings, decreasing energy needed for heating and cooling.
- *Community Benefits* – Trees and plants improve urban aesthetics and community livability by providing recreational and wildlife areas and can raise property values.
- *Cost Savings* - Green infrastructure may save capital costs on digging big tunnels and stormwater ponds, operations and maintenance expenses for treatment plants, pipes, and other hard infrastructure; energy costs for pumping water; and costs of wet weather treatment and of repairing stormwater and sewage pollution impacts, such as streambank restoration.

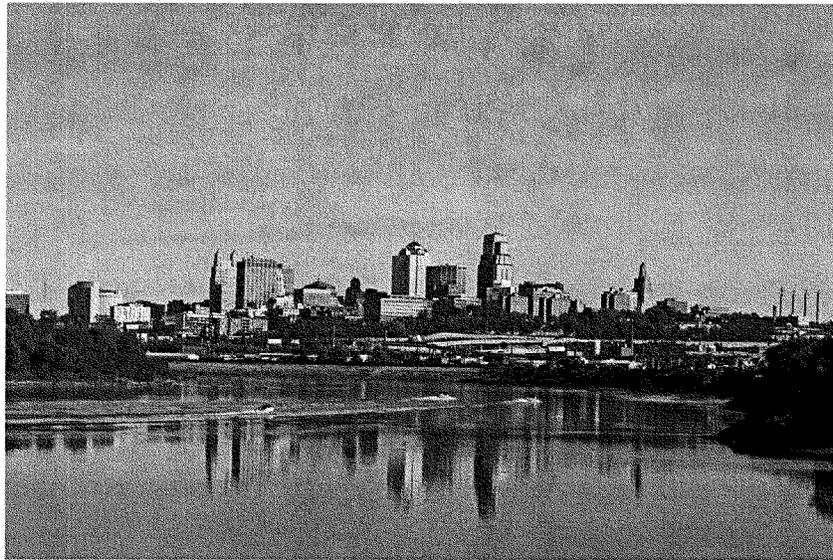
The Office of Water is working with a coalition of organizations, including the Natural Resources Defense Council, the National Association of Clean Water Agencies, and the Low Impact Development Center, to develop additional strategies for green infrastructure approaches to water quality challenges. As those strategies take shape, we will send you additional tools and information on implementing green infrastructure in our water programs.

I am pleased that EPA Regions and States are looking for opportunities to incorporate green infrastructure. We would be very interested in hearing about your efforts, and to the extent they can be applied elsewhere, assist in disseminating information and tools. If you have any questions, please contact me or have your staff call Jenny Molloy at (202) 564-1939 with any questions, comments, ideas or information on green infrastructure approaches.

cc: Water Division Directors
OW Office Directors

Kansas City, Missouri Overflow Control Plan Overview

January 30, 2009



WATER
the future is clear

Kansas City, Missouri • Wet Weather Solutions Program

Prepared by the City of Kansas City,
Missouri

CITY OF FOUNTAINS
HEART OF THE NATION



KANSAS CITY
MISSOURI



WATER
the future is clear

Kansas City, Missouri • Wet Weather Solutions Program



Water Services Department

Office of the Director

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To Water Services Customers and Citizens of Kansas City,

Since 2002, the City of Kansas City has been in discussions with the Environmental Protection Agency and the Missouri Department of Natural Resources to address overflows from the City's sanitary sewer systems. In December of 2008, the City Council authorized submittal of this Overflow Control Plan to the agencies for approval. The Overflow Control Plan commits us to design and implement a new generation of sewer infrastructure. Hereafter, we will continue to actively work with the agencies to review the selected plan and finalize the City's commitment to protecting our regions streams and rivers.

We recognize that this plan will be a financial burden on every ratepayer. While the City has little choice in complying with the unfunded State and federal mandates driving sewer overflow control, we have utilized opportunities within the regulatory programs to first address the long term maintenance needs of our sewer system and then turn to cost-effective capital solutions to our sewer overflow challenge. This approach and investment will extend the life of our sanitary sewers for many years to come. To obtain the greatest benefit from our sewer dollars we also have begun actively pursuing green infrastructure strategies that will maximize the economic, social, and environmental benefits associated with this investment.

It will be up to all of us to adapt and adjust this plan so that we have cleaner streams and rivers for our children and grandchildren, as well as a modern, efficient and effective sewer system critical to a viable and sustainable community. In the future, we will be calling on you many times to support these efforts. Thank you for your patience and understanding, and most importantly your guidance as we enter into this prolonged effort.

*Sincerely,
 John Franklin
 Assistant City Manager
 Acting Director, Water Services Department*

Foreword

The people of Kansas City have long had a love affair with water. It began with the first Americans who settled here because of the abundance and quality of water and soil at the confluence of the Missouri and Kansas Rivers. This was documented by Meriwether Lewis in his journal and later by William Clark who returned to create the Fort Osage trading post.

This affinity is celebrated today with the quantity and quality of our fountains, international recognition of Kansas City as the "City of Fountains" and the receipt of national awards for the quality of our drinking water. It has become obvious, however, that our regard for and management of this critical resource has deteriorated. Nationally and locally, demand for water is growing faster than our population, and traditional urban development and conventional methods of storm and wastewater management now threaten our historic relationship with water quality. The remarkable expansion of impervious surfaces in our watersheds along with unfathomable increases in pollutants has dramatically diminished the quality of our ground water and the vitality of our soil and landscape. Furthermore our current control system of collecting, conveying and discharging stormwater to prevent flooding have failed at many levels. The system has not prevented flooding, and in areas of combined sewers, wastewater overflows are increasingly common. When this system works as intended "the problem" is transferred into our river systems and to our downstream neighbors.

It is time to take a closer look at our relationship with water, our management of this precious resource and its impact on the health and vitality of our community.

WATER IS A RESOURCE, NOT A WASTE PRODUCT

A doctrine, by its definition, governs the direction of all thoughts and ideas generated by the people or groups that embrace it. America's view of water, since the earliest days of its independence, can be viewed as a doctrine of collect, convey, and discharge. Guiding the formation of this doctrine was a medieval belief that low, wet areas were sources of miasma, an agent of disease. As America's water supply was seen as "endless", our country's use and treatment of it focused on effective water mitigation that verged on an "out of sight, out of mind" approach. Our society's practices of agricultural land modification, including drainage and many other "modern" agricultural practices, coupled with our headlong surge toward prosperity in the Industrial Age, drove our policies toward water. During these critical early growth and development years in our nation, negative consequences were just not in the consciousness of most of our people and leaders.

In the last two centuries, there has been no overt, carefully considered policy development based upon the value of rainwater and its presence in our communities or on the consequences that our development trends might have on future generations. All of the creativity and genius that have influenced strategies and tactics have done so within the influences and constraints of these doctrines: Man does not belong in Nature; water must be collected and conveyed from where it falls and discharged "away", off the property as someone else's concern and responsibility. These two doctrines, among others, have led us to where we are today—stuck in an ill-guided convention of capturing our rainwater, often funneling it into our sewer systems, and dumping the overflow into our streams and rivers. Unconsciously absent from our doctrine has been any idea that the rain that falls on us should be stewarded for the resource and blessing it offers.

It wasn't until 1962, when Rachel Carson wrote her book, "Silent Spring," that a generation of Americans was caught flat-footed with the implications of our current doctrines and the realization that only a fundamental

change to the way we interact with our planet could avert irreversible harm. On January 1st, 1970 the National Environmental Policy Act was signed into law. Two years later, the Water Pollution Control Act was signed into law, proposing to have "the waters of the United States fishable and swimmable by 1983." The next year brought the Endangered Species Act.

While this flourish of policy was visionary and optimistic, it was not accompanied by any scrutiny of the doctrines that would drive our heartfelt and creative responses. Since that time our society has developed strategies in a doctrine that still collects, conveys, and discharges water, just "less badly." What have become known as "best management practices," including various forms of detention and retention, have proliferated—along with increased flooding, deterioration of water quality, depletion of aquifers, and general imbalances with respect to our water needs.

There will be no lasting solution to combined sewer overflows, or any of our other environmental maladies, until we have examined the doctrines within which our civic leaders, ecologists, engineers, architects, landscape architects, and craftsmen apply their efforts and trades. While we have been brilliant and clever in our solutions, our energies have been misguided. Short-term plans will have to include some existing methodologies, but a long-term plan must acknowledge a new water doctrine that treats water not as the enemy but as a resource and a blessing, a thing to be integrated into our infrastructure, lives, and national spirit by this and the next generation of Americans, who will benefit from our vigilance and build upon what we do today.

As Kansas City begins a new journey of discovery, many undertakings have laid the foundation for future enlightenment. Since 2005, Kansas City has passed, adopted or endorsed the following initiatives:

- Mayor's Climate Protection Plan
- LEED Silver for all City projects
- 10,000 Rain Gardens
- Stream Setback Ordinance
- KC Green
- Chamber's Climate Protection Partnership
- America's Green Region
- KCP&L Renewable Energy
- KC-One
- MARC Sustainability Academy
- Conversations on the Environment
- Sustainable Skylines Initiative

The journey has begun and this Overflow Control Plan represents a significant milestone for change, specifically with regard to water issues that will grow evermore important as the future draws nearer. We must rethink our understanding of water and, in turn, embrace the potential that this vital, life-giving resource can provide to Kansas City and the region.



Kansas City, Missouri Overflow Control Plan Overview

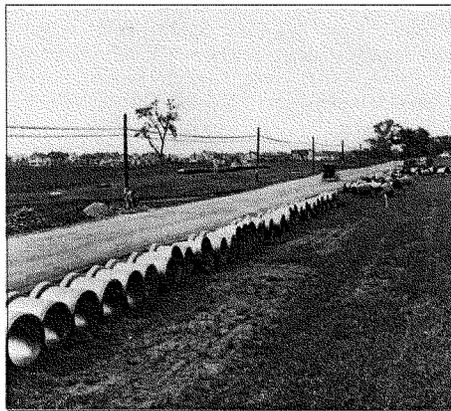
Kansas City's Sanitary Sewer System

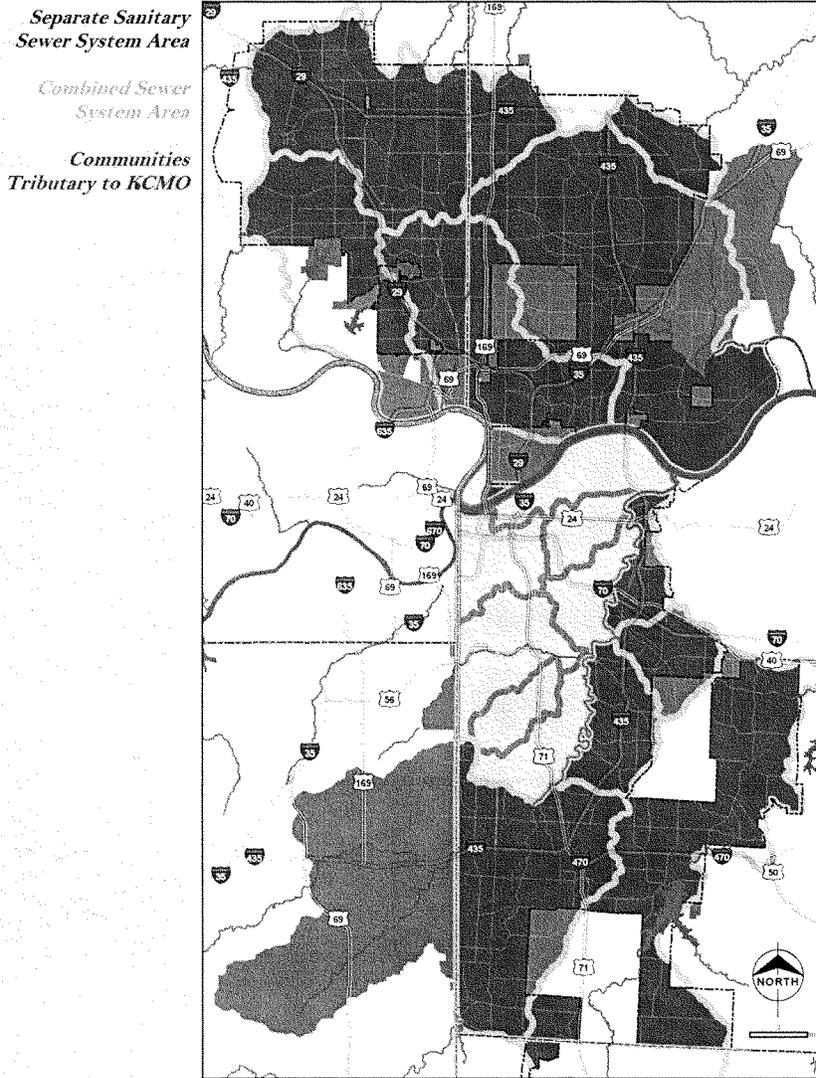
Kansas City began building the basic sewer infrastructure that would allow the City to grow and prosper over 150 years ago. Amazingly, some of that infrastructure is still in use today. While focused on controlling overflows, a significant portion of the Overflow Control Plan addresses repairing, improving, and maintaining the City's basic sanitary sewer system so that it can be used by Kansas Citizens for years to come.

Kansas City's overall sanitary sewer system is comprised of both combined and separate sewer systems. A combined sewer system is simply a single sewer system that carries both sewage and stormwater. Kansas City has 58 square miles of combined sewers. Typically these systems are in the oldest areas of the City and are not capable of carrying the large amounts of stormwater that now run off of our urban landscape. During moderate to heavy rainfall events, the system will reach capacity, overflow, and discharge a mixture of sewage and stormwater directly to our streams and rivers. Although there is a desire to minimize these overflows, the discharge of combined sewer overflows is not uncommon from combined sewer systems and is allowed under a National Pollutant Discharge Elimination System (NPDES) permit issued to Kansas City's Water Services Department by the Missouri Department of Natural Resources.

The remainder of Kansas City's sanitary sewer system is considered a separate system. A separate sanitary sewer system collects sewage and a relatively small percentage of inflow (stormwater) and infiltration (ground water which gets into the sewers through cracks) and is not designed to overflow unless a storm occurs which exceeds the sanitary sewer design capacity. In Kansas City, however, the separate sanitary sewer system is in great need of repair. Stormwater entering through joints, broken pipes and manholes, and unpermitted direct connections causes the system to overload during rain events much smaller than its design storm. When flows in the sanitary system exceed its capacity, it too overflows a mixture of sewage and stormwater. Unlike combined sewers, however, overflows from the separate sanitary system are not currently authorized in the City's discharge permit.

1942 Country Club Plaza





Developing the Overflow Control Plan

In 2003, Mayor Kay Barnes appointed the Wet Weather Community Panel to help guide the City's efforts in addressing combined sewer overflows and flooding issues. This group has met extensively over the last five years and established goals by which the Overflow Control Plan and Kansas City's stormwater initiatives have developed.

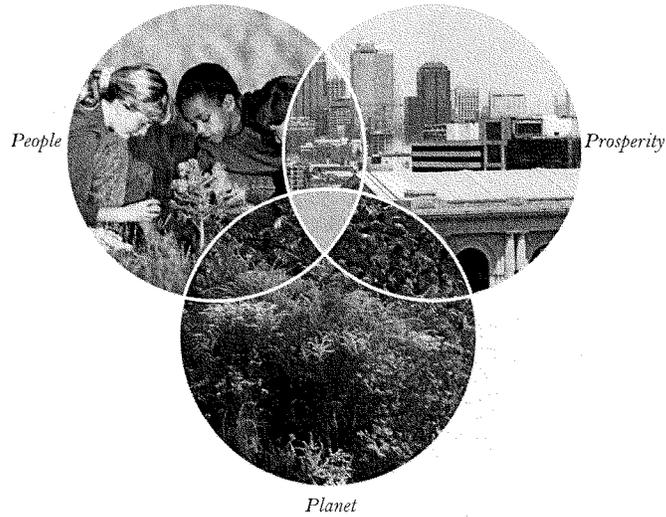
Goals and objectives of the Wet Weather Community Panel are as follows:

- Minimize loss of life and injury and reduce property damage due to flooding
- Improve water quality
- Maximize economic, social and environmental benefits

Almost 300 different alternative solutions were evaluated during the five year development of the Overflow Control Plan. Alternatives were evaluated by cost, feasibility, ability to control overflows, and multi-benefit potential to help control stormwater. In an effort to maximize benefits received from the investment, final alternatives were also evaluated for potential to incorporate green infrastructure as part of the proposed solution.

TRIPLE BOTTOM LINE

People, Planet, and Prosperity: Sustainable design establishes a balance between social, economical and environmental factors – between people, prosperity and the planet. Within the triple bottom line cycle, the benefits propagate naturally into other areas.



SYSTEMS THINKING

Systems thinking is a unique approach to problem-solving that examines systems in a holistic manner. Essentially, the only way to fully comprehend why a problem or issue occurs is to understand the part in relation to the whole.

INTEGRATED DESIGN

Through a process of integrated design, which is both an organized collaboration between disciplines and an interweaving and interconnectivity of man made and natural systems, teams create design solutions that are both environmentally responsible and that achieve the highest level of design excellence. The practices of our civic leaders, ecologists, engineers, architects, landscape architects, and craftsmen requires an understanding of a number of complex and varied issues and the ordering of those issues, based on project needs, desires and abilities. Successful design requires a process that includes all stakeholders in its dialogue and encourages feedback in a process of continuous refinement and improvement.

Adaptability in Future Years

This Overflow Control Plan is premised on an adaptive management approach. Adaptive management integrates design, management, and monitoring to systematically test assumptions, learn from results, and adapt future plans throughout implementation. Its uniqueness is grounded in the flexibility it can bring to the Overflow Control Plan and the City's ability to meet regulatory requirements and achieve "triple bottom line" results. Integrating adaptive management principles into the Overflow Control Plan will require strong leadership, strategic business planning, an effective performance measurement system, and a "continual improvement" operational framework.

The adaptive management framework will be applied to the Overflow Control Plan on various levels. Adaptive management will be part of the overall programmatic approach, and will also be specifically applied at the basin and project level. Data gathered through project implementation will provide opportunities for feedback loops that subsequently inform decision-making at the basin level and ultimately at the overall program level.

A critical aspect of adaptive management is the ability to measure and evaluate project activities, which requires the identification of performance indicators, or measures of success. As this Overflow Control Plan moves forward, performance indicators that relate to overall program development and implementation will be formulated to measure program success in reducing sewer overflows and maximizing social, economic and environmental opportunities for the Kansas City community. Additionally, specific performance indicators will be devised to evaluate success at both the project and basin level.

As part of the adaptive management approach, the proposed Overflow Control Plan focuses on first repairing the existing system and reducing inflow and infiltration, while also measuring the potential of green infrastructure. Completing these activities early in the program will allow the City to use monitoring, modeling and measurement tools to evaluate program results, and adapt the plan accordingly, before constructing more expensive structural controls.

In addition to conducting a regulatory review of the plan every five years, the Overflow Control Plan incorporates intermediate, internal program reviews occurring at the mid-point of each 5-year cycle that will focus on the direction of the Plan and its benefit to the rate payers and citizens of Kansas City.

Public Policy Changes

The Overflow Control Plan is just one element of a comprehensive approach to position Kansas City as America's Green Region. The broader approach will systematically incorporate low impact development strategies, tools, and practices that focus on maintaining the natural hydrologic cycle. A great example of this strategy is the City's recent adoption of a stream setback ordinance in August of 2008. Other initiatives which will enhance the effectiveness of this plan include:

INTEGRATION WITH OTHER CITY AND REGIONAL EFFORTS

The Overflow Control Plan will complement and be integrated with other city and regional programs related to integrated water resource management, climate protection, land use, community development, parks and trails, air quality, and transportation.

DEVELOPMENT REGULATIONS FOR PUBLIC AND PRIVATE PROPERTY

A review of the full city development code to support broad low impact development strategies will be used to formulate proposed code revisions to be submitted to the City Council for its review and approval.

STORMWATER ENGINEERING CRITERIA, STANDARDS AND SPECIFICATIONS FOR NEW AND REDEVELOPMENT PROJECTS

Existing standards applied to public and private projects alike, will be reviewed to ensure that low impact development benefits are maximized through state-of-the-art stormwater management practices.

URBAN AND COMMUNITY FORESTRY PROGRAM

Expanded urban forestry programs will achieve multiple benefits, such as improved air and water quality, reduced energy use and urban heat islands, and restored habitat and biodiversity.

STANDARD OPERATING PROCEDURES

City operations and maintenance practices will be guided by new procedures to capitalize on the many opportunities to implement more distributed, green infrastructure solutions, and to ensure the long term effectiveness of these practices.

Cost and Affordability

A financial capability assessment for the recommended Overflow Control Plan was prepared using procedures suggested by the EPA. The EPA's approach calls for an evaluation of costs of the proposed improvements against Kansas City's median household income. In general, the EPA considers wastewater costs below two percent of median household income to be an acceptable cost burden to ratepayers.

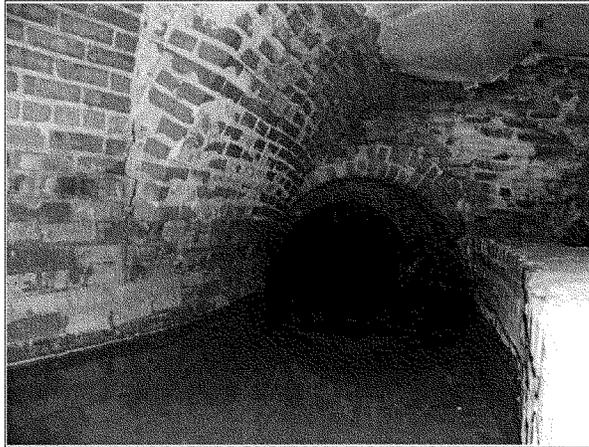
As suggested by the EPA, costs for implementing the Overflow Control Plan were estimated in current day dollars at \$2.4 billion. Based on the cost and a preliminary 25-year implementation schedule, the affordability assessment determined that the Overflow Control Plan would result in a cost to Kansas City residents of approximately 1.7% of median household income. This will impose a heavy financial burden on Kansas City residents.

Overflow Control Plan

The Overflow Control Plan was developed to meet regulatory requirements put forth by the Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (MDNR) related to minimizing overflows from the combined and sewer separate sewer systems. This plan meets those objectives by providing a planned list of improvements targeted at eliminating or capturing for treatment approximately 88% of the wet weather flow in our combined sewers and controlling sanitary sewer overflows during a 5-year rainfall event. While it would be desirable to completely eliminate all wet weather sewer system overflows, the financial burden that would be placed on the rate payers to achieve those goals would simply be too great.

The Overflow Control Plan addresses issues beyond combined sewer overflows, such as deferred maintenance, repairs, and overflow control in all parts of the sanitary sewer system. Completing these repairs not only extends the life of the system for future generations, but they also help in reducing the size of the problem which Kansas City must overcome.

While this Overflow Control Plan is recognized as one of the "greenest" ever developed, WSD will strive to make it even greener through the adaptive management approach described above. There is a desire to utilize above ground, green infrastructure in a manner which provides substantial ancillary benefits to Kansas Citizens beyond sewer overflow control, such as cleaner air, cooler ambient air temperatures, recreational and aesthetic amenities, and economic opportunities. This plan lays the ground work for Kansas City to realize those benefits with a substantial initial investment in green infrastructure and an adaptive management approach that will allow additional green infrastructure to be utilized as its benefits to the system and the City are measured and confirmed.



Some of Kansas City's oldest sewers are still functioning today

PUBLIC EDUCATION AND OUTREACH

Active citizen participation will be critical to the overall success of the Overflow Control Plan. To facilitate this participation, the City will partner with neighborhood associations to develop a public education and outreach program that helps inform citizens of the problem and their role in the solution. Creating successful individual projects is also highly reliant on positive citizen participation. Throughout the life of the plan, public education and outreach will also focus on informing citizens about proposed project designs, schedules and progress towards completion. Funding for public education and outreach has been estimated at \$12 million, to be spent over the life of the program.

RAIN GARDENS AND DOWNSPOUT DISCONNECTS

Since 2005, Kansas City's award-winning 10,000 Rain Gardens Campaign has focused on educating homeowners on the positive effects of rain gardens. In the Overflow Control Plan, the campaign's focus will be expanded to include an aggressive rain garden establishment program along with a new downspout disconnection program. Funding for the program is estimated at \$5 million. The initiative, which will incentivize citizens to disconnect their downspouts, will also include assistance and information related to helping homeowners and businesses manage and hold water on their own property.

GREEN COLLAR JOBS AND WORKFORCE DEVELOPMENT

Preparing our community for the work required in the Overflow Control Plan is critical. Every dollar of this \$2.4 billion investment that can be kept within Kansas City is a dollar of economic development opportunity for our local businesses and residents. To keep those dollars home, local minority and woman owned business enterprises, design firm, contractors, and the City itself will have to ramp up their capabilities and skill sets. The plan includes \$5 million to be utilized in job creation and work force development initiatives related to program specific objectives. The City will work with job training and work force development organizations to develop a green collar jobs program related to green infrastructure and sustainable projects proposed in the program. New jobs will help address many concerns, among them unemployment, community support and long term maintenance obligations for green infrastructure.

MONITORING AND MODELING

One of the first activities in the Overflow Control Plan will be to install additional flow meters and level sensors in both the combined and separate sanitary sewer systems. The results of monitoring will help in the development of enhanced system models, evaluating enhanced performance in the system and potential water quality improvements.

Current system models analyze performance characteristics in pipes 24 inches in diameter and larger. In order to evaluate the potential impact of green infrastructure solutions, these models will need to be extended further up the drainage basins. Technical models will be complemented by a triple bottom line evaluation framework including well specified social, economic, and environmental metrics. Once system models and related evaluation frameworks are developed, adjustments to the design, construction, and operation of remaining components will be analyzed throughout implementation of the Overflow Control Plan. Funding for the enhanced monitoring and modeling activities has been estimated at \$24 million over the life of the program.

Blue River Watershed Management Plan

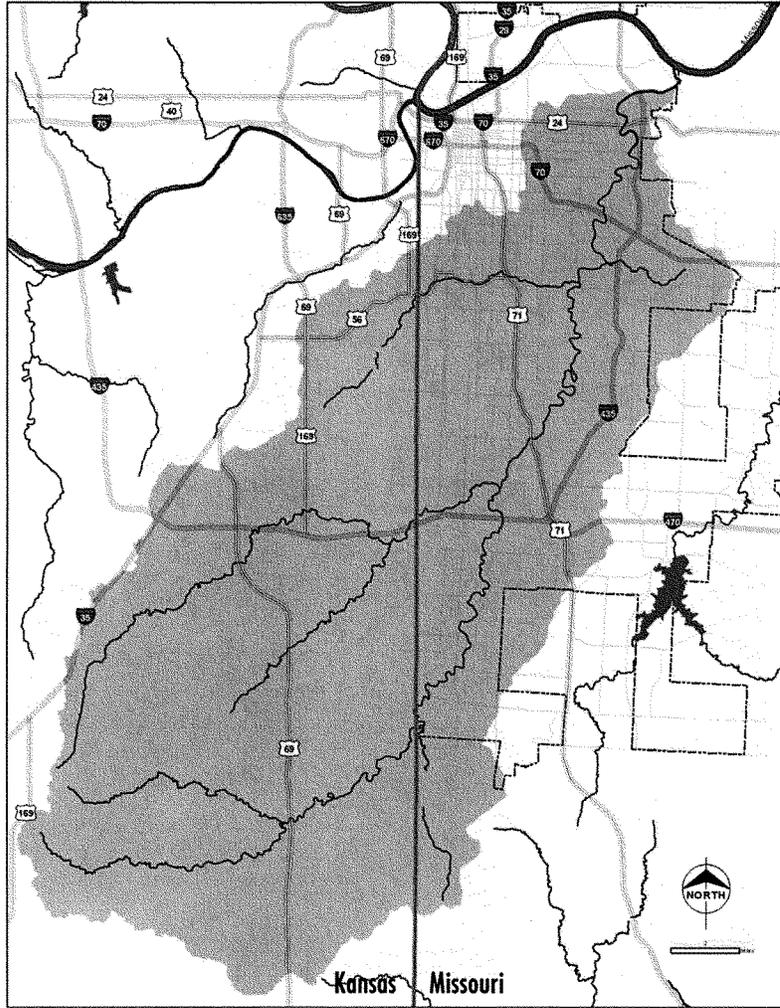
One important premise of this Overflow Control Plan, and indeed the City's more comprehensive approach to managing water resources, is to approach planning and management from a holistic watershed perspective. The benefits of watershed-based planning and management are many. Approaching water resource management from a watershed perspective allows the resource itself to become the focal point of study, leading to a more complete understanding of the various impacts on the water body. A watershed approach is also more cost-effective, because it embraces the involvement of key stakeholders in the process and allows for coordination and communication in addressing pollution sources and issues. Moreover, a watershed approach is the best method of maximizing social, economic, and environmental benefits, because the approach itself is grounded in a broader focus on all activities within a watershed that might have an impact on human health and the environment.

A large portion of the flow and bacterial loading in the Blue River comes from upstream of Kansas City. For this reason, simply reducing overflows from Kansas City's sewer system may not be enough to meet MDNR's water quality standards, particularly in the stretch of the Blue River between 59th and 95th Streets. The water quality standard in this stretch of the Blue River is more stringent than the standards applicable to adjacent upstream and downstream reaches of the Blue River. For these reasons, the Overflow Control Plan includes \$2 million as Kansas City's contribution to the preparation of a Blue River Watershed Management Plan. A watershed management plan for the Blue River, developed together with Johnson County and other significant watershed stakeholders, is critical to determining the best methods to address the pollution issues that affect this waterway, and to determining appropriate water quality standards for all reaches of the Blue River.

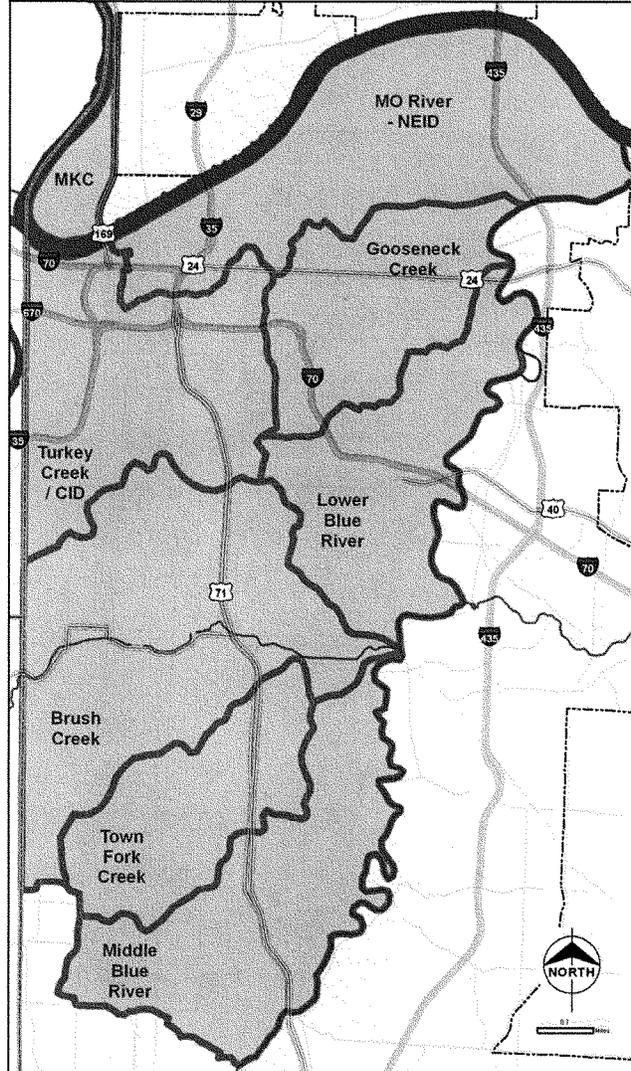


Blue River at Blue Ridge Boulevard

Blue River Watershed



Combined Sewer
System Basins



Combined Sewer System

About 58 square miles within Kansas City are served by combined sewers. This area is generally bound by the Missouri/Kansas state line on the west, 85th Street on the south, the Blue River on the east, and the Missouri River on the north. The area served by the combined sewer system is subdivided into seven principal basins, Gooseneck Creek, Lower Blue River, Town Fork Creek, Brush Creek, Middle Blue River, Northeast Industrial District, and Turkey Creek/Central Industrial District. North of the river, the Charles B. Wheeler Municipal Airport is also served by combined sewers.

The estimated overflow volume from Kansas City's combined sewer system in a typical year is 6.4 billion gallons. Overflow frequency varies significantly within the individual basins, with the average overflow frequency estimated at more than 18 times in a typical year.

In the combined sewer system, repairs to the existing system are scheduled to occur early in the implementation of the Overflow Control Plan. The early years of the plan will also include aggressive pilot projects focused on developing green infrastructure solutions, which will modify proposed structural solutions scheduled for construction in the later years of the plan. The middle years of the plan will focus on maximizing the capacity within the existing system and analyzing the results of source volume reductions and pilot projects, together with improvements to the City's wastewater treatment plants. The final years of the plan will address necessary improvements to the City's wastewater treatment plants and adjustment and construction of proposed structural storage solutions.

NEIGHBORHOOD SEWER REHABILITATION

The first objective of the Overflow Control Plan is to maximize the effectiveness of the existing system. The Overflow Control Plan includes \$122 million in capital maintenance and repairs to neighborhood sewers in the combined sewer system. These repairs will help reduce the amount of stormwater entering the system, will address significant outstanding maintenance items, and will improve system performance and life span. To minimize disruption to the neighborhood and improve efficiencies, the City will coordinate sewer rehabilitation efforts with other planned infrastructure projects.

GREEN INFRASTRUCTURE PILOTS AND PARTNERSHIPS

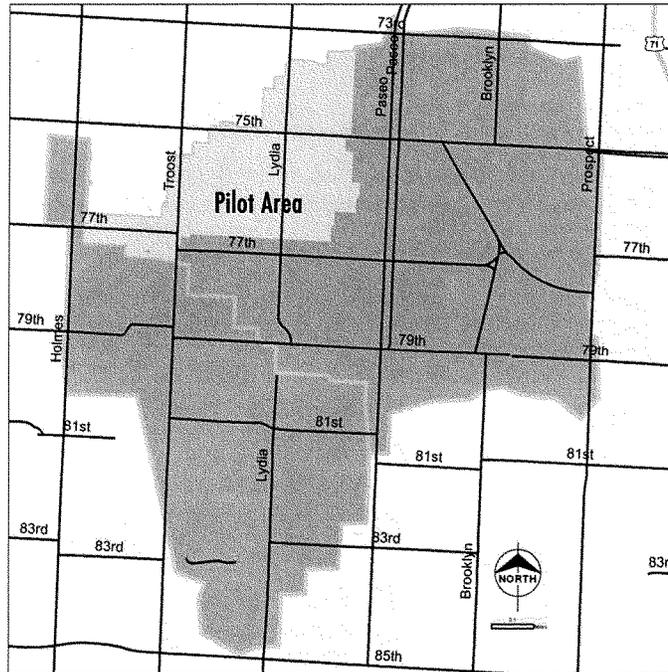
The Overflow Control Plan includes \$28 million of funding dedicated to developing green infrastructure pilot projects and partnerships in the combined sewer basins. While proven individually or as part of small systems, green infrastructure has yet to be utilized in a widespread effort to address combined sewer overflows. By developing large scale pilots, the City will be gathering the information required to effectively implement green infrastructure on a much broader scale while simultaneously constructing a portion of the basin specific solution. Green infrastructure partnerships will focus on creating private sector participation in the pilots and proposed basin solutions.

The first pilot project will be implemented in the Middle Blue River Basin as part of the Marlborough Green Infrastructure Project. In this pilot, green infrastructure is planned to provide distributed storage of stormwater throughout a 100-acre area of the neighborhood. The area is primarily residential, but does include commercial businesses. In addition to gaining valuable information about the effectiveness of green infrastructure in controlling combined sewer overflows, this initial pilot will also evaluate alternatives to achieve additional plan objectives, including:

- Effectiveness of green infrastructure as a systematic solution;
- Codes and ordinances in conflict with green infrastructure utilization;
- Socio-economic benefits/change;
- Construction techniques and costs on a wide-scale programmatic level;
- Interdepartmental coordination to minimize neighborhood disruption;
- Development of preliminary green design standards for Kansas City;
- Maintenance approaches and costs;
- Public/Private partnership opportunities; and
- Community interaction and support of green infrastructure practices.

Other pilot projects will be developed in the early years of the plan based on the specific basin solutions proposed. In order to develop green infrastructure strategies that will be applicable across Kansas City, it is important that the development of those pilots consider different land uses such as industrial areas and urban areas.

The 100-acre Marlborough Pilot Project area represents the largest focused installation of green infrastructure for combined sewer overflow control in the United States currently.



MARLBOROUGH GREEN INFRASTRUCTURE PROJECT

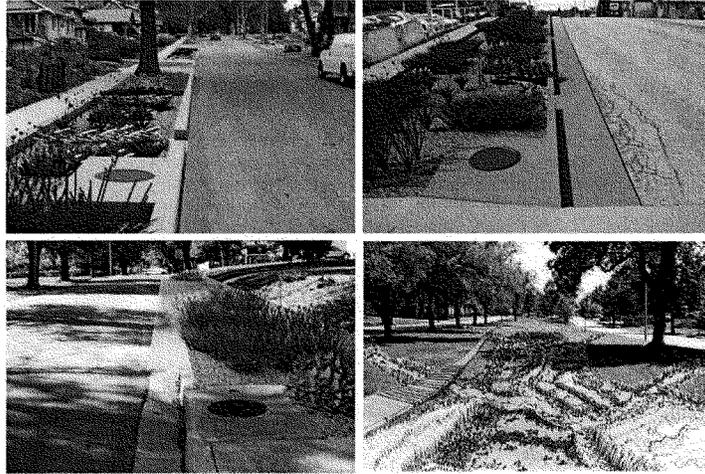
As mentioned in the previous section, the Marlborough Pilot Project will help define the utilization of green infrastructure across many areas of the City. However, this 100-acre pilot project is only a portion of the area in Marlborough where the use of green infrastructure looks very promising.

Four basin areas in the combined sewer system were evaluated to determine the opportunity for green infrastructure utilization. Based on this analysis, it was determined that an area in the Middle Blue River Basin is a prime candidate to implement a green infrastructure approach. This area, located in and around the Marlborough neighborhood, is comprised of approximately 744 acres draining to combined sewer overflow outfalls 059 and 069.

The draft Overflow Control Plan called for two underground storage tanks and associated pumping equipment to store and transfer approximately 3.5 million gallons of anticipated overflow from these outfalls. In the selected Plan, these tanks have been replaced with an equivalent amount of storage in the basin itself through the use of green infrastructure.

While final designs will be modified based on results of the pilot project in the basin, initial estimates indicate that green infrastructure in the 744-acre area could include as much as 330 curb inlet modifications, and 25 acres of rain gardens, bioswales, permeable pavement, and green roofs.

A capital budget of \$40 million has been included in the plan for the remainder of green infrastructure construction in this 744-acre area. The proposed sole reliance on utilizing distributed green infrastructure to achieve combined sewer overflow control performance goals in an area of this size is unprecedented in both scale and scope at the national level.



Renderings of potential green solutions in the Marlborough Area

SYSTEM IMPROVEMENTS

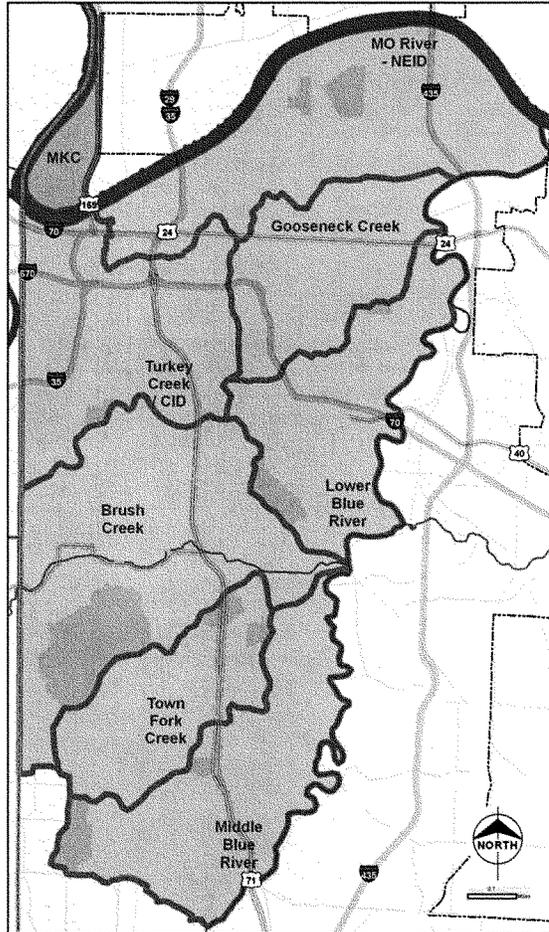
Many of the improvements proposed in the Overflow Control Plan relate to improving the performance of the sanitary sewer system itself. The investment in these facilities will help the City in their daily duties of collecting and treating sewage, as well as help reduce overflows and system backups by pushing more flow through the system. Additionally, some areas of the system have extra capacity and can be modified to store flows within the system itself. This approach of maximizing the use of the City's existing investment is fundamental in the proposed Overflow Control Plan

SEPARATION PROJECTS

In many areas of the combined sewer system, it is less costly to modify the existing system so that it functions as a separate sanitary and storm sewer system. These areas typically have a separate sanitary sewer system already functioning in the general area, which at some point connects to the combined sewer system. Separating the systems involves eliminating those interconnection points and providing new sewer lines that convey sewage only.

While these separation projects may be small in scope, their proximity to neighborhoods makes them disruptive to the everyday life of citizens. The City will focus on minimizing disruption through the use of innovative design, construction and management techniques aimed at shortening construction times, limiting disruption, and coordinating with other planned improvements in the neighborhoods.

Separation Projects



STORAGE PROJECTS

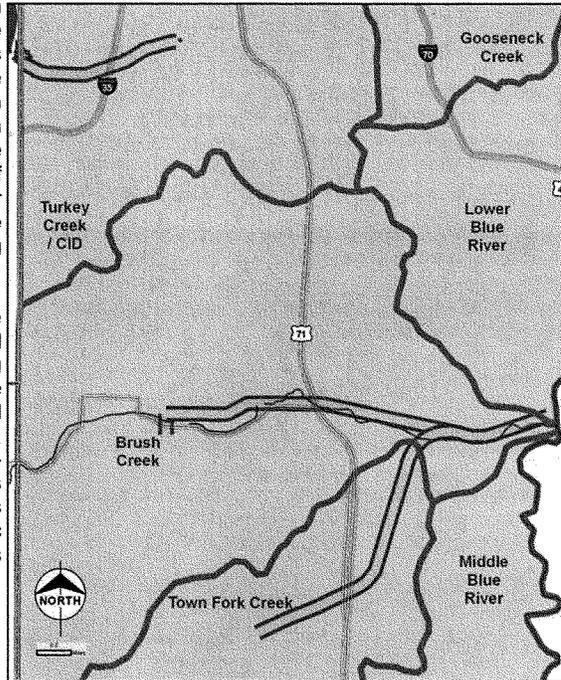
Despite all of the significant system repairs and improvements and green infrastructure projects proposed in this Overflow Control Plan, the potential still exists that these improvements may not be sufficient to reduce sewer overflows to the levels intended. In that case, structural storage components will have to be relied upon to meet regulatory requirements. For that reason, this Overflow Control Plan includes contingency plans for the construction of structural storage facilities.

It is important to understand that the adaptive management approach used throughout this plan gives the City the opportunity to gauge the effectiveness of the system repairs and improvements and green infrastructure projects as Overflow Control Program implementation progresses. If those activities result in meeting the sewer overflow requirements in effect in the later years of this plan, then the need for structural storage facilities will be greatly diminished, if not eliminated. The intent of this Overflow Control Plan is to focus on all reasonable methods of reducing or eliminating the need for structural storage facilities, yet retain the option to construct some or all of those storage facilities if no other reasonable alternatives are available to meet regulatory requirements in effect in the later years of this plan.

The structural storage projects currently proposed as the contingency approach in the Overflow Control Program are comprised of deep tunnels used to store and convey sewer overflows during rain events until such time as the sewer system has capacity to accept those flows. Deep tunnel storage has been proven to be a cost effective method of storage on a per gallon basis. It is also less disruptive than many above ground storage solutions. The disadvantage of utilizing a tunnel system is that for the most part, the tunnels serve only one purpose, storing combined sewer overflows.

Throughout implementation of the Overflow Control Plan, the City will actively evaluate emerging technologies and other storage alternatives. Final evaluations will take into account social, economic, and environmental aspects of the proposed solutions as they pertain to meeting regulations and improving the economic vitality and quality of life in Kansas City.

Combined Sewer System Tunnels



Separate Sanitary Sewer System

Kansas City's separate sanitary sewer system is comprised of nine principal basins, covering 250 square miles of the City. The four separate sanitary sewer system basins north of the Missouri River are the Northern and Northwestern watersheds and the Line Creek/Rock Creek and Birmingham/Shoal Creek basins. The five separate sanitary sewer system basins south of the Missouri River are the Blue River North, Round Grove, Blue River Central, Blue River South, and Little Blue basins.

Under existing conditions, the collection systems and wastewater treatment plants have adequate capacity to convey and treat dry weather flows. During heavy rainfall, however, the amount of water infiltrating into the sewers exceeds the system's capacity.

In addition to the uncontrolled overflows from the separate sanitary sewer system, a constructed sanitary sewer overflow is present at the lower end of the Line Creek system. The plan addresses flows from this structure as an early priority.

Recommended strategies in the separate sanitary sewer system include reducing inflow and infiltration of stormwater by repairing the existing system where cost-effective. A combination of wet weather storage and treatment will also be provided to address inflow and infiltration determined to be too expensive to keep out of the system. Because work in the separate sanitary sewer system relates only to repair of the sanitary sewer system, green infrastructure is not included in the proposed plan.

In the separate sanitary sewer basins, a design storm with duration of 24 hours and a depth that would be equaled or exceeded, on average, once every five years was utilized to develop the Overflow Control Plan. In Kansas City, that design storm would result in a rainfall depth of 4.68 inches.

INFLOW/INFILTRATION REPAIR WORK

Many parts of the separate sanitary sewer system are in need of general repair and have experienced deferred maintenance. In addition to extending the life of the system, these repairs will help reduce the amount of rainwater inflow into the system. Inflow, however, is not the only problem. The age of the system and the construction techniques utilized at the time of construction create many challenges in keeping rainwater from entering the system below ground. To combat these issues, the Overflow Control Program proposes an aggressive inflow and infiltration reduction initiative focusing on lining existing pipes within the system to combat infiltration through pipe joints and connection points. While effective, the system itself is so large geographically that inflow and infiltration reduction efforts are only expected to partially reduce the amount of stormwater entering the system.

SYSTEM IMPROVEMENTS

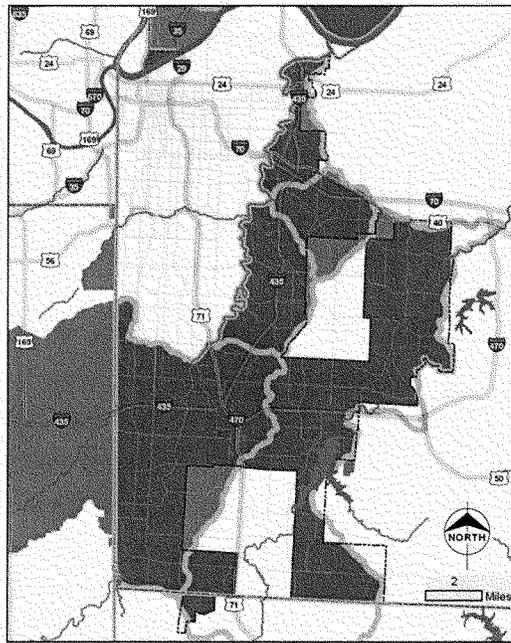
Addressing overflows from the constructed sanitary sewer overflow located within the Line Creek/Rock Creek basin, just upstream from the Line Creek Pumping Station, is a priority to the City. The plan provides \$37 million for construction of a 30 million gallon per day high rate treatment facility to be constructed near the Line Creek Pumping Station early in the program. This facility will allow the City to begin treating sewage overflows early in the program and will stay in service until final solutions are implemented.

Ultimately, it is anticipated that wet weather flows from the Line Creek/Rock Creek and Northwestern basins will be transported through a conveyance and storage tunnel to the Birmingham Wastewater Treatment Plant. The Plan also provides \$44 million in funding for a high rate treatment facility to be added to the Birmingham plant to address peak wet weather inflows.

Northern Separate Sanitary Sewer Area



Southern Separate Sanitary Sewer Area



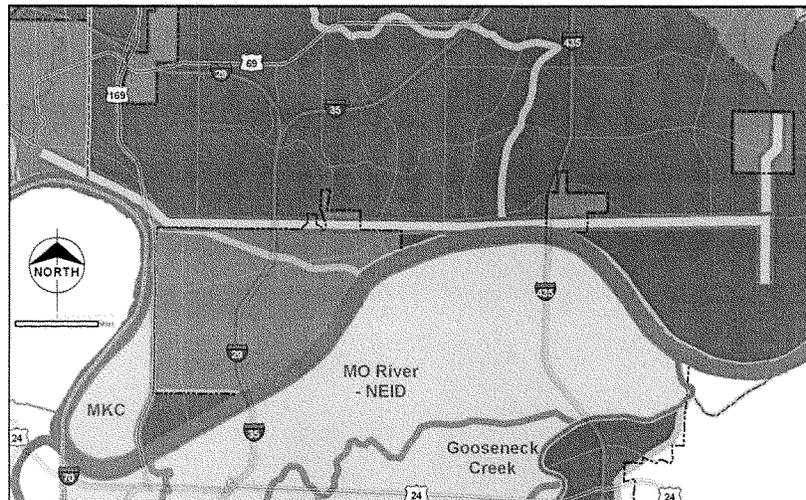
STORAGE PROJECTS

Two major structural storage projects are currently proposed in the separate sanitary sewer areas. Similar to the storage projects in the combined sewer area, through an adaptive management approach, the City will retain the flexibility to reduce the size or eliminate these storage projects depending on actual flow reductions achieved in early phase projects.

The North Bank Tunnel is proposed as the primary solution to store sanitary sewer overflows from the entire separate sanitary sewer system north of the Missouri River. In addition to providing 42 million gallons of storage, this tunnel also provides conveyance capacity in an undersized portion of the system.

South of the Missouri River, the plan proposes 68 million gallons of tank storage to hold excess inflow and infiltration from the Blue River South Basin and flows from Johnson County Wastewater. The adaptive management approach of the plan gives the City the flexibility to postpone final decisions on storage capacity until the results of ongoing technical and contractual discussions between Kansas City and Johnson County Wastewater are fully evaluated. The cost for addressing Johnson County Wastewater flows to the 87th Street Pumping Station will be recovered through either increased rates charged to Johnson County Wastewater or other funding agreements. Should Johnson County choose to manage the flows themselves, the proposed storage necessary will be reduced accordingly.

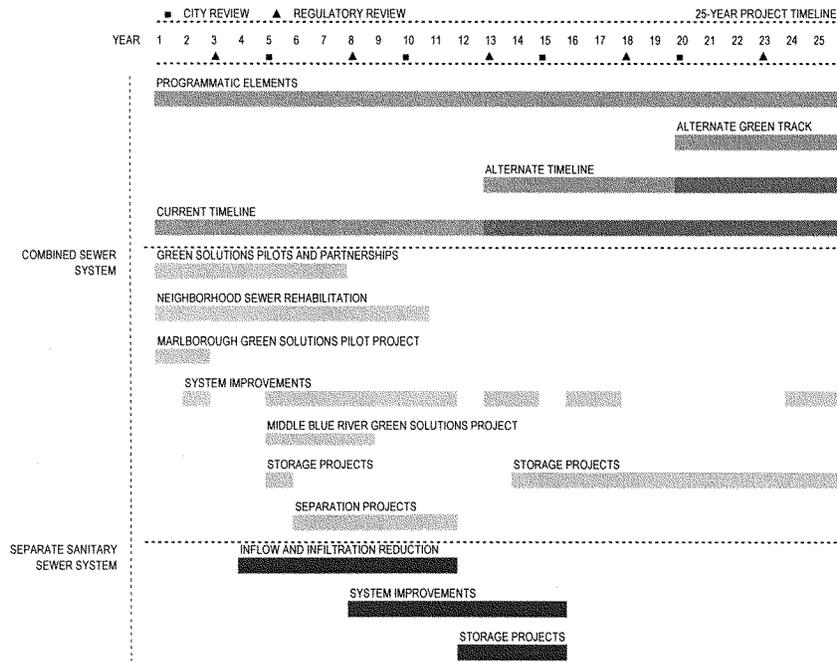
North Bank Tunnel



Preliminary Schedule

Financial projections prepared for the Overflow Control Plan suggest that between 25 and 33 years will be needed to complete construction of the projects identified in the Plan and other presently identified wastewater utility capital needs. Each of those projections is predicated upon acceptance of a heavy financial burden by the City and its ratepayers. Wastewater rates are expected to almost quadruple over the next 13 years, eventually leading to a cost to residents in the City's retail service area equivalent to 1.7 percent of the City's median household income. Completing the Overflow Control Plan at the lower end of the 25-33 year range will require the identification of revenues other than presently projected user rate increases sufficient to comply with any new regulatory requirements and other wastewater utility capital improvement needs.

As we continue to work with the agencies to finalize our commitment to protecting our region's streams and rivers, we will continue our efforts to establish a final implementation schedule acceptable to the agencies that maximizes our opportunities to benefit from the adaptive management approach and recognizes our responsibility to properly operate and maintain the system while responding to future requirements in an ever-changing regulatory environment.



Estimated Cost of Selected Plan in 2008 Dollars

Project Description	Estimated Cost (in Millions, 2008 \$)	
	Capital	Annual
Programmatic Elements		
Enhanced Monitoring and Modeling	\$24	\$1.0
Public Education and Outreach	12	---
Rain Gardens and Downspout Disconnects	5	---
Green Collar Jobs and Workforce Development	5	---
Blue River Watershed Management Plan	2	---
Subtotal, Programmatic Elements	\$48	\$1.0
Combined Sewer System		
Green Infrastructure Pilot Projects and Partnerships in CSS	\$28	\$1.40
Neighborhood Sewer Rehabilitation	122	---
Sewer Separation	104	0.26
Outfall Consolidation Piping	35	0.06
Increased Collection System Capacity	39	0.58
In-Line Storage and Other Improvements in Existing System	22	0.16
Distributed "Green" Storage (Outfalls 059 and 069)	40	2.00
Deep Tunnel Storage and Pumping	576	5.34
High Rate Treatment and Other WWTP Improvements	428	15.63
Subtotal, Combined Sewer System	\$1,393	\$25.44
Separate Sanitary Sewer System		
I/I Reduction	\$172	---
Increase Collection System and Pumping Capacity	26	\$0.03
North Bank Tunnel System	371	1.78
Tank Storage at 87 th Street Pumping Station	265	1.13
Interim Line Creek Wet Weather Treatment Plant	37	0.53
Additional Pumping Capacity and Wet Weather Treatment at Birmingham WWTP	72	3.16
Subtotal, Separate Sanitary Sewer System	\$943	\$6.63
TOTAL ESTIMATED COST	\$2,384	\$33.07

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THOMAS C. LEPPERT
MAYOR

Testimony

Of

Mayor Tom Leppert
City of Dallas, Texas

Subcommittee on

Water Resources & the Environment

Committee on Transportation & Infrastructure

United States House of Representatives

March 19, 2009

Chairman Johnson, Ranking Member Boozman and members of the Subcommittee, thank you for this opportunity to provide testimony regarding efforts to address urban stormwater runoff. I am Tom Leppert, Mayor of the City of Dallas, Texas, and I'm here to share some of our experiences in the management of stormwater runoff.

Just last week we were honored to host a Sustainable Communities Conference in Dallas along with the Region 6 Office of the EPA and the North Central Texas Council of Governments. This highly successful gathering attracted over 900 local, state, federal, and foreign officials, as well as private and not-for-profit interests. We feel the high attendance is indicative of the enormous and growing interest in and emphasis on this topic across the country. The focus of the conference was building partnerships and sharing ideas about green infrastructure, low impact development, and other sustainability initiatives. Some of the best practices related to stormwater mitigation issues and strategies included:

- Tree Mapping and Planting Modeling;
- EPA's Green Infrastructure Partnership;
- Rain Gardens, Swales and Grass Pavers;
- Pervious Concrete Design, Construction, and Maintenance; and
- Life Cycle Costs and Environmental Analysis of Pavement Types.

The conference included several presentations by City of Dallas staff including topics such as:

- Urban Forestry and Sustainable Landscaping;
- Downtown Parks and Green Spaces;
- Green Building Codes and Green Building Efforts;
- City of Dallas Green Fleet Program;

- City of Dallas Lawn Mower Exchange Program;
- Implementation of the City of Dallas Idling Restriction Rules;
- McCommas Landfill Enhanced Methane Recovery Project;
- Green Ratings for Cities; and
- Green Dallas.

The City of Dallas staffed an exhibit booth with information on our stormwater management program and on green infrastructure projects recently completed or under construction in the City. The exhibit booth and Dallas-led sessions were all well-attended and stimulated interest. There were many follow-up questions and conversations regarding programs and initiatives that we have implemented along our journey to sustainability.

Additionally, the conference provided an opportunity to share best practices with our colleagues from across the country. For example, there were great presentations on the rain garden program in Kansas City and Philadelphia's green infrastructure program.

We were honored to play an active role in planning and hosting the conference for a number of reasons. Perhaps chief among those is our genuine commitment to leadership in environmental stewardship – not just in our own municipal operations, but also in terms of working with the private sector. Not too many years ago, you would not have found the City of Dallas included on very many lists of what we now commonly refer to as “green” cities. Just in 2006, the City entered into a consent decree with the EPA, Department of Justice, and State of Texas to address issues with our stormwater management program particularly in the areas of staffing and

housekeeping practices at City service and operations centers. Two and one-half years later, we are emerging as a municipal leader in both areas and beyond.

- We have increased staffing in the stormwater management program by 67 percent compared to 2003 levels and are maintaining staffing levels required in the consent decree.
- We are maintaining compliance with required inspections of outfalls, industrial facilities, and construction sites, and have adopted a culture of continuous process improvement to continue exceeding these requirements.
- We implemented an environmental management system to provide an overall framework for managing factors that affect the environmental performance of the City. We also went the extra mile to have it certified by undergoing a rigorous third party evaluation under the International Standards Organization 14001 (ISO14001) standard for environmental management systems.
- We are making progress with the Department of Justice and EPA on modifying one of our supplemental environmental wetland projects to make it greener by incorporating a pretreatment cell to remove even more pollutants from stormwater runoff.

Beyond the consent decree, we have adopted a sincere commitment to environmental stewardship and leadership. We have adopted greener city policy and we are revising our development and redevelopment code to make it easier for the private sector to adopt sustainable practices and ultimately make these green practices the standard. This commitment to environmental leadership is evidenced by recognition from several state and federal agencies including:

- In 2008, Dallas is largest city to become a member of the EPA's National Environmental Performance Track Program, which recognizes organizations that go above and beyond their environmental legal requirements to reduce the environmental impacts of their operations.
- In 2006, Dallas was selected as the first city to pilot the EPA's Sustainable Skylines Initiative that officially kicked off in 2007. The purpose of the program is to develop a holistic approach to sustainability. As a result of our participation:
 - \$250,000 in initial funding has grown to \$4M by developing partnerships with local agencies, organizations, and others interested in sustainability;
 - Numerous taxi cabs are being replaced to reduce emissions with funding from a local private foundation;
 - 40 green Habitat for Humanity homes have been built and are now occupied; and
 - 400 gasoline powered private lawn mowers were replaced and recycled to help reduce NOx emissions, again with help from a local private foundation.
- We were the first major U.S. city to implement an environmental management system covering the vast majority of our major operations which entailed achieving ISO 14001 certification.
- 41% of our entire fleet of over 5,000 vehicles and pieces of heavy equipment are either hybrid or run on alternative fuels.
- And lastly, Dallas is one of the largest purchasers of green power in the country even among private entities.

I would like to focus my testimony today on sharing Dallas' perspective regarding three topics:

1. Our experience with green infrastructure and low impact development;
2. The challenges to expanding the use of green infrastructure and low impact development; and
3. The impact of recently passed legislation.

Green Infrastructure and Low Impact Development in Dallas

The City of Dallas, like many other cities, is extremely interested in expanding our use of green infrastructure and low impact development best management practices in order to manage the quality of stormwater runoff. Stormwater runoff is best treated as close to its source as possible rather than using “end of the pipe” structural control solutions. Dallas has utilized several green infrastructure techniques and tools to treat stormwater runoff at its source.

We have adopted a strategy to require more sustainable and greener buildings and implementation is underway. The City established a Green Building Task Force, comprised of for profit builders, nonprofit and affordable housing providers, the North Texas Home Builders Association and other stakeholders. The Task Force met for several months in 2007 and 2008 to develop a set of green building standards that would work for the City of Dallas. The Task Force recommended a two-phase implementation strategy for the Green Building program, which was adopted by the City Council in April 2008.

Phase 1 of the Green Building Program becomes effective on October 1, 2009. This phase requires that homebuilders construct their homes to be 15 percent more efficient than the base energy code and meet four out of six high-efficiency water reduction strategies, including low flow faucets, showerheads, and toilets as well as use of ENERGY STAR rated appliances.

In Phase 2, the ordinance requires all homes to be built to a standard such as the LEED for Homes or the Green Built Texas (GBT) standard. LEED is the system developed by the U.S. Green Building Council for designing, constructing, operating, and certifying green buildings. There are four levels of LEED ratings – Certified, Silver, Gold, and Platinum. This is where stormwater management guidelines, as set forth by LEED, are incorporated into the Dallas Green Building ordinance. Green Built Texas is an initiative of the Home Builders Association. The program's guidelines address strategies for improving energy efficiency, water efficiency, indoor air quality, material usage, site management, waste recycling, and cleaner electricity. This includes points toward a 20 percent water use reduction and a minimum 17.5 percent increase in efficiency over the base energy code or the performance of an ENERGY STAR for homes with a HERS rating of 83 or less. The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2006 International Energy Conservation Code) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy efficient it is in comparison to the HERS Reference Home.

For commercial projects, Phase 1 of the new ordinance requires that buildings *less than* 50,000 square feet must:

1. Be 15 percent more efficient than the base energy code;
2. Utilize 20 percent less water than required by the current Dallas Plumbing Code;
3. Incorporate EPA's ENERGY STAR low-slope roof requirements for roof surfaces with a slope less than or equal to 2:12; and
4. Comply with outdoor lighting restrictions in order to reduce light pollution.

For commercial projects larger than 50,000 square feet, Phase 1 requires buildings to meet 85 percent of the points required under the appropriate LEED rating system for a certified level. This includes one point for 20 percent water use reduction, and a minimum two points for 14 percent more energy efficient than the base energy code requires.

Phase 2, requires all commercial projects to be LEED certifiable under the appropriate LEED rating system, or an approved alternate green building standard. Additionally, each project must implement a 20 percent water use reduction and be 17.5 percent more efficient than the base energy code.

Already, the City of Dallas has a growing inventory of 27 green municipal facilities that were built to achieve LEED standards in the Certified, Silver and Gold categories.

For example, our new Timberglen Branch Library was designed to achieve **LEED-silver** certification. Among other features, it includes two 50,000 gallon underground cisterns used to collect stormwater runoff for irrigation and grey water reuse on-site. Not only does this feature save money by lowering the amount of potable water used for irrigation and non-consumption activities, it decreases the amount of urban stormwater runoff and allows us to manage the runoff close to its source. In the final analysis, this facility exceeded design expectations and was awarded a **LEED-gold** certification. We think our stormwater techniques had a lot to do with obtaining this higher LEED certification.

The design of our South Central Police Substation, also designed to achieve **LEED-silver**, obtained **LEED-gold** in the final analysis. The station opened in 2008 and includes a permeable pavement for its overflow parking area. Because the surrounding site was less densely developed, it was important to preserve greenspace and to treat the stormwater runoff prior to discharging it to the natural drainage system. Permeable pavement was selected as an appropriate tool in this instance and again we are able to manage stormwater runoff close to its source.

Green infrastructure and low impact development tools to address urban stormwater runoff were incorporated into the design of several additional municipal, LEED registered or certified projects constructed in the last several years including the new animal shelter, Fire Stations 33, 38, and 40, the Hensley Field Operations Center, the Northwest Service Center, the Bachman Lake Branch Library, and the Jack Evans Police Headquarters. A variety of green infrastructure practices were used on these projects including:

- Roof-top and ground level cisterns for collection of rainwater for use in irrigation;
- Permeable paving to reduce runoff and increase both infiltration and pollutant removal;
- Bio-retention for on-site stormwater runoff treatment prior to discharge off-site; and
- Separators to divert fire engine and apparatus wash water from the storm drainage system.

Another important effort underway is updating our development code to incorporate the concept of integrated storm drainage design to increase the use of green infrastructure and other low impact development tools. The goals are to incorporate drainage planning in the early stages of site development and to address post-construction control of urban runoff in a much more structured fashion. Both have been challenging tasks and I'd like to share some of these challenges with the Committee.

Challenges to Expanding Green Infrastructure / Low-Impact Development

One of the largest obstacles we are facing is obtaining the buy-in of developers and their engineers. Developers think that green infrastructure will add additional costs and some

indicate that they won't build in the first few cities that enact these requirements, preferring instead to develop in cities without these requirements. As a former CEO for a major international construction company I can tell you that building and developing green does not automatically mean higher construction costs and it is imperative for the sake of future generations that everyone begins to move in this direction and this has to start with education.

In order to successfully implement change in this area significant training resources will be necessary educate the developer and engineering communities. This is the only way to convince developers that incorporating green infrastructure into their planning does not mean making their projects infeasible from a cost perspective.

Our efforts to make our development code more green began by participating in a regional effort coordinated by the North Central Texas Council of Governments several years ago to craft an Integrated Stormwater Management (iSWM - pronounced "I swim") guidance document. To date, however, very few cities have adopted this regional document as part of their development code and very few developers are using it. As we prepared to adopt the guidance as part of our development code we conducted a very open and inclusive public involvement process and found home builders were not very receptive to the concept. As a result, we are utilizing a phased approach whereby we would initially upgrade our drainage design criteria to include use of the iSWM tools as recommended, but optional, in the first phase.

It is our hope that our phased in approach will allow the City and developers to use the integrated design practices without seeking waivers from the current standards and also provide additional time for an extensive education and outreach campaign. Phase two might include offering

incentives to developers to adopt these practices. For example if certain levels of green infrastructure and low impact development techniques are used, we may:

- Allow more dense development which adds directly to the developer's bottom line;
- Reduce parking requirements in warehouse and industrial projects, which again, positions the developer for additional profit; and
- Reduced of right of way width requirements in residential subdivision projects, which would puts money into the developer's pocket.

The City of Dallas would be the first city in Texas to implement such program. In Phase three, we would assess effectiveness and consider making the use of the green infrastructure tools mandatory. Again, we are looking at offering incentives to encourage the development community to adopt these more sustainable practices.

Earlier while highlighting some of the green design features of our South Central Police Substation I mentioned that we included permeable pavement on the overflow parking area. Ideally, to address both urban stormwater runoff and the heat island effect that plague urban environments, we would likely have chosen a pervious concrete application for all of the paved areas. Pervious concrete would not only help treat stormwater runoff but also reflect rather than absorb heat throughout the day, resulting in lower ambient temperatures, which leads to lower building cooling costs, which leads to lower energy consumption, which leads to reduced air emissions and fossil fuel consumption. Engineers have traditionally relied upon compressive strength as a key design element for concrete. Unfortunately, the porous nature of pervious concrete that allows it to allow runoff to infiltrate into the ground and remove pollutants also precludes the standard strength testing methods that have been used on traditional concrete for

decades. Determining the structural strength is crucial because it gives an indication of how much load or weight a pervious concrete pavement structure can handle. Basically, this drives the decision of whether it should only be used in the construction of sidewalks and light vehicle parking areas or if it can safely and cost-effectively be used to construct neighborhood streets. Having a standard method of assessing the material's strength is critical to expanding its use and realizing the tremendous potential of urban stormwater runoff and urban heat island benefits of pervious concrete. The American Concrete Institute has developed fairly robust design specifications for pervious concrete, but they note that additional work is needed in the area of determining the strength of the material. Perhaps this is an area in which Congress can direct the National Institute of Standards and Technology or some comparable group to address this issue.

The second challenge I would like to mention is again related to the expanded use of pervious concrete pavement, but also a number of other green infrastructure tools that we think have tremendous potential for addressing urban stormwater runoff and the urban heat island effect. Consistent with Dallas' commitment to leadership in the area of sustainability in general, we see a tremendous opportunity to significantly expand the use of these tools by serving as a model for municipalities throughout our region and beyond.

In order to do this, **it is necessary to equip and train city staff** to properly install and maintain green infrastructure. We see staff development as a huge opportunity to better position ourselves to install and properly maintain the types of green infrastructure that will be absolutely critical as we all move further along the journey of sustainability. In 1991, the City of Dallas created a stormwater utility in order to provide funding for compliance with EPA's unfunded municipal

stormwater mandates. The utility's first annual budget was \$8.25M. As the cost of compliance and the amount of infrastructure to maintain has increased over the past 17 years, so have the stormwater fees charged to our property owners. A 2008 survey of 58 stormwater utilities throughout Texas indicated that annual revenue ranged as high as \$51M and operations (including compliance) and maintenance were consistently reported as the primary expenses in each of those communities. In Dallas for the current fiscal year, the adopted budget is \$35.1M consisting of nearly \$30M in maintenance, operations and compliance expenses and approximately \$5M in debt service and administrative expenses. I see green infrastructure as a real opportunity to enhance environmental stewardship and potentially reduce the cost of compliance long-term. In order to take advantage of this opportunity, we must prepare our infrastructure maintenance staff in the means and methods of installing and maintaining green infrastructure. As leading cities located in diverse climates and geographies are able to show successful implementation of the various tools at our disposal, the result will be increased confidence among other cities to adopt these tools. I believe as more cities within a watershed implement and begin to require these tools as standard development practices, the cost of compliance for the watershed region will decrease over time. One method to make progress in this area is to ensure that municipal maintenance staffs across the nation are equipped and trained to install these tools as retrofits.

Recent Legislation

I commend the House of Representatives for the recently passed Water Quality Investment Act of 2009 (HR 1262). As you are aware, this legislation includes reauthorization of the Clean Water State Revolving Fund Program which is vital to the expansion of the use of green

infrastructure and low impact development tools. The legislation also provides important funding designated for small and rural communities which ultimately helps level the playing field by enabling smaller communities to address wastewater treatment needs and other funding to manage, reduce, reuse, or treat municipal stormwater including the use of low-impact development tools. When smaller communities get on board, regional watershed management becomes possible. We are also pleased that there is funding in the American Recovery and Reinvestment Act designated specifically for green infrastructure projects. This will be tremendously helpful in expanding the nation's use of green infrastructure to address stormwater management.

In Conclusion

I would like to commend the Subcommittee taking up the issue of urban stormwater runoff. I appreciate the opportunity to share from the perspective of a large city that has utilized several green infrastructure tools as part of our renewed commitment to environmental leadership. Despite current obstacles, cities across the nation like Dallas are implementing and supporting the expanded use of green infrastructure and low impact development tools and techniques. These tools are vital to addressing the overarching challenges of urban stormwater runoff and the urban heat island effect. Reauthorization of the Clean Water State Revolving Fund Grant program is vital to expanding the use of these tools and your continued support is appreciated.

Testimony of Howard M. Neukrug

Director, Office of Watersheds
City of Philadelphia Water Department

On Behalf of

The City of Philadelphia and
The National Association for Clean Water Agencies
(NACWA)

U.S. House of Representatives
Transportation and Infrastructure Committee

Subcommittee
on
Water Resources and Environment

March 19, 2009

Good morning, Chairwoman Johnson, Ranking Member Boozman, and members of the committee. My name is Howard Neukrug, and I am the director of the Office of Watersheds for the City of Philadelphia Water Department (PWD). I am honored to be here today to testify on behalf of my water utility, the City of Philadelphia and the National Association of Clean Water Agencies (NACWA), which represents the interests of municipal wastewater treatment agencies throughout the nation.

Opening Statement

Let me begin by getting right to the point: it is time for the Clean Water Act to acknowledge the linkage between land use and water resource protection and to set cities on a course towards a sustainable future. If we are going to rebuild the drainage systems of America's cities in order to harvest rain water and prevent stormwater from commingling with sanitary sewage in the first place, then the law needs to be revised to recognize the significant impacts land use policies have on local water quality.

Congress should direct the U.S. Environmental Protection Agency (EPA) to revise its 1994 Combined Sewer Overflow (CSO) Control Policy to require municipalities to adopt stormwater regulations and to encourage the use of green infrastructure solutions to water management.

We believe that it is incumbent upon EPA to develop ways to incorporate these ideas into their regulatory and enforcement framework. When cities invest in green infrastructure and other innovative, cost-saving strategies to manage their stormwater, they need to know they're going to get credit for it. There clearly is a better use for our money, such as the green programs being implemented in Philadelphia, that provide the model for a wise investment in a 21st century infrastructure. The rest of my testimony will clarify these points and, I hope, gain your support for this exciting vision that we have embraced for Philadelphia.

The Greenest City in America

A hallmark challenge of Philadelphia Mayor Michael Nutter's administration is to make Philadelphia "the Greenest City in America." He has created a new cabinet-level Office of Sustainability and a Sustainability Advisory Board representing public, private, and nonprofit interests from across our metropolitan area. In April, we will be launching our ambitious action plan to reduce our exposure to rising energy prices, limit our environmental footprint, and reposition our workforce and economic development strategies to leverage our enormous competitive advantages in the emerging green economy. The effort is being described as "strengthening our economy by reducing our environmental footprint."

As we finalize our strategy on how to become the Greenest City in America, it has become clear that a critical link must be forged to connect the Clean Water Act and its goals with those of sustainable 21st century cities. Two hundred years ago, Philadelphia became famous for many things, one of which was our water system and another, its Greene Country Towne. It is with great pride that I can say that we are now returning to our forebears' understanding of the connection between a green city and clean water.

Green Cities – Clean Waters

Philadelphia's declaration that it will be the greenest city in America is an energizing call to action for the PWD. As the department charged with ensuring optimal compliance with Philadelphia's federal CWA permit, we are striving to define an infrastructure management program that protects and enhances our region's waterways by managing stormwater runoff in a way that significantly reduces our reliance on increasing underground infrastructure. Like other major cities, we have enough fiscal concerns with maintaining the system we have, without having to actually increase its capacity.

Over the past year we have crafted a vision that focuses on the treatment of publicly-owned land, such as city properties, streets and right-of-ways that constitute 45 percent of the impervious land area of the city. This sustainable, environmentally beneficial treatment is known as green infrastructure and modifies the relationship between land and stormwater.

The goal of our green infrastructure program is to reduce the amount of stormwater runoff from the city's built environment by creating urban landscapes and streetscapes that also perform as stormwater infrastructure. We look at our city's streets with an eye that seeks sometimes modest and sometimes grand opportunities to peel back the existing concrete and asphalt to recreate a green element that welcomes the rain – storing, draining and cleaning it. Ideally, when we complete a public land transformation, the new green infrastructure will manage the first one inch of rainfall that would normally flow along its street gutters and into its storm drains within the targeted drainage area. Our focus is on creating new standards of sustainable urban design that will guide the development and redevelopment of American cities in the 21st century.

To that end, we firmly believe that money spent on stormwater management and the attainment of CWA goals should also represent money spent to improve the natural resources of the city and to enhance the community, while guiding us to new standards in sustainable urban design. This is why we are working to incorporate a Green Cities – Clean Waters approach into the larger citywide sustainability policy to address not only water resources issues, but to also address other environmental issues such as air quality, waste product reuse, urban heat island mitigation, carbon sequestration, and energy conservation.

Green Build Partnerships

However, we cannot implement a green infrastructure program in a vacuum. Retrofitting a street or public facility is certainly more costly than building new infrastructure as a component of a complete renewal project. For PWD to solely focus on retrofit opportunities, our limited funding will be poorly invested. We believe the ideal is a true citywide partnership, one that would result in an incredibly innovative, cost-effective, and transforming incremental approach to how city departments revitalize neighborhoods to make them healthier and more sustainable places in our little corner of the biosphere. Philadelphia's Sustainability Framework will be the key to focusing the water utility green infrastructure programs with the standards, protocols and building practices of other city departments and agencies.

And this new approach for a water and wastewater utility to fully embrace its water and land environment has received recognition, praise and support from our friends in the environmental and regulator communities. As just one example, in 2007, the Pennsylvania Resources Council, Inc., a

nonprofit organization formed with the goal of promoting the conservation of natural resources and protection of scenic beauty, bestowed its Leader in Sustainable Design and Development award on the Philadelphia Water Department for its innovative efforts in the area of effective and sustainable solutions to stormwater management.

In addition, the EPA has been a tremendous supporter of the efforts of NACWA, the Philadelphia Water Department, and other water sector utilities. We are working together to identify the mechanisms and policies needed to fully embrace the Green Cities – Clean Waters approach into the regulations and policies that are under the legislative umbrella of the Clean Water Act.

Needed: A 21st Century Sustainable Cities Interpretation of the CWA

With this little bit of background, I'd like to take this opportunity to seek your help.

Every day as my colleagues in other cities and I approach this new paradigm between clean water and the 21st century sustainable city, we are under the challenge to make these programs work within a 20th century interpretation of the goals of the Clean Water Act, which acknowledges the benefits and costs and risks of only one part of our environment – water. While this may seem very logical – after all it is the Clean Water Act and I am here representing the water and wastewater utility sector – the new solutions to our urban and environmental challenges are, as I stated above, incredibly linked to other environmental, ecological, and financial realities.

In Philadelphia and other cities, mayors and directors of local clean water utilities are working on solutions that embrace a more holistic approach to watershed management and stormwater control by employing non-traditional, “green infrastructure” approaches to limit, and eventually reverse, the negative impacts of past stormwater management practices. Yet these approaches, while encouraged by EPA, are simultaneously made difficult-to-impossible to implement by current regulatory practices which apply standards of construction scheduling and water quality goals that are unachievable using a green infrastructure approach.

This brings utility managers across the country back to hard, gray, single-goal oriented infrastructure as the only solution to their regulatory and consent ordered environmental programs. Like it or not, the reality is that implementing a sustainable approach takes a lot of time. It took 150 years of sewer construction to create the conditions that now exist; it will take 30 to 40 years to evolve our cities into fully sustainable, green urban centers for the 21st century.

So, despite the good wishes of our many friends at EPA, the state regulators, mayors, governors, Congress, and environmental advocacy groups, we remain burdened with doubt about the future of our programs by a sometimes myopic interpretation of how to achieve the goals of the Clean Water Act.

Stepping Back: From the 19th Century to Modern Day CWA

Our 19th and 20th century solution to stormwater management was designed to remove water from the urban environment quickly and safely, not to protect our water resources. The solution was to build a network of drainage pipes to move rainwater, along with other industrial, household and

human wastes, away from homes, streets and businesses for disposal into our rivers, lakes, streams and estuaries.

The CWA moved to address surface water protection by promoting significant national and local investment to capture and treat this piped waste before it entered our waterways. It has been extremely successful in controlling the release of wastewater during dry weather, but has had less success in controlling the increased volume of wastewater plus stormwater resulting from wet weather events. During heavy storms, the amount of water to be collected and treated greatly exceeds the capacity of our pipes and treatment plants. Thus, when it rains in many U.S. cities, rainwater and sewage overflow, adding pollutants mixed with storm run-off into our waterways. These are what we call combined sewer overflows or CSOs.

This problem has been exacerbated by the expansion of our cities, suburbs, and even the development of our rural areas. As more green space is paved over, the ability of the land to absorb rainwater is diminished, causing more water to be carried to already overburdened networks of pipes. Changing climatic conditions – especially changes in the intensity and frequency of rain events – also contribute to increased stormwater discharges, and combined sewer overflow events.

And perhaps most troubling is that, as a result of suburban development and poor stormwater management requirements, and despite great progress and huge expenditures by cities like Philadelphia to solve its CSO problem, at the end of the day, we will still have a polluted river.

National Pollutant Discharge Elimination System Permits

The primary vehicle for regulating stormwater, the National Pollutant Discharge Elimination System (NPDES) program under the Clean Water Act, was designed as the means for reducing the amount of pollutants entering our rivers, lakes, streams, and estuaries from municipal and industrial wastewater. In addition to establishing this federal NPDES permit program, the CWA authorized significant funding in the form of grants to help municipalities build and/or upgrade their existing wastewater facilities to meet secondary treatment standards. This program was an enormous success, and we still see its benefits today, even as we witness the steady decline of the federal government's financial commitment to clean water.

While managing stormwater is a basic service, it is also a huge challenge for most local government entities. Despite our best efforts and the best intentions of Congress and USEPA, municipalities still face myriad obstacles in curbing the impacts of stormwater in order to meet our water quality goals. First and foremost is the lack of adequate funding to upgrade our infrastructure sufficiently to meet stormwater requirements and other regulatory mandates.¹ As NACWA and others have testified before in this committee, our stormwater and wastewater infrastructure is old and crumbling and in desperate need of additional funding to finance its upkeep and rehabilitation.

¹ EPA, the Government Accountability Office (GAO), and the Water Infrastructure Network (WIN) estimate a \$350-\$500 billion funding gap for wastewater infrastructure over the next 20 years.

Meanwhile, the population continues to grow right along with the number of regulatory requirements imposed upon municipalities. Contaminants of emerging concern, nutrient controls, and the challenges associated with climate change place new burdens on our struggling communities. Climate change, in particular, could impose significant challenges, particularly if the result is more intense and more frequent storms taxing overburdened wastewater collection and treatment systems. Simply put, yesterday's sewer systems were not designed to handle today's challenges and an ever expanding set of regulatory requirements.

The National CSO Policy Does Not Encourage Green Solutions

In the early 1990s, EPA conducted a national advisory committee process that resulted in the development of the National CSO Policy. The goal for this process was to respect and account for the decade's worth of experience of EPA's stakeholders, resulting in a consensus approach to what, at the time, was regarded as the most reasonable means to solve the nation's CSO problems. However, as is the case for all such planning, the policy is a product of its time — a time which had only recently focused billions of dollars on facility and infrastructure improvements aimed to modernize wastewater treatment and minimize the impacts of point source pollution to our rivers and streams. This point source approach was extremely successful as we have witnessed with the increasing numbers of fish species in our rivers. But its success resulted in the need to address “that other pollutant” – uncontrolled stormwater. And the tools and methods that were instrumental in substantially eliminating point source pollution were not, and could not, be effective in the new challenge of managing stormwater.

Today I think we – environmentalists, engineers and the regulated and regulator communities — would all agree that stormwater management is most efficient and environmentally sound when the strategies that mimic nature are used – strategies that recognize that stormwater is a natural resource, a critical component of the hydrologic cycle that irrigates the earth and recharges our groundwater supplies as was nature's intention. Green infrastructure uses nature's designs and transforms trees, vegetation, and soil (when combined with manmade features) into the ultimate stormwater management systems. These GI innovations have happened only over the last 10 years in the United States. The stakeholders who helped develop the CSO Policy of the 90s could have not foreseen the initial gentle adoption and subsequent, full-blown enthusiasm for low-impact development techniques that pioneering cities employed to protect and restore their streams. But this would be the case for any specialty and the technologies that advance them. All policies should have the built-in capability to be revised and renewed based upon new, life-altering information and technologies.

The existing CSO policy, formed around the expectations that traditional, or “gray” infrastructure approaches, would be the preferred pathway to stormwater (combined sewage) control, must be flexible enough to allow revisions that reflect our new understanding about green infrastructure and other alternative strategies for addressing this growing water quality challenge. A surgeon would not use the tools or methods developed 10 years ago if they wished the best success for their patient. Utilities should demand, and be given, the opportunity to use the most cost effective, environmentally beneficial and rational solutions that are available to it to meet its Clean Water Act requirements – and the desires of its citizens who are shouldering the burden of these improvements.

Philadelphia is committed to meeting the goals of the CSO Policy, but it is also primed to meet these goals with the wealth of strategies that green infrastructure and traditional systems can offer. Our plea: do not demand that Philadelphia, or other cities that are passionate about watershed protection, as evidenced by our own 10 year focus on regional watershed protection solutions, settle for traditional solutions. These solutions can only be implemented through the construction and operation of massive tunnels and tanks, intended to store combined stormwater and sanitary sewage for later pumping and treatment. Enable us to do even better for our environment by blending the natural and traditional technologies that – in the end – will work the best while delivering multiple benefits.

In addition to concerns over capital financing for these gray systems and their inability to truly restore our waterways, the long-term operation and maintenance and energy required to de-water these systems after each storm make this approach unsustainable. These traditional approaches to stormwater and combined sewage management embody a never-ending requirement for the consumption of vast amounts of electrical power with the intent that the stormwater will be pumped and treated forever.

This traditional or gray infrastructure approach to stormwater management that the policy encourages also creates artificial, and often irreversible, boundaries to nature's water cycle – reducing groundwater infiltration (and thus groundwater tables and stream flows) as well as habitat and vegetation (and thus the natural conditions of transpiration and evaporation).

Perhaps the most important result of the policy's encouragement of gray approaches is that it has a pre-defined end-point that the system was designed to achieve. The system will never provide benefits beyond that end-point. When our cities are required to build a large, gray project for stormwater control under the policy, typically they are required to do so to their limit of affordability. This leads to the city spending all available resources on a project that will bring about a static water quality control result (often recognized as a condition of four-to-six uncontrolled overflows in a year that experiences average precipitation conditions). When the project is completed and the money is spent, the controlled condition will continue to persist (e.g., 4-6 overflows per typical year).

Absent some new initiative and some new source of funds, the area's now "protected" waterways will never improve beyond that condition. And, at the end of the day, we will still have a river that does not meet water quality standards because of the number of uncontrolled issues involving stormwater management.

However, when communities adopt green infrastructure regulations and design standards on redevelopment and capital investment that force the control of stormwater at the source, the water quality of the area's receiving waters improve with each new building project in the city. Over time, the improvements derived from a green approach to stormwater control eclipse those of gray approaches, and eventually they will lead to the virtual elimination of the problem of stormwater pollution in our urban areas.

It is evident that much of what I discuss here is understood by and being debated at EPA and elsewhere within and among agencies of the federal government. There are those sections of the agencies whose responsibility it is to enforce the CWA and the policy as they are now written, which does not readily encourage the use of comprehensive, sustainable solutions based on green stormwater infrastructure. However, others in the agencies are trying to encourage the incorporation of green stormwater infrastructure into the water planning process and to evolve new, forward-looking NPDES permits for U.S. cities².

Expansion of the traditional systems of gray infrastructure is not the sustainable approach to developing water quality solutions for the future. Simply put, yesterday's sewer systems were not designed to handle today's challenges and the ever-expanding regulatory regime, nor, more importantly, are they equipped to mimic natural stormwater management principles essential for true environmental restoration.

And isn't that what this is all about? Caring for our streams so that they are clean and thriving and beautiful again?

NRC Report Urges Changes to our Approach to Urban Stormwater Management

Just last fall, the National Research Council (NRC) issued a report, *Urban Stormwater Management in the United States*³, reviewing the Phase I and Phase II stormwater programs, addressing the challenges municipalities face in managing their stormwater, and recommending options for USEPA to consider. Among other things, the report cited a number of problems and inefficiencies with the stormwater program that badly need to be corrected in order for there to be noticeable improvements to the quality of our nation's waterways.

The NRC attributes these shortcomings in large measure to the fact that federal regulatory requirements have only been in place for about 20 years even though stormwater runoff has long been seen as a key source of water quality impairment. Laws mandating better stormwater control are often incomplete or conflict with state and local rules programs focused primarily on the flood control aspects of stormwater management. A more effective and holistic approach recommended by NRC for regulating stormwater discharges would include direct controls on land use, limits on the quantity and quality of stormwater runoff into surface waters, and rigorous monitoring of adjacent waterbodies. Moreover, EPA should focus on green infrastructure strategies that reduce impervious surfaces and stormwater flow volume.

We agree with the NRC's findings that "significant changes to the current regulatory program are necessary to provide meaningful regulation of stormwater dischargers in the future." In particular, the NRC goes further and embraces a strategy advocated by NACWA and being studied by

² EPA, *Use of Green Infrastructure in NPDES Permits and Enforcement*, joint Memorandum from the EPA Water Permits Division and Water Enforcement Division, August 16, 2007; and, *Green Infrastructure Statement of Intent*, EPA, NACWA, NRDC, LIDC and ASIWPCA, April 19, 2007

³ National Research Council. *Urban Stormwater Management in the United States*. The National Academies Press, Washington, D.C., October 2008. po (http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf)

Philadelphia and other cities – watershed-based permitting. “[T]he most likely way to halt and reverse damage to waterbodies is through a substantial departure from the status quo – namely a watershed permitting structure that bases all stormwater and other wastewater discharge permits on watershed boundaries instead of political boundaries. Watershed-based permitting is not a new concept, but it has been attempted in only a few communities.”

The Philadelphia Experience

As I have already indicated in my testimony, Philadelphia is one such community that is working – on a voluntary basis – to implement some of the innovative approaches identified in the NRC report and discussed among policy makers and the best minds in the country who are studying the future of clean water policy.

Philadelphia’s stormwater management program has been developed to include the right mix of infrastructure-heavy solutions, such as the construction of storage tanks with a strong commitment to green infrastructure solutions to provide control of stormwater at its sources. This allows the department to minimize the size of underground infrastructure and provide maximum benefits to Philadelphia’s waterways and to the community where construction is taking place. These programs have been fully integrated into a watershed management-based approach that uses land, waterway, infrastructure, and sustainability practices to support policies and programs targeted to protect Philadelphia’s drinking water supply and ensure the protection of fish and wildlife habitat. Whether it is through tree trenches, street/sidewalk planters, bioswales, rain gardens, porous pavement, green roofs, living walls or infiltration beds, these technologies maximize the benefits and re-use of rainwater. Nature has always provided the premier stormwater management benchmark; the Philadelphia Water Department is seeking to utilize green infrastructure practices to recreate those natural stormwater management benefits lost to urbanization.

These programs seamlessly complement the goals of the City’s GreenPlan Philadelphia initiative, which recognizes the necessity of sustainable green space and its positive impact on air quality, public health, and stormwater management.

Philadelphia’s green stormwater infrastructure approaches include:

- Some of the nation’s strongest stormwater regulations, that require developers to return land parcels to a condition much closer to how nature intended. This reduces the collective costs for managing stormwater in Philadelphia.
- A “cost of service” stormwater charge which encourages land owners to use their properties in a sustainable manner—using pervious pavement in parking lots, carving out green space on the site, or planting trees, for example—or pay more for the privilege of the city collecting their rain water for them.
- Encouraging developers and property owners to use green infrastructure approaches like green roofs to meet their stormwater requirements. This guidance already has made Philadelphia # 2 in the nation’s race to construct green roofs, behind our friendly rival Chicago, and nearly all of them have been created by the private sector.
- A first-in-the-nation urban wetlands registry to help developers identify sites for remediation as a trade-off for water takings or wetland losses due to construction activities. This encourages the re-development of our industrialized riverfront properties by expediting an

often arduous process with Federal agencies for wetlands protection. In addition, we have developed an evaluative tool to allow mitigation funds to be used to improve urban streams and wetlands in areas of the city often overlooked and under funded for such activities.

- Best-in-nation regional and statewide partnerships to manage our water resources. We are working together with our up-state and out-of-state partners to limit the impact our individual plans and actions can have on the greater environment.

The innovations in Philadelphia are just a few examples of how municipalities are demonstrating leadership on this critical issue. Other NACWA member agencies across the country have likewise stepped up to the plate with environmentally sustainable programs aimed at reducing the amount of stormwater entering storm drains and overtaxing our systems. A few examples include:

- Portland, Oregon, has created nearly 500 blocks of green streets, using vegetated curb extensions or street-side planters that collect stormwater runoff from streets, and is a leader in building eco-roofs to absorb stormwater and reduce the heat-island effect;
- In Milwaukee's Green Seams program, more than 1,600 acres of land have been purchased along area streams and shorelines, including wetlands, that will be preserved and serve to protect water by providing the ability to store rain and melting snow;
- Cities, such as Chicago, St. Louis, and Kansas City are employing the use of wetlands as storage areas for stormwater that also provide valuable habitat for migrating birds and wildlife.

These examples represent a growing trend among U.S. cities that are trying to get ahead of the curve in applying innovative green infrastructure approaches to address their water quality and other environmental issues. NACWA is working to support those efforts through a number of initiatives and collaborations with the goal of ensuring that our public member agencies can continue to ensure clean and safe water for generations to come.

NACWA's Efforts in Support of Green Infrastructure Solutions

NACWA was proud to join USEPA, the Natural Resources Defense Council (NRDC), American Rivers, and the Low-Impact Development Center on Earth Day in 2007 in signing a *Statement of Intent on Green Infrastructure*, which calls for "a collaborative effort among the signatory organizations in order to promote the benefits of using green infrastructure," and outlines a number of steps to be taken in this regard such as development of models for all components of green infrastructure and exploring regulatory incentives for the use of green infrastructure. NACWA has also been working with USEPA on a strategy for utilizing green infrastructure as a way to reduce stormwater and sewer overflows.

The association also joined with NRDC, American Rivers, and other groups in advocating for the inclusion of a set aside for green infrastructure projects in the *American Recovery and Reinvestment Act* (H.R. 1). We are also working with this coalition on a legislative proposal to establish a national pilot program to promote green infrastructure approaches to managing stormwater by providing incentives to more communities. And, NACWA is working with The Conservation Fund on a pilot course, *How Green is My Infrastructure? A Regional Approach to Municipal Planning and Investment*, to be held in Shepherdstown, W. Va., in April. This course offers strategies on implementation of green infrastructure specifically designed for public utility managers and officials, with an emphasis on how

utilities can initiate, fund, construct, and maintain green infrastructure projects and address their water supply and water quality needs.

Finally, recognizing the need to create a high-level forum to look at water holistically, NACWA recently founded the Clean Water America Alliance (Alliance), of which I am a board member. The Alliance is an organization whose mission is to explore the complex issue of water sustainability and advance holistic, watershed-based approaches to water quality and quantity challenges. With visionary leadership that embraces innovation, the Alliance promotes the concept that water is water, and we as a nation need to consider the management of water resources on a holistic basis with a focus on the nation's urban centers. The Alliance will set the tone and be the catalyst for developing and implementing an integrated national water policy to address the interconnected water quality and quantity challenges before us, including stormwater, and help promote and advance environmentally sustainable communities.

As the competition for limited natural resources, especially for water, grows, we must be mindful of the need to shift the paradigm for how we managed these precious assets. The Alliance brings together some of the best minds in the water community, including three former EPA assistant administrators, as well as industry, engineering, environmental/conservation, academic, utility, and local and state leaders who will help us formulate 21st century solutions for moving forward in a smarter, more holistic fashion.

NACWA is also working to advance this holistic thinking through its Watershed Task Force, which is in the process of drafting a 21st Century Watershed Act. While we recognize and applaud the significant improvements made in water quality in the last 36 years, we have reached a plateau—or should I say we are treading water—in terms of what we can achieve unless we start to think differently about how we manage our precious water resources.

Finally, NACWA is actively engaged in efforts to promote the establishment of a Clean Water Trust Fund to assist municipalities in meeting their clean water goals, including support for green infrastructure and water-based approaches. We very much appreciate the support of this subcommittee and the full T&I Committee in working with us to help make a trust fund, similar to what's available for airports and highways, a reality and stand ready to assist you in any way to attain this vital objective.

Recommendations

To summarize, I cannot over-emphasize the importance of updating the Clean Water Act to acknowledge the linkage between land use and water resource protection and to set cities on a course towards a sustainable future. This effort should include revisions to the CSO policy and how it is applied.

A not so obvious result of the way in which the policy is currently applied for CSO control is that if cities are forced to do any substantial amount of gray, it actually makes the implementation of a green approach impossible. In short, forcing expenditures on any significant amount of gray infrastructure into a CSO control program causes the program to become too expensive to afford keeping the green approaches in the mix.

If allowed, the efforts of NACWA, Philadelphia, and other cities to promote innovative solutions and take a more holistic view of water resource management will result in significantly greater environmental benefits than the current approaches. As currently enforced, however, cities with CSO control programs are faced with three unsatisfactory choices:

- Adding some green infrastructure to a full program of gray infrastructure resulting in costs far above the affordability limit;
- Abandoning the green approach to meet current regulations, thus losing significant environmental and social benefits to meet the overflow targets;
- Going with the green approach with the risk that the regulator communities will not accept your green, sustainable approach to water management based on their interpretation of what is an acceptable CWA CSO Control Program.

Cities across America are committed to spend up to their affordability limits to solve this significant pollution issue. The question then becomes how to balance a positive, proactive program to reduce sewage overflows to rivers and streams, while making the most of this opportunity to move our cities and towns forward to be more green and sustainable.

To promote the sustainable, green approach, EPA needs to revise the National CSO Control Policy to require municipalities to adopt stormwater regulations and to encourage the use of green infrastructure solutions to water management. If they don't, it is up to Congress to amend the CWA to legislate this outcome. At any rate, when the CWA is reauthorized, it should not incorporate the Policy until it has been changed to allow and encourage the use of green solutions.

We believe that it is incumbent upon EPA to develop ways to incorporate these ideas into their regulatory and enforcement framework. When cities invest in green infrastructure and other innovative, cost-saving strategies to manage their stormwater, they need to know they're going to get credit for it. There clearly is a better use for our money, such as the green programs being implemented in Philadelphia to provide the model for a wise investment in a 21st century infrastructure.

Congress should:

- Recognize that the Clean Water Act does not fully address the needs of 21st century urban waterways. A fundamental shift in how we view and manage the urban landscape is needed.
- Clarify its desire for utilities to implement watershed based, green infrastructure solutions to stormwater management. This will require the acceptance of the innovative nature of these approaches and the ability to apply adaptive management approaches to their implementation.
- Direct the EPA to reconsider how the CSO Policy is applied to provide flexibility that will allow cities to evolve to green, sustainable urban centers. Strict overflow targets must be balanced against the impacts of other impairments. An integrated solution that uses Triple Bottom Line accounting (to balance ecology, social and financial needs) would favor solutions that address open space, habitat restoration, and other approaches that will

achieve the best environmental result for the dollars spent and, ultimately, best meet the CWA.

- Recognize that stormwater control solutions can and should address more than a simple reduction in intermittent pollutant loads, but can be structured to improve the triple bottom line i.e., air quality, aquatic habitat, human health and the urban living environment.

Congress should be aware that NACWA and its partners are working on language for new environmental legislation called the *21st Century Watershed Act*. This legislation will allow us to address these ongoing water quality challenges on a more holistic basis.

Congress and EPA should also support more money for research to help us measure the effectiveness of non-traditional techniques but also provide funds needed by cash-strapped communities to implement an effective stormwater control program as called for in the NRC report. Congress should also support long-term, sustainable funding for our clean water infrastructure through a Clean Water Trust Fund.

The opportunities and the benefits of green stormwater programs are too great, and the potential for failure and an unsustainable future for our urban centers is too unacceptable for us to fail to act. We need your help to frame policy and enforcement strategies that meet the goals of the CWA through implementation of green and sustainable cities.

Madam Chair, we look forward to working with you and the other members of Congress on accomplishing these important goals. Thank you very much, and I will be happy to take any questions.



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Testimony of the National Association of Flood
And Stormwater Management Agencies

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Efforts to Address Urban Stormwater Runoff

U.S. House of Representatives
Committee on Transportation and Infrastructure
Subcommittee on Water Resources and Environment

Rep. Eddie Bernice Johnson, Chairwoman

March 19, 2009

The National Association of Flood and Stormwater Management Agencies (NAFSMA) is very pleased to submit this testimony regarding “Efforts to Address Urban Stormwater Runoff” on behalf of its membership.

Background on NAFSMA

NAFSMA is a 30-year old national organization based in the nation’s capital that represents close to 100 local and state flood and stormwater management agencies, most of which are in large urban areas. Its members serve a total of more than 76 million citizens by providing flood and or stormwater management and as a result, the association has a strong interest in the proposed discussion on urban stormwater runoff.

The mission of the Association is to advocate public policy and encourage technologies in watershed management that focus on issues relating to flood protection, stormwater and floodplain management in order to enhance the ability of its members to protect lives, property, the environment and economic activity from the adverse impacts of storm and flood waters.

It is important to note that many of NAFSMA’s member agencies are currently Phase I or II jurisdictions falling under the Clean Water Act’s NPDES Permit Program.

Formed in 1978, NAFSMA works closely with the U.S. Environmental Protection Agency, the Corps and the Federal Emergency Management Agency to carry out its mission. NAFSMA members are on the front line protecting their communities from loss of life and property, while protecting and if possible, improving the quality of the nation’s surface and ground waters. Therefore, the organization is keenly aware that all options for mitigating damages that can be caused by urban stormwater runoff should be considered as tools to meet clean water goals.

NAFSMA is pleased to present these views and suggestions on efforts to address urban stormwater runoff and understand the focus of today’s hearing is on Green Infrastructure and low impact design approaches. We will be sharing with you the opinions of our member agencies as they relate to general comments on these approaches, barriers to their implementation and recommendations for alleviating these barriers.

General Comments on Green Infrastructure and Low Impact Design Approaches

NAFSMA supports the spirit and intent of the Clean Water Act and the use of tools such as the NPDES Permit Program and adaptive management to help jurisdictions determine the appropriate activity towards protecting and cleaning the nation’s waters.

Many agencies, represented by our members throughout the country, at their own expense and without Federal funding, are making significant improvements in managing stormwater quantity and quality and have been largely successful in awakening their residents, businesses and leaders to the importance of reducing pollution resulting from non-point sources. Non-point source pollution is caused by rainfall and snowmelt runoff that moves over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.

NAFSMA believes that it must be recognized that non-point sources of pollution cannot be addressed the same way as point source pollution resulting from activities like industrial or municipal sewage treatment plants. It is impractical and most likely impossible for local jurisdictions to use end-of-pipe treatment techniques (treatment plants) to reduce pollution from non-point sources as is customarily done for point sources. Management of non-point sources is more appropriately performed through better site planning and design measures, as well as “best management practices” such as public education on non-point sources, public involvement in protecting and cleaning waterways, non-structural and structural solutions such as zoning and land use rules, Green Infrastructure and conventional stormwater management.

For purposes of this testimony, Green Infrastructure will be considered, as defined by the US EPA, “...An adaptable term used to describe an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide utility services. As a general principal, Green Infrastructure techniques use soils and vegetation to infiltrate, evapotranspire, and/or recycle stormwater runoff. When used as components of a stormwater management system, Green Infrastructure practices such as green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits.”

Low Impact Design techniques are intended to produce a hydrologically functional site that mimics predevelopment conditions. For purposes of this testimony, we will consider low-impact design approaches to be a component of Green Infrastructure.

NAFSMA would like to acknowledge that many of the Green Infrastructure techniques are very successful in reducing the amount of runoff, as well as certain pollutants from stormwater runoff, such as total suspended solids, nitrogen, certain metals and even bacteria. However, data shows that in certain cases some of these practices actually cause increased levels of nutrients in runoff as well and we have to be careful of its wholesale application throughout the country without

further research. We encourage their use in those areas where site conditions are suitable, and should be considered an important strategy in managing stormwater runoff. Green infrastructure techniques should be considered along with other complimentary strategies to provide for flexibility and innovation. We by no means want to state an all encompassing opposition to the use of Green Infrastructure or low impact design techniques; rather, we propose a balanced approach to the use of Green Infrastructure together with, and as a supplement to conventional stormwater management.

As described by the EPA, NAFSMA considers Green Infrastructure to be a “component” of a stormwater management system, appropriate in certain situations, but by no means the sole solution or even generally preferred method of addressing the nation’s water quantity and quality management. As such, we provide the following barriers to implementing Green Infrastructure.

Barriers to Implementing Green Infrastructure

NAFSMA believes Green Infrastructure should neither be prescribed as the preferred tool for addressing stormwater quality nor used in a regulatory fashion. The following information reflects our opinions as to why Green Infrastructure should remain simply a component of a stormwater management system and/or an optional mechanism for complying with the Clean Water Act’s Permitting Program. Our opinions are listed in no particular priority order.

1. Green Infrastructure is not more appropriate for some parts of the country, but not for others.

Green Infrastructure techniques such as rain gardens often rely on infiltration of stormwater runoff into the ground as a means of both filtering the pollutants out of the runoff as well as recharging the groundwater. In areas where ground infiltration occurs readily, this process works well. In other areas of the country, the naturally occurring clay and plastic soils limit infiltration measures, making them very difficult, ineffective and expensive to construct and maintain. These areas rely on modifications to Green Infrastructure techniques including, but not limited to providing pipe systems to drain the system artificially, thus providing treatment with minor reductions in runoff and little groundwater recharge. If Green Infrastructure is to be used in such areas, it will be necessary to supplement those techniques with conventional stormwater management techniques to achieve pollutant removal efficiencies necessary to meet regulatory requirements and accomplish clean water goals.

In this respect, it is important to note that different management techniques are available to address runoff at different spatial scales. Green Infrastructure techniques are designed to address the smallest scale at the parcel or neighborhood scale, and this is considered desirable from a point source control point of view. However, there are major efforts at watershed planning in our country where a system of integrated regional facilities are part of a system of controls that also can be cost effective in protecting our receiving waters.

Thus, Green Infrastructure may be an appropriate response to urbanization in some regions and communities, but not so for other locations. For example, in some parts of the country such as the Southeast, a primary degradation concern is stream bank erosion. In such areas of naturally erosive soils, a large contributor of pollutants to streams and rivers and the ponds and lakes they feed, is sediment generated from the streams themselves. In such situations, it is clearly necessary to control excess runoff through the utilization of techniques that control the quantity of runoff and may include conventional stormwater detention techniques, as well as Green Infrastructure. Again, the key is to provide planners and managers flexibility in selecting the most appropriate mix of management tools, taking into account the site conditions, planning opportunities, and beneficial uses of receiving waters subject to stormwater discharges.

In addition, infiltration of surface waters to groundwater has been shown to, in some instances, increase certain pollutant concentrations in groundwater. These potential risks must be considered when evaluating Green Infrastructure as a stormwater system component.

Frequent reference to incorporation and implementation of "LID principles" are made. A clear goal and definition of these LID principles as they apply to various climates, such as semi-arid Riverside County, California is needed to ensure a consistent understanding of compliance expectations. It is particularly important to ensure that these principles do not conflict with water conservation or urban density policies, objectives, or requirements. LID principles for coastal or wetter areas may not be applicable to the warmer and more arid climates. For example, use of green roofs in these areas needs the installation and use of lawn watering systems, increasing water consumption. We would like to emphasize that LID is a tool to achieving compliance, and it is not desirable or appropriate to require implementing LID as a compliance measure.

2. **Green Infrastructure may be appropriate for developments such as larger lot single-family development, but can be problematic for higher density development.**

Green Infrastructure techniques are commonly based on controlling stormwater at the source by the use of *micro-scale controls that are distributed throughout the site*. Proponents often claim Green Infrastructure is useful for managing stormwater in high density development where a small development footprint on the landscape can be achieved. This may be true in certain situations; however, our experience is that in high density development, the land comes at a premium, available at all, and utility of the land for parking, buildings and pedestrian movement often prohibits even the small amount of property required for rain gardens, vegetated swales or infiltration trenches. Moreover, we are sensitive to geotechnical concerns regarding infiltration near foundations or steep slopes, which may limit the applicability of some Green Infrastructure techniques. Given this space limitation, it is often more prudent to allow higher density development to participate in paying for more conventional measures like dry and wet detention basins that serve a more regional function.

3. The development market place has not shown broad support of Green Infrastructure techniques.

Green Infrastructure, by its very nature, involves the use of systems which have to be placed on private home property and require perpetual property owner responsibility and expense. While this would appear to offer the benefit of nature up close and personal, many buyers want a cleaner, more well-defined streetscape and lawn area that offers close to maintenance-free assurance. In addition, Green Infrastructure application also requires extensive local government oversight and administration. Our position therefore is that we must educate our citizens and developers about the utilization of Green Infrastructure techniques, and when and under what circumstances they are appropriate, and that endorsement of Green Infrastructure strategy is not desirable in general, and certainly not at this somewhat early stage.

4. Green Infrastructure could mean an exponential increase in the number of measures and facilities being implemented, operated and maintained in a municipality.

Since the techniques employed in Green Infrastructure seek to mimic pre-development conditions, it is necessary to capture stormwater runoff at or near its source. In other words, the runoff cannot travel very far before it needs to be captured, slowed and infiltrated to appropriately mirror the pre-developed hydrology. This requirement creates the need to construct many small structural features, such as rain gardens to accomplish this. Conventional stormwater management allows the runoff to be carried further

downstream, into regional facilities. It is not unreasonable to expect an increase of 10 – 40 or more times the number of actual treatment facilities required by using Green Infrastructure versus conventional stormwater management. Being able to capture a larger drainage area in fewer structures (albeit larger ones) allows the construction, oversight by the permit holders, administration, maintenance and rehabilitation to be focused in fewer areas of the development. As a result, administration and maintenance is simplified, aesthetic and functional issues are more easily addressed, the inspection and logistics of repair are reduced, and effectiveness of performance is more easily maintained.

We have found that it is often very difficult to get private homeowners or Homeowner Associations to adequately maintain the many rain gardens and swales that invariably have to be constructed on or very near private property. It is even more challenging when these facilities on private properties will need to be rehabilitated. The decentralized approach conflicts with the homeowner's sense of what is their property, and what can or cannot be done in these areas, as well as creates issue over what *must* be done to keep the devices functional. This has the potential to become a significant administrative burden.

5. The financial burden of Green Infrastructure has the capacity to be much greater than conventional stormwater management.

Studies and actual results of programs run by our member agencies have shown that the costs of not only capital construction, but even more so, costs associated with administration, maintenance and rehabilitation of Green Infrastructure can be much higher than conventional stormwater management. A study in the Denver, Colorado area showed that total costs for construction, administration, maintenance and rehabilitation of rain gardens to be over six times the costs for conventional stormwater management techniques in a 50-year life cycle analysis of a given site. The 50-year analysis showed the total costs for a 100-acre multi-family development be approximately \$38 million (Green Infrastructure) compared to approximately \$6 million (conventional measures).

This cost has to be borne by both the private property owner, through individual costs or Homeowners Association dues, and the municipality providing administration of programs requiring the measures or the complete assumption of all these facilities by municipalities, which complicates their use even more. The home and/or business owner eventually pays, either through self financing or supportive funding of governmental stormwater programs through fees and/or taxes.

In Charlotte, North Carolina, we have shown that in some high density areas, a practical physical solution for managing water quality on-site is a Green Infrastructure technique called porous pavement. However, the construction costs alone for this measure are approximately \$200,000 per acre, compared to \$25,000 - \$40,000 per acre for bio-retention ponds to a low of \$10,000 per acre for conventional stormwater management ponds. It is clear that in even the most difficult of economic times, conventional measures can be affordable to build and maintain, while assuring continued performance. Conventional measures can also be as effective and attractive, while providing other ecological benefits (such as wildlife habitat and open space) as Green Infrastructure features.

That said, there are studies, including studies that indicate cost savings associated with Green Infrastructure. In some instances, comparing Green Infrastructure to conventional techniques in their pollutant removal role is valid; however, we must not forget that stormwater management also involves making sure the capacity of the system is adequate to handle flood waters and provide for public safety. Green Infrastructure inherently promotes the use of small structures to catch the “first flush” of runoff to treat the pollutants through infiltration. To make this happen, you have to have more structures capturing small amounts of water so that they are not overrun in larger runoff events. Even with Green Infrastructure being in place, there still needs to be a by-pass system large enough to keep our homes, businesses and streets from harm’s way of flooding. As a result of this necessity, the claimed cost savings of Green Infrastructure approaches may be appropriate for water quality, but do not include the costs required for flood management.

6. Lawsuits by environmental groups (claiming Green Infrastructure should be mandatory) is taking money away from, and delaying implementation of, effective stormwater management programs.

In the State of Washington, a recent ruling by the Washington Pollution Control Hearings Board, ruled in favor of writing certain Phase II NPDES permits to make Low Impact Design (LID) “allowable when feasible”, rather than “mandatory when feasible”. The Board recognized that there are many issues to be resolved concerning the feasibility of LID, construction and performance standards, technical guidance and acknowledging that LID is still relatively new and should not be mandatory.

Many State agencies are requiring Green Infrastructure or LID to be used in all development regulations, despite concerns cited by the Washington Board.

The cost of defending lawsuits focused on making LID mandatory is taking away money that could be used for testing new Green Infrastructure techniques to learn what does and does not work best.

7. Technical and local barriers exist that will take time and education to overcome

Discrepancies and contradictions with new LID strategies exist in the existing local regulations such as building, fire, plumbing, or health codes. (For example: mosquito issues with rain barrels, turf requirements and incentives for drought tolerant planting, health concerns with stormwater reuse, etc.). Developers and design professionals have not yet transitioned from conventional site design practices to new LID design concept. Furthermore, LID designs have not been standardized for wide application and easy enforcement. Design reviewers or building plan checkers must have standard procedures in place and be trained in LID design concepts.

8. LID needs to complement and support Smart Growth (anti-sprawl) development concepts and other regional planning activities

It is important to think about scale when considering low impact development. Low Impact Development is often equated with local, distributed BMPs on individual sites. In fact in recent draft stormwater permits in California the overriding desire to mandate LID implementation through the use of limiting effective impervious areas will actually exacerbate urban sprawl. LID needs to be balanced with Smart Growth (transit friendly and anti-sprawl) development concepts and other regional planning activities such as Habitat Conservation Plans, Special Area Management Plans, etc. Both large and small scale activities need to be identified and credited.

9. LID cannot be defined as a specific or effective impervious area for permitting purposes.

Due to varying site soil, slope and rainfall character, it is not possible to standardize LID (Green Infrastructure) to equal an effective impervious area. Permittees support the concept of using a prioritization system to ensure that proposed LID BMPs promote

infiltration, reuse and/or evapotranspiration and are encouraged prior to considering more traditional treatment control technologies where physically and financially feasible.

Recommendations for alleviating the barriers

1. Increase funding for research and science for stormwater management.

It is clear that there is a real need for more study and research into the relationships between stormwater and receiving water quality. While there are opinions from all sides on what is most effective, the best strategy is one that allows one to develop an integrated control strategy in the context of site conditions and constraints, regional planning efforts, and institutional and political opportunities. Funding for pilot programs along with monitoring of both site-level and watershed-level effectiveness is needed to make good decisions. This monitoring is very expensive, requires significant amount of time and is often financially impossible for local jurisdictions to accomplish on their own. Federally-funded grants and supportive programs are needed to supplement what many of our member agencies are already trying to do on their own, which is utilize the EPA-recommended approach of adaptive management to improve on what we learn by trying different approaches, then monitoring their effectiveness before revising the approach. This takes many years and huge amounts of money to accomplish and if the responsibility continues to fall on the local jurisdictions, we will lose.

2. Continue to educate and involve leaders, municipal officials, developers and the public on stormwater management issues.

One of the most useful best management practices for protecting and improving water quality is education and public involvement. We need to continue to highlight the need for educating everyone on known causes of water quality pollution and help them find ways to participate in protecting and cleaning the nation's waters. Each person plays a role in environmental stewardship, whether as a human being, resident, official or professional. Knowing how we can effectively support clean water goals in our role is the first step to meeting those goals.

3. Congress should encourage, rather than mandate Green Infrastructure when and where feasible and economically sustainable.

NAFSMA supports the Washington Pollution Control Hearing Board ruling of encouraging rather than mandating Green Infrastructure and requests that in any

Congressional considerations regarding the use of LID or Green Infrastructure requirements in the Phase I or II NPDES permit programs, that these techniques not be made mandatory, but remain optional or allowable.

We believe this direction from the Federal government would go a long way in promoting what the EPA has stated as their goal of using an adaptive management philosophy of managing stormwater and related receiving water quality. It is this adaptive management process that will allow us to scientifically and procedurally remove methods that in the long run may turn out to be too costly, ineffective and infeasible, thus also not meeting the "Maximum Extent Practicable" basis of NPDES permitting.

**TESTIMONY OF
MICHAEL H. SHAPIRO
ACTING ASSISTANT ADMINISTRATOR FOR WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY**

**BEFORE THE
SUBCOMMITTEE ON WATER RESOURCES AND ENVIRONMENT OF THE
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
UNITED STATES HOUSE OF REPRESENTATIVES**

March 19, 2009

Madam Chair and members of the Subcommittee, I am Michael H. Shapiro, Acting Assistant Administrator for Water at the United States Environmental Protection Agency (EPA). I appreciate the opportunity to provide EPA's perspectives on the important issues associated with urban stormwater and green infrastructure.

Introduction

Stormwater pollution from point sources and nonpoint sources is one of our nation's most challenging water quality problems and is a significant contributor to the impairment of the country's streams, rivers, and watersheds.

Unlike pollution from industry or sewage treatment facilities, which is caused by a discrete number of specific sources, stormwater pollution derives from a very large number and variety of sources. Rainwater and snowmelt run off lawns, parking lots, streets, farms, and construction and industrial sites. It picks up fertilizers, soil and sediments, pesticides, oil and grease, heavy metals and many other pollutants on the way to our rivers, lakes, and coastal waters. The impermeable surfaces of our traditional urban and suburban landscapes also result in increased stormwater volume and rates.

Smaller tributaries and even larger streams cannot accommodate the increased water volume and flow that occur immediately following rainfall and snowmelt events, leading to eroded streambanks, incised channels, streams choked with sediment, destroyed aquatic life and aquatic habitat, and increased flooding and property damage.

In September 2007, the EPA Inspector General concluded that stormwater discharges in the Chesapeake Bay associated with increased impervious surface area, which was attributable to development were far outstripping gains made from addressing other sources of degradation. Addressing the actual volume and rates of stormwater discharges into the Bay watershed, as in many other watersheds, is the primary challenge for protecting and restoring the integrity of this system.

Stormwater also transports excess nutrients to our surface waters. Nutrient pollution, or excess nitrogen and phosphorus in the natural system, is also responsible for a large proportion of water quality impairments in the U.S. It threatens water quality, human health, and habitats across the nation. Nutrient pollution is a national issue of widespread and growing environmental urgency. Across the nation, nitrogen levels in water are climbing and phosphorus pollution is spreading.¹ Further, EPA has seen little progress in removing waters impaired by nutrients from the impaired waters lists. Without changes, data indicate that the U.S. may lose ground on the environmental progress in responding to the pollution of the nation's waters achieved over the past four decades.

In addition to these problems, many older cities (including many of the largest cities in the United States), have combined sewage and stormwater pipes which periodically—and in some cases frequently—overflow due to precipitation events. Moreover, piped stormwater and combined sewer overflows (“CSOs”) may also, in some locations, have the adverse effects of upsetting the hydrological balance by moving water out of the watershed, thus bypassing local streams and ground water. Because stormwater pollution is caused by so many different activities, green infrastructure is a promising approach for reducing stormwater pollution and improving our nation's water quality.

¹ Information obtained from a comparison of the national summary tables and charts for available water quality data reported by the States to EPA under Section 305(b) and 303(d) of the Clean Water Act.
<http://www.epa.gov/waters/ir/index.html>

The Advantages of Green Infrastructure

Green infrastructure represents an effective response to a variety of environmental challenges that is cost-effective, sustainable, and provides multiple desirable environmental outcomes. EPA's Office of Water initially endorsed green infrastructure because of the benefits for managing wet weather and wet weather-related events, including stormwater, combined sewer overflows (CSOs) and nonpoint source discharges. However, as will be emphasized here today, green infrastructure provides a variety of other benefits as well.

In October 2008, the National Research Council released the study: *Urban Stormwater Management in the United States*. Among other findings, the study concluded that stormwater is a serious source of impairment to the waters of the U.S., and that the National Pollutant Discharge Elimination System (NPDES) program can take a number of actions to reduce those impairments and improve water quality. As land surfaces are paved and stormwater discharges are carried directly to waterways via pipes and other conveyance systems, the natural hydrologic cycle is preempted. The National Research Council study highlighted the importance of managing stormwater rates, and recommended a focus on the use of technologies that capture, infiltrate and evapotranspire stormwater.

With respect to wet weather management, green infrastructure techniques use exactly those mechanisms of stormwater collection, infiltration and evapotranspiration by utilizing natural systems, or engineered systems that mimic natural landscapes, to capture, cleanse and reduce stormwater discharges using plants, soils and microbes. Green infrastructure can also support reuse of rainfall, thus also reducing the volume and impacts of stormwater discharges to water quality.

On the regional scale, green infrastructure consists of an interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands) that improve water quality while providing recreational opportunities and wildlife habitat. When discussing green infrastructure at large geographic scales, it is also important to consider the value of open space preservation and natural resource protection for purposes of wildlife

habitat and other ecological functions. On the local scale, green infrastructure consists of site-specific management practices (such as rain gardens, porous pavements, green roofs and cisterns) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls, and by returning it to the atmosphere via plants.

Green infrastructure has a number of other environmental and economic benefits in addition to improving water quality, including: recharge of ground water and surface water supplies; cleaner air; reduced urban temperatures; reduced energy demand; carbon sequestration; reduced flooding; community benefits, such as improved aesthetics; improved human health; additional recreational and wildlife areas; and potential cost savings associated with lower capital costs for paving, curb and gutter, and building large stormwater collection and conveyance systems.

EPA is reaping many of the benefits of green infrastructure less than one mile away at our Headquarters Federal Triangle complex. As part of a larger effort to beautify our Headquarters and demonstrate more environmentally sound building and landscaping techniques, in June 2007, we unveiled a green project in our Ariel Rios South building's courtyard. It showcases green infrastructure techniques including rain gardens, bioretention cells, permeable concrete and pavers, and a cistern, which reduce runoff from storms and can lessen sewer overflows. In addition to the courtyard, we have added four additional rain gardens on the perimeter of our buildings. Stormwater runoff is also being diverted from the EPA West building roof into six 1000 gallon cisterns located in the below grade parking garage. In an excellent example of water reuse, the cistern water is being used to irrigate planting beds and grassy areas. Working with our partners at GSA, these projects have helped showcase how building design can minimize the impact to our natural environment.

There is an ever growing interest and excitement by communities across the country in green infrastructure approaches. Cities such as New York City, Louisville, Cincinnati, Kansas City, Philadelphia, Seattle and Portland are making, or are planning to make, significant investments in green infrastructure to help manage their wet weather challenges, including CSOs and stormwater. Their interest in these approaches is based on analyses that green

infrastructure offers cost savings when used with more traditional “grey infrastructure” approaches. They also see that these approaches provide multiple benefits to their communities.

Cincinnati, Kansas City and Philadelphia have undertaken similar analyses of how green infrastructure can supplement grey infrastructure within the context of their CSO long-term control planning and have concluded that green infrastructure elements can help provide the necessary water quality outcomes for less money in a number of watersheds or sewersheds. While green infrastructure approaches are not a complete substitute for grey infrastructure, they can limit the frequency of sewer overflow events, delay stormwater discharges, and reduce the amount and rate of CSO discharge to receiving waters.

Barriers, Accomplishments and Recommendations

Two years ago, EPA embarked on an enhanced effort to promote green infrastructure through all of our water programs in conjunction with several partners including American Rivers, the National Association of Clean Water Agencies, the Natural Resources Defense Council, the Low Impact Development Center, and the Association of State and Interstate Water Pollution Control Administrators. One of our initial releases, in January of 2008, was the *Green Infrastructure Action Strategy*. The Strategy is an action plan of several dozen activities and initiatives to overcome barriers to green infrastructure implementation, moving these sets of technologies from supplemental components of wet weather management to mainstream approaches. A variety of challenges to successful and wide-spread implementation were identified and EPA and its partners are meeting many of the challenges identified in the *Strategy*. However, we still have much to accomplish. I would like to discuss some of the most notable challenges.

One of the most significant barriers to green infrastructure is one that is typical to all novel approaches requiring significant change to existing institutional, technical and administrative frameworks: it’s new! Design engineers, utilities, public works departments, transportation agencies and others are not only familiar with traditional grey infrastructure approaches, but

their institutions are built around those paradigms. They understand pipe diameters and basin sizing, but often are not familiar with soil engineering and plants.

To address this needed shift in industry culture, we are engaged in a wide variety of outreach and training activities, including workshops, webcasts, publication of many documents on a variety of critical topics, working partnerships with a variety of sectors such as Federal highways, and modification and development of models and calculators to make design work and life cycle costing analyses easier. However, we also know that the most effective outreach can be done by state regulatory agencies in their one-on-one interactions related to permit and enforcement order implementation. These interactions can provide permittees and others assurance that such approaches are both beneficial and legal. The National Research Council stormwater study discussed funding for state stormwater programs.

EPA has heard concerns that green infrastructure approaches would not be effectively “credited” by EPA in permitting and enforcement processes. We have taken several steps to partially address this concern:

- 1) In August 2007, EPA’s water permits and water enforcement programs issued a joint memo indicating that green infrastructure approaches are consistent with National Pollutant Discharge Elimination System (NPDES) requirements, and should be encouraged in CSO and stormwater programs; and
- 2) We have increased our emphasis on outreach to State and EPA Regional regulatory programs to assist them in specific permitting and enforcement cases and also to provide general guidance on incorporating green infrastructure into regulatory programs.

I am encouraged by the success of these efforts as increasing numbers of state regulators and permittees are making use of green infrastructure options.

Local regulations are often another challenge. Whether deliberate or inadvertent, local codes and ordinances frequently pose barriers to green infrastructure. Sometimes these are direct prohibitions on practices such as green roofs or permeable pavements. Indirect barriers often reside in plumbing codes that restrict water harvesting, fire codes that limit certain green streets approaches, or parking ordinances that require oversized parking lots.

Most of these barriers can be overcome without compromising the original intent of those policies. Cities with successful green infrastructure programs have had to thoroughly review their codes and ordinances, usually resulting in valuable modifications to these policies. To assist communities with this process, we have developed a helpful guidebook entitled *Aligning Local Codes and Ordinances with Water Quality Goals*. This document outlines a process for evaluating local policies and provides multiple options in a variety of different areas for modifying those policies to meet community objectives. The guide identifies the advantages for communities who conduct comprehensive reviews of their local policies, and revise them as necessary. Such reviews would do a great deal to institutionalize green infrastructure approaches at the local level.

Long-term maintenance and performance issues pose a challenge with decentralized approaches. Many green infrastructure elements are located on private property. Municipal entities are reticent to rely on long-term performance of practices outside of their immediate control, especially when they must achieve specific regulatory endpoints. Communities, such as Portland, have opted to implement a significant portion of their green infrastructure within public rights-of-way. Ordinances and maintenance agreements are also an important part of a program designed to achieve long-term effectiveness over wet weather controls.

As this is still a relatively new area, some questions remain. With respect to water quality and quantity, we understand performance of green infrastructure practices very well in some cases and reasonably well in others. However, we need better tools for estimating collective performance at regional scales, and there are still questions about long-term performance of some practices under various maintenance regimes. In addition, we need better quantification of those other benefits we have discussed, such as urban heat island reduction

and removal of particulates from the air. A comparison of the economics and performance of green infrastructure and how it can supplement grey infrastructure for the entire life cycle will be extremely useful in establishing the utility of green infrastructure.

Moving research to practice is also an important need. There are many green technologies that can help protect water quality, and no single set of practices can be identified as the best for all circumstances. For example, in a very heavily developed downtown area, where space is at a premium, the placement of green roofs on the top of office buildings and residential high rises may be the most economical way to retain stormwater on site. The cities of Chicago, Philadelphia; Seattle and Portland are excellent models of successful green infrastructure and green roof programs.

A study of green roofs in Portland, Oregon demonstrated that, over a period of 18 months that included the wettest month on record, 5 different configurations of green roof type and thickness reduced the volume of runoff leaving the site 65 to 94 percent. On the other hand, in a suburban setting characterized by many single-family homes, rain gardens might provide a more cost-effective means to obtain similar results. Similarly, the problems presented and the solutions to be prescribed will differ greatly between Washington, D.C., and the arid Southwest. Thus, the determination of the most appropriate technologies will depend on a number of site-specific factors, such as available space, soil characteristics, depth of the water table, and climatic factors.

The Chesapeake Bay, the nation's largest estuary, suffers from excessive nutrient and sediment loads resulting from a range of human activities. Runoff from developed and developing lands is the only source of nutrients and sediments that is actually increasing. Between 1990 and 2000, the watershed's population increased by 8% while impervious cover increased by 40%. In addition, population now grows by 130,000 people annually and 100 acres of watershed forest lands are lost each day. Growth projections through 2030 show continued explosive growth in many areas.

While the States and EPA are making good progress to improve the effectiveness of our Clean Water Act regulatory program to address stormwater, the Chesapeake Bay Program is working with partners to identify situations where progressive developers, builders and homeowners realize very low levels of runoff through a full suite of green infrastructure practices that capture and reuse, infiltrate and evapotranspire runoff from the site.

EPA's Bay Program is issuing grant money and developing incentive campaigns to support projects and sites that pursue and achieve "low runoff," even under extreme rain events. This is just one of the innovative approaches that EPA is pursuing to address the Inspector General's recommendations. The Bay Program's efforts, in coordination with its state and local partners, is a good example of the progress being made in moving design and technology research to implementation.

Financing frameworks are another challenge. These technologies are considered new, and perhaps 'riskier,' so States, municipalities and their financial institutions tend towards technologies that they understand. Financial incentives can generally offset the reticence to adopt new technologies. The American Recovery and Reinvestment Act set-aside for green projects, via the Clean Water State Revolving Fund, is a great first step. It is helping communities with green infrastructure plans initiate actions sooner, and has created interest in places where previously there was none. This set-aside provision will greatly facilitate the evolution of green infrastructure from a boutique approach to a mainstream technology.

Conclusion

EPA has made significant progress since April 2007 when the Agency and four national groups signed an agreement to promote green infrastructure. With our national and local partners, we are helping to change the way our nation views and manages stormwater.

We look forward to working with this Committee, our Federal and state colleagues, and the many partners, stakeholders, and citizens who want to promote green infrastructure to achieve our mutual water quality goals as well as to promote more livable communities.

Thank you again for inviting me to testify and I would be happy to respond to any questions you may have.



NATURAL RESOURCES DEFENSE COUNCIL

**Testimony of Nancy Stoner
Co-Director, Water Program
Natural Resources Defense Council
Before the Subcommittee on Water Resources and Environment
Concerning “Efforts to Address Urban Stormwater Runoff”
March 19, 2009**

Good morning, Madame Chair. It is a pleasure to be back before you again on behalf of the Natural Resources Defense Council to discuss one of my favorite topics – the role of green infrastructure in revitalizing our waterways and our cities. I want to thank you for your leadership on these issues and the hard work of your staff in both the Economic Recovery legislation and reauthorization of the Clean Water State Revolving Fund already this year.

Interest in green infrastructure is skyrocketing among members of Congress, the sewage treatment industry, state and local governments, and the public. This is an opportune moment to discuss the barriers to full, effective implementation of green infrastructure as an integral part of water and wastewater resources management in communities across the country.

Background

Many communities, ranging from highly developed cities to newly developing towns, are looking for ways to assure that their rivers, streams, lakes, and estuaries are protected from the impacts of urbanization and climate change. Traditional development practices cover large areas of the ground with impervious surfaces such as roads, driveways, and rooftops. Once such development occurs, rainwater cannot infiltrate into the ground, but rather runs off site at levels that are much higher than would naturally occur. The collective force of all such rainwater scours streams, erodes stream banks, and causes large quantities of sediment and other pollutants to enter the waterbody each time it rains.

In addition to the problems caused by stormwater and nonpoint source runoff, many older cities (including many of the largest cities in the United States), have combined sewage and stormwater pipes which periodically and in some cases frequently overflow due to precipitation events. In the late 20th century, most cities that attempted to reduce sewer overflows did so by separating combined sewers, expanding treatment capacity or storage within the sewer system, or by replacing broken or decaying pipes. However, these traditional practices can be enormously expensive and take decades to implement. Moreover, piped stormwater and combined sewer overflows (“CSOs”) may also in some cases have the adverse effects of upsetting the hydrological balance by moving water out of the watershed, thus bypassing local streams and ground water. Many of these events also have adverse impacts and costs on source water for municipal drinking water utilities.

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Climate change is already stressing aquatic ecosystems, infrastructure, and water supplies. While impacts vary regionally, in much of the U.S., more frequent heavy rainfall events overload the capacity of sewer systems and water and wastewater treatment plants, as well as result in more stormwater runoff, exacerbating water pollution from sediments, nutrients, pathogens, pesticides, and other pollutants. In addition, decreased summer precipitation and other changes to the volume and timing of flows reduce stored water in reservoirs and reduce groundwater levels. Sea-level rise will adversely affect groundwater by causing an increase in the intrusion of salt water into coastal aquifers. All of these impacts will make less fresh water available for human use.

To ameliorate these problems, a set of techniques, approaches and practices can be used to eliminate or reduce the amount of water and pollutants that run off a site and ultimately are discharged into adjacent waterbodies. We refer to these collectively as “green infrastructure.” As cities move towards sustainable infrastructure, green infrastructure can be a valuable approach.

“Green infrastructure” is a relatively new and flexible term, and it has been used differently in different contexts. Thus, to date, there is no universally established definition of the term. For example, some writers have defined it broadly as “an interconnected system of natural areas and other open spaces that conserve natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.”¹ The Green Infrastructure Statement of Intent signed by U.S. EPA, NRDC, the Low Impact Development Center, the National Association of Clean Water Agencies (NACWA) and the Association of State and Interstate Water Pollution Control Administrators (ASWIPCA) uses the term “green infrastructure” to generally refer to systems and practices that use or mimic natural processes to infiltrate, evapotranspire (the return of water to the atmosphere either through evaporation or by plants), or reuse stormwater or runoff on the site where it is generated.²

What is Green Infrastructure?

Green infrastructure involves management approaches and technologies that utilize, enhance and/or mimic the natural hydrologic cycle processes of infiltration, evapotranspiration and reuse. Green infrastructure is the use of soil, trees, vegetation, and wetlands and open space (either preserved or created) in urban areas to capture rain while enhancing wastewater and stormwater treatment. Green infrastructure approaches currently in use include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, porous and permeable pavements, vegetated median strips, reforestation/revegetation, and protection and enhancement of riparian buffers and floodplains. Green infrastructure can be used almost anywhere soil and vegetation can be harnessed or worked into the urban or suburban landscape. Green infrastructure also includes decentralized rainwater harvesting approaches, such as the use of rain barrels and cisterns to capture and re-use rainfall for watering plants or flushing toilets. These approaches can be used to keep rainwater out of the sewer system so that it does not contribute to a sewer overflow and also to reduce the amount of untreated runoff discharging to

¹ Benedict and McMahon, *Green Infrastructure* (2006).

² <http://cfpub.epa.gov/npdes/greeninfrastructure/gisupport.cfm>.

surface waters. Green infrastructure also allows stormwater to be absorbed and cleansed by soil and vegetation and either re-used or allowed to flow back into groundwater or surface water resources.

Green Infrastructure Benefits³

Green infrastructure has a number of environmental and economic benefits in addition to reducing sewer overflows and stormwater discharges, including:

- *Cleaner Water* – Percolation of stormwater through soil, uptake by vegetation, and water reuse reduce the volumes of stormwater runoff and, in combined systems, the volume of combined sewer overflows, as well as reduce concentrations of pollutants in those discharges.
- *Enhanced Water Supplies* – Most green infiltration approaches involve allowing stormwater to percolate through the soil where it recharges the groundwater and the base flow for streams, thus ensuring adequate water supplies for humans and more stable aquatic ecosystems. In addition, capturing and using stormwater conserves water supplies.
- *Reduced flooding* – Green infrastructure both controls surface flooding and stabilizes the hydrology so that peak stream flows are reduced.
- *Cleaner Air* – Trees and vegetation improve air quality by filtering many airborne pollutants and can help reduce the amount of respiratory illness. Green infrastructure approaches that facilitate shorter commute distances and the ability to walk to destinations also reduce vehicle emissions.
- *Reduced Urban Temperatures* – Summer city temperatures can average 10°F higher than nearby suburban temperatures. High temperatures are also linked to higher ground level ozone concentrations. Vegetation creates shade, reduces the amount of heat absorbing materials and emits water vapor – all of which cool hot air. Limiting impervious surface, using light colored impervious surfaces (e.g., porous concrete), and vegetating roofs also mitigate urban temperatures.
- *Moderated Impacts of Climate Change* – Climate change impacts and effects vary regionally, but green infrastructure techniques provide adaptation benefits for a wide array of circumstances, by conserving and reusing water, promoting groundwater recharge, reducing surface water discharges that could contribute to flooding. In addition, there are mitigation benefits such as reduced energy demands and carbon sequestration by vegetation.
- *Increased Energy Efficiency* – Green space helps lower ambient temperatures and, when incorporated on and around buildings, helps shade and insulate buildings from wide temperature swings, decreasing the energy needed for heating and cooling. Also energy use associated with pumping and treating is reduced as stormwater is diverted from wastewater

³ <http://www.nrdc.org/water/pollution/rooftops/contents.asp>.

collection, conveyance and treatment systems. Energy efficiency not only reduces costs, but also reduces generation of greenhouse gases.

- *Source Water Protection* – Green infrastructure practices provide pollutant removal benefits, thereby providing some protection for both ground water and surface water sources of drinking water. In addition, green infrastructure provides groundwater recharge benefits by putting stormwater back into the ground and enhances surface water quality by redirecting the high volume and velocity flows that scour streams and muddy drinking water sources.
- *Wildlife Habitat* – Stream buffers, wetlands, parks, meadows, green roofs, and rain gardens increase biodiversity within the urban environment.
- *Community Benefits* – Trees and plants improve urban aesthetics and community livability by providing recreational and wildlife areas. Studies show that property values are higher, homes sell faster, and crime is reduced when trees and other vegetation are present.
- *Health Benefits* – Studies show that people who have access to green infrastructure in their communities get more exercise, live longer, and report better health in general. Exposure to green infrastructure (even through a window) improves mental functioning, reduces stress, and reduces recovery time from surgery.
- *Green Jobs* – Designing, installing, and maintaining green infrastructure creates new jobs for architects, designers, engineers, construction workers, maintenance workers, plumbers, landscapers, nurseries, etc.
- *Cost Savings* – Green infrastructure saves capital costs associated with paving, curb and gutter, building large collection and conveyance systems, and digging big tunnels and centralized stormwater ponds; operations and maintenance expenses for treatment plants, pumping stations, pipes, and other hard infrastructure; energy costs for pumping water around; cost of treatment during wet weather; and costs of repairing the damage caused by stormwater, such as streambank restoration.

New Strategies, and Benefits, for Wet Weather Management

The last few decades of wet weather management have resulted in the current convention of control and treatment strategies that are largely hard infrastructure: engineered, end-of-pipe, and site-focused practices concerned primarily with peak flow rate and suspended solids concentrations and other pollutant control. Conventional practices, however, fail to address the widespread and cumulative hydrologic modifications within the watershed, including increased stormwater volumes and runoff rates, excessive erosion and stream channel degradation, and decreased groundwater recharge.

While conventional practices work to drain each site, continued expansion of dispersed, low-density developments over the past years means that too much water, carrying too much pollution, is flowing into waterways. The results are poor water quality, especially at drain outlets, and a dramatic drop in the refill rate of aquifers and streams. The 20 regions in the

country that developed the most land over the period 1982 to 1997 now lose between 300 and 690 billion gallons of water annually that would otherwise have filtered through the earth and been captured as groundwater.⁴

The loss, or waste, of this water is particularly relevant as prolonged drought and the incipient effects of climate change impact wide regions of the United States. Areas as diverse as the states along the Colorado River Corridor and the urban southeast have experienced (or are currently experiencing) moderate to severe water shortages in the past two years. As recently as 2003 the U.S. General Accounting Office predicted that 36 states were anticipating localized, if not statewide, water shortages within the next decade.⁵ But through implementing green infrastructure practices that emphasize rainfall harvesting – infiltrating rainfall to recharge groundwater sources and capturing rooftop runoff for onsite reuse – cities and states can dramatically increase their available water supplies. This benefit occurs in addition to the benefits green infrastructure provides with respect to reducing the problems of pollution and erosion generated by urban runoff.

NRDC, in cooperation with leading academics, has recently conducted a study in California incorporating analyses of land use, water supply patterns, and the energy consumption of water systems. The study examined the potential for use of green infrastructure practices that emphasize water harvesting to augment water supplies in urbanized Southern California and limited portions of the San Francisco Bay Area. Based upon this analysis, we found that through implementing green infrastructure practices at new and redeveloped residential and commercial properties alone in these areas, the potential exists for saving as much as 400,000 acre-feet (af), more than 130 billion gallons of water, each year by 2030. The amount of water savings available increases considerably if green infrastructure practices are implemented at other types of land use and development. This critical benefit is available in urban areas across the country, and could be used on a wide scale to address water supply issues brought on by population growth, drought, and climate change in any number of settings.

Furthermore, in areas such as Southern California that are dependant on distant or energy-intensive sources of water, practices that augment local water sources such as groundwater or captured rainwater can be used as a means of reducing the amount of energy used to supply water, and its attendant greenhouse gas emissions. Each gallon of water used to recharge groundwater locally represents one gallon of water that no longer needs to be supplied, at great energy costs, through the California State Water Project or through ocean water desalination. Our study found that the 400,000 af of increased local water supplies potentially available in California corresponds to a potential savings of over 1,100,000 megawatt hours of electricity, avoiding the release of over 340,000 metric tons of carbon dioxide per year.

⁴ American Rivers, NRDC, and Smart Growth America, *Paving Our Way to Water Shortages: How Sprawl Aggravates The Effects of Drought* (Smart Growth America: 2002).

⁵ U.S. General Accounting Office, *Freshwater Supply: States' Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages* (July 2003).

Barriers to Green Infrastructure Implementation

Given all those benefits, lots of communities are interested in investing in green infrastructure, and an increasing number are doing so despite the barriers, but there are several major reasons why others have not yet done so. I will identify a number of the barriers and my recommendations for overcoming them below:

- (1) Lack of familiarity with green infrastructure techniques by wastewater professionals

Green infrastructure techniques have been in use for many years (and in some cases, for centuries), but have not been the dominant paradigm for water and wastewater management that most those professionals currently working in the field have studied. This could be addressed by setting up regional centers of excellence on green infrastructure that could collaborate with universities and private and public organizations on research and technical assistance projects, assist universities and technical training centers to develop green infrastructure curriculum, and provide university and professional program trainings on green infrastructure methods.

- (2) Lack of integration and coordination of water and wastewater management at the watershed level

In most communities, drinking water provision, wastewater treatment, and stormwater management are all managed by separate utilities, which may or may not coordinate their activities. Stormwater management itself is also very complex because multiple agencies are involved in activities related to stormwater pollution, such as street cleaning, road building, trash collection, snow removal, and park maintenance. While there is no perfect solution, communities that adopt watershed protection or environmental services agencies are better able to identify and seize upon the synergies provided by the use of green infrastructure to yield multiple environmental and economic benefits. Incentives for such multi-function local entities would encourage such integrated thinking.

- (3) Lack of aggregated monitoring data showing environmental benefits on a watershed or sewershed scale

There are a number of excellent sources of data on the performance of green infrastructure techniques, including universities, federal and state agencies, industry research arms, local government monitoring, and citizen monitoring. However, such information is rarely available to demonstrate the aggregated effect of a series of site level or neighborhood level practices on a watershed, subwatershed, or sewershed. For example, while there are models that predict the reductions in combined sewer overflow volume into the Anacostia and Potomac Rivers and Rock Creek from intensive use of green infrastructure in the District of Columbia,⁶ those models have not been validated through on-the-ground implementation of controls with appropriate monitoring. Congress should expand research and development efforts into green infrastructure technology, management approaches, and the associated environmental, social, and economic benefits, including demonstration projects here in D.C. and across the nation to evaluate the

⁶ <http://cfpub.epa.gov/npdcs/greeninfrastructure/modelsandcalculators.cfm>.

benefits of intensive green infrastructure implementation on a watershed, sewershed, or combined sewer system.

- (4) Local building codes, road codes, or other ordinances that prohibit the use of green infrastructure techniques

In many communities across the U.S., there are a host of regulations on the books that prohibit such safe, sensible green infrastructure practices, such as using permeable pavement for driveways, disconnecting downspouts so that the rain percolates through the soil instead of flowing into the streets, capturing rainwater to use for watering plants and flushing toilets, and narrowing side streets and putting vegetated swales alongside them to capture runoff. In 2002, NRDC issued *Out of the Gutter*,⁷ which included a checklist of legal impediments to the use of green infrastructure from such codes and ordinances, which is attached to this testimony. Clean Water Act municipal stormwater permits should require permit holders to remove local ordinance impediments to the use of green infrastructure.

- (5) The single source, single media regulatory scheme

Effective green infrastructure implementation requires having sewer authorities, stormwater utilities, planning and zoning authorities, and private entities, including developers, builders, and property owners contribute to a watershed-wide effort. To do this effectively, a community needs a comprehensive green infrastructure strategy, which requires getting a lot of people to work together who don't normally do so. The current regulatory system is not structured to facilitate cross-media, watershed-wide solutions. Every water pollution source has its own permit requirements to meet, and many entities are not required even to reduce their own stormwater pollution discharges, much less contribute to a larger sustainability strategy. In addition, most of the requirements are based on pollutant loadings, not maintaining hydrology, which is the guiding principle for green infrastructure. As a result, many permit holders are focused too narrowly to see the benefits that green infrastructure can provide. My recommendation for this would be to pilot water resource permits for urban water, wastewater, and stormwater that apply to all sources within a political boundary (i.e., city, county) or that apply to multiple political entities covering an entire watershed, subwatershed, or sewershed. If successful, such pilots could demonstrate ways to enhance water resources more cost effectively and with more non-water resource benefits as well.

- (6) Ineffective integration of green infrastructure into the NPDES permitting program

Stormwater permits under the National Pollutant Discharge Elimination System (NPDES) program are often vague and largely unenforceable. The NPDES program as a whole relies on two types of effluent limitations –technology-based standards and water quality based standards. Most stormwater permits currently contain neither. EPA has still not set technology based standards for the construction and development industry, and has indicated that it does not propose to set any such standards for post-construction stormwater discharges from development despite the fact that green infrastructure techniques have been demonstrated to be effective, and the most cost effective way in which to implement those controls is to integrate them into new

⁷ <http://www.nrdc.org/water/pollution/gutter/gutter.pdf>.

and redevelopment rather than retrofit existing buildings and streets.⁸ EPA needs to set such standards, and they need to be based on maintaining predevelopment hydrology, which is the widely recognized first principle of green infrastructure approaches.⁹ NPDES permits for stormwater are also ineffective because they usually do not require controls to reduce pollutant loadings into streams by any specified amount even when stormwater has been identified as the source of water quality impairment downstream. So, they often do not even contain basic Clean Water Act requirements, much less provisions reflective of broader water resource goals, such as groundwater recharge, minimum stream flow, streambank protection, and aquatic habitat protection, which green infrastructure can help a community to achieve. There have been significant improvements in some jurisdictions over the past several years to require environmental results from stormwater programs, not just program development, but there is a long way to go. Technology-based standards focused on hydrology would be one next logical step. Minimum requirements linked to water quality standards compliance and total maximum daily loads would be another.

Green infrastructure can also be used to reduce combined sewer overflows, but, to date, very few communities have been allowed to use this approach as a significant component of their combined sewer overflow long term control plans in part due to the lack of watershed-wide or sewershed-wide monitoring results as discussed above. Congress should provide funding targeted to communities that want to use a green infrastructure approach for CSO control and commit to monitoring their results and sharing that data widely. In addition, proposals by communities to use green infrastructure to reduce CSOs should be evaluated by regulatory authorities at least as favorably as those relying solely on hard infrastructure. Some regulators now discourage communities from using green infrastructure approaches. Exactly the opposite should be the case.

- (7) Lack of coordination between land use planning and permitting and stormwater management

Decisions about stormwater management are usually made after development projects have been fully platted and the design has been approved by multiple entities. It is too late at that point to do effective environmental site design to, for example, reduce impervious surfaces, preserve tree canopy, enhance stream buffers, or employ many of the other green infrastructure techniques. Stormwater, wastewater, and drinking water planning should be coordinated and integrated with land use and transportation planning through all available permitting mechanisms.

- (8) Lack of public awareness of stormwater pollution and green infrastructure techniques

To most people stormwater pollution does not sound like a big problem. Since the pipes that carry trash, road runoff, pesticides, fertilizers, pet waste, and other stormwater contaminants into waterways are underground, most people never think about them at all, or, perhaps worse, think the pipes lead to a treatment plant somewhere, even though most dump directly into waterways. Since most people don't even understand that there is a problem and that they contribute to it, they don't feel obliged to contribute to the solution. In addition, people are often concerned

⁸ <http://www.epa.gov/owow/nps/lid/costs07/>.

⁹ <http://cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm>.

about potential adverse impacts of green infrastructure solutions, such as mosquito breeding and basement flooding, which do not occur in well designed and maintained systems. Education needs to occur at multiple levels with multiple audiences to address these obstacles, including landscapers, builders, property owners, land care professionals, engineers, plumbers, architects, business owners, regulators – the list goes on and on. This type of education needs to occur at the retail level, by state and local governments, schools, community groups, and so forth, but the trainers need training and materials, and those can and should be developed along with identification of best practices for training each target audience at centralized locations, such as regional green infrastructure centers of excellence.

- (9) Lack of investment in water and wastewater infrastructure and in research and development to improve techniques for managing water and wastewater

Finally, green infrastructure suffers from some of the maladies shared by hard infrastructure, including lack of sufficient funding at the federal, state, or local levels. Water is our most precious resource, yet we do not invest in ensuring its availability and safety for future generations. Communities need to invest in green infrastructure and other cost effective solutions; they need to establish incentives to leverage private investment in green infrastructure; and they need to be supported by robust federal and state green infrastructure programs that provide technical support, grant funding for pilot projects, training, research and development, compliance assistance, and model development and application.

Conclusion

Communities across the U.S. are poised to use green infrastructure to revive their waterways, revitalize their neighborhoods, and create green jobs, but there are significant barriers that they face in adopting green infrastructure solutions. Thank you for holding this hearing today to explore those barriers and Congress' role in removing them. I appreciate the opportunity to appear before you to address these issues and look forward to your questions.



**OUT
OF THE
GUTTER**

*Reducing
Polluted Runoff
in the District
of Columbia*

July 2002

APPENDIX A

LEGAL REVIEW CHECKLIST

Impediments to Voluntary Low Impact Development in the District of Columbia

DEVELOPMENT STANDARDS

- Do the District's codes and regulations guiding construction and development explicitly restrict any core LID principles and practices (e.g., infiltration, exfiltration, vegetative controls, open drainage, temporary surface storage)?
- Are there officially adopted model designs, standards, or guidance documents that encourage certain types of development and/or site design that incorporate LID principles?
- Do the codes and regulations incorporate, encourage, or recommend any multi-functional LID principles or practices?

Site Preparation and Restoration

Site Disturbance and Clearing

- Does the Erosion and Sediment Control (ESC) ordinance require widespread clearing of construction sites?
- Does the ESC ordinance require removal of all trees and woody vegetation as part of site preparation?
- Does the ESC ordinance encourage phasing and scheduling of site clearing activities?
- Does the ESC ordinance place limits on the size and extent of material storage areas and stockpiles exposed to precipitation and runoff?

KEY

- Potential legal impediments that were evaluated by NRDC for the District of Columbia
- Critical issues that do not constitute potential legal impediments to voluntary LID practices and were not evaluated by NRDC for the District of Columbia.

Out of the Gutter

- Does the ESC ordinance provide for the protection of sensitive soil, sensitive slopes, wetlands, waterways, and other critical areas?
- If forest or specimen trees are present at a development site, does some of the stand have to be preserved?

Grading/Slope Requirements

- Do grading and slope requirements limit or impede the use of post-construction LID practices?
- Do codes and regulations require conventional drainage practices, or is there flexibility for alternatives (*e.g.*, do sites have to be graded toward the street or municipal drainage infrastructure, or can existing natural drainage patterns be used)?

Site Restoration

- Does the ESC ordinance encourage or mandate any revegetation with woody plants?

Building Standards**Disconnection of Impervious Surfaces/Areas**

- Are there District regulations that require runoff to be directed toward the street?
- Do sites have to be connected to the District's stormwater sewer system?
- Are gutters and downspouts required to be connected to the stormwater sewer system?
- Is there a prohibition on the discharge of rooftop runoff to yards/landscaped areas?

Lots*Driveways*

- Is the minimum driveway width specified in the District greater than 18 feet for residential properties?
- Are shared driveways prohibited in residential developments?
- Is the use of pervious materials prohibited for residential properties?
- Is the use of pervious materials prohibited for commercial, industrial, and institutional properties?
- Is the use of "two-track" design prohibited for single-family properties?

Post-Construction Natural Resource Protection

- Are there any tree preservation/reforestation requirements in the District?
- Are there any requirements for property owners to protect sensitive soils, slopes, wetlands, recharge areas, buffers, and/or waterways?*Grading Requirements*

Grading Requirements

- Do current grading or drainage requirements prohibit temporary ponding of stormwater on yards, landscaped areas, or rooftops?

KEY

- Potential legal impediments that were evaluated by NRDC for the District of Columbia
- Critical issues that do not constitute potential legal impediments to voluntary LID practices and were not evaluated by NRDC for the District of Columbia.

Building Codes*Storage*

- Do District codes and regulations restrict the temporary storage of stormwater on rooftops?
- Do District codes and regulations restrict the temporary storage of stormwater on the sides of buildings (planter boxes, type of material used as siding)?
- Do District codes and regulations restrict the use of roof gardens?
- Are there roof weight bearing requirements that restrict the use of roof gardens?

Transportation Infrastructure**Roads***Drainage*

- Do municipal regulations require curbs and gutters for all street classes?
- Do municipal regulations require curbs and gutters in parklands and parkways?
- Are there regulations that prevent the use of any type of open drainage channels or overland flow of runoff?

Medians

- Are there requirements that limit the maximum width of medians and their use for treating runoff?

Surfacing Materials

- Are pervious surfaces prohibited? If yes, on what street classes?
- Are there guidelines on acceptable types and uses of pervious surface materials?

Maintenance and Repair

- Are there public works maintenance regulations that limit the use of alternative road surfaces and alternative street design?
- Are there public works repair regulations that limit the use of alternative road surfaces and alternative street design?
- Are there appropriate regulations to ensure property maintenance?

Tree/Vegetation Planter Boxes (also applies to sidewalks and all streetscapes discussed below)

- Do municipal regulations prevent the use of tree/vegetation boxes in certain streets?
- Are there municipal regulations requiring tree planter boxes to be raised above grade?

Sidewalks

- Do municipal regulations require a minimum sidewalk width in the District?
- Are sidewalks always required on both sides of residential streets?
- Do sidewalks have to be sloped so they drain to the street?
- Are pervious surfaces prohibited?
- Can runoff be stored under sidewalks?

*Out of the Gutter***Parking***Parking Lots*

- Does the District require standard parking spaces to be larger than 9 x 18 feet?
- Are parking lots prohibited from having a percentage of smaller dimension spaces for compact cars?
- Is the use of pervious materials for parking areas prohibited?
- Is there a prohibition on greenspace/landscaping in parking lots or are there limits on landscaping that would preclude the use of LID?
- Are there requirements to direct runoff to the street or existing drainage infrastructure?
- Is there a requirement for a percentage of the parking lot to have tree cover/greenspace/landscaping?

Parking Codes

- Are there restrictions limiting the use of shared parking arrangements in the District?

Structured Parking

- Are there any incentives for developers to provide parking within garages rather than surface lots?

Rights-of-Way

- Are LID practices, including natural landscape surfaces, restricted in transportation ROWs?
- Are landowners and developers restricted from using ROWs to implement and maintain LID-type stormwater management?

PUBLIC HEALTH AND SAFETY***Standing Water***

- Do any codes or regulations prohibit intentional ponding of water on yards and landscape areas?

Open Drainage

- Do any building, development, or public health and safety codes or regulations prohibit or otherwise limit the use of open drainage channels, swales, ditches, or other conveyances for stormwater?

Noxious Weeds and Weed Control

- Are there weed control regulations that limit or impede the use of vegetated channels, bioretention areas, swales, tree planter boxes, or other LID practices that incorporate vegetation on public or private property?
- Are there weed control regulations that limit or impede the use of certain LID practices on private property?

KEY

- Potential legal impediments that were evaluated by NRDC for the District of Columbia
- Critical issues that do not constitute potential legal impediments to voluntary LID practices and were not evaluated by NRDC for the District of Columbia.

Pest Control (Mosquitoes, Vermin)

- Are there pest control regulations that limit or impede the use of vegetated channels, bioretention areas, tree planter boxes, or other LID practices that incorporate vegetation on public and private property and ROWs?

POST-CONSTRUCTION STORMWATER MANAGEMENT**Stormwater Requirements (Stormwater Management Plan and CSO Long Term Control Plan)**

- Are any LID techniques expressly prohibited?
- Are any nonstructural LID BMPs expressly prohibited?
- Are LID techniques recommended in the District's stormwater manual?
- How is LID incorporated into the District's MS4 Stormwater Management Plan?
- Does the District's CSO Long Term Control Plan incorporate LID principles and practices?
- Are the CSO Long Term Control Plan and Stormwater Management Plan integrated?
- Are there incentives for residential property owners to use LID techniques such as Rain Gardens and pollution prevention?

Stormwater Management Issues**Water Conservation**

- Do the District's Plumbing Codes restrict or prohibit water conservation measures?

Buffers

- Is there guidance for the protection or creation of stream buffers?
- If so, are there any limitations to their application?
- Are there limitations on allowable uses/activities within the buffer?
- Is the recommended buffer width at least 35 feet?
- Is there any guidance as to the use of native vegetative species, or other species specific requirements, or restrictions for riparian buffer or plantings that promotes or limits LID application?

Homeowner Association Rules

- Do homeowner associations have the authority or ability to require or restrict LID-type practices?

Maintenance and Land Management Rules for Property Owners (Private and Public including commercial areas, office parks, and public institutions)

- Are there maintenance requirements for property owners that may limit the use of LID practices?
- Are there land management requirement for property owners that may limit the use of LID practices?

Out of the Gutter

- Can maintenance and land management requirements be enforced in the District of Columbia? If so, by whom?

COMPREHENSIVE ISSUES**Zoning****Special Areas**

- Does current zoning allow uses incompatible with special watershed districts or other environmentally sensitive land?
- Has the District identified areas where LID practices may not be technically feasible (e.g., areas where water table is too high for infiltration practices)?

Building and Development Review

- Does the District's Master Planning process consider drainage, CSO, and source water resource protection issues?
- Does site plan review include stormwater management and LID? If so, at what point in the process are these issues considered?
- Do building inspections, construction inspections, and maintenance inspections consider drainage, development patterns, and pollution prevention?

Planning**Transportation Planning**

- Does the District consider water quality, drainage, development patterns, and pollution prevention in its transportation planning activities?
- Does the District have a standard suite of LID design practices that will allow these practices to be implemented during construction, maintenance and reconstruction of roadways.

Interagency Cooperation

- What framework exists for fostering multiagency cooperation, coordination, and planning?
- Are there any apparent roadblocks to multiagency cooperation, coordination, or planning?

Infill and Brownfield Development Issues

- Do the guidelines for infill development and/or brownfields development directly address stormwater (e.g., does the District have any special procedures for brownfields and infill development projects that relate to drainage and stormwater management)?

Natural Resource Protection

- Does the District discourage creating open space in redevelopment projects? Is there a percentage of open space required for a development permit?

KEY

- Potential legal impediments that were evaluated by NRDC for the District of Columbia
- Critical issues that do not constitute potential legal impediments to voluntary LID practices and were not evaluated by NRDC for the District of Columbia.

- Can open space be managed by a third party using land trusts or conservation easements?
- Are there mechanisms or incentives in place to encourage open space protection?
- Are there any incentives to developers or landowners to conserve land (open space design, density bonuses, stormwater credits, or lower property taxes)?
- Is flexibility offered to developers to meet regulatory or conservation restrictions (density compensation, buffer averaging, transferable development rights, off-site mitigation)?

Applicability to Other Water Quality Regulations

- Does the District incorporate LID into other activities related to water quality (TMDLs, SDWA, wetlands, CWA Sec. 404 permits, Dredging, C&D Regulations)?

Financial Incentives/Disincentives

- Is there a framework for fee reduction and/or subsidy programs to encourage the use of LID techniques?
- Is there an LID guidance document for developers that highlight financial advantages of LID practices?

EFFORTS TO ADDRESS URBAN STORMWATER RUNOFF

Statement of

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Director, Villanova Urban Stormwater Partnership
Villanova University

and

Member, Committee on Reducing Stormwater Discharge Contributions to Water
Pollution
Water Science and Technology Board
Division on Earth and Life Studies
National Research Council
The National Academies

Before the

Subcommittee on Water Resources and Environment
Committee on Transportation and Infrastructure
U.S. House of Representatives

March 19, 2009

Good morning, Madam Chair and members of the Committee. My name is Robert Traver. I am a Professor of Civil and Environmental Engineering at Villanova University, Director of the Villanova Urban Stormwater Partnership, and served as a member of the National Research Council (NRC) Committee on Reducing Stormwater Discharge Contributions to Water Pollution. The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the

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government on matters of science and technology. I have been asked to focus on the utility of green infrastructure and low impact design approaches in mitigating urban stormwater runoff, to identify barriers in implementing these approaches, and recommendations for alleviating these barriers. My testimony will address each of these in order.

...utility of green infrastructure and low impact design approaches...

As the NRC committee report states, although stormwater's contribution to water quality impairment has been known for many decades, only in the last 20 years have federal regulations addressed the issue. In order to protect our nation's waters, our expectations of stormwater management have shifted from solely a flood control perspective, to one of addressing water quality, water quantity and supply, aquifer recharge, base flow and stream channel protection, in addition to flood control. Consequently, this shift of goals has dramatically changed the approaches used to address these challenges. We have moved from detention strategies of simply storing the water during a major storm event, to natural control measures encompassing both small and larger storms. Our tool box of green infrastructure control measures has also grown, from measures as simple as reducing the amount of pavement used, or disconnecting drainpipes so that stormwater runs over the grass, to water reuse, and to engineered structures that integrate with nature, such as bioretention / bioinfiltration facilities, green roofs and pervious pavements.

Green infrastructure and low impact design to me are approaches that first reduce the creation of and then employ nature to address the detrimental impacts of urban stormwater. Rainwater collected in rain barrels or cisterns is a resource that can be used for irrigation, vehicle washing, or other uses, reducing runoff and the need for treated water. Natural runoff management practices incorporate the hydrological, physical, chemical, and biological processes of our soils, plants, and water bodies. These practices target runoff from impervious surfaces like pavements and roofs, and work together as an engineered system in meeting stormwater mitigation goals. Some,

if not all of the control measures can be incorporated in the drainage infrastructure. As an example, Figures 1 and 2 below show two retrofit control measures at Villanova that are described in the NRC report. The green roof in figure 1 is designed so that approximately the first inch of rainfall is captured and evaporated such that it does not enter the stormwater drainage system and ultimately impact nearby streams. From a

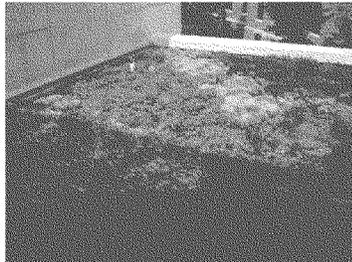


Figure 1 - Villanova Green Roof

small storm perspective, its hydrological properties would be similar to a meadow or a forest. While not sufficient alone in addressing flood control during an extreme event like a hurricane, the green roof does provide a tremendous benefit in reducing runoff in areas like Seattle and Philadelphia where the great majority of storms average an inch or less. The green roof works by capturing rainfall, soaking it

into a soil layer, and then using the plants and sunlight to evapotranspire the water. Note that the green roof works well at Villanova due to our pattern of rain and climate, but may not work as well in other areas of the country. Figure 2 shows a bioinfiltration

site also at Villanova. This stormwater control measure was constructed in an existing traffic island, and routinely captures 80 to 90 percent of the rainfall, and filters out over 95% of the particulates



Figure 2 - Villanova Retrofit Bioinfiltration Traffic Island

and sediment, by infiltrating the water through the soil. The plant's root structure aid in maintaining pathways of infiltration, and the chemically and biologically active soil layer captures and treats most of the pollutants in the runoff (Davis et al 2009). Note that the pavement temperature effect is also reduced in this manner. Yearly only a handful of storms normally exceed the capacity of the control measure, and the site has shown no statistical reduction in performance over the last

eight years (Emerson, Traver 2008). If more control is needed, overflow from these sites can be directed to a stormwater wetland, underground chamber or other detention facility. We should not forget that green infrastructure also makes use of constructed surfaces such as pervious pavements (Fig 3), and detention facilities such as stormwater wetlands.



Figure 3 - Pervious Concrete during a Storm Event

Any talk of utility needs to discuss the performance and maintenance of these stormwater control measures. Several documented successful LID / Green Infrastructure projects are discussed at length in the NRC report, including a LID subdivision in Jordan Cove, Connecticut that uses bioretention, bioswales and pervious pavements. Other effective projects include the use of bioinfiltration raingardens in Burnsville, Minnesota, Villanova's Stormwater Research and Demonstration Park, and bioswales in Seattle, Washington. All of these projects are similar in that the green infrastructure is incorporated in the pathways of the drainage infrastructure, thereby minimizing implementation costs, and reducing their footprint. My belief is if we had included the bioinfiltration control measure as part of the original traffic island construction at Villanova, it would have ultimately reduced construction costs due to the elimination of drainage piping and inlets. Maintenance practices at all of the Villanova sites have been found to be minimal and involve cutting and removing dead grasses at the end of the growing season, trash removal, weeding, and vacuum street sweeping of pervious pavements, activities that differ little from normal landscaping.

Research continues to document the benefits of low impact design and green infrastructure. From an engineering perspective they are the most cost effective and sustainable approach in mitigating the effects of urban stormwater runoff. These measures reintroduce hydrological processes lost during urbanization and, thus, are better able to meet the goals of the Clean Water Act.

... identifying barriers in implementing these approaches ...

As with any new approach or technology, there are barriers to implementation. Most of our current institutional and regulatory structures were developed without considering the quality aspects of urban runoff, and the subject was not included in our engineering curriculums until recently. Residents have grown accustomed to pipes and nicely mowed detention basins in their neighborhoods.

Institutional Barriers: - As stated in the NRC report, "*Because this longstanding environmental problem is being addressed so late in the development and management of urban areas, the laws that mandate better stormwater controls are generally incomplete and are often in conflict with state and local rules that have primarily stressed the flood control aspects of stormwater management.*"

The simplest examples are ordinances that mandate outdated practices like required curbing, house setbacks or large parking areas. More insidious are design codes that underestimate the performance of green infrastructure control measures, and fail to put their purpose in perspective. An example would be design requirements resulting in unnecessary enormous footprints for bioinfiltration / bioretention sites that would exclude their use in favor of more traditional and expensive and less sustainable alternatives.

Another institutional barrier rooted in the past is the separation of stormwater quantity and quality that has occurred in both the regulatory and scientific arenas. Unlike many types of polluted water, stormwater typically is characterized by rapidly changing and widely fluctuating flows and quality depending on the season, the land use and preceding storm events. The high flow rates and extended duration of urban stormwater runoff erodes stream channels, such that control measures that reduce these flows and high volumes are extremely important. Furthermore, any stormwater control measure that reduces volume has a positive impact on reducing the pollution associated with stormwater to include temperature. I have heard from several scientists and engineers that they do not favor green roofs as they export nutrients during larger storm events.

They miss the connection. If the roof captures and removes 90% of the rainfall, export of some nutrients in a handful of large events is not important, and natural wooded areas would also export nutrients during these same events.

Technology Barriers – The implementation of green infrastructure and low impact design has proceeded faster than our understanding and ability to predict the outcomes of the many processes involved. We know that these green infrastructure and low impact design practices are tremendously more effective than those used in the past. However what we are not able to do well is to predict the performance during a unique storm event, or understand with certainty how a grouping of green infrastructure practices can achieve our goals in a specific watershed. For example the most common measure of performance today is percent removal of a pollutant, and this metric has flaws. A very dirty storm event entering a control measure may have a great pollutant removal percentage, but what leaves could still be high enough to be detrimental. On the other hand runoff that is relatively clean entering, can meet water quality requirements but if used to measure the performance, it would lead to a poor removal percentage.

An engineering or science based approach requires understanding of the treatment and flow mechanisms involved. For bioinfiltration (Fig. 2), we need to quantify the evapotranspiration, the seepage through the surface, and the movement of stormwater through the soil. At the same time we need to understand the chemical and biological actions in the soil, how the soil incorporates the incoming pollutants, and the effects of seasonality. As you can imagine, expanding this to a small group of control measures, or scaling up to a county level, greatly increases the complexity of predicting their performance and the reliance on our understanding of the treatment and flow mechanisms.

Perception Barriers- The public perception of green infrastructure varies widely. At Villanova we have had thousands of visitors to our research sites. Groups have included engineers, scientists, public officials, school groups of all ages,

facility managers and even garden clubs. Many of their questions reflect misperceptions about green infrastructure and low impact design. Frequently west Nile virus and mosquitoes are of concern to the visitors, and they are surprised to learn these sites reduce the mosquito population if designed correctly. They envision bioswales and bioinfiltration sites to be always wet, when the opposite is true. Professionals with little to no experience with LID/green infrastructure assume construction and maintenance are unreasonably expensive, and that the control measures have short life cycles. With good design both of these are also untrue.

All of these barriers are amenable to solutions, as I will discuss next.

...recommendations for alleviating these barriers...

Any recommendation as to the removal of these barriers must be inclusive, and founded on a deeper understanding and consideration of all aspects of urban stormwater runoff. Solutions to institutional, technology and public barriers are interrelated, each supporting one another.

Institutional Solutions- The NRC report recommends a systems approach tailored to the watershed and implemented at the municipal level. This approach must incorporate land use and all stressors including urban runoff quality, quantity and temperature. Antiquated codes and design standards that preclude or inhibit green infrastructure and low impact design must be retired, and replaced with codes that allow the full potential of green infrastructure to be realized. The coupling of quality expectations to land use is a critical component.

Regulatory standards and performance metrics should be based on science. Clearly this includes the role of flow as a pollutant. The real or perceived inability to include flow within the regulatory process reduces the effectiveness and increases the cost of our mitigation efforts, and artificially promotes less

sustainable practices. It is simply not scientifically possible to meet the goals of the Clean Water Act without targeting flow.

I believe green infrastructure / low impact design is the approach of choice for dealing with the impacts of urban stormwater, as it is the most protective and cost effective solution for the community, the property owner, and our waters.

Technology Solutions- A broad based research effort is needed to further our understanding of green infrastructure. This effort must reach across different climates (with consideration of climate change) and soil conditions, with a short term goal of predicting with reasonable accuracy the performance of an individual green infrastructure control measure for a specific storm event. This will enable the longer term goal of predicting the impact of green infrastructure from a larger watershed perspective. It is critical that these research efforts look past the current surface water perspective and include baseflow and groundwater effects as well.

To reach this goal requires a research effort integrating laboratory, field, and modeling studies. This research must include multiple long-term continuously monitored sites because the variability of performance, the effects on the surrounding environs, and maintenance and longevity issues can only be addressed with long-term research. Multiyear data will allow us to use more precise designs to lower the cost to the landowner and community, and to avoid investing millions on ineffective practices as has been done in the past. Monitoring multiple sites would allow the direct comparison of design components. It is also worthwhile to search out older green infrastructure projects to better understand the effects of aging. For example at Villanova we found two seepage pits that are estimated to be 80 to 100 years old, and preliminary studies of their continued capacity have changed the way we view longevity. Green infrastructure and low impact design have many other potential benefits beyond stormwater control that need to be substantiated. It is my understanding that cooling properties of a green roof aid the performance of solar

panels, and both can be installed together. Rainwater use via water harvesting has an energy benefit. Carbon removal by green roofs, wetlands, bioswales, and bioinfiltration and bioretention sites may be a significant benefit as well. All of these additional benefits require substantiation.

Perception Solutions- The technology solutions also start to address the barriers in perception. Simply visiting LID and green infrastructure sites and seeing that they work and are good neighbors is key to changing perceptions. This has happened most

effectively in the higher education arena, where students are hired to work on the projects, the concepts are introduced in their courses, and they see the technology in action every day. For example, at Villanova our new green dormitory is in the final planning stages with solar panels and green infrastructure practices. Every day leaving their dorm students will pass the bioinfiltration and bioretention control measures and see on a display the amount of power saved and urban runoff mitigated. This level of education could accompany new or retrofitted projects at schools, municipal buildings, and shopping centers, and would be key to engaging the community and greatly expanding their knowledge base. Redevelopment should be viewed as an opportunity to incorporate green infrastructures to areas of the U.S. where it has never existed.

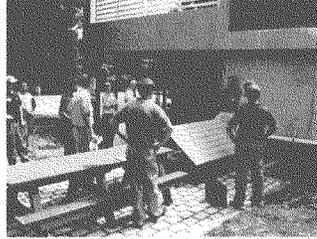


Figure 4 – Villanova Stormwater Tour

That concludes my statement. I applaud the Committee for recognizing the importance of LID and green infrastructure to the future management of urban stormwater. The impacts of urban stormwater continue to be critical as our country has been urbanizing at a rate faster than population growth. Thank you for the opportunity to testify. I would be happy to address any questions the Committee might have.

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Biographical Sketch

Robert G. Traver

Dr. Robert G. Traver has been a member of the Water Resources and Environmental Engineering Program at Villanova since 1988. He is a registered professional engineer, and a Diplomat of the American Academy of Water Resource Engineers. He teaches graduate courses in hydrology, hydraulics, urban storm water management, and undergraduate courses in all facets of water resources. He is a retired LTC of the US Army Reserves, and a veteran of Desert Storm.

While at Villanova Dr. Traver has conducted research on topics that include modeling of stream hydraulics, urban hydrology, water quality, and measures to mitigate adverse stormwater effects. He constructed the Stormwater Best Management Practice Demonstration and Research Park on the Villanova Campus, and founded the *Villanova Urban Stormwater Partnership* to enable continuing long term stormwater research. Dr Traver believes that research supports and enhances the undergraduate and graduate educational experience.

Immediately after the tragic failure of the New Orleans Hurricane Protection System, Dr Traver was asked to serve on ASCE's External Review Panel (ERP) of the Corps investigation of Hurricane Katrina. He was awarded the Outstanding Civilian Service Medal for his commitment and contribution by the Commanding General of the Corps of Engineers.

Recognizing the link between policy and engineering, Dr. Traver continues to be involved with the implementation of stormwater policy. He participated with a team study to review the effects of Pennsylvania's water regulation on watershed

sustainability (1994), and was appointed by the Secretary of PaDep to the oversight committee for Pennsylvania's 2006 Stormwater BMP manual. Dr Traver has served as Chair for the 1998, 1999, 2001, 2003, 2005, and 2007 Pennsylvania Stormwater Management Symposium's held at Villanova. He has recently concluded his work as a member of NRC Committee *Reducing Stormwater Discharge Contributions to Water Pollution*, and has been appointed to the Pennsylvania Department of Environmental Protection Water Resources Advisory Committee.

Testimony of

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Before the

House Committee on Transportation and Infrastructure
Subcommittee on Water Resources and Environment Subcommittee

On

Thursday, March 19, 2009

Testimony of
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 (503) 823-7115

Before the
 House Committee on Transportation and Infrastructure
 Subcommittee on Water Resources and Environment Subcommittee
 Thursday, March 19, 2009

Chairwoman Johnson, Members of the Subcommittee:

Thank you for the chance to speak to you today. My name is Mary Wahl and I am the Director of Watershed Services, at the Bureau of Environmental Services representing the City of Portland, Oregon.

The Committee requested the City's perspective on the utility of green infrastructure for mitigating urban stormwater runoff, barriers to implementation, and recommendations for addressing the barriers. In this testimony, I will address these issues, and then add general comments on protecting water and urban watersheds.

1. What is the utility of green infrastructure in mitigating stormwater runoff?

- a. Portland makes extensive use of green infrastructure because it works. Green infrastructure has developed to the point engineers now rely and design based on the performance of these facilities. We do not plan to build bigger and bigger pipe systems to manage added runoff as more growth and density occur, but ARE planning to manage that stormwater on site, at the surface, in vegetated facilities.
- b. When costs for green infrastructure are close to the costs for grey (pipes) to achieve the same purpose, we opt for the green because they bring a number of environmental and other benefits in addition to the immediate objective.



Both of these are responses to the Clean Water Act. The one on the left is the \$1.4 billion, 10 mile long tunnel built roughly 100 feet under ground to store enough water we don't overflow the combined storm/sanitary lines when it rains. On the right is a curb extension, one of the green infrastructure facilities that will collectively manage the additional stormwater created as growth and in-fill occur.

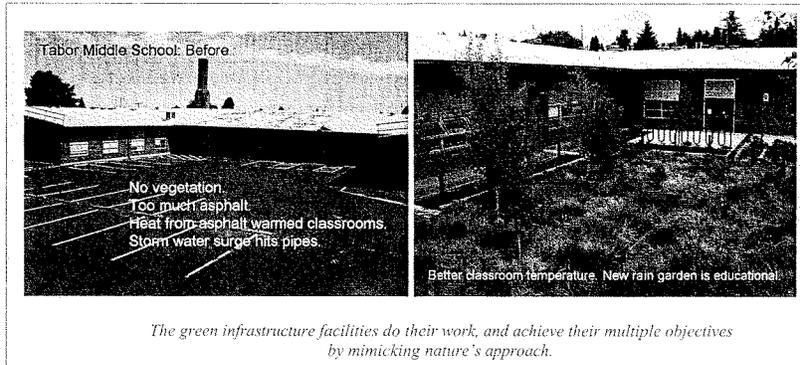
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c. An example of the utility of green infrastructure is that the first billion gallons of Combined Sewer Overflow (“CSO”) control Portland has to generate each year comes from the 50,000 homeowners who disconnected their roof downspouts so they empty on the ground, not into the sewers. The utility of this solution is that it is better for the environment, it preserves pipe capacity, it is the least expensive per gallon stormwater control we have found, there are now neighborhoods where as high as 90% of the people are aware of the stormwater problem and of their contribution to the solution. An additional benefit is that the disconnects created ongoing work for small businesses.

d. The rain gutter disconnect example is very small scale individually, but stormwater runoff is a distributed problem, and the downspout disconnects are a distributed solution that work environmentally, economically, and as a business source. This experience is typical of the many ways these solutions have value.

e. Curb extensions (pictured above) are a form of vegetated swales that can be sized to manage the amount of runoff coming to them. This curb extension manages the stormwater from ~1/4 acre. People living near these facilities appreciate them variously as stormwater facilities, as an excellent means of “traffic calming” in the neighborhood, or as a “street garden.” Like the rain gutter disconnects, they seem small compared to the size of urban stormwater runoff. As noted above, though, the downspout disconnects by themselves now manage more than one billion of the annual 10 billion gallons of CSO flow Portland has to control. This program is estimated to have cost ~\$225 million less than it would have cost for additional pipe capacity to manage the additional one billion gallons each year.

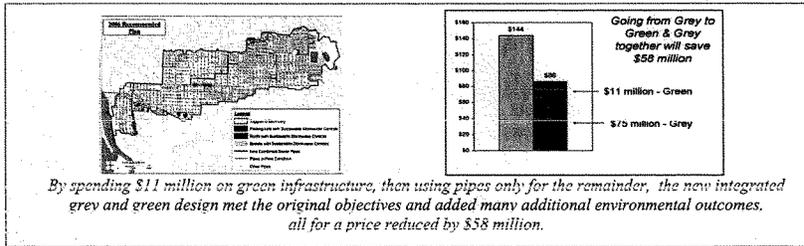
f. It is the job of the green infrastructure to manage both peak flows and flow volume so the flows don’t surge into the pipes and cause basement backups or overflows to the rivers and streams. Our experience is that the curb extensions consistently reduce peak flows by ~80%. These facilities also need regularly reach annual levels of total volume reduction as high as 85%.



g. Perhaps Portland’s best example of the utility of green infrastructure is in a 1,400 block area of the City where the stormwater is combined with sanitary flows, and has until now created overflows to the Willamette River or backups to basements nearly every time it rained. Here, the City’s planned solution in 2000 was an all-pipe solution, which costs \$144 million. The current design takes the use of green infrastructure to unprecedented levels, using 600 green facilities and 4000 street trees in this single area, and

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now costs \$86 million. By first using the green facilities to manage as much stormwater as possible, then managing only the remainder with pipes, the total price dropped a remarkable \$58 million, and the City gets the additional water quality, livability and urban tree canopy benefits these facilities deliver.

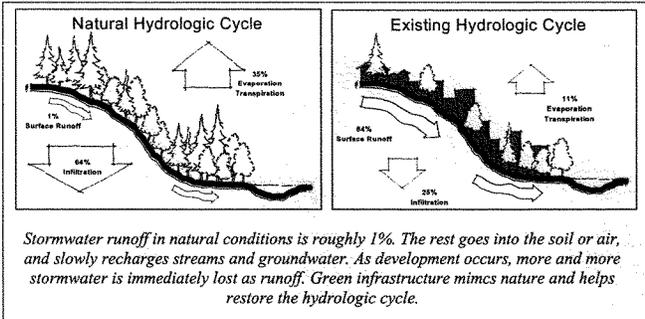


2. Four key barriers to the use of green infrastructure are listed here. Recommended solutions to these, based on Portland's experience, are in section #3 below.

a. **Maintenance** is often the first question asked by cities considering green infrastructure, in part because the nation's grey infrastructure has a maintenance backlog. Making the strategic shift to investments in green can be obscured by the maintenance concern.

b. **Regulatory acceptance:** When Portland began its CSO efforts in the 1990s, the City asked for an extension of the time to comply in exchange for implementing up to \$90 million worth of green infrastructure. Since then, we have at least two examples of regulatory implementation supporting green infrastructure, but the typical regulatory demand --especially at the federal level-- is for piped responses, even when green infrastructure is proposed.

Water and watershed regulations, policy, and restoration efforts have focused primarily until now on water quality. Watershed science requires us to expand that focus to hydrology. That means we need to



concentrate at least as much on where the water is, when it is there, and how much is there, as we do on water quality. The importance of actions that improve hydrology needs to be recognized in applying regulations. The green infrastructure is designed to address hydrology and flow in ways that mimic the natural system.

c. **Reliability:** These approaches are relatively new, particularly compared to the many decades collective experience we have with piped systems. The green technologies are judged based on achieving what pipes would otherwise be called on to achieve. With limited data, it has been difficult to gain acceptance of them as part of the long-term stormwater infrastructure.

d. **Funding and cost/ benefit ratio:** Funding is always a barrier for the green solutions, and so is the lack of good information about the economic and environmental value of the natural systems. Few people question how important the green systems are, but we have historically lacked cost/ benefit information on a par with that available about pipes, and when certainty is required, the call typically goes to pipes.

3. What are a few of Portland's recommendations to address the barriers?

a. **Implementation by the federal government:** Portland's experience is that the best route to overcoming several barriers described above is to learn through demonstration projects, then move to full implementation. Because green infrastructure has proven effective environmentally, economically, and in an engineering context, we have moved to the level of integrating hundreds of these facilities along with the conventional facilities. If the federal government called for green stormwater management facilities at the developments, roads, and buildings it funds, we would move rapidly beyond the demonstration phase, and the green economy would mature much faster.

Portland's response to the Clean Water Act included adopting a "Stormwater Management Manual" that requires all but the smallest developments – private or public – to manage stormwater at the source in vegetated, surface facilities, unless that is not feasible. Similarly, we have a "Green Street Policy" and a Council Resolution requiring all streets to manage stormwater in green facilities, and all City-funded roofs to be eco-roofs, unless those are not feasible. These policies have set the direction for Portland, and contributed in important ways to Portland now being a hub for the green economy. The federal government could do the same.

b. **Capitalize trees:** It is clear trees are critical assets, and a few jurisdictions have found ways to capitalize them. Until there is a broad, national interpretation that allows all jurisdictions to capitalize them, tree planting will rely on very limited operating dollars, or will occur only if they can be an incidental part of a capital project. Trees intercept rainfall, decreasing the speed and volume of stormwater runoff, they help move the stormwater to the ground so it is infiltrated rather than becoming runoff, and they improve stream temperatures and habitat. Encouraging investments in trees improves watershed health and can decrease the need for additional grey investments.

c. **Incentives:** Portland's green street and eco-roof programs have benefited over the past several years from EPA's "Wet Weather" grants that let us provide small incentives to innovative private and public developers of roads, building sites, eco-roofs, etc., to implement green and low impact approaches. These facilities helped move us to the point that the green solutions are generally the first ones analyzed for stormwater management.

d. **Quantify the benefits:** There is little disagreement about how important the green infrastructure is, but engineering, design, business, and – importantly – regulatory decision need to be based on a broadly accepted quantification of the benefits of trees, vegetated swales, habitat, eco-roofs, and wetlands. What is needed nationally is to quantify the benefits so regulatory decisions can be based on the information, and so the multiple benefits for water quality, habitat, fish recovery, and as an economic engine are available.

e. **Maintenance:** Decide the best strategic grey and green infrastructure investments based on environmental, economic, engineering and watershed factors, and then set maintenance levels across the entire system. This represents a shift away from avoiding green solutions because of the maintenance history for grey. The nation's crumbling water infrastructure is testimony to out-of-sight/ out-of-mind. Green infrastructure is on the surface and if it is well-designed, maintenance can be performed as a part of normal landscaping work.

Green Infrastructure Guiding Principles

1. Preserve and maintain existing natural processes.
2. Manage storm water runoff both at the source and on the surface.
3. Use plants and soil to slow, filter, cleanse, evapotranspire, and infiltrate runoff.
4. Achieve other City goals.



GENERAL COMMENTS

Stormwater is a valuable resource, not a waste. Treating it as a waste is a very expensive operation, and losing the resource starves groundwater and surface water. Stormwater is the base flow for ground water and it recharges rivers and streams. Managing stormwater as a resource, particularly improving hydrology, provides multiple benefits, including habitat improvements and giving us a better chance of recovering fish populations.

Fortunately, managing stormwater more like nature does can achieve a great deal for people and cities, too. It can bring an economic boost and competitive edge, and it does terrific things for the environment. In the development pictured below, the buried stream was brought to the surface, which is good for the environment and adds a "marketable amenity" to the apartment complex. Our experience is that rents, and therefore property values, are higher when buildings are near facilities like the one on the right above, or near water. There are air quality, habitat and neighborhood enhancement benefits from developing with green infrastructure, along with the stormwater quality and hydrology benefits of these facilities.



This development, by using and restoring natural stormwater systems, is better for the environment, attracts tenants and better rents, and for this developer it brought publicity, design awards, and help from agencies. He is now involved in additional sustainable developments.

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CONCLUSION

I appreciate the opportunity to be here, and would be happy to contribute to your efforts to address the barriers to implementing the green solutions. There is great potential for the environment, for communities, and for the economy through this approach and your work can help move us in that direction.

Thank you.

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