Applying the Triple Bottom Line Analysis to Develop the Framework and Tools for Quantifying Green Infrastructure Co-Benefits

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Outline

• Introduction and acknowledgement
• Overview of technical approach
• Initial inputs from a survey of participating utilities
• Preliminary efforts to date
• Summary and path forward
The Water Research Foundation - WE&RF / WRF Integration

• Represents the evolution of water research
  o 1,200 subscribers
  o 2,300 research studies
  o $700M integrated research portfolio

• Launched January 1, 2018
Summary of Stormwater & Green Infrastructure Research

- Integrated Decision Support System -
  Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC)

Performance Information
* Stormwater BMP Database
* Add Stream Restoration Module to BMP Database
* Algorithm Development

Maintenance Information
* Template to compare Green vs Gray Maintenance Costs
* Update BMP Whole Lift Cost Tool

Co-Benefit Analysis
* Workshop and Template for Co-Benefit Analysis
* Subsequent Data Development and Sharing of Co-Benefit Values

Permitting Guidance
* TCR for Stream Restoration as a BMP

Stormwater Harvesting
Flood Management / Resiliency
Green Infrastructure Co-Benefits

- Framework and Tools for Quantifying Green Infrastructure Co-Benefits and Linking with Triple Bottom Line Analysis
- Incentives for Green Infrastructure Implementation on Private Property: Lessons Learned

Community and Ecosystem Benefits
Project Objectives

• Develop economic analysis framework and a supporting tool to help utilities quantify the multiple benefits of GI at the community level.
  • Developing a transparent and customizable process for a rigorous yet easy-to-follow framework
  • Focusing on methodology / algorithm for quantifying and monetizing the multiple benefits of GI

• Coordinate with Community-enabled Life Cycle Analysis for Stormwater Infrastructure (CLASIC) project.
Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC)

- Project Duration: 4 Years (2016-2020);
- Funding: 2 Million Dollars (plus $0.5M matching funds by Foundation);
- National Collaborating Partners (e.g. ASCE; WEF; American Rivers);
- Life Cycle Cost Analysis of Stormwater Infrastructure Considers “Co-Benefits” of Green Infrastructure;
- Community Engagement for Municipalities & Utilities.
Overview of Project Approach

• Literature/Data Review

• Initial inputs from a survey of participating utilities

• Web Meeting and Workshop

• Analysis Framework and Tool Development

• Case Studies and Beta-Test

• Draft and Final Work Products
16 Participating Utilities Nationwide

- Anne Arundel County (MD)
- Boston Water and Sewer Commission (MA)
- City of Calgary (AB)
- Capitol Region Watershed District (MN)
- Fort Collins Utilities (CO)
- L.A. Bureau of Sanitation (CA)
- City of Raleigh, Stormwater Program (NC)
- Metropolitan Sewer District of Greater Cincinnati (OH)
- Milwaukee Metropolitan Sewerage District (WI)
- Montgomery County DEP (MD)
- New York City DEP (NY)
- Philadelphia Water Dept. (PA)
- Anne Arundel County (MD)
- DC Water (DC)
- Metropolitan Water Reclamation District of Greater Chicago (IL)
- Northeast Ohio Regional Sewer District (OH)
- Seattle Public Utilities (WA)
Survey Response by Participating Utilities

**Question:** Has your utility quantified/monetized stormwater/GI benefits and/or co-benefits?

| Have **not** quantified or monetized stormwater/GI benefits | 27% |
| Have quantified and/or monetized stormwater/GI benefits   | 60% |
| Have quantified and/or monetized GI co-benefits           | 33% |
Reasons why you are interested in quantifying and/or monetizing GI co-benefits

- Identify alternatives that maximize community value
- Understand the distribution of benefits
- Gain community support and buy-in
- Compete for funding
- Inform asset management decisions
- Inform project/sewershed prioritization
- Conduct project-/site-specific analysis
- Gain upper management buy-in
- Support alternative project delivery models
- Leverage additional funding sources

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Priorities for types of GI benefits you are most interested in quantifying and/or monetizing

- Runoff volume reductions
- Water quality improvements
- Climate resilience/adaptation
- Reduced localized flooding
- Ecosystem values
- Urban heat stress reduction
- Value of local green jobs
- Improved air quality
- Other community benefits
- Energy savings
- Groundwater recharge benefits
- CO2 reductions
- Recreation benefits
- Increased property values

[Bar chart showing the priorities with Runoff volume reductions and Water quality improvements being the highest, followed by Climate resilience/adaptation, Reduced localized flooding, Ecosystem values, Urban heat stress reduction, Value of local green jobs, Improved air quality, Other community benefits, Energy savings, Groundwater recharge benefits, CO2 reductions, and Recreation benefits being the lowest.]
General Expectation from Participating Utilities

• Information on the TBL benefits of GI can help utilities/municipalities to:
  • Identify stormwater management alternatives that maximize community values;
  • Compete for scarce funding (e.g. green vs. gray);
  • Leverage private capital and alternative funding sources;
  • Support alternative project delivery models;
  • Gain community support and buy-in.
What is Triple Bottom Line (TBL) Analysis?

• Comprehensive benefit-cost analysis that accounts for the full range of
  • financial
  • social
  • environmental
costs and benefits of a project or program over time, and to whom they accrue.

• Reflects the fact that public agencies aim to provide the greatest total value to their communities
Example Category of GI Co-Benefits

Co-Benefits of Green Infrastructure Program include:
- Hydrology / Water Quantity;
- Water Quality / Pollutant Loading;
- Ecosystems (e.g. biodiversity, habit and wildlife);
- Energy Saving and Heat Mitigation;
- Climate Resilience / Flood Management;
- Air Quality (air pollution mitigation and the decrease of carbon footprint);
- Community Benefits (including social impacts; more green space and parks; increasing property values; green jobs);
- Traffic (e.g. reducing noise impact by damping traffic; the use of green streets).
TBL Benefits of Green Infrastructure

**Social**
- Improved quality of life
- Increased property values
- Green job creation
- Increased economic development
- Increased recreational space
- Increased resiliency

**Financial**
- Capital costs (and potential savings over lifecycle)
- Maintenance and replacement costs
- Avoided gray infrastructure (e.g., stormwater pumping and treatment costs)

**Environmental**
- Improved air and water quality
- Groundwater recharge
- Improved habitat/ecosystem benefits
- Decreased GHG emissions
- Reduced urban heat stress
- Greater flood protection
Key Components of Technical Approach

• Work with utility partners to understand information and data needs

• Develop transparent process and rigorous method rather than “one size fits all” approach or calculator

• Focus on benefits methodology

• Address existing research gaps (e.g., “hard-to-quantify” benefits)

• Provide a range of outputs to meet user’s needs

• Conduct sensitivity analysis and document uncertainties
Example of Analysis Framework
Data Availability Relating to “GI Co-Benefits”  
(Based on an Initial Survey)

- Capital costs of GI practices: 80%
- Maintenance costs of GI practices: 70%
- Performance/effectiveness of GI practices: 60%
- Gray infrastructure stormwater treatment costs: 50%
2016 was the 20 Years’ Anniversary of “BMP Database”!
Leaders Innovation Forum for Technology (LIFT)

Utility Peer Network
Technology Scans
LIFT Link
FAST Water Network

Technology Survey
SEE IT
University-Utility Partnership
Hubs, Partners, and Affiliates
Example Output of Stormwater Infrastructure Life Cycle Cost Tool (1)
Example Output of Stormwater Infrastructure Life Cycle Cost Tool (2)
Summary and Path Forward

• **Objective:** To identify stormwater management and GI practices that maximize community value by considering co-benefits

• **Framework:** Develop a Rigorous Framework for Quantifying / Monetizing the Multiple Benefits of GI via TBL Analysis

• **Tool:** Develop an User-Friendly Supporting Tool for Quantifying GI Co-Benefits

• **Linkage:** To coordinate with Life Cycle Cost Analysis for Stormwater Infrastructure at Community Level
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