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**Green Infrastructure Maintenance - Case Studies in Program Development and Implementation**

April 5th, 2017
1:00 PM - 3:00 PM ET
How to Participate Today

- Audio Modes
  - Listen using Mic & Speakers
  - Or, select “Use Telephone” and dial the conference (please remember long distance phone charges apply).
- Submit your questions using the Questions pane.
- A recording will be available for replay shortly after this webcast.

Today’s Moderator

Dwayne Myers, P.E., D.WRE
CDM Smith
Today’s Presentations

PWD’s Green Stormwater Infrastructure Maintenance Program
Meg Malloy
Barbara Cushing

Green Infrastructure Manager for DC Water’s DC Clean Rivers Project
Bethany Bezak, PE, LEED AP

Introduction to the National GI Certification Program (NGICP)
Stacy J. Passaro, P.E., BCEE
Drinking Water
1.73 million customers in Philadelphia, Bucks, Montgomery & Delaware Counties

Wastewater
2.22 million customers in Philadelphia, Bucks, Montgomery & Delaware Counties

Stormwater
Philadelphia City/County only

Distribution of Philadelphia GSI
**Relational Asset Management**

**SMP**

**Component**

**Attribute**

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**FY2016 Scope of Work**

53 new projects
71 new SMPs
Overview of Typical Assets

Vegetated Area (ft²)

Pipe Length (ft)

Count of SMP Trees

Water Environment Federation
GSIMN’s Plant ID Guide
Relational Asset Management & Maintenance Maps

Routine Surface Maintenance
Routine Subsurface Maintenance

- Routine Maintenance
  - Regenerative air vacuum sweeper (Tymco 210 or 435)
- Restoration of Porosity
  - Water broom with vactor attachment

Porous Pavement Maintenance
Porous Pavement Winter Maintenance

• Precipitation events >0.25"
• De-icer pre and post treatment for every
• Organic de-icer at SWWPCP
• Calcium chloride in ROW
• Plowing > 1" (*City triggers for ROW)
• Plow blade with rubber tip raised approx. 0.5" above surface

Aesthetic Maintenance
Partnership With PowerCorps_PHL

“In-House” Reactive Maintenance: GSI Maintenance Apprentices
Dry Weather Inspections

Wet Weather Inspections
On-Call Additional Maintenance

- Reactive Maintenance
  - redevelopment and utility maintenance impacts

[Diagram showing various maintenance activities]

- Velocity Drainage Reconstructions 9%
- Plantings 9%
- Managed Drainage Allocations 12%
- Subsurface Investigations 15%
- Inlet Drainage Modifications 14%
- Track Construction/Repair 24%
- Other 5%
Landscape Public Works Contract

- Landscaping Public Works Contract (50153) started in March 2016
- Planting, seeding, mulching, and fencing for all capitol projects
- GSIMN completed site inspections
- GSI Unit to assist in FY 2018

Photopoints?
**Soil Moisture Sensor Study**

- Watering is a large annual cost
- Improving predictions of watering needs can save costs
- 9 moisture monitoring units at 4 GSI sites
- Results: Moisture is highly variable, depending on soil type and sensor location
- Recommend to continue in FY 2017-18 season

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**Surface Maintenance Cost Analysis**

Costs per Area (as Vegetated Footprint) by SMP
Vegetation Study

- Mapped 100 “soft” sites with species
- Identified 1,233 unique target species
- A range of 2-45 species per SMP

Bethany Bezak, PE, LEED AP

- Green Infrastructure Manager for DC Water’s DC Clean Rivers Project
Incorporating Adaptive Management into Maintenance
Bethany Bezak
DC Clean Rivers Project

Agenda

- Overview of DC Water’s DC Clean Rivers Project (DCCR)
- DCCR’s GI Asset Management and Maintenance Program
- Adaptive Management Examples
- Green Infrastructure, Green Jobs
Combined Sewer System in Washington, D.C.

- Combined Sewer System covers 1/3 of the District (12,478 acres)
- 47 Active CSO outfalls
  - 13 to Anacostia
  - 10 to Potomac
  - 24 to Rock Creek
- Three receiving waters
  - Anacostia River
  - Potomac River
  - Rock Creek

Magnitude of the Problem and DC Water’s Solution

- Combined Sewer Overflow (mg/avg year)
  - Anacostia River: 2142 (1996), 54 (2016), 79 (Program Completion), 138 (Total System)
  - Potomac River: 1282 (1996), 638 (2016), 43 (Program Completion), 5 (Total System)
  - Rock Creek: 1063 (1996), 3254 (2016), 49 (Program Completion), 1963 (Total System)
- 96% Reduction
DC Clean Rivers Project Scope

- CSO’s 027, 028, 029: Manage volume equal to 1.2” of rain falling on 133 impervious acres
- CSO 049: Manage volume equal to 1.2” of rain falling on 365 impervious acres
- CSO’s 025, 026: Separate sewers
- CSO’s 020-024: Control using Potomac River Tunnel

GI Volume Management Requirements

- Consent Decree requires DC Water to construct 5 projects in Rock Creek and 3 projects in the Potomac River
- Volume Requirement: Manage 1.2” of runoff from 500± impervious acres total
- Deadlines for first project in each sewershed:
  - Rock Creek Project A: Place in Operation 3/30/19
  - Potomac River Project A: Place in Operation 6/23/19
Adaptive Management Process for GI Implementation

- Amended Consent Decree - phased GI implementation into multiple projects
- DCCR will incorporate lessons learned on design, construction, maintenance, etc. as projects are built

Asset Management and Maintenance Goals

- GI maintenance will be required via NPDES permit.
- Long-term, DCCR must improve the cost-effectiveness of maintenance while ensuring GI’s:
  - Function and performance
  - Safety to the public
  - Aesthetics

Data collection must be in real-time to improve long-term maintenance efficiencies
DC Water’s Enterprise-wide Asset Management

• DC Water currently operates and maintains water and sewer infrastructure, which includes:
  - 1,350 miles of water pipes and 1,900 miles of sewers,
  - 4 water and 9 wastewater pumping stations, and

• DC Water’s Asset Management Program used across all departments uses a combination of GIS and Maximo

Considerations to Achieve Asset Management Goals

• Defining the data to collect
• Determining the mechanism to collect data
• Enforcing the contractor’s completion of data collection
DCCR’s Defined Data

- Representation within GIS
  - Inlets/energy dissipation
  - Surface layer(s)
  - Subsurface layers (if different than surface)
  - Cleanouts and observation wells
  - Underdrains
- Data to be input
  - General information, i.e. Contract number
  - Practice definition, i.e. planter bioretention
  - Warranty end date
  - Mixes and depths for permeable pavement and/or bioretention soil media

Mechanism for Data Collection

- DCCR is using mobile program because too much data is needed to be captured to allow paper forms or data input after maintenance to be effective
- Any mobile solution for DCCR must be:
  - Easy to pick up and use for expected contractors in the near-term
  - Be compatible with DC Water’s software for the long-term
- DCCR’s mobile application development to-date includes:
  - Gaining an understanding of DC Water’s wider asset management program,
  - Defining the data to collect, and
  - Evaluating software and hardware available for use.
Evaluation of Mobile Software App

- DC Water’s Options for a Mobile Asset Management Software

- DCCR initially chose Maximo Anywhere to pilot among other programs based on:
  - Cost (startup and operating)
  - User experience/training needs
  - Customization needs vs. ‘out-of-the-box’ features
  - Coordination with IT to get up and running
  - Ability to work without internet

  - Hardware needs
  - Server needs
  - Ability to take pictures
  - Ability to be enterprise-wide solution

User Testing Maximo Anywhere

- Maximo Anywhere determined to meet data collecting requirements.
- DCCR evaluated ways to improve the usability for a less-experienced Maximo user, included:
  - The information presented/the order of the information
  - Size of buttons
  - The speed of clicking through features
  - The fields available for selection

- Mobile applications must balance software’s data collection abilities with user-friendliness
Evaluation of Hardware for Mobile App

**Toughbooks**
- IT-recommended
- Little customization
- Limited mobility
- Expensive ($5,000)

**Tablets**
- Customization required
- Greater mobility
- Moderate Cost

**Smartphones**
- Most customization
- Greatest mobility
- Small viewport
- Least cost

Other considerations:
1. OS Compatibility
2. OS-specific customization
3. Organization’s IT security policies (i.e. contractor’s cannot provide own devices)

*Tablets selected due to balance between mobility and customization needs*

Examples of Maximo Anywhere

![Maximo Anywhere Task Example](image)
Incorporating Adaptive Management into Planning

Potential Changes:
- Contract
- Maintenance Tasks and Frequencies
- Design

Potential Questions:
- Is the contractor completing work orders? On time?
- Are tasks taking too long?
- Are the practices functioning?
- Are there common failures that could be fixed?

Examples of DCCR’s Adaptive Management Changes

- Contract
  - Defined period to complete maintenance, i.e. “Between the 7th and 15th day of every month”
  - Payment contingent upon completed work order

- Maintenance Tasks and Frequencies
  - Multiple “as-needed” vacuum tasks to allow additional maintenance during fall, dependent on when leaves fall

- Design
  - Incorporation of a catch basin-type inlet into bioretention to centralize
Green Infrastructure, Green Jobs

- Skilled workforce is critical to performance of GI
  - Knowledge across full lifecycle of GI - Construction, Inspection, Maintenance
- Green jobs is important component to realizing Triple Bottom Line benefits
- Strong focus in DC and other communities
- DC Water formalized commitment via DC Water/District ‘Green Jobs MOA’ (available at dcwater.com/green)

Need for GI Certification

- Creating a National Certification establishes a long term pathway for living wage jobs across the United States
- No national certification program exists for GI construction and maintenance
- GI and stormwater controls are becoming more common and grow substantially
- GI maintenance is increasingly required in many NPDES permits
- There is a need to establish minimum standards and assure workers have skill sets required for GI to be effective over long term
- DC Water and WEF partnered to establish the National Green Infrastructure Certification Program
Stacy J. Passaro, P.E., BCEE
NGICP Program Manager
Office Number: (301) 829-5163
spassaro@wef.org

Introduction to the National GI Certification Program (NGICP)
What is NGICP?

- A national credential that is awarded after successful completion of an exam designed to verify that candidates possess the foundational knowledge and understanding to properly perform entry level field job tasks in constructing, inspecting and maintaining a variety of common GI practices.

Objectives of NGICP

- Ensure that a skilled labor pool is available to construct, inspect and maintain GI facilities.
- Support sustainable performance of GI practices.
- Create perennial GI jobs that will pay a living wage to unemployed or underemployed local residents.
Eligibility Requirements

Candidates must have
- A high school diploma/GED
  and
- Recently participated in GI construction, inspection and maintenance training (minimum 35 hours combined classroom and field time)

Program Components

National Job Analysis  Body of Knowledge

Learning Objectives & Curricula  Exam Blueprint

Training Support Materials  Exam Development

- NGICP developed in accordance with ANSI accreditation guidelines
Certification Council Members

- Geoff Brosseau, Executive Director of the California Stormwater Quality Association
- Jeanette Brown, Assistant Professor, Manhattan College
- Bart Jones, Principal at Barton Jones, LLC
- Sandra Ralston, Principal at Consensus, LLC
- Marsha Slaughter, Utilities Director for the City of Oklahoma
- Alan Vicory, Principal at Stantec
- Jennifer Wigal, Water Quality Program Manager at the Oregon Department of Environmental Quality
- Carlton Ray, Director, DC Water DC Clean Rivers Project, District of Columbia

Current NGICP Partners

- DC Water, Washington, D.C.
- Milwaukee Metropolitan Sewerage District (MMSD), Wisconsin
- Montgomery County, Maryland
- Kansas City Water Services Department, Missouri
- Fairfax County, Virginia
- City of Baltimore Department of Public Works, Maryland
- Louisville Metropolitan Sewer District, Kentucky
- San Francisco Public Utilities Commission, California
- Capital Region Water, Harrisburg, Pennsylvania
- Metropolitan Water Reclamation District of Greater Chicago, Illinois
- New Orleans Delegation, Louisiana
- Pittsburgh Water and Sewer Authority, Pittsburgh, Pennsylvania
- Metropolitan Sewer District of Greater Cincinnati, Cincinnati, Ohio
- Boston Water and Sewer Commission
Partners’ Roles

• Participate in the Strategic Advisory Group
  ▪ Help WEF develop a flexible program that meets a variety of needs

• Provide technical expertise for:
  ▪ Job task analysis survey
  ▪ Curriculum/training support material development
  ▪ Exam development
  ▪ Organize/provide training

NGICP Development

• NGICP development kicked off January 2016

• Job task survey conducted May 2016

• Exam blueprint approved early summer 2016

• Program policies and procedures developed in summer/fall 2016

• Exam developed summer/fall 2016

• Curriculum and training support materials developed summer/fall 2016
NGICP Exam Blueprint

1. Watershed Fundamentals 6-10%
2. GI Practices 19-23%
3. GI Methods and Materials 50-54%
4. GI Functionality and Appearance 17-21%

Recommended Training Structure

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<th>Module</th>
<th>Number of Slides</th>
<th>Estimated Classroom Time (hrs)</th>
<th>Estimated Hands On or Field Time (hrs)</th>
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<td>Module 12 - Managing GI for Long-Term Performance</td>
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</tbody>
</table>
Bioretention

- Creates opportunities for:
  - Capture
  - Storage
  - Infiltration
  - Evapotranspiration

Permeable Pavements

- Allows for:
  - Capture
  - Storage
  - Infiltration
Rainwater Harvesting

• Cisterns and rain barrels achieve:
  ▪ Capture
  ▪ Storage
  ▪ Potable water conservation

Green Roofs / Blue Roofs

• Achieve:
  ▪ Capture
  ▪ Storage
  ▪ Evapotranspiration (green roofs)
Dry Wells

- Allows for:
  - Capture
  - Storage
  - Infiltration

Stormwater Wetlands

- Creates opportunities for:
  - Capture
  - Storage
  - Infiltration
  - Treatment
  - Evaporation
  - Transpiration
Inaugural Group of Certificants

- First training conducted October/November 2016
- First exam administered December 13, 2016
- First round of NGICP Certifications awarded January 2017

Current Status

- Pilot year with partners - 2017
  - Spring training underway now
  - Exam on June 6, 2017
  - Fall training planned
  - Exam in early November 2017
- Business planning underway
- National rollout scheduled for early 2018
Additional Resources

• www.ngicp.org

Supporting GI Maintenance Programs

• DC Water example
Questions?

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