

## Mayors Innovation Project Winter Meeting 2011

From the forthcoming *The Value of Green Infrastructure: A Guide to Recognizing its Economic, Environmental and Social Benefits* (The full document will be available at [www.americanrivers.org](http://www.americanrivers.org) and [www.cnt.org](http://www.cnt.org)).

### **The Value of Green Infrastructure**

**A Guide to Recognizing Its Economic,  
Environmental and Social Benefits**



© Center for Neighborhood Technology 2010



# TABLE OF CONTENTS

## ACKNOWLEDGEMENTS

### INTRODUCTION .....

WHAT IS GREEN INFRASTRUCTURE & WHY DOES IT MATTER? .....

WHY THIS GUIDE? .....

PURPOSE OF THE GUIDE.....

### GREEN INFRASTRUCTURE BENEFITS AND PRACTICES.....

GREEN ROOFS .....

TREE PLANTING.....

BIO-RETENTION AND INFILTRATION PRACTICES .....

PERMEABLE PAVEMENT .....

WATER HARVESTING .....

### ECONOMIC VALUATION IN ACTION.....

ECONOMIC VALUATION METHODS & TOOLS .....

OUR FRAMEWORK .....

BENEFIT MEASUREMENT AND VALUATION .....

1. *Water*.....

STEP 1: Quantification of Benefit: Reduced Stormwater Runoff.....

STEP 2: Valuation of Quantified Benefits: REDUCED Stormwater Runoff.....

2. *Energy*.....

STEP 1: Quantification of Benefit: Reduced Energy Use .....

STEP 2: Valuation of Quantified Benefits: Reduced Energy Use.....

3. *Air Quality* .....

STEP 1: Quantification of Benefit: Reduced Criteria Pollutants.....

STEP 2: Valuation of Quantified Benefits: REDUCED Criteria Pollutants.....

4. *Climate Change* .....

STEP 1: Quantification of Benefit: Reduced Atmospheric CO<sub>2</sub> .....

STEP 2: Valuation of Quantified Benefits: Reduced Atmospheric CO<sub>2</sub> .....

5. *Urban Heat Island* .....

6. *Community Livability*.....

Aesthetics .....

Recreation .....

Reduced Noise Pollution.....

Community Cohesion .....

7. *Habitat Improvement* .....

8. *Public Education*.....

EXAMPLE DEMONSTRATION 1: BENEFIT ASSESSMENT OF A SINGLE GREEN ROOF.....

EXAMPLE DEMONSTRATION 2: BENEFIT ASSESSMENT OF A NEIGHBORHOOD SCALE.....

### CONSIDERATIONS & LIMITATIONS.....

FULL LIFE CYCLE ANALYSIS .....

LOCAL PERFORMANCE AND LEVEL OF BENEFITS REALIZED .....

SPATIAL SCALING AND THRESHOLDS .....

TEMPORAL CONSIDERATIONS AND SCALE.....

*Discounting*.....

*Operation and Maintenance* .....

PRICING VARIABILITY .....

DOUBLE COUNTING.....

### CASE STUDIES: VALUING GREEN INFRASTRUCTURE ACROSS THE U.S.....

AURORA, IL.....

CHICAGO, IL.....

MILWAUKEE, WI.....

NEW YORK CITY, NY.....  
PHILADELPHIA, PA.....  
PORTLAND, OR .....  
SEATTLE, WA .....  
CONCLUSION.....

## INTRODUCTION

### What Is Green Infrastructure & Why Does It Matter?

Green infrastructure (GI) is a set of decentralized stormwater management practices such as green roofs, trees, rain gardens and permeable pavement that can capture and infiltrate rain where it falls, thus reducing stormwater runoff and improving the health of surrounding waterways. While there are different scales of green infrastructure, such as large swaths of land set aside for preservation, this guide focuses on GI and its benefits within the urban context.

The ability of green infrastructure practices to deliver multiple ecological, economic and social benefits or services has made it an increasingly popular strategy in recent years (see Case Study section). In addition to reducing polluted stormwater runoff, GI practices can also positively impact energy consumption, air quality, carbon reduction and sequestration, property prices, recreation and other elements of community health and vitality that have monetary or other social value. Moreover, green infrastructure practices provide flexibility to communities faced with the need to adapt infrastructure to a changing climate.

### Why this Guide?

Although valuation of green infrastructure’s monetary benefits has advanced considerably in recent years, it is still a developing field. The EPA publication *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices* (2007) documented the comparative construction costs of green infrastructure practices in residential construction, but did not explore performance benefits. While there are numerous published studies addressing either the benefits coming from one type of practice, such as energy implications of green roofs, or the collective impacts of a single practice, such as urban forestry’s impact on water, energy, and other elements, such studies do not reach a cumulative assessment of multiple benefits.

Green infrastructure’s value as a municipal or private investment depends in part on its effects beyond water management, and thus upon a community’s ability to model and measure these additional values. Short of conducting an

intensive study and calculation of actions in a specific community, municipalities have generally lacked the tools to determine green infrastructure's multiple benefits. As such, defining or measuring the extent of green infrastructure's multiple benefits has remained a challenge. While a number of cities have begun to explore GI within their own municipal infrastructure programs, no general method for estimating or documenting such benefits has yet emerged.

Due to these issues, decision making regarding stormwater infrastructure investments has generally lacked recognition of the monetary benefits that GI provides communities. As a result, municipalities have often favored single-purpose grey infrastructure projects. However, any benefit cost analysis process comparing grey infrastructure with green infrastructure would be incomplete without factoring in the multiple benefits green infrastructure can provide.

## Purpose of the Guide

The purpose of this guide is to distill some of the considerations involved in assessing the relative economic merits of green infrastructure practices. The Guide provides a list of common benefits gained by implementing GI strategies and then, where possible, demonstrates simplified illustrative examples that work toward estimating the magnitude and value of these benefits.

The guide is intended to:

1. Inform decision-makers and planners about the multiple benefits green infrastructure provides to communities.
2. Provide guidance to communities on valuing the benefits of potential green infrastructure investments.

In clarifying how to assign value to potential green infrastructure benefits, the approach described in this guide aims to assist decision-makers in evaluating options for water management and deciding where, when and to what extent green infrastructure practices should become part of future planning, development and redevelopment within communities. Rather than proposing methods to calculate a definitive dollar amount, the guide's intention is to move the field of GI valuation forward. By illustrating GI's additional benefits, the guide enables communities to better understand the infrastructure choices they have and how green infrastructure can be a viable option.

## U.S. EPA Stormwater Program – Regulatory Opportunities

Polluted stormwater runoff is one of the leading causes of pollution to our streams, rivers, and lakes across the country, and a significant cause of flooding and sewer overflows. Despite the efforts of the stormwater management industry, the most commonly used pollution controls and management approaches have been woefully inadequate to deal with this problem. Now, for the first time in years, the U.S. Environmental Protection Agency (EPA) has announced its intention to tackle this issue through new national stormwater regulations slated for proposal in September 2011 and finalization by November 2012.

EPA's commitment to substantially improve its national stormwater regulations has the potential to curtail and prevent this major and growing source of water pollution. The rule change presents a major opportunity to advance and institutionalize green infrastructure approaches that capture and manage stormwater on site. Such approaches improve clean water, urban livability and reduce energy use while creating jobs for stormwater practitioners.

The potential to advance green infrastructure solutions to stormwater management within the EPA rulemaking process has numerous advantages for local governments and communities across the country. Green infrastructure practices are often more effective and less expensive than traditional stormwater controls and can enhance the effectiveness of traditional infrastructure by diverting stormwater from overburdened pipes and reducing sewer overflows. By capturing and treating stormwater where it falls, green infrastructure approaches minimize the amount of water that enters treatment plants and keep energy costs low. A recent study estimates that by 2030, the use of green infrastructure technologies in California could save enough energy to power more than 120,000 single-family homes for one year. Green infrastructure practices, like rain gardens, urban trees, and green roofs create more green space which mitigates the urban heat island effect, keeping energy costs low, and can increase property values. These approaches offer a cost-effective solution to managing stormwater runoff that provide multiple benefits to communities from decreased sewer overflows to increased green space.

### Industries that could benefit

Green Roofs  
Permeable Pavements  
Interlocking Pavers  
Nurseries  
Arboriculture  
Cisterns  
Landscape Design  
Bioretention Design  
Many Others

### Benefits to Local Communities

- ✓ Improved clean water supplies
- ✓ Enhanced urban livability
- ✓ Cost savings from reduced energy costs
- ✓ Increased green space
- ✓ Increased property values

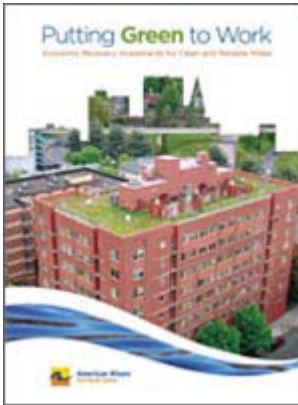
For more information:

U.S. EPA Rulemaking - <http://cfpub.epa.gov/npdes/stormwater/rulemaking.cfm>

NRC Report - [http://www.epa.gov/npdes/pubs/nrc\\_stormwaterreport.pdf](http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf)

U.S. EPA Green Infrastructure - [http://cfpub.epa.gov/npdes/home.cfm?program\\_id=298](http://cfpub.epa.gov/npdes/home.cfm?program_id=298)

## Funding Green Infrastructure



### **NEW REPORT:**

***Putting Green to Work: Economic Recovery Investments for Clean and Reliable Water*** (available at [www.americanrivers.org/greenfunding](http://www.americanrivers.org/greenfunding))

American Rivers' new report evaluates the groundbreaking water infrastructure investment in green infrastructure pioneered under the American Reinvestment and Recovery Act (ARRA) that provided \$1.2 billion for green infrastructure, water and energy efficiency, and environmental innovation.

### **Executive Summary**

Only a few days after taking office, President Obama signed the American Recovery and Reinvestment Act of 2009 (ARRA), the largest government public works package since the New Deal. ARRA included a much-needed \$6 billion for clean water and drinking water infrastructure.

Like much of the nation's infrastructure, our water systems are crumbling. After several decades of inadequate investment and unmanaged sprawl, America's water and wastewater systems now receive the lowest grade, a D-, of all infrastructure rated by the American Society of Civil Engineers. EPA already estimates capital investment needs for clean water and drinking water infrastructure at over \$600 billion over 20 years.

Forecasts for greater extremes due to climate change will make the problem worse, as more frequent and intense storms will increase flooding and produce corresponding sewer overflows and stormwater pollution. And more frequent and intense droughts will cause water shortages and higher concentrations of water pollution.

At the same time, we are in dire need of a new approach to investing in America's clean water and drinking water infrastructure. We are at a crossroads today in how we manage our water systems. Traditional water infrastructure will continue to play a role, but much of it is static, solves only a single problem, and requires a huge expense to build and maintain. We must move from old 19th century infrastructure to a wiser combination of green and traditional infrastructure that will meet the needs of the 21st century.

The American Recovery and Reinvestment Act took a groundbreaking step in the right direction, dedicating twenty percent (\$1.2 billion) of water infrastructure funding to programs for green infrastructure, water and energy efficiency and environmental innovation (collectively called the Green Project Reserve). This effort represented the first, decisive step in a much needed shift away from solely “gray,” inflexible water infrastructure towards innovative approaches that will bring our water management into the 21<sup>st</sup> century.

More communities are beginning to understand that economic vitality and resilience to change rests on adaptation strategies that provide multiple benefits for every public dollar invested. By dedicating 20 percent of water infrastructure funding for the Green Project Reserve, the ARRA provided states with the resources to repair and rebuild their water and sewer systems to protect communities for a future marked by more frequent and more intense droughts and floods.

Just as we continue to reap the benefits of the New Deal more than sixty years later, the Green Project Reserve will result in lasting changes toward environmental sustainability for years to come. This report examines the implementation of this green project reserve. Among the key findings:

- The need for funding for “green” projects is far greater than the 20 percent provided through this effort. States have substantial lists of “shovel-ready” green projects that simply lack funding;
- Within the overall category of “green” we identified a group of “bright green” projects that provide a comprehensive set of environmental and economic benefits. Future investments should be targeted toward these “bright green” projects;
- Some states, such as Maryland and New York are clearly leaders and should be used as models for other state programs.

The report also builds on nearly a decade of work by American Rivers to reform the nation’s primary public water infrastructure fund, the federal State Revolving Fund (“SRF”) program, and includes a series of recommendations on how to sustain the progress begun under the ARRA. Among those recommendations:

- National
  - Federal water infrastructure funding should be continued and increased to support state demand for “bright green” projects. Congress should reauthorize the Clean Water and Drinking Water State Revolving Funds to include dedicated funding for “bright green” projects;
  - Federal water infrastructure funding should provide incentives for states to fund bright green projects such as waiving state match requirements;
  - Climate adaptation planning and implementation should prioritize bright green approaches;
  - EPA must continue to improve its guidance to states and provide additional technical assistance to ensure the best use of limited funds.

- States
  - States must act quickly to remove statutes, regulations or policies that stand in the way of pursuing integrated approaches to “bright green” infrastructure;
  - Project evaluation criteria should be revised to reflect and prioritize multiple environmental benefits;
  - Vigorous outreach for new green reserve projects to a range of traditional and non-traditional partners should be required and to result in wide range of strong projects;
  - States should promote loan-payback mechanisms for green projects to ensure that communities can integrate these approaches as part of regular financial planning for clean and safe water.

ARRA marked a bold step forward for our nation, but it was only a first step. Now we must continue to accelerate our progress toward 21<sup>st</sup> century “bright green” infrastructure to ensure long-term reliable, clean water supplies. The challenge is to make today’s “bright green” tomorrow’s norm, and to constantly push the boundaries of environmental and economic sustainability.

Available at [www.americanrivers.org/greenfunding](http://www.americanrivers.org/greenfunding)





## Green Infrastructure: The 21<sup>st</sup> Century Tool for Clean Water

Our nation is fast approaching a crisis point with how we manage our clean water. Green infrastructure offers an effective alternative to conventional water infrastructure that has both the flexibility and economic viability to address the challenges of polluted runoff, flooding, and sewer overflows. Unlike traditional water infrastructure, green infrastructure protects, restores, and replicates the natural hydrology of the landscape. From implementing green roofs to adopting water efficiency standards, green infrastructure offers a 21<sup>st</sup> century tool to address today's water management challenges.

**H.R. 4202 introduced by Representative Edwards (D-Md.) will provide critical support to green infrastructure strategies, improving our ability to effectively manage polluted runoff and sewage overflows while relieving pressure on aging infrastructure. This bill would:**

- **Establish a green infrastructure program** within the Environmental Protection Agency's Office of Water to promote the use of green infrastructure and provide technical assistance to states, local governments, and the private sector.
- **Invest \$1.2 billion** in planning, development, and implementation grants for community-based green infrastructure projects.
- **Establish up to five Centers of Excellence for Green Infrastructure** which would conduct research, develop recommendations, and provide training and technical assistance for implementing green infrastructure best management practices.



*Rain Garden, Courtesy Maplewood Public Utilities*

## Support H.R. 4202: The Green Infrastructure for Clean Water Act of 2009

Passage of the Green Infrastructure for Clean Water Act of 2009 would provide benefits beyond improving our nation's ability to manage our clean water and drinking water. Supporting the green infrastructure approach through this bill will result in multiple benefits, including:

- **Increased research and development** of innovative green infrastructure techniques.
- **Job creation across diverse sectors**, such as plumbing, landscaping, and engineering.

American Rivers

- **Cost savings** because green infrastructure projects are less costly, they reduce the amount of water entering treatment plants which keep energy costs low, and they prolong the life of existing conventional water infrastructure.
- **Environmental and economic benefits to communities**, including reduced flooding and energy use as well as increased community greenspace and property values.

Update – We anticipate that this legislation will be reintroduced in the House and Senate in the 111<sup>th</sup> Congress.

For more information, please contact: Katherine Baer, [kbaer@americanrivers.org](mailto:kbaer@americanrivers.org)