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**TESTIMONY OF
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**BEFORE THE
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
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I. Introduction

Mr. Chairman and members of the Subcommittee, I am Benjamin Grumbles, Assistant Administrator for Water at the United States Environmental Protection Agency (EPA). Thank you for inviting me to discuss EPA's programs and initiatives on green infrastructure, clean water, and healthy watersheds. I believe that there are many opportunities for green infrastructure practices to be applied to protect water quality and enhance our communities. States and thousands of communities and transportation agencies across the nation face difficult challenges in meeting stormwater and sewer overflow regulatory requirements. Green infrastructure provides tools for these communities to meet regulatory requirements and non-regulatory needs in the context of broader community goals. EPA believes green infrastructure has great potential to advance environmental protection and economic prosperity through technology, innovation, and collaboration.

II. What Is Green Infrastructure, and How Does It Help Protect Water Quality?

"Green Infrastructure" is a relatively new and flexible term, and it has been used by various speakers and writers in various contexts. Thus, to date, there is no universally established definition of the term. In addition, several other terms are often used interchangeably with, or as aspects of, "green infrastructure", such as "low impact

development (LID)” and “conservation development”. In my remarks today, as well as in my March 5, 2007, memorandum entitled, “Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs,” I have intended 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 on the site where it is generated.

Green infrastructure encompasses a large set of specific practices. Typical techniques include literally green practices such as green roofs, rain gardens, and bio-swales. However, the term is also often used to include other technologies, such as permeable concrete or rain barrels, that similarly promote the onsite infiltration, evapotranspiration, or reuse of stormwater. At EPA, we promote all such onsite practices and technologies under the green infrastructure umbrella.

Green infrastructure practices protect water quality primarily in two ways. First, they reduce the amount of pollutants that run off a site and ultimately are discharged into adjacent waterbodies. Second, they reduce or eliminate the water that runs off the site. Traditional development practices cover large areas of the ground with impervious surfaces such as roads, driveways, and buildings. The Center for Watershed Protection (“CWP”) has classified our nation’s development patterns as “habitat for cars, habitat for people, and habitat for nature.” Once such development occurs, rainwater cannot infiltrate into the ground, but rather runs offsite at levels that are much higher than would naturally occur. The collective force of all such rainwater scours streams, erodes stream banks, and thereby causes large quantities of sediment and other entrained pollutants to

enter the waterbody each time it rains. Green infrastructure techniques are designed to reduce such runoff through infiltration, evapo-transpiration and re-use, thereby helping to protect the receiving streams as well as replenish ground-water supplies.

EPA believes that green infrastructure approaches and practices can be a significant component of States' and cities' programs to reduce and control stormwater, combined sewer overflows, and nonpoint source pollution. They can be used by communities to help meet requirements of their stormwater permits under the National Pollutant Discharge Elimination System ("NPDES") permit program under the Clean Water Act, and similarly can play a significant role in the creation and implementation of long-term control plans ("LTCP") to reduce combined sewer overflows. Moreover, green infrastructure can play a critical role in the broader context of sustainable infrastructure by being integrated into comprehensive plans that simultaneously address communities' drinking water supply, wastewater management, stormwater management and recreational needs. The use of green infrastructure can help communities meet their overall water resource management goals and reduce the costs (or free up funding for other uses such as land purchases) of constructing and maintaining engineered infrastructure including pipes and treatment systems.

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; approaches should be tailored to fit local 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. A recent study of green roofs in Portland, Oregon demonstrated that,

over a period of 18 months which included the wettest month on record, 5 different configurations of green roof types 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.

III. To What Extent Are States and Communities Already Implementing Green Infrastructure Projects?

In the 1990's, several communities and nonprofit groups began promoting and demonstrating the effectiveness of green infrastructure techniques. In 2000, Prince George's County, MD, authored, and EPA published, two companion books, "LID Design Strategies" and "LID Hydrologic Analysis", which provided detailed guidance for local communities to install rain gardens and other LID techniques to reduce and control stormwater runoff. Since that time, throughout the country, numerous additional documents have been published, conferences and technical seminars held, and local ordinances modified or enacted, that promote the incorporation of green infrastructure into development practices. See, e.g. www.epa.gov/nps/lid.

A number of cities across the nation are already investing heavily in green infrastructure in order to manage their stormwater and/or abate their combined sewer overflows. The list includes large cities such as Portland (OR), Seattle (WA), Chicago (IL), and Philadelphia (PA), and smaller jurisdictions such as Lexana (KS), Prince

George's County (MD), Griffith (GA), Emoryville (CA), Warsaw and Stafford Counties (VA), and Huntersville (NC). This list is growing as I speak, with recent announcements, proposed and final ordinances, and policy changes having been made by the cities of Boston, Washington, D.C., and New York City, and by States such as California and New Jersey.

Many organizations are currently working cooperatively to improve our understanding of the costs and benefits of green infrastructure. Nonprofit groups such as the LID Center, Center for Neighborhood Technology, Casey Trees, CWP, and others have published studies that estimate the costs, cost savings, and/or water quality benefits associated with various LID technologies at particular sites. Detailed studies and demonstration projects are being implemented by leading universities around the country, Federal agencies (e.g., the Department of Defense has published an LID Design Manual to be used at all DOD facilities and recently FHWA and EPA co-founded a Green Highways Partnership grant for innovative watershed management projects within the Anacostia Watershed) and State and local governments (e.g., through funding provided by EPA's Nonpoint Source Program under Section 319 of the Clean Water Act).

IV. What is EPA Doing to Promote Increased Adoption of Green Infrastructure?

A. Partnerships to Promote Green Infrastructure

On March 7, 2007, I issued a memorandum to all of EPA's Regional Administrators expressing my strong support for the increased development and use of green infrastructure in water program implementation. I listed the many benefits that green infrastructure provides, including cleaner water, enhanced water supplies, cleaner air, reduced urban temperatures, increased energy efficiency, community benefits, and

cost savings. On April 19, 2007, EPA Administrator Stephen L. Johnson signed a “Green Infrastructure Statement of Intent” with representatives of the National Association of Clean Water Agencies, Natural Resources Defense Council (“NRDC”), LID Center, and Association of State and Interstate Water Pollution Control Administrators, that formalized a collaborative effort among the signatory organizations to promote the benefits of using green infrastructure in protecting drinking water supplies and public health, mitigating overflows from combined and separate sewers and reducing stormwater pollution, and to encourage the use of green infrastructure by cities and wastewater treatment plants as a prominent component of their programs. EPA will work to include green infrastructure components and water quality trading and watershed projects. EPA is working with these and other key groups to develop a multi-pronged green infrastructure strategy. See www.epa.gov/npdes/greeninfrastructure.

At the same time, EPA has partnered with numerous organizations in a variety of other forums to promote and understand the benefits of green infrastructure approaches and practices. We are working with nongovernmental organizations and associations such as the American Institute of Architects to promote urban design and planning to protect and restore water resources. We are participating in an effort led by Ladybird Wildflower Center and the American Society of Landscape Architects to develop sustainability metrics to aid design and planning professionals in designing landscapes that are functional components of our water resource infrastructure. To promote green building, we are working with the U.S. Green Building Council, the Congress for the New Urbanism and NRDC to incorporate metrics for onsite infiltration, evapotranspiration and re-use into a new Leadership in Energy and Environmental

Design for Neighborhood Development (LEED-ND) rating system. As another example, working with The Conservation Fund, EPA, and the U.S. Department of Agriculture Forest Service has sponsored training for diverse audiences and participated in stakeholder processes in the development of green infrastructure plans at different geographic scales. There are in fact many other cooperative initiatives, such as a Source Water Collaborative and a Sustainable Infrastructure Initiative, whereby EPA works actively with many partners to promote green infrastructure.

EPA has also funded and partnered with leading engineering and science organizations in the United States, and the Federal Highway Administration (FHWA), in the development of the International Stormwater Best Management Practices (BMP) Database. The database, available online at www.bmpdatabase.org, provides a public platform for sharing information on best management practices to manage stormwater, including LID practices.

B. Overcoming Existing Barriers to Green Infrastructure

The future looks very bright for green infrastructure. However, we will need to overcome some long-standing barriers in order to expedite its progress. Pursuant to the April 19, 2007, agreement that Administrator Johnson co-signed with partnering groups, EPA and its partners have begun to work together to meet its objectives. These include components such as:

- Continuing research and development of green infrastructure management practices performance and effectiveness. This information is critical to increasing the rate of implementation of green infrastructure practices.

- Guidance, assistance and education on selecting and applying green infrastructure approaches.
- Regulatory guidance that provides direction to promote utilization of green infrastructure approaches in lieu of, or in combination with, gray infrastructure approaches. Such guidance could be issued in the context of stormwater permits, long-term control plans for combined sewer overflows, enforcement documents, and funding programs.
- Documentation of the multiple benefits and relative life-cycle costs of green infrastructure approaches as compared to more traditional technologies.
- Publicizing, cataloging, and recognizing successful green infrastructure projects and approaches.

Interestingly, one of the most significant barriers to implementing green infrastructure is local regulation. Many local ordinances, written a generation or two ago, require wide streets, curbs, gutters and underground storm sewers, and expansive ratios for paved parking square footage. Others require detention ponds and in some cases retention ponds, without giving credit for onsite practices that infiltrate, evapotranspire, or re-use stormwater. Useful books have been written about such local codes and provided guidance on how to change them. An example includes “Better Site Design: A Handbook for Changing Development Rules in Your Community” (CWP, 1988, funded in part by EPA. EPA intends to work with its partners to continue to provide information to municipalities, counties, States, and others that explains the many economic, social,

and environmental advantages that they can achieve by using green infrastructure alternatives in appropriate circumstances.

C. EPA Research Efforts Related to Green Infrastructure

The EPA Water Quality Research Program includes studies on the control of stormwater pollution, including the use of green infrastructure processes. Research specific to the transportation sector has included the ability of retention basins and constructed wetlands, such as are installed as part of highway drainage systems for flood control, to mitigate nutrients, sediment, metals, and bacteria. EPA has also begun an evaluation of the effectiveness of swales, commonly used as a drainage tool along roadways where transportation right-of-ways can provide space and infiltration systems.

EPA's research program has documented and modeled the performance of porous surfaces in controlling stormwater runoff. The research program is now installing and evaluating porous pavement parking and a modular block system. These projects will allow evaluation of changes in the technology over time. Demonstrations have also been undertaken to examine the ability of green roofs to reduce the effect of roof-top impervious area with respect to hydrology and selected stressors. EPA will continue to evaluate these and other low impact development technologies in the future.

EPA plans to publish a new study within the next few months that will examine about a dozen LID and green infrastructure projects. The vast majority of these projects have been found to cost less money than a more traditional hard infrastructure project would have cost. Cost savings often result from site design techniques such as narrower streets, smaller storm sewer pipes, and elimination or reduction of detention basins, which can more than offset the increased costs of adding some LID practices.

Consideration of additional factors, such as the energy savings achieved by green roofs or the increased sales value of a home with a rain garden and reduced imperviousness, could tip the cost-benefit balance even more in favor of green infrastructure.

V. Green Infrastructure and Transportation

Transportation, ranging from super-highways to unpaved county roads, constitutes a significant component of our national infrastructure. As such, it presents similar opportunities for the incorporation of green infrastructure techniques, such as diverting flows onto medians and rights-of-way, where the flows may be evapotranspired and/or infiltrated.

EPA cooperates with federal agencies (e.g., Department of Transportation, U.S. Department of Agriculture Forest Service, and Bureau of Land Management), the National Association of County Engineers, the National Association of Counties, the American Public Works Association, and state and local governments to promote environmentally sound LID designs and maintenance practices for low volume and rural roads. Working together, we have collectively developed a guidance manual, a website to promote environmentally sound maintenance practices for dirt and gravel roads (<http://www.ltapt2.org/resources/ruralresources.php>), and, through DOT's Local Transportation Assistance Program (LTAP), a clearinghouse and electronic discussion list-serve focused on environmental considerations relating to low-volume roads. In addition, EPA staff actively participates in Transportation Research Board ("TRB") committees on low volume roads, ecology and transportation, and environmental analysis in transportation, and have worked with the Federal Highway Administration (FHWA) to

develop training courses on water quality/stormwater management and erosion and sediment control for highway engineers and public works staff.

An essential aspect of any green infrastructure strategy is comprehensive planning. Watershed planning should be integrated with transportation planning and other local and regional community planning efforts. EPA participated on a workgroup chaired by FHWA that wrote *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects*. *Eco-Logical* emphasizes integrated planning approaches. EPA has worked with FHWA and groups such as the National Association of Regional Councils to promote integrated planning to protect water resources. Approaches such as Context Sensitive Solutions help communities plan the placement and design of transportation facilities that are safe and meet a community's transportation needs while preserving scenic, aesthetic, historic and environmental resources.

A Transportation Model: The Green Highways Partnership

EPA is very proud to be a primary sponsor of the Green Highways Partnership, a voluntary, public/private collaboration in the Mid-Atlantic region with an expansive list of partners from the environmental, transportation and industry sectors. Green Highways, like Green Infrastructure, is not a defined term of art. However, some characteristics of green highways are that they are:

- built with permeable materials that provide superior watershed-driven stormwater management, thus preventing metals and toxins from leaching into streams and rivers;
- constructed with recycled materials, thereby reducing landfill usage; and

- designed using cutting-edge technologies to protect critical habitats, waterways, and ecosystems from the adverse impacts and encroachment of highway infrastructure.

The Green Highways Partnership is demonstrating the opportunities that exist through integration of environmental and transportation planning, using the green infrastructure approach. Through concepts such as regulatory flexibility and market-based rewards, Green Highways seeks to incorporate environmental streamlining and stewardship into all aspects of the highway lifecycle. Green Highways looks for opportunities to design roadways using cutting-edge technologies, like those which support green infrastructure, including LID practices, to protect critical habitats, waterways, and ecosystems from the adverse impacts and encroachment of highway infrastructure; build roadways with permeable materials that provide superior watershed-driven stormwater management, thus preventing metals and toxins from leaching into streams and rivers; and construct roadways with recycled materials, thereby reducing landfill usage. The outcome is sustainable transportation infrastructure that is “beyond compliance” and leaves the environment and communities “better than before.”

While examples and practices are occurring throughout the Mid-Atlantic region, the Partnership is actively engaged in several demonstrations in Maryland and DC. The U.S. Highway 301 Waldorf Transportation Improvements project is working towards becoming the nation’s first truly green highway by incorporating the principles of the Green Highways Partnership and green infrastructure in its earliest planning stages.

Through Green Highways, EPA has partnered with FHWA, State Departments of Transportation, and county planning organizations to map the natural resources in a geographic area and conduct green infrastructure assessments to inform and complement the

comprehensive transportation plan. For example, the U.S. 301 Project team is working on updating the regional green infrastructure assessment to aid in decision-making at every level of the project: location, design, stormwater management, and mitigation. Similarly, the District of Columbia DOT has developed its own design standards to create an infrastructure to support the sustainable economic and environmental health of the region and the creation of livable communities. As an example, the District DOT has implemented a bioretention cell, which has reduced pollutant loads by more than 90 percent.

Conclusion

We have made and are continuing to make major investments in the implementation of programs and practices to protect and restore waters that are impacted or may be impacted by stormwater, urban runoff, and combined sewer overflows. 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. We will continue to work with this Committee, our Federal colleagues, and the many partners, stakeholders, and citizens who want to promote green infrastructure to achieve our water quality goals as well as to promote more livable communities. This concludes my prepared remarks; I would be happy to respond to any questions you may have.