Welcome to *The Current*, the North Central Region Water Network's Speed Networking Webinar Series

Getting the Green Light for Green Infrastructure: 2pm CT

Submit your questions for presenters via the Q&A panel. There will be a dedicated Q&A session following the last presentation. The Q&A panel can be found via the Q&A icon at the bottom of the webinar screen.

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This session will be recorded and available at northcentralwater.org.

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Today's Presenters:

- **Paula Conolly**, Director, Green Infrastructure Leadership Exchange: *"The Green Infrastructure Leadership Exchange: Challenges and Success Stories"*

- **Harry Zhang**, Research Program Manager on Integrated Water and Stormwater, The Water Research Foundation: *"Advancing Green Infrastructure Practices through CLASIC Life Cycle Cost Tool and Co-Benefit Analysis"*

- **John Watson**, Associate Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago: *"Greening Chicagoland for Reduced Flooding"*

Paula Conolly

Paula Conolly, AICP, is committed to making green stormwater infrastructure work in communities across North America. She is the Director of the Green Infrastructure Leadership Exchange (Exchange), a peer learning network of municipalities, water utilities, and counties seeking to advance their green stormwater infrastructure programs. Prior to the Exchange, she led policy initiatives for Philadelphia's renowned Green City, Clean Waters program, helping to change "business as usual" to implement over 30 acres of green stormwater infrastructure on vacant lands, parks, streets and private property. Ms. Conolly helped to spearhead a state-of-the art drinking water protection program for the City of Philadelphia, helping to raise over $3M to improve and protect the Schuylkill River Watershed. Prior to that, Paula consulted on public health and environmental initiatives at Booz Allen Hamilton. Paula is a graduate of the University of Notre Dame.

the green infrastructure leadership exchange

The "Current" Webinar Series

Green Infrastructure Leadership Exchange

Challenges and Successes



The Exchange

giexchange.org

MISSION

To accelerate the affordable and equitable implementation of green stormwater infrastructure (GSI) throughout North America by supporting peer learning, innovation and collaboration among cities, counties and utilities.

VISION

Communities with thriving GSI systems that further social equity, public health, and climate resilience.

the **green** infrastructure leadership exchange

Discussion Points

- Challenge 1: Centering community needs in GSI design and implementation
- Challenge 2: Funding & financing
- Challenge 3: Knowledge creation

Challenge #1

Centering Community in GSI Work

- **Local Level Solution**: City of Grand Rapids
- **Collective Level Solution**: Equity Evaluation Framework (under development) & Adaptive Management Resources

Challenge #2

Emphasizing co-benefits within financing programs

- **Local Level Solution**: City of Atlanta
- **Collective Level Solution**: giexchange.org/resources/

Challenge #3

Knowledge creation: Costs, co-benefits, performance

- **Local Level Solution**: University Partnerships
- **Collective Level Solution**: Water Research Foundation, State of the Field Report

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Harry Zhang

Dr. Harry Zhang is the Research Program Manager on Integrated Water and Stormwater at The Water Research Foundation (WRF) where he directs the research portfolios on Stormwater and Sustainable Integrated Water Management. He is the Section Editor on Water Sustainability for the Encyclopedia of Sustainability Science and Technology (Second Edition). Harry holds a PhD in civil and environmental engineering (water resources) and is a registered professional engineer.

Advancing Green Infrastructure Practices through CLASIC Life Cycle Cost Tool and Co-Benefit Analysis

Harry Zhang, PhD, PE
Research Program Manager on Integrated Water and Stormwater
The Water Research Foundation
Email: hzhang@waterrf.org

September 15, 2021

CLASIC Decision Support System

What is CLASIC?

*- CLASIC stands for "**C**ommunity-enabled **L**ifecycle **A**nalysis of **S**tormwater **I**nfrastructure **C**osts"*

*- The CLASIC tool is a user-informed screening tool which utilizes a **lifecycle cost framework** to support stormwater infrastructure decisions on extent and combinations of **green, hybrid green-gray and gray infrastructure practices**.*

- CLASIC tool is part of EPA's Green Infrastructure Modeling Toolkit.

Questions the CLASIC Tool Seeks to Answer

- How do various scenarios of stormwater infrastructure compare in terms of:
  - Lifecycle cost
  - Runoff volume reduction
  - Pollutant removal
  - Social benefits
  - Environmental benefits

- How does land use and climate change affect future performance of scenarios of green and gray infrastructure?

- How do maintenance and long-run costs compare for user selected scenarios?

Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC)

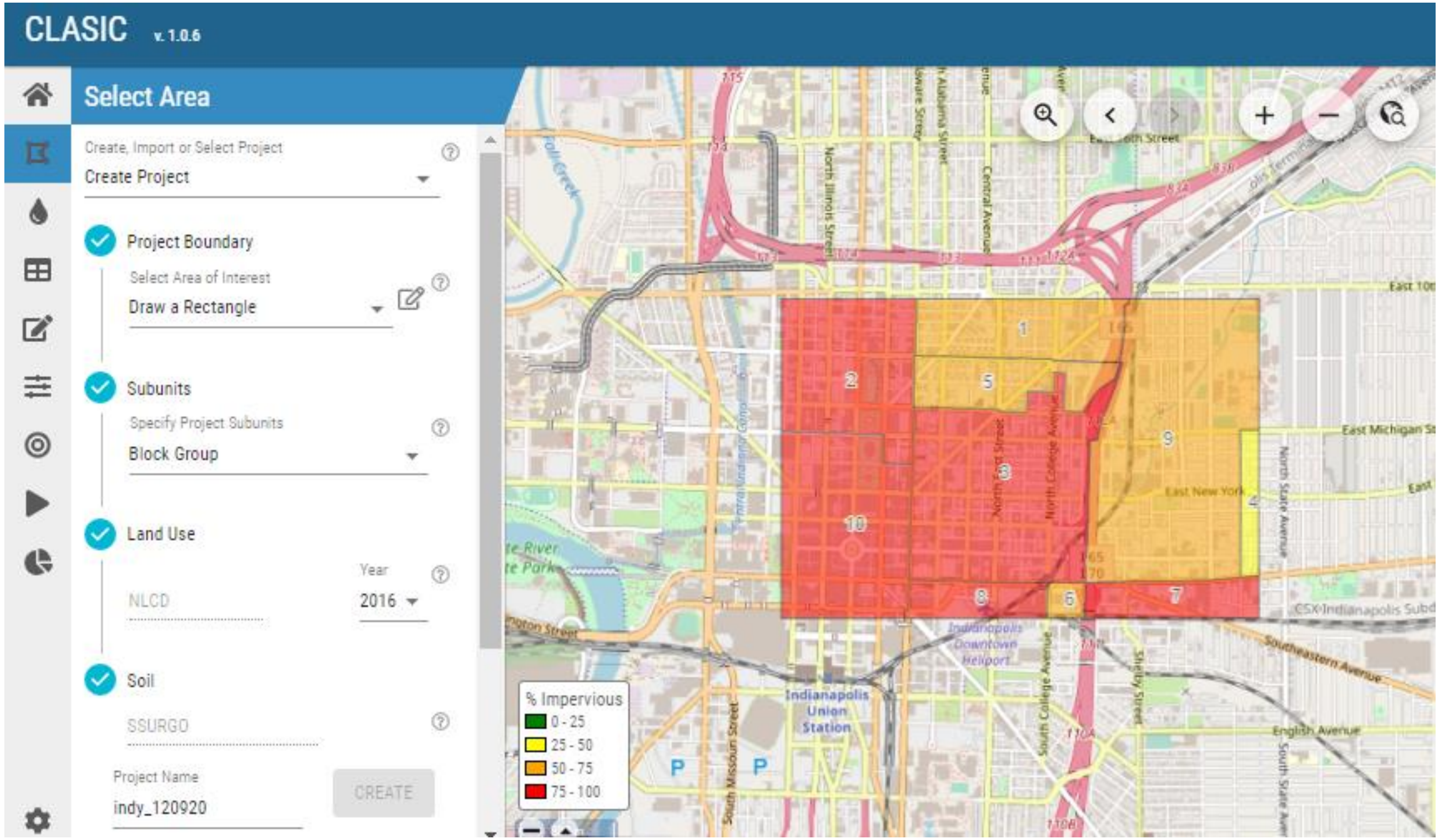
(https://waterrf.org/CLASIC) and (https://clasic.erams.com/)

Output	Included in CLASIC Life Cycle Cost Tool
Pollutant Load Reduction	· TSS (Total Suspended Solids) · TN (Total Nitrogen) · TP (Total Phosphorus) · FIB (Fecal Indicator Bacteria)
Hydrologic Performance	· Runoff Volume · Volume Infiltrated · Volume Evapo-transpired · Number of runoff events
Life Cycle Cost (LCC)	· Net Present Value ○ Construction ○ Maintenance ○ Replacement · Average annual cost over design life · Unit cost for scenario comparison
Co-Benefits	· Score of economic, environmental, social benefits based on user-selected importance factors

CLASIC

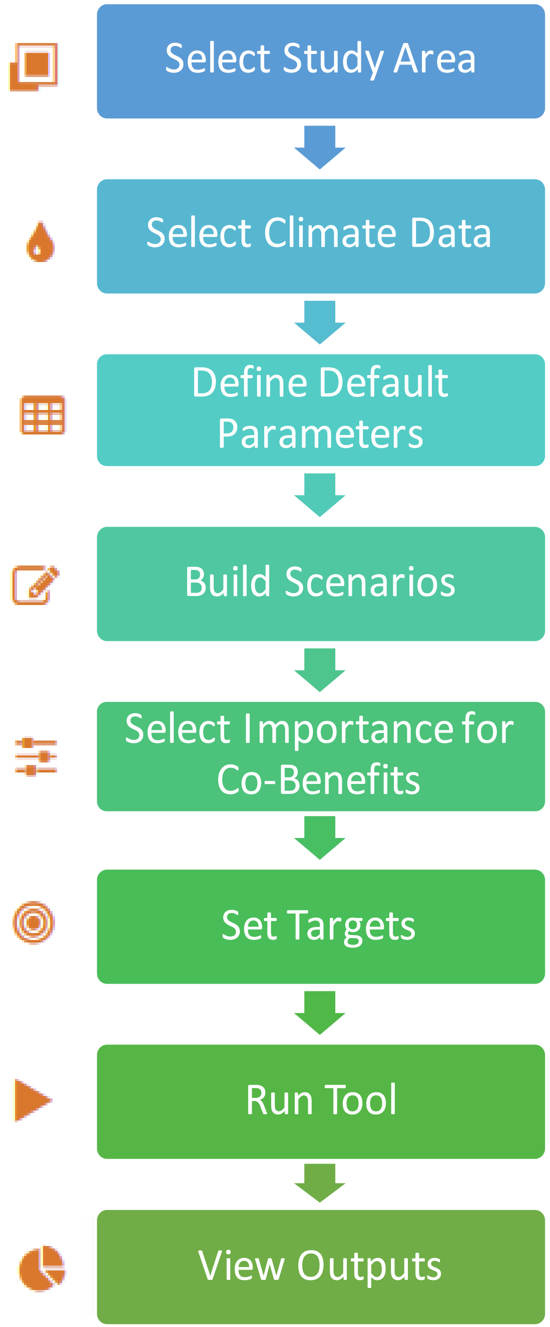
Web based Decision Support System for Stormwater Management

https://waterrf.org/CLASIC or https://clasic.erams.com/



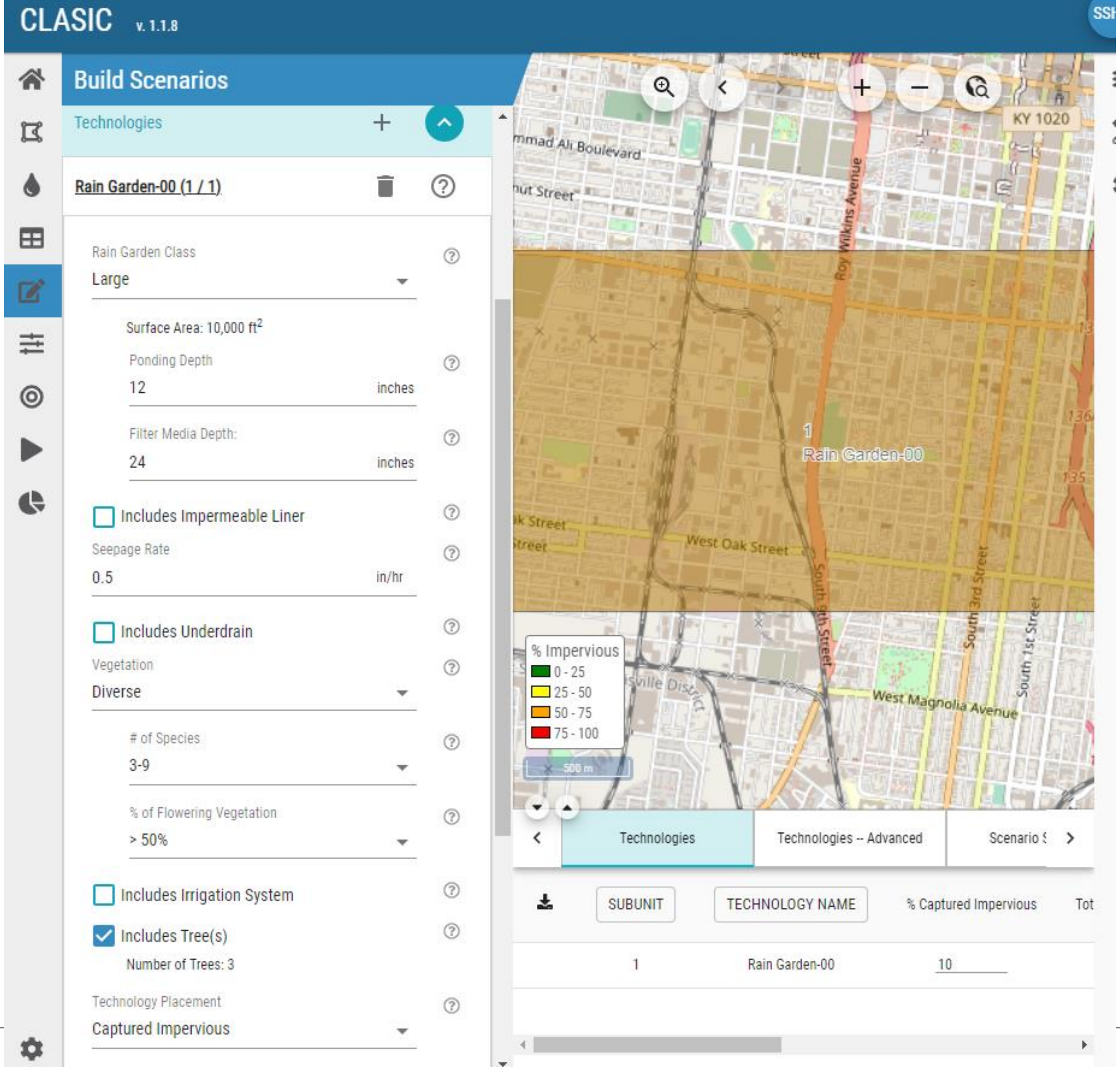
GIS Interfaced for automated data collection of CLASIC inputs (area characteristics)

CLASIC Tool Steps



BMP Technology Categories in CLASIC Life Cycle Cost Tool

- Rain Garden / Bioretention
- Sand Filter
- Infiltration Trench
- Grass or Vegetated Swales
- Permeable Pavement
- Vegetated Buffer
- Grass Strip
- Green Roof
- Extended Detention Basins
- Wet Pond
- Wetland channel
- Stormwater Harvesting
- Rooftop Disconnection
- Storage Tunnel/Vault

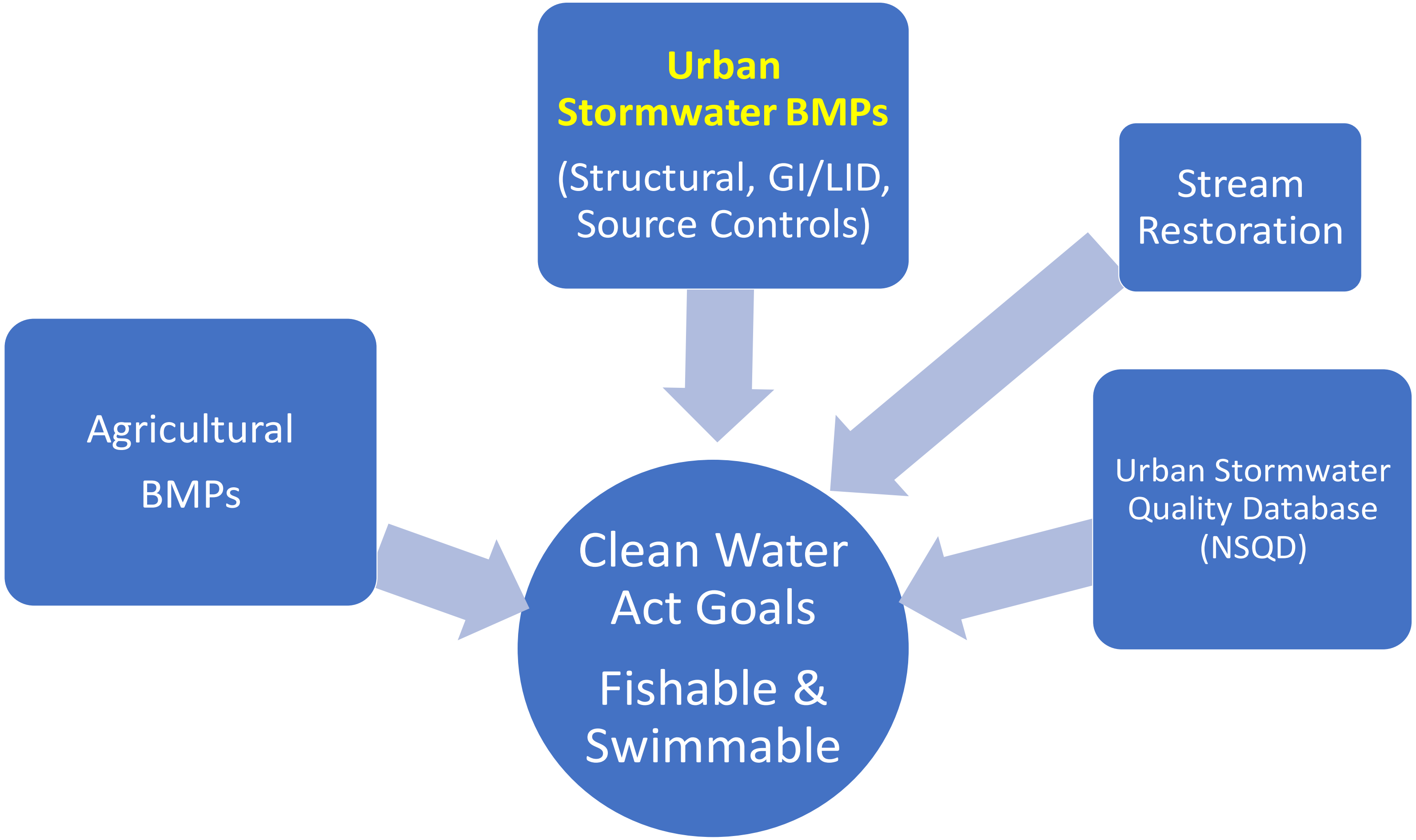


Example interface for Stormwater BMP in CLASIC Tool

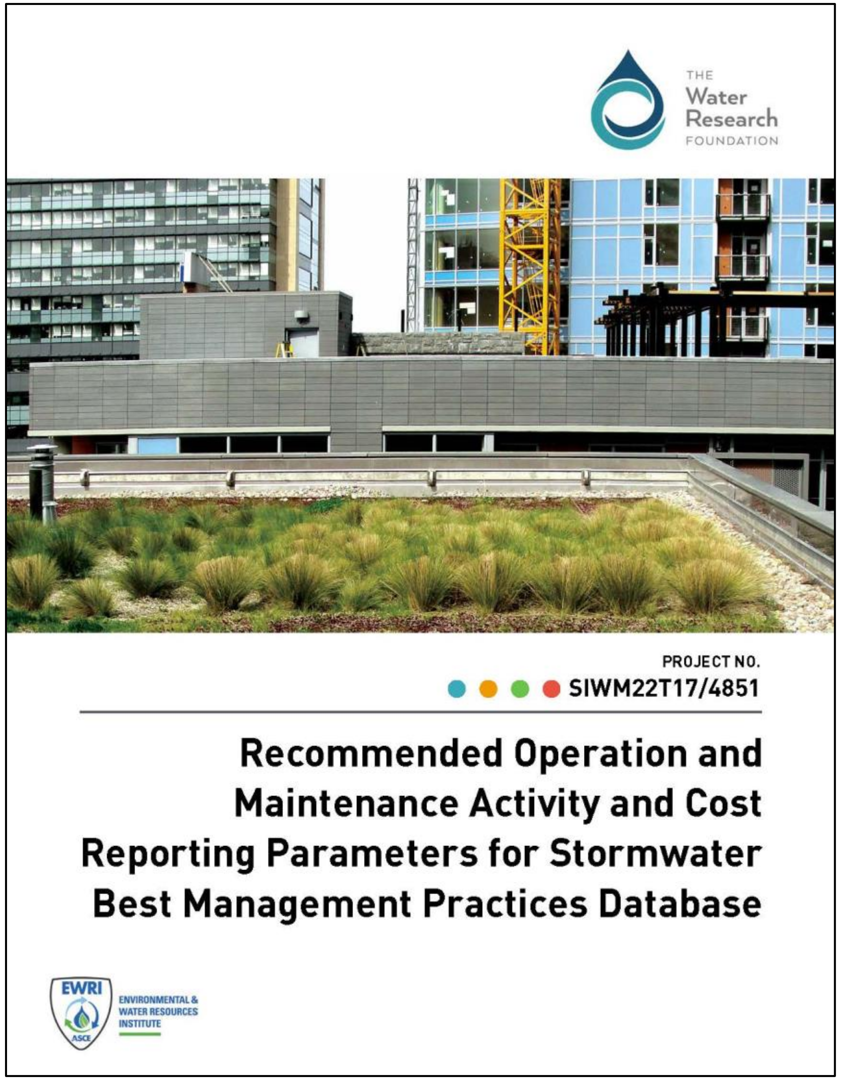
International Stormwater BMP Database

(https://www.bmpdatabase.org/)

INTERNATIONAL STORMWATER BMP DATABASE
www.bmpdatabase.org



Stormwater BMP Performance and Cost Database



Urban BMP O&M Cost Database (https://bmpdatabase.org/urban-bmp-cost)

Three Outputs from CLASIC Life Cycle Cost Tool

Performance

Water Quality
Runoff Volume
Volume Infiltrated
Volume Evapotranspired

Lifecycle Cost

Cost buildup method
Construction
Maintenance
Rehabilitation
- Net present value
- Average annual cost over design life
- Per unit cost for scenario comparison

Co-Benefit Analysis

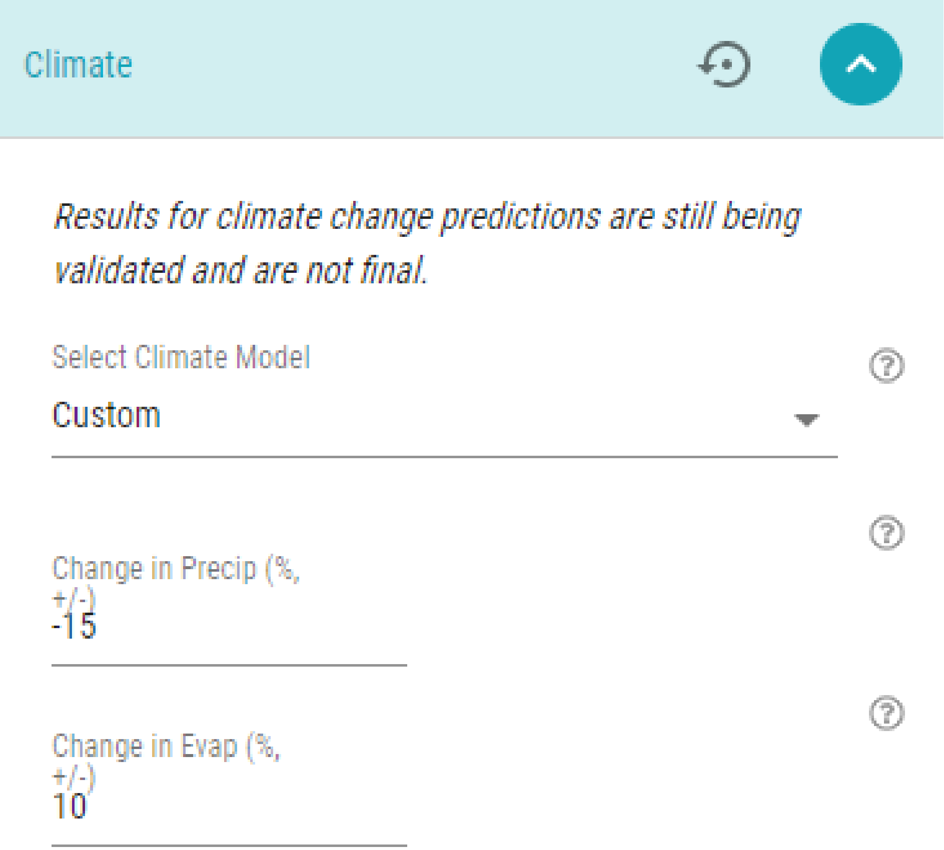
Score of economic, environmental, social elements based on:
- User selected importance factors
- Performance and cost output

CLASIC Tool Outputs

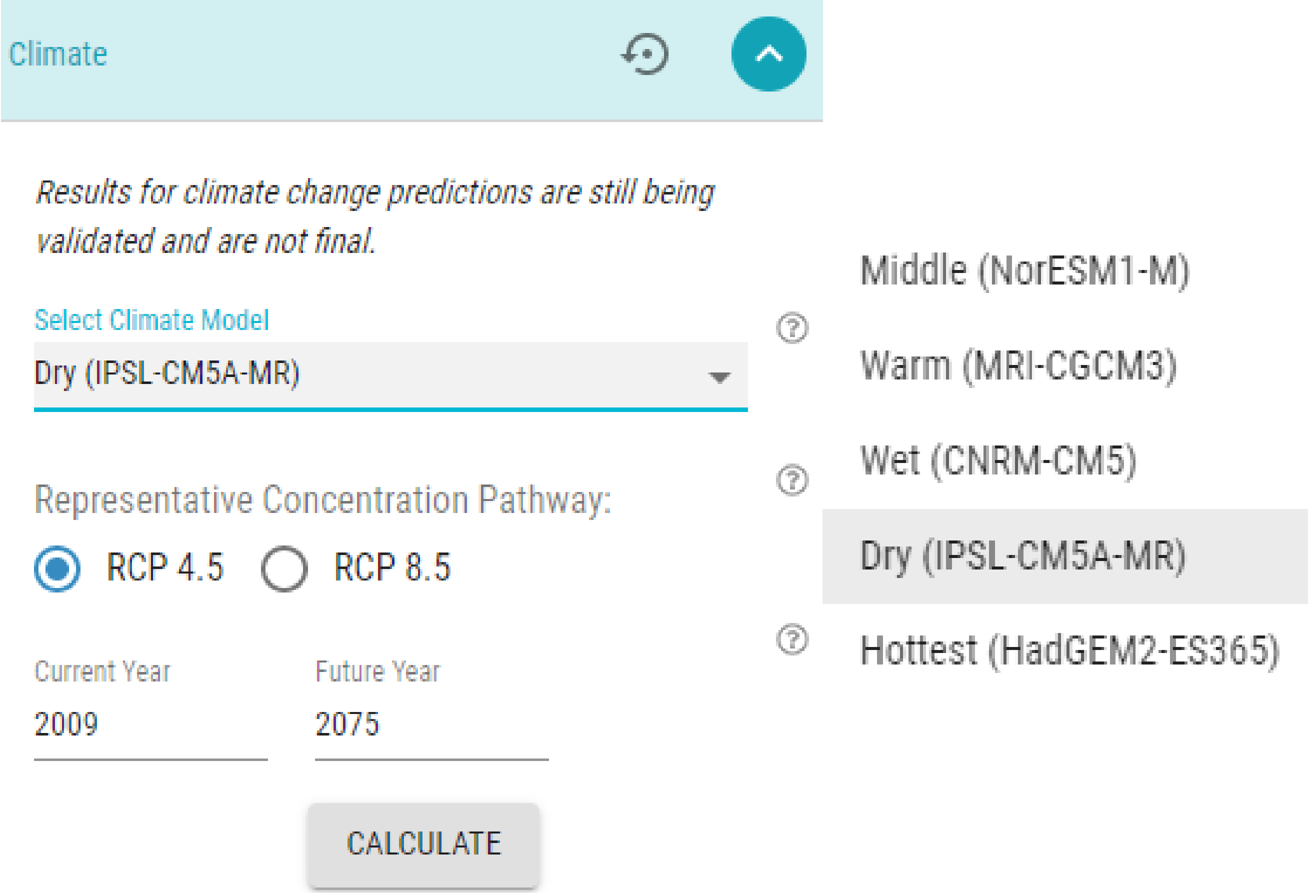
- Performance
- Life Cycle Cost
- Co-Benefits

Building Climate Scenarios in the CLASIC Tool

Custom



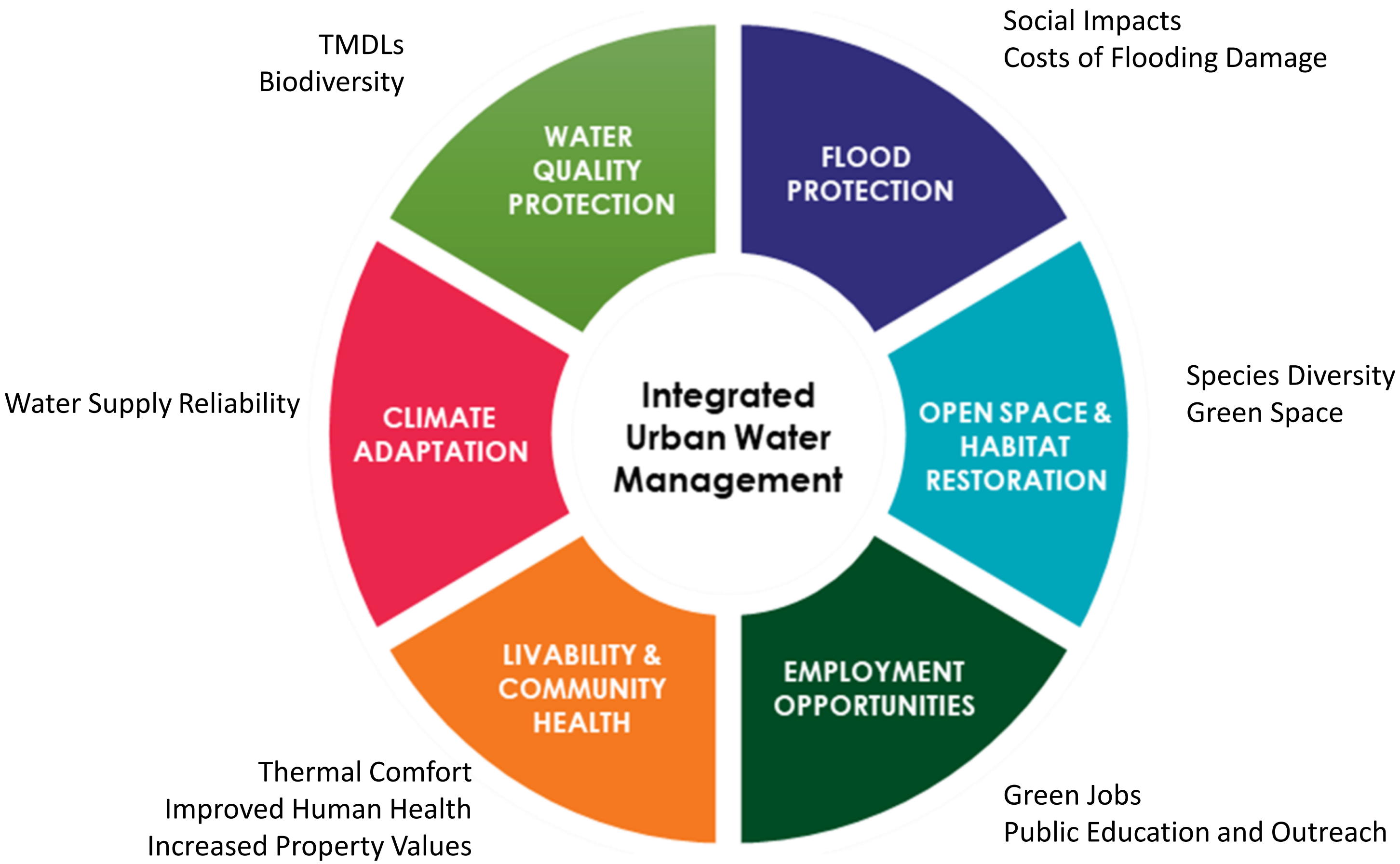
Use CMIP5 Climate Models



CLASIC Scenario Comparison

- ***Technology***
- ***Climate***
- ***Climate & Technology***

Co-Benefit Analysis in CLASIC Tool



Benefit: Economic Framework and Tools for Quantifying and Monetizing the Triple Bottom Line Benefits of Green Stormwater Infrastructure

(WRF Projects 4852 and 5105)

Social

- ✓ Improved air quality and related health benefits
- ✓ Water supply
- ✓ Ehanced aesthetics and community livability
- ✓ Flood risk reduction
- ✓ Reduced urban heat stress and related health benefits
- ✓ Increased recreational opportunities and enjoyment of green space
- ✓ Green job creation

Financial

- ✓ Avoided infrastructure and/or treatment costs
- ✓ Asset life extension
- ✓ Energy savings

Environmental

- ✓ Water quality and associated aquatic habitat improvements
- ✓ Carbon reduction
- ✓ Ecosystem benefits

WRF Free Webcast on 9/23/21 (3 to 4:30 PM Eastern Time) – Registration Link is Here

John Watson

John Watson is an Associate Civil Engineer at the Metropolitan Water Reclamation District of Greater Chicago, where he manages green infrastructure stormwater projects and helped to develop their green infrastructure plan to meet the EPA Consent Decrees. He earned his bachelor's degree in Civil & Environmental Engineering from Valparaiso University and his master's degree in Environmental Hydrology and Hydraulic Engineering from University of Illinois - Urbana Champaign, where he worked on modeling Chicago's Deep Tunnel system (TARP). Today, John is a Professional Engineer, a Certified Floodplain Manager, and a committee member for the Water Environment Federation, working in the green stormwater infrastructure program at the MWRD of Greater Chicago.

Metropolitan Water Reclamation District of Greater Chicago

Greening Chicagoland to Reduce Urban Flooding

"The Current" Webinar

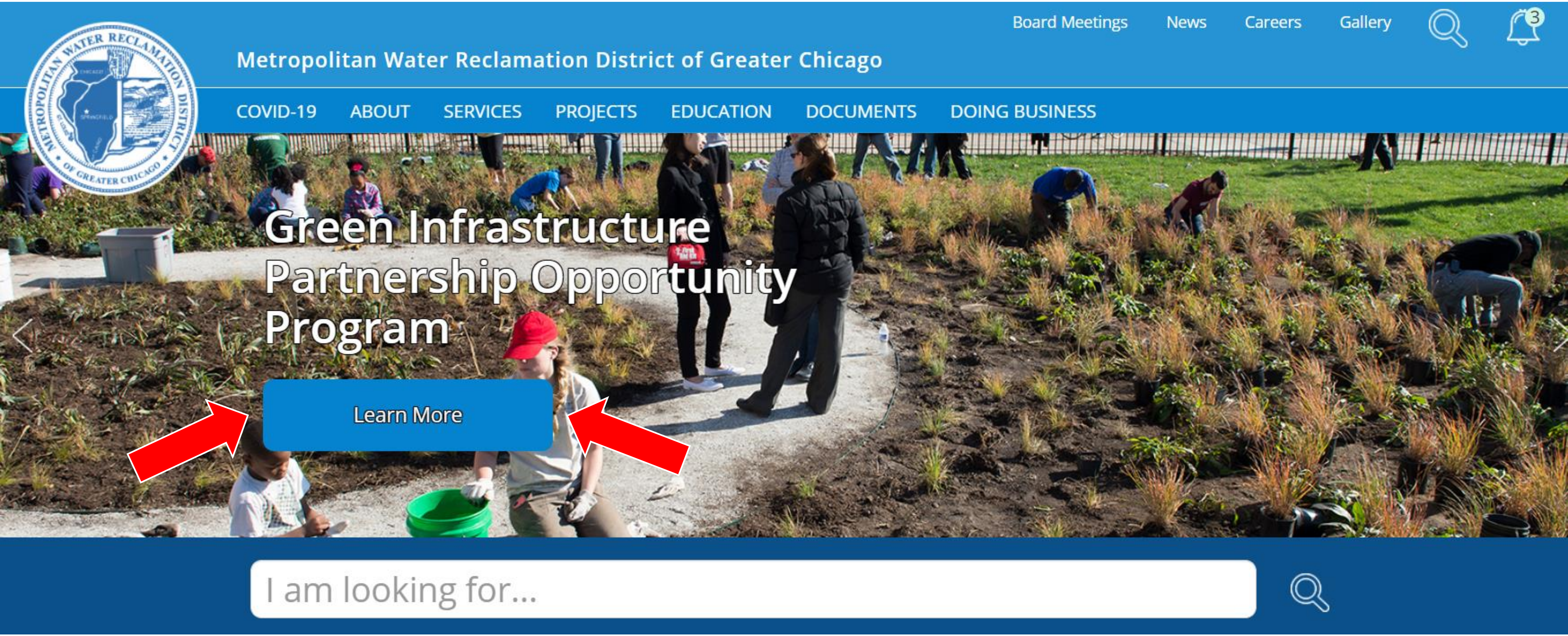
9/15/2021

Agenda

- Summary of previous-year GI program partnerships
- 2021 GI Call for Projects
- Eligibility and Project Prioritization
- Project benefits (in liu of ROI)
- Funding options
- Example GI projects

GI Project Partnership Opportunity Program

Visit www.mwrd.org



2020 GI Call for Projects

Applications Submitted

32

Projects Selected

16

Estimated Structures Benefitted

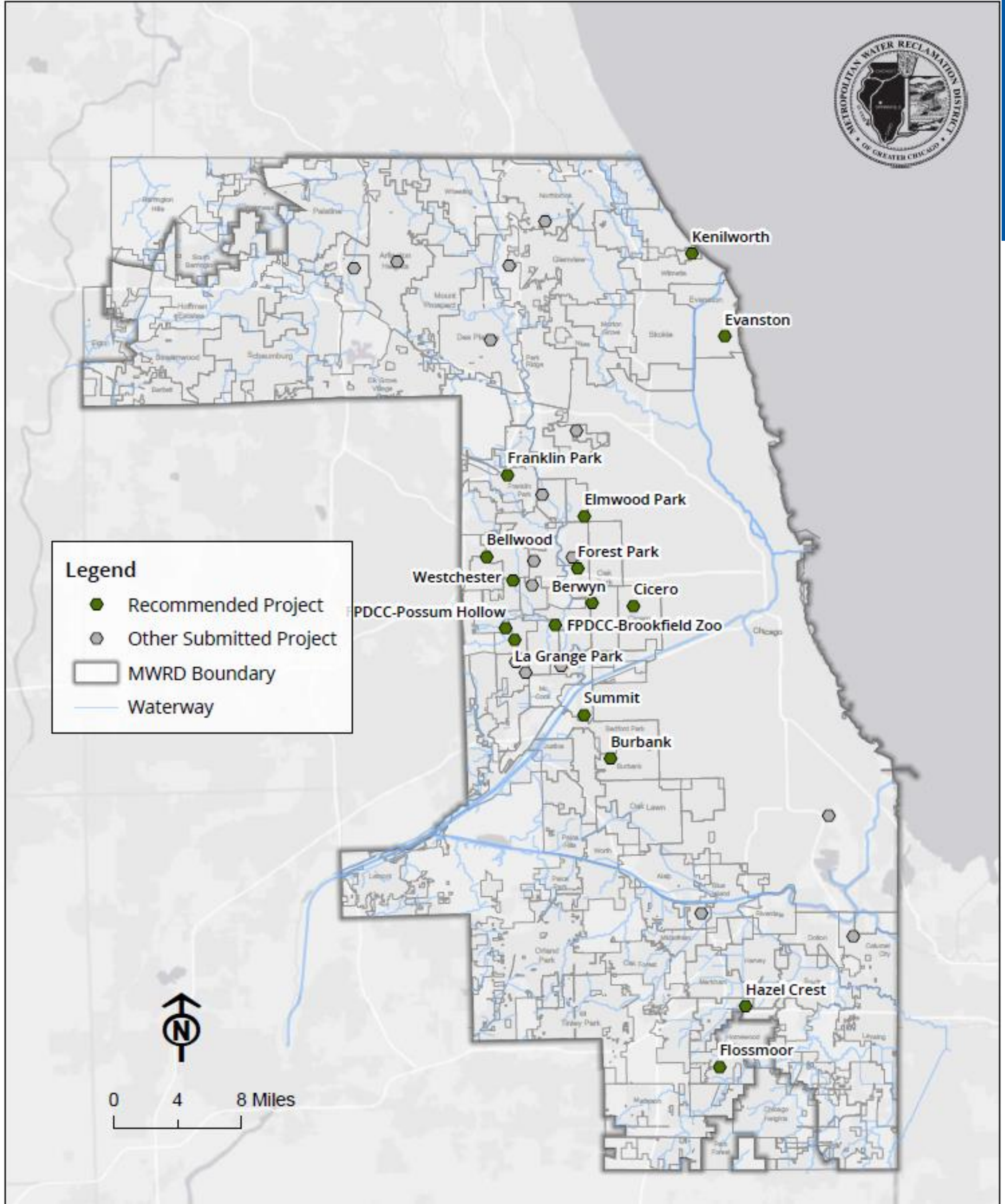
1,672

Estimated Total Construction Costs

$10.6M

Estimated Design Retention Capacity

1.6M gallons



2021 GI Call for Projects

Applications Submitted

35

Projects Selected

TBA!

Estimated Structures Benefitted

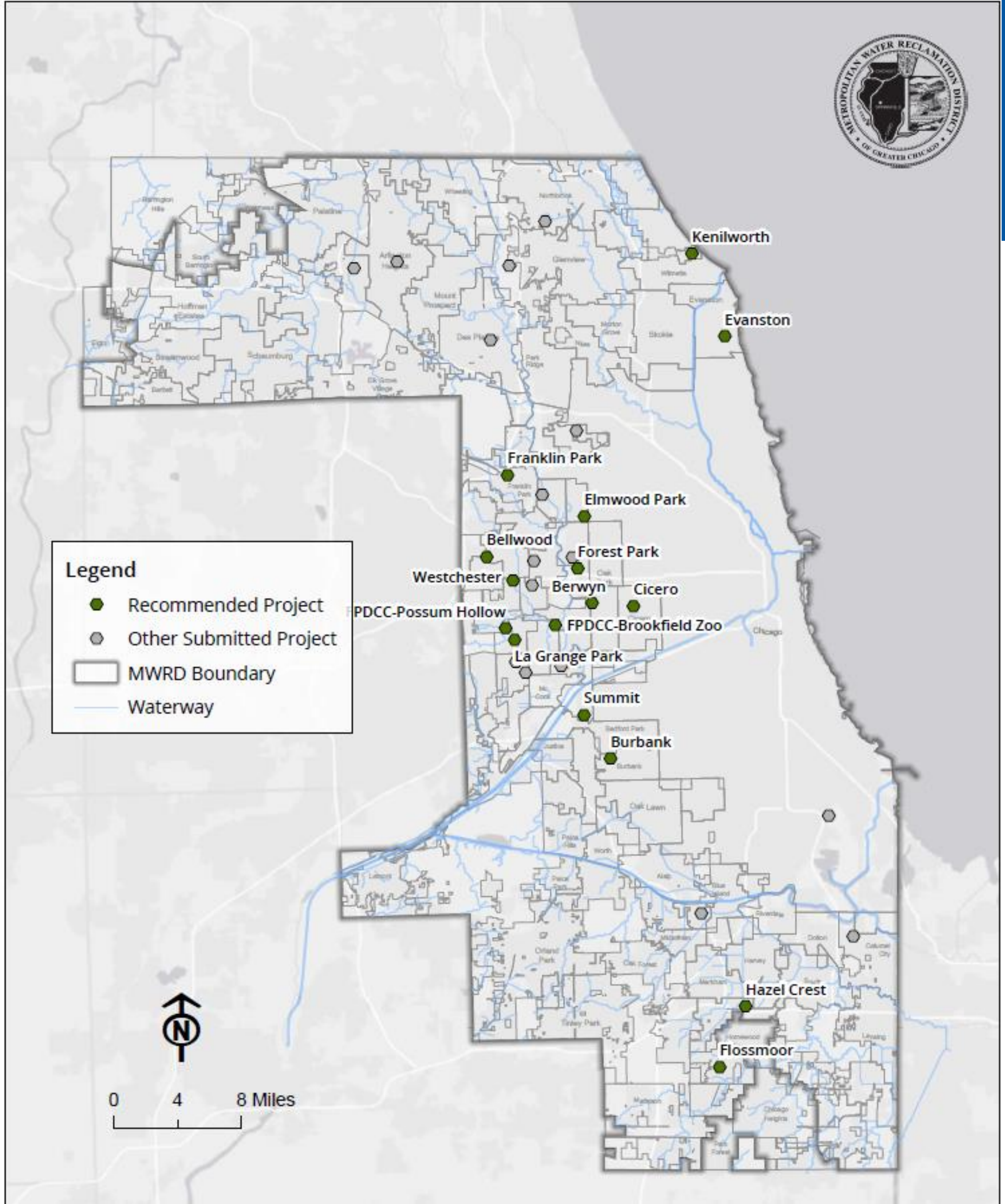
many

Estimated Total Construction Costs

~$3M

Estimated Design Retention Capacity

~0.4M gallons



GI Applicant Eligibility Requirements

1. Project located within District corporate limits (please see the link on the website for a map of these limits.)
2. Project designed to manage stormwater control measures using Green Infrastructure
3. Project must be bid in accordance with District's Purchasing Act (public ad, bid, and award), labor and diversity requirements
4. Applicant must be willing and capable of contract admin. and maintenance long-term
5. District will consider whether potential partner agency is in compliance with WMO & IICP
6. Cannot use funding to satisfy any stormwater permitting requirements, including WMO requirements for detention or volume control.

More detail at mwrd.org/gi-app

IGA Summary

- Applicant must be able to enter into an Intergovernmental Agreement with MWRD
    - Must be a public entity

- Components:
    - Diversity Requirements:
        - 20% Minority Business Enterprises (MBE)
        - 10% Women’s Business Enterprise (WBE)
        - 10% Small Business Enterprise (SBE)
        - 3% Veterans Business Enterprise (VBE)
    - Public Education Requirement
    - Agree to maintain and operate project long-term according to O&M Plan

- Please see website for more information on typical IGA requirements: **www.mwrd.org/gi-app**

GI Project Prioritization

- Primary Selection Criteria
  - $/gal used in determining MWRD funding
  - $/structure benefitted by project
  - Project timeframe: constructed within the next calendar year

- Other factors
  - Flooding frequency and severity
  - Combined sewer areas
  - Total cost of project
  - Median income of area
  - Maintenance resources and experience
  - Visibility/Educational opportunity
  - Past receipt of recent MWRD funding for similar projects

Funding Options

- Cost-shares
  - Local match, budgeted and planned ahead for as part of CIP
  - Stormwater utility (Urbana-Champaign, Rolling Meadows, Downers Grove, etc.)
  - Grants: IGIG, IEPA Section 9, HUD, Cook County Disaster Relief, USACE, NWFW, etc.
  - Partnerships like with MWRD, County, State

Example GI Projects

Blue Island Rain Garden

Riverside Permeable Parking Lot and Bioretention

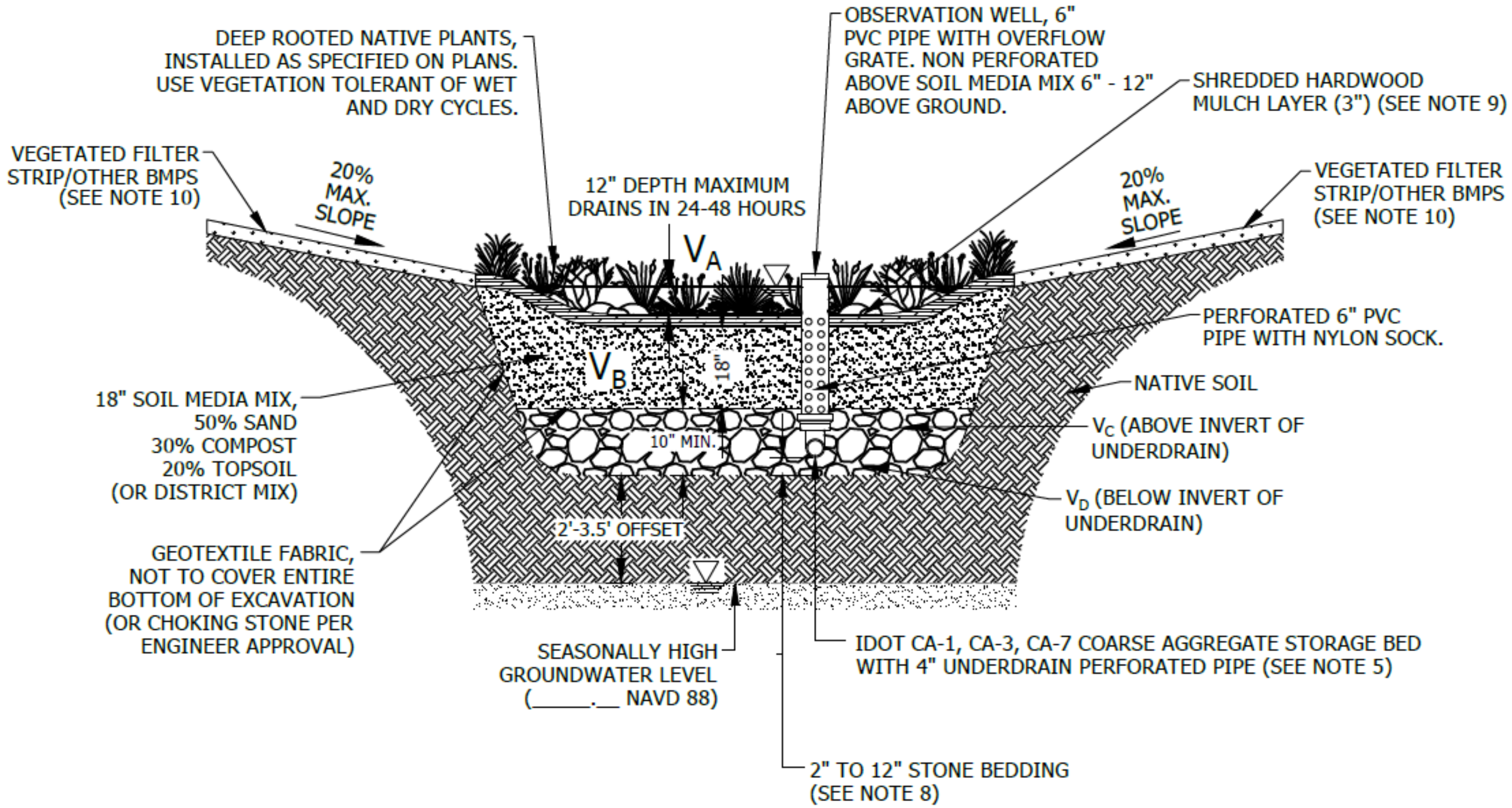
Evanston Bioswale & Permeable Parking Lot

Berwyn Green Alleys During Construction

Broadview Green Alley After Construction

Virgil Grissom Elementary School After

Bioretention Facility Detail



BOTTOM OF THE FACILITY:	ELEV.	______
SEASONALLY HIGH GROUNDWATER:	ELEV.	______
SEPARATION:	FEET	______

VOLUME TYPE	SURFACE AREA	DEPTH	POROSITY	STORAGE VOLUME	VOLUME PROVIDED
V_A : SURFACE STORAGE			1.00	1.00 X V_A	
V_B : SOIL MEDIA MIX			0.25	0.50 X 0.25 X V_B	
V_C : COARSE AGGREGATE (ABOVE INVERT)			0.36	0.50 X 0.36 X V_C	
V_D : COARSE AGGREGATE (BELOW INVERT)			0.36	0.36 X V_D	

Design Retention Capacity Calculations

Stormwater Design Retention Capacity Calculations
For Bioretention and Permeable Pavement

KEY
user input
calculated

Note:
For questions or a digital copy, please contact MWRD Engineer:
John Watson: John.Watson@mwrd.org
Please reference all user-input data using Reference Column

Name of Project:	
Address:	
Plan Revision Used:	
Calculation Revision	r20210518
Total DRC [gal]:	0

Standard Assumptions:

Media	Porosity
CA-1	0.41
CA-7	0.38
CA-16/ASTM 8	0.28
FA-1	0.28
Engr. Soil	0.25

Infiltration rate is conservatively estimated at 0.10 in/hr, if tests or soil classifications are not yet available.

TECHNICAL NOTE: For DRC, retention volume is counted at 100% (below the invert of a pipe draining the area, if any), and detention is counted at 50%.

Retention Area #1 (______________________________)

	Section 1 Upstream Drainage Area				Reference (Sheet #, report, etc)
6	Design soil infiltration rate of surrounding soil	i		in/hr	
7	Elevation of bottom of BMP (the infiltration surface) IF there is no underdrain, OR the lowest underdrain invert elevation	$ELEV_{BMP}$		feet	
8	Groundwater elevation	$ELEV_{GW}$		feet	
9	Depth to seasonal groundwater level (Must be 2 feet or greater, or 3.5 feet or greater if draining to combined sewer)	D_{GW}	0.0	feet	
	Section 3 BMP Specifications				**Reference (Sheet #, report, etc)**
10	Dimensions of the bioinfiltration facility (length, width, or area)	L		feet	
		W		feet	
		A_{BMP}		square feet	
11	Depth of prepared soil	D_1		feet	
12	Prepared soil porosity (0.25 maximum unless detailed materials report provided)	P_1		[unitless]	
13	Depth of underlying aggregate (optional)	D_2		feet	
14	Aggregate porosity (0.38 maximum unless detailed materials report provided)	P_2		[unitless]	
15	Surface storage volume (provide supporting calculations, max depth 12 inches) (=6" for projects with safety-limited surface storage (CPS))	V_{AIR}		cubic feet	
16	Total media void volume = $A_{BMP} * [(D_1 * P_1) + (D_2 * P_2)]$	V_{MEDIA}	0	cubic feet	
	DRC Volume Including Infiltration				**Reference (Sheet #, report, etc)**
20	Depth of Prepared Soil Below Drain (if drained, if not drained, total depth of prepared soil)	D_3		feet	
21	Soil Void Volume Below Drain = $(A_{BMP}*D_3*P_1)$	V_3	0	cubic feet	
22	Depth of Prepared Aggregate Below Drain (if drained, if not drained, total depth of prepared aggregate) (must be less than or equal to total depth, D_1+D_2)	D_4		feet	
23	Aggregate Void Volume Below Drain = $(A_{BMP}*D_4*P_2)$	V_4	0	cubic feet	
24	6-hr infiltrated volume = $(i*A_{BMP}*6[hrs]/12[in/ft])$	V_5	0	cubic feet	
25	50% of Volume Above Drain = $0.5*(V_{MEDIA}-V_4-V_3)$	V_6	0	cubic feet	
26	Total Retained and Infiltration Volume $(V_3+V_4+V_5+V_6+V_{AIR})$	V_{DRC}	0	cubic feet	
27	V_{DRC} = Above [in Gallons]	V_{DRC}	0	gallons	

Question and Answer Session

We will draw initial questions and comments from those submitted via the Q&A panel during the presentations.

Today's Speakers

Paula Conolly – paula@giexchange.org
Harry Zhang – hzhang@waterrf.org
John Watson – watsonj@mwrd.org

Thank you for participating in today's *The Current*!

Visit our website, northcentralwater.org, to access the recording and our webinar archive!

Join the Green Infrastructure Community of Practice – an Extension-Sea Grant collaboration working to support outreach professionals advancing community stormwater management and green infrastructure practices.

More information at
https://northcentralwater.org/green-infrastructure/