# City of Green Bay
# City-Wide Green Stormwater Infrastructure Plan

**Carrie Bristoll-Groll, PE, ENV SP**
**Exec VP Engineering Services/AQUALIS**

AQUALIS

# AQUALIS: The Nationwide Leader in Sustainable Water Management Services

## Sustainable Water Engineering

- Flood Management
- Integrated Site Design
- SWMP Recertification and SWMPMA Certification
- Grant Assistance

## Stormwater Management

- Maintenance
  - Above and Below Ground
- Repair and Rehabilitation
- Inspections
- Green Stormwater Infrastructure
- Consulting Credits

## Hydro Excavation

## Industrial Vacuumation and Jetting

## CCTV Pipe Inspection

## Water Quality Testing

## Emergency Response

## Lift Station Management

- Preventative Maintenance
- Repairs
- Inspections

## Wastewater Management

- System Inspections
- System Cleanings
- System Repairs


**Comprehensive Stormwater, Lift Station & Support Service Capabilities**

**30,000 + Yearly Maintenance & Inspection Visits**

**6,200+ Yearly Repair & Retrofit Services**

**Service 49 States + Puerto Rico**

**10 Regional Branches**

**5,700+ Locations Serviced**

# Project Overview

## Purpose of the Project/Plan

- Provide steps toward flood and climate resiliency and water quality
- Guide the ID and tracking of GSI projects within the City (public and private property)
- Reduce flood risk and provide water quality improvement (TMDL)
- Prioritize actionable list of GSI projects
- Create processes and framework for implementation
- Ensure this plan ties in with other City-GSI related programs and goals.

Melissa Schmitz, CEM, LEED GA

Resiliency Coordinator/City of Green Bay

Plan Deliverables Include:

- Summary of the Analysis and Identification of the Highest Priority Subbasin Locations
- Identification and Prioritization of 30 Public and 20 Private GSI Projects Within the Priority Subbasins and the water quality and quantity modeling used to ID the projects
- Output Summary of Triple Bottom Line (TBL) Analysis of Proposed GSI Projects
- Summary of GSI Location Maps and GIS Tracking Tool
- Evaluation Process Tool for the Feasibility of GSI Projects Within the Public Right of Way
- Design Guidance for GSI Projects
- Maintenance & Operations Guidance for Identified GSI Projects

# GREEN STORMWATER INFRASTRUCTURE OPTIONS
## As provided to Stakeholders at Project Kick-Off Meeting

### BIOSWALES

Landscape features that capture and infiltrate runoff and can also remove pollutants.

### GREEN ROOFS

Partially or completely planted roofs with vegetation growing in soil or other growing media to hold rainwater.

### GREENWAYS

Riparian and non-riparian buffer zones and strips that store and drain stormwater runoff into the ground naturally.

### NATIVE LANDSCAPING

The use of native plants that can tolerate drought and flooding cycles because of deep roots and climate-specific adaptations.

### PERMEABLE PAVEMENT

Pavement that can reduce and infiltrate surface runoff through its permeable surface into a stone or filter media below.

### RAIN GARDENS

Gardens that are watered by collected or pooled stormwater runoff, slowly infiltrating it into the ground along root pathways.

# GREEN STORMWATER INFRASTRUCTURE OPTIONS

## RAINWATER CATCHMENT

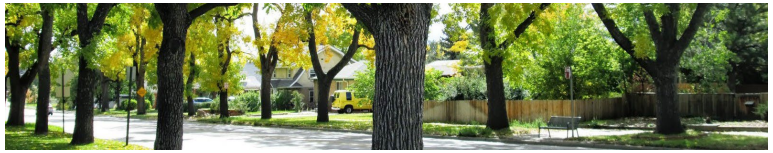
The capture and storage of water, potentially for reuse later.

## REMOVAL OF PAVING & STRUCTURES

Removal of structures or paving in order to allow infiltration.

## SOIL AMENDMENTS

Materials worked into the soil to enhance its ability to infiltrate or absorb water.



## TREES

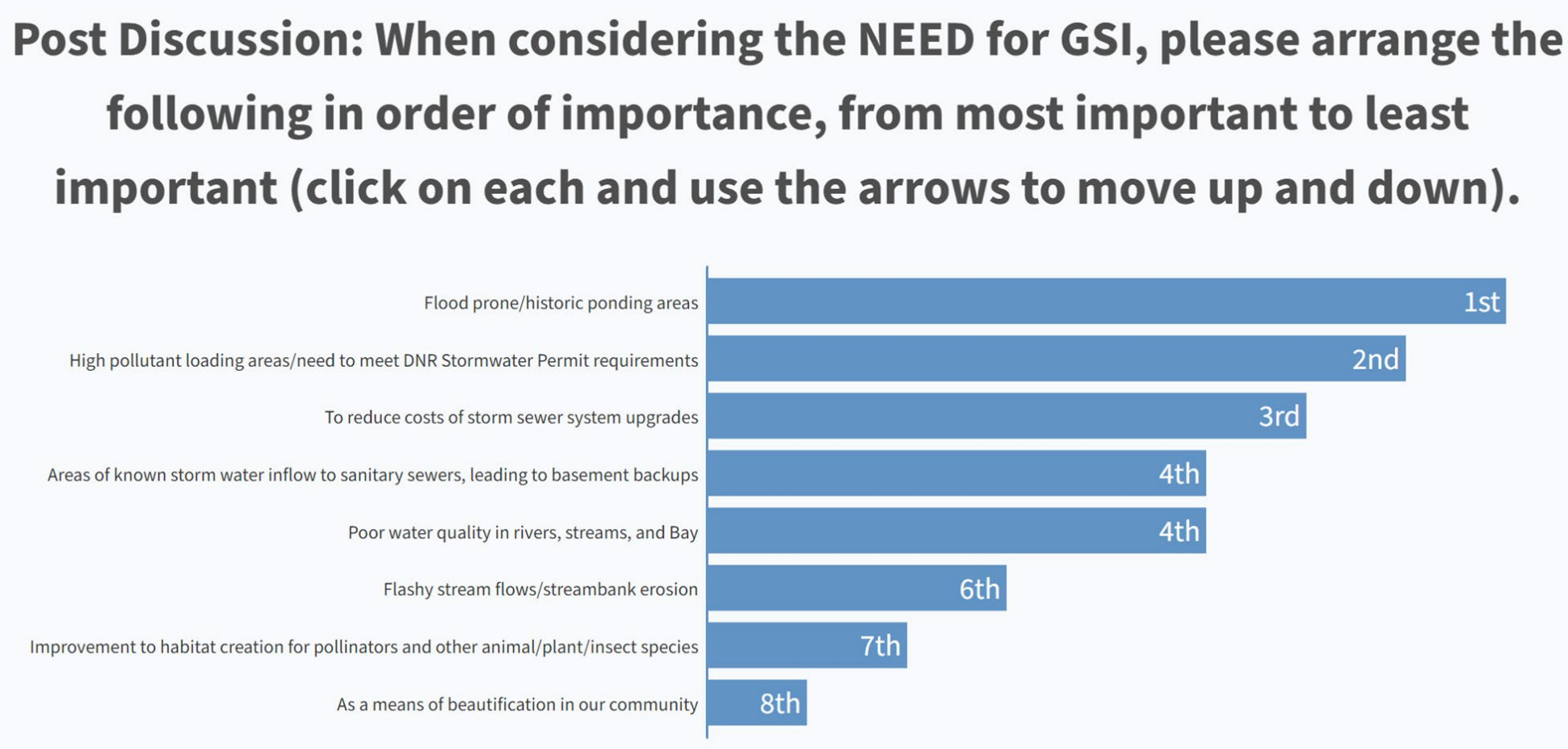
Trees that can hold rainwater on their leaves and branches, infiltrate it into the ground, absorb it through root systems, and evapotranspire it to the atmosphere.

## WETLANDS

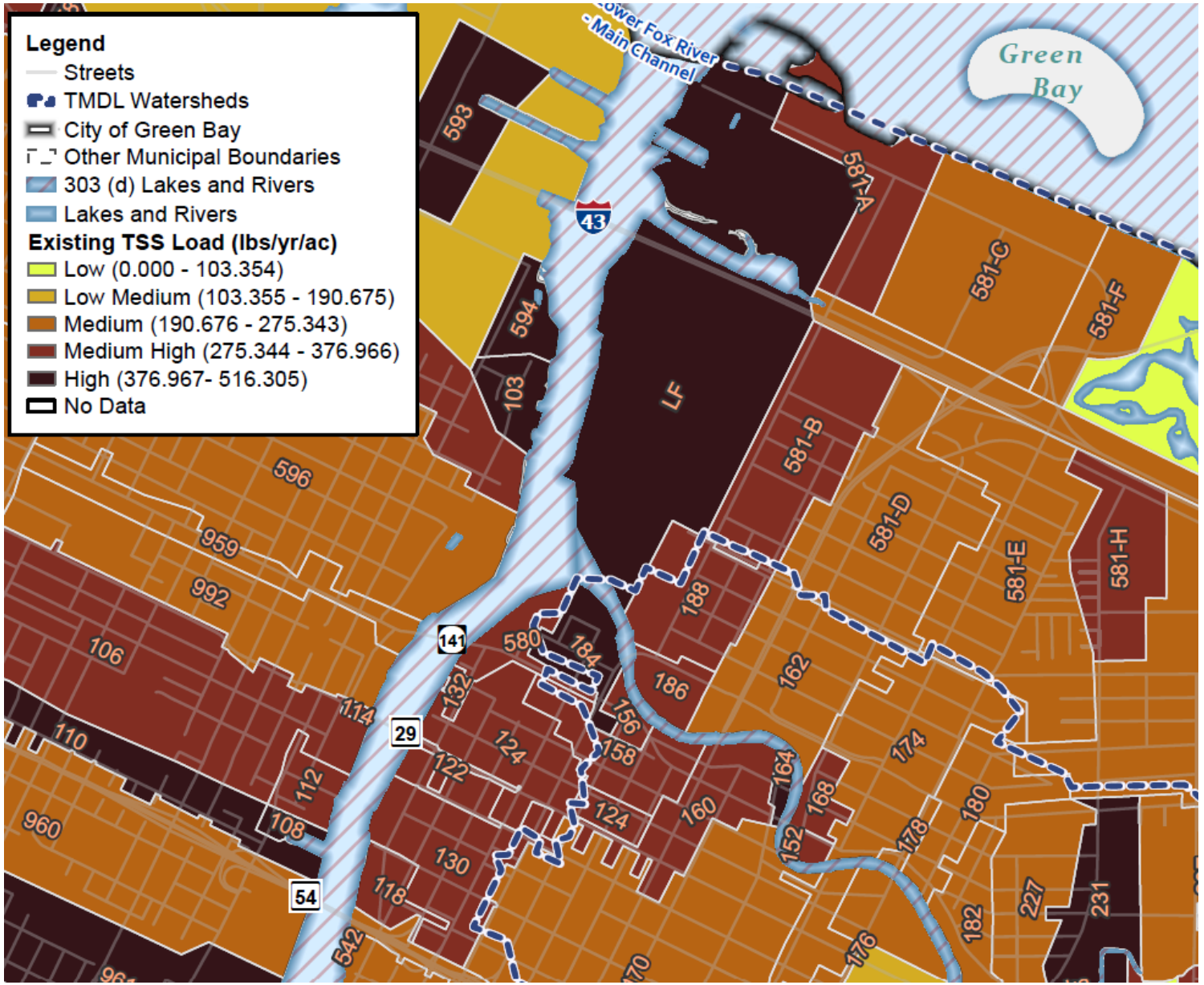
Areas that have soils that are inundated or saturated for part of the year or the entire year.

# To Determine Priority Subbasins

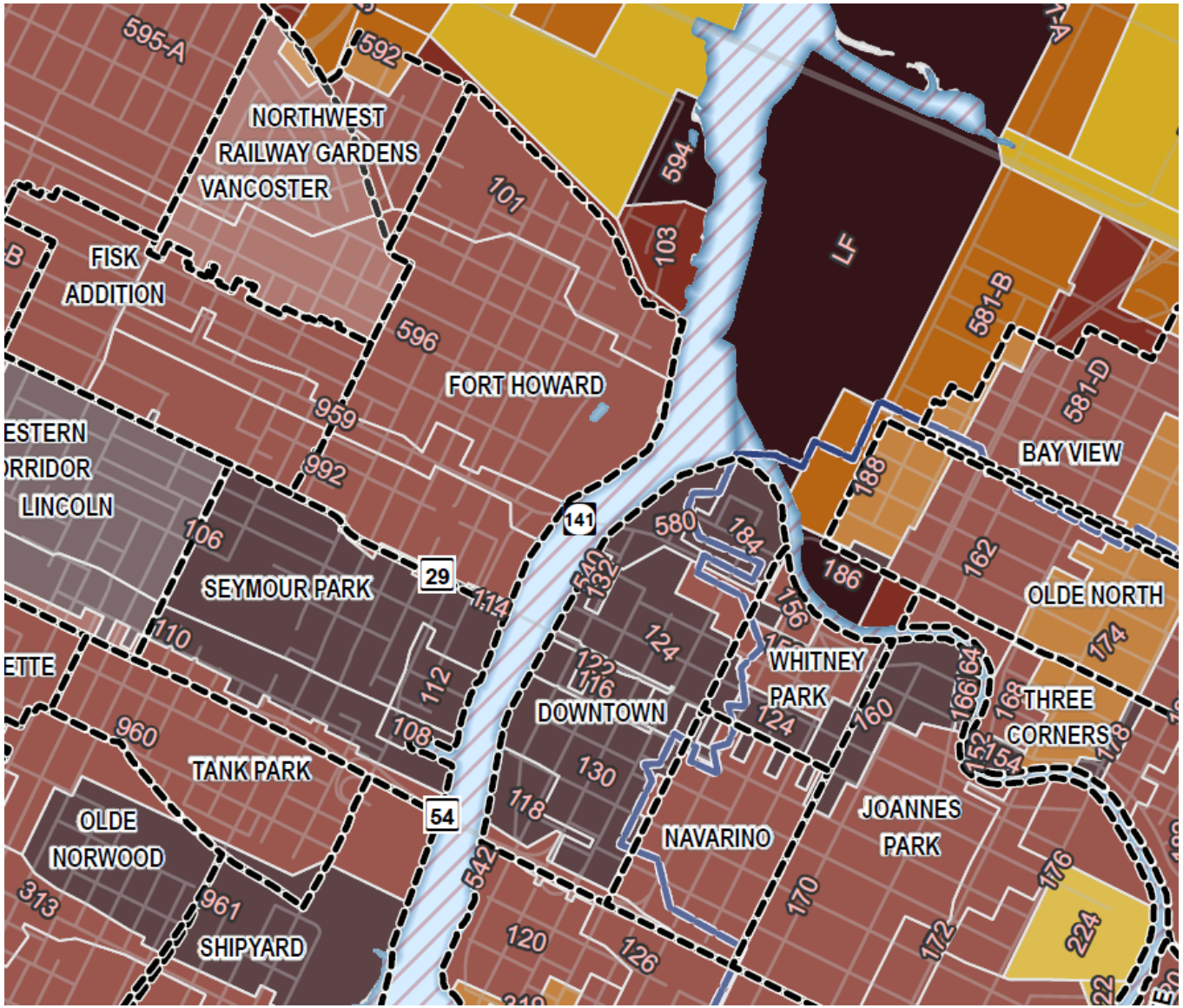
- Using **water quality analysis** and reports from **flooding** experienced, coupled with **feedback** from Stakeholders, a GIS analysis was used to determine highest priority (NEED and Location) subareas



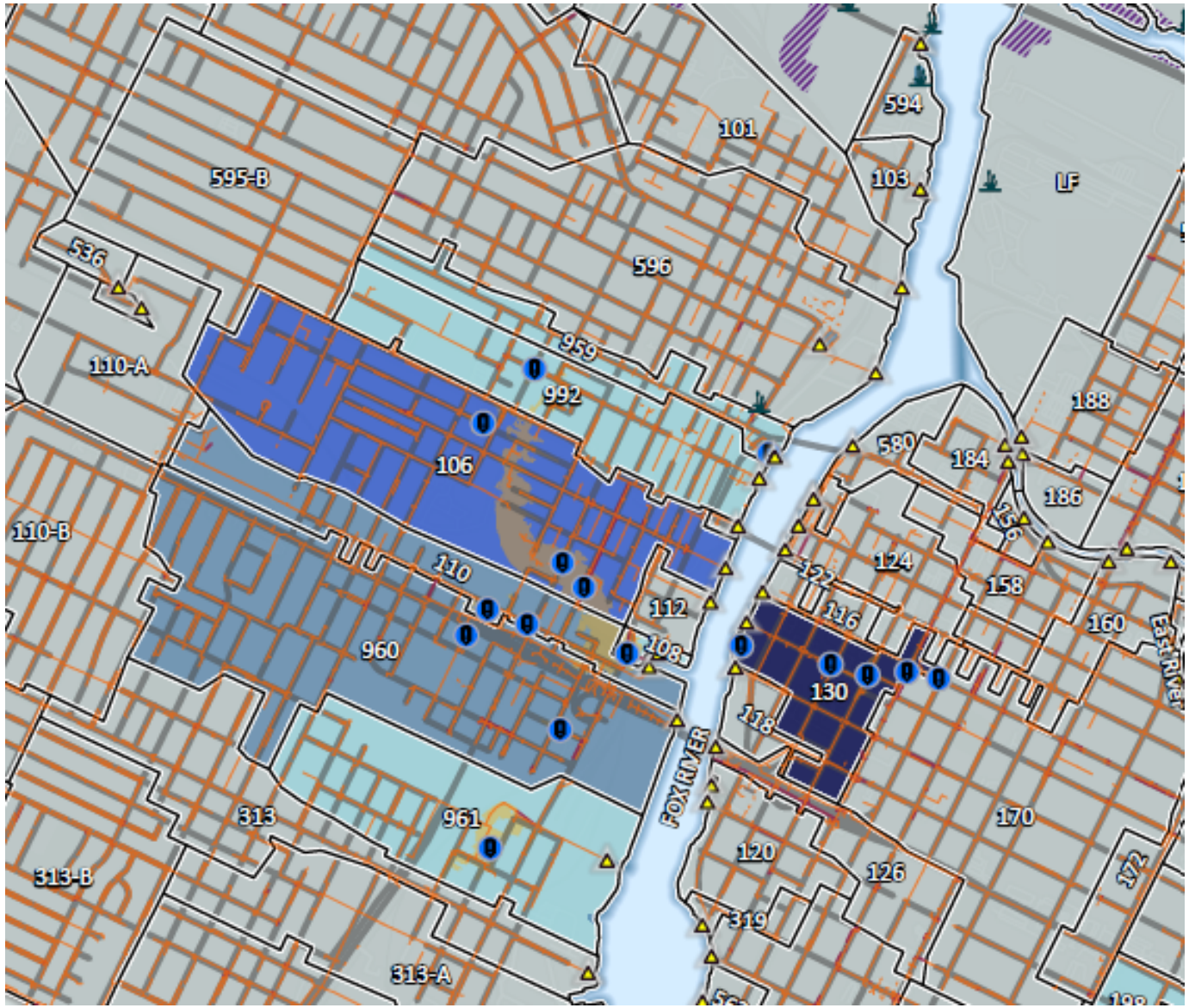
# Using GIS, Create heatmap with water quality results of Total Suspended Solids and Total Phosphorus



# Adding neighborhoods to assist City in their Revolving Loan Fund Program for GSI



Flood/ponding areas added with heatmap for most occurrences within subareas

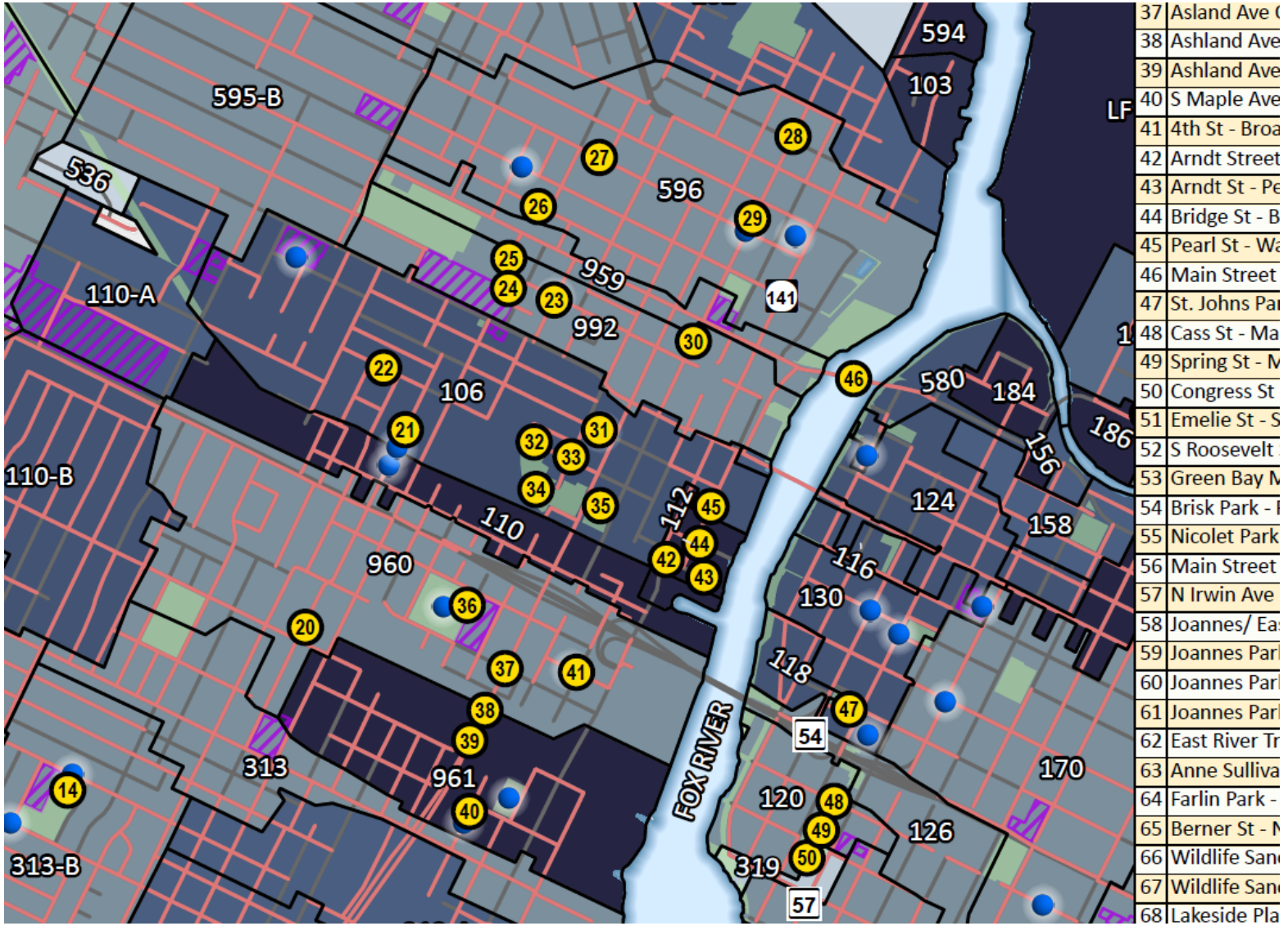


# City's Capital Improvement Program projects added

## Additional maps provided views to opportunity and constraint areas with:

- Parcels of lower than average property values
- Proposed development areas
- Soils, groundwater, bedrock, high slopes

- Select from list of potential GSI Options for best fit given local constraints and needs



# Perform Water Quality and Quantity Modeling for 30 public and 15-20 private GSI locations

- Quantity of gallons captured (using Hydrocad software)
- Pounds of Total Suspended Solids (TSS) and Total Phosphorus (TP) captured (using WinSLAMM software)

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City of Green Bay GSI Plan

Drainage Subbasin: 130

Project ID: PU-130

**Site Location:**

S Jefferson St & Stuart St,

Green Bay, WI

**GSI Description:**

Two bioswales placed at low points along streets. The proposed bioswale placements would capture the stormwater runoff from the street, resulting in better water quality and a reduced flood risk.

**Drainage Area** = 0.294 acres (12,800 sq. ft.)

**Proposed Bioswale Area** = 0.01 acre (535 sq.ft.)

**Approximate Cost** = $27,000 + $535/year

**Annualized Cost** = $6.99 / lb TSS reduction

**Benefits of Captured Stormwater:**

Total Phosphorus Reduction =

0.4199 lbs (78.33%)

Total Suspended Solids Reduction =

269.5 lbs (81.26%)

Volume Captured = 2,506 gallons

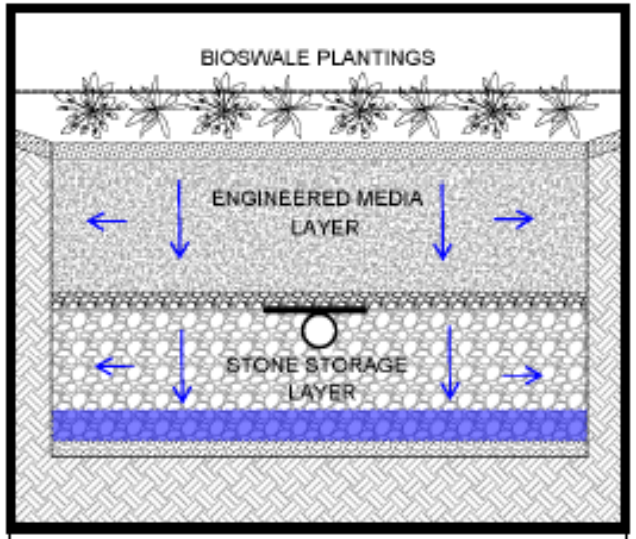
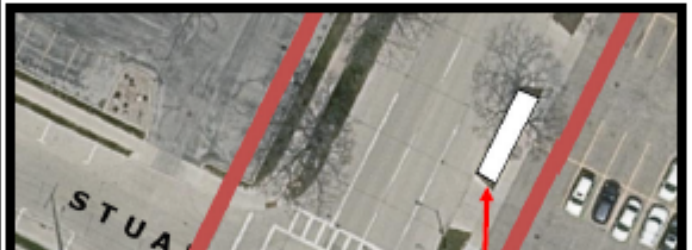



Figure 1: Typical bioswale detail.

# Perform Water Quality and Quantity Modeling for 30 public and 15-20 private GSI locations


Figure 2: Aerial image of CoGB with the project site outlined in red.

Figure 1: Typical bioswale detail.

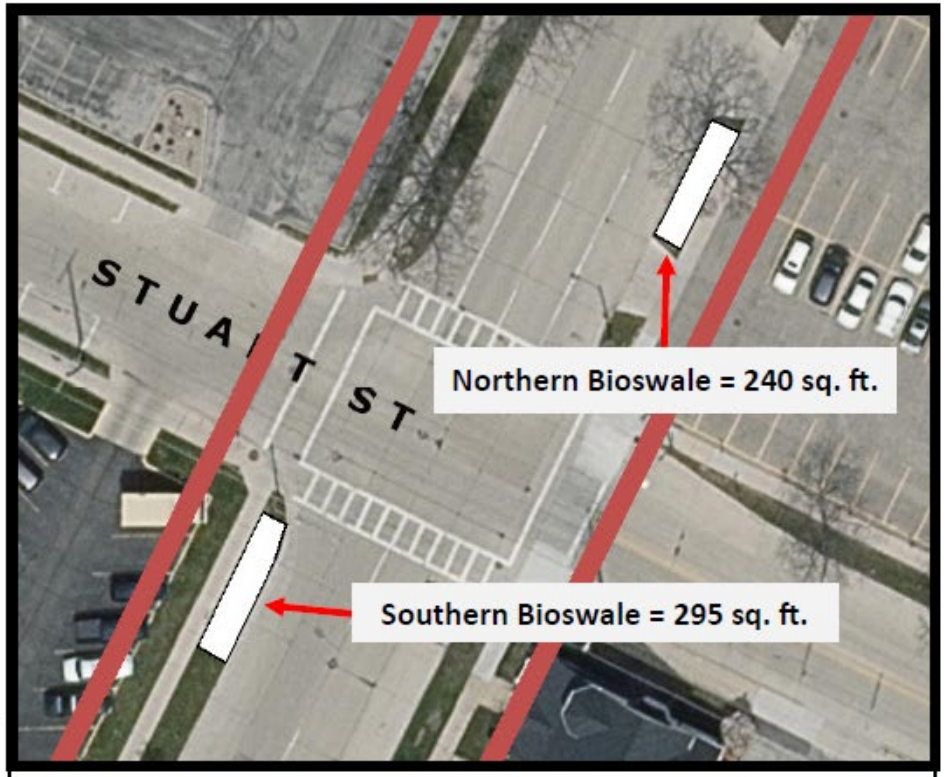
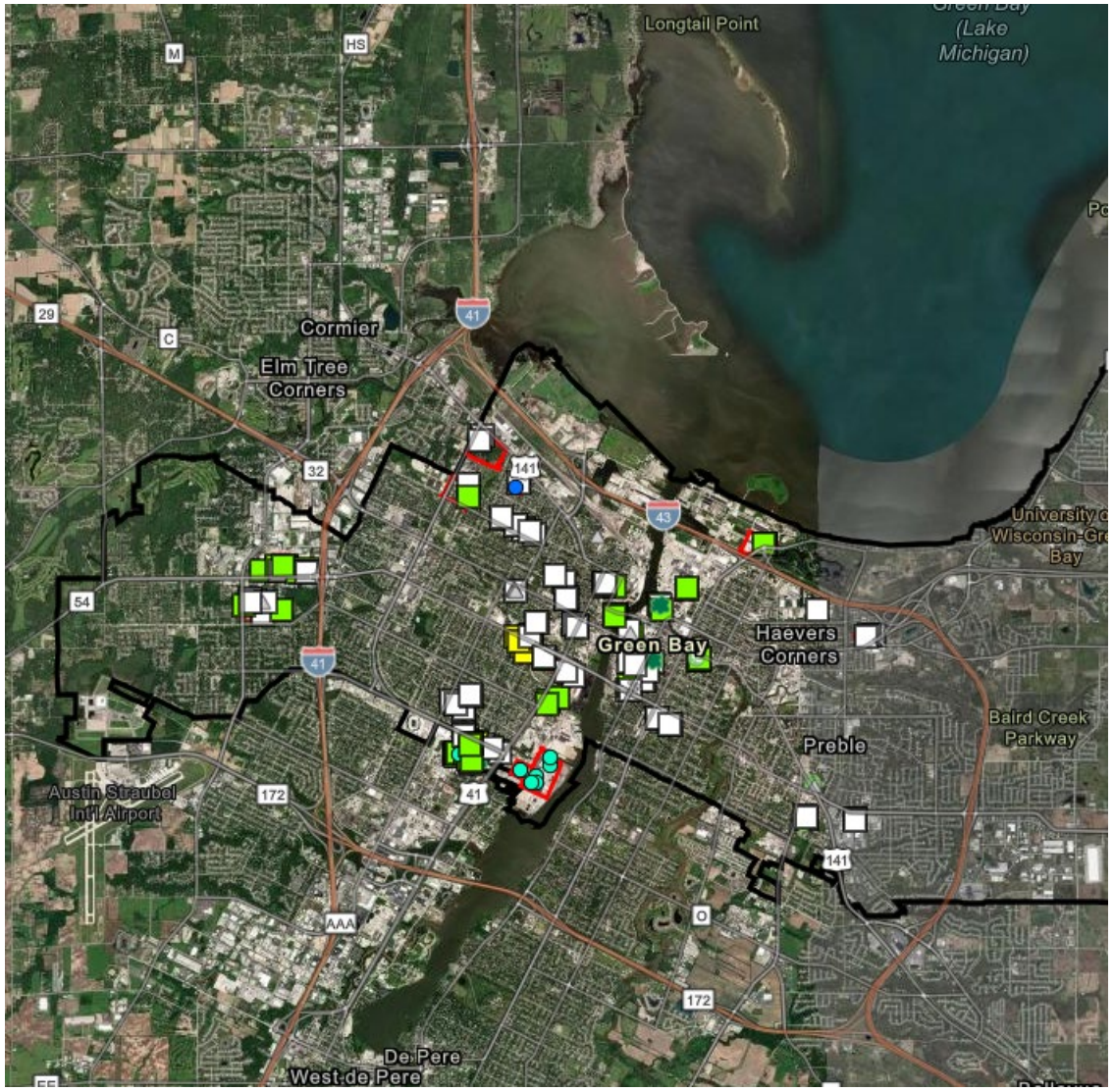



Figure 3: Proposed site with bioswales shown as white rectangles.

# Creation of Maps for Integration to City's GIS

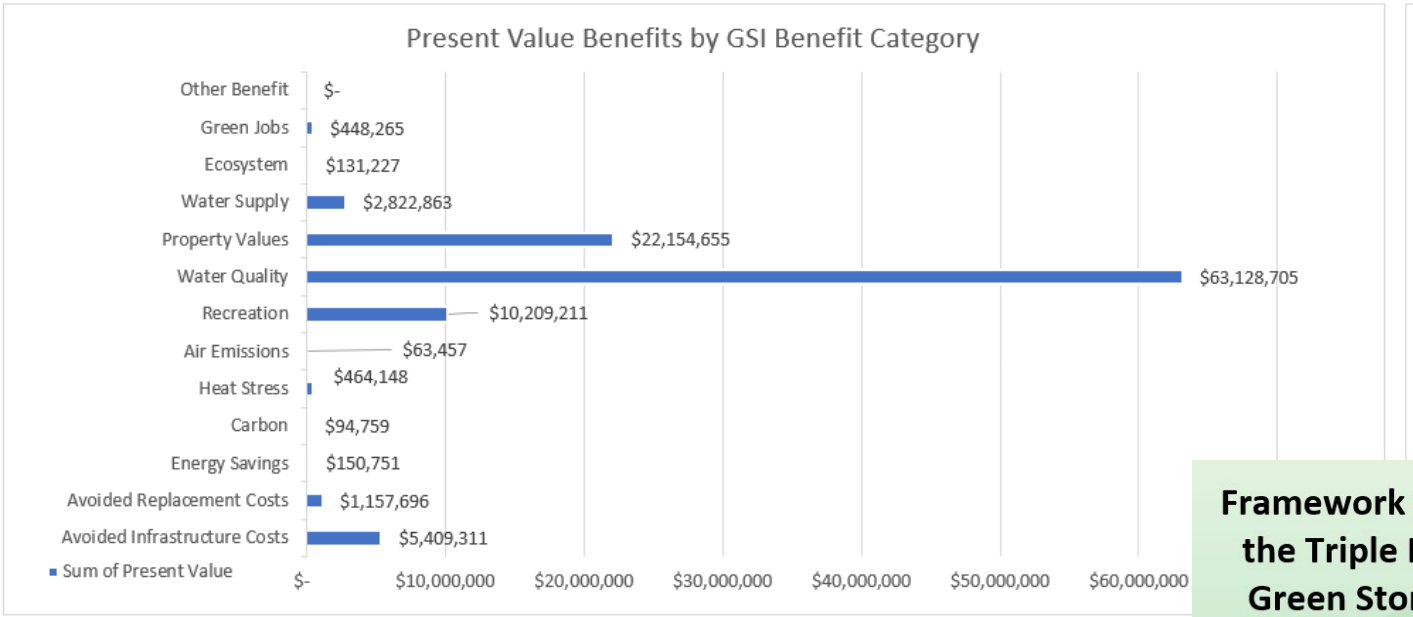


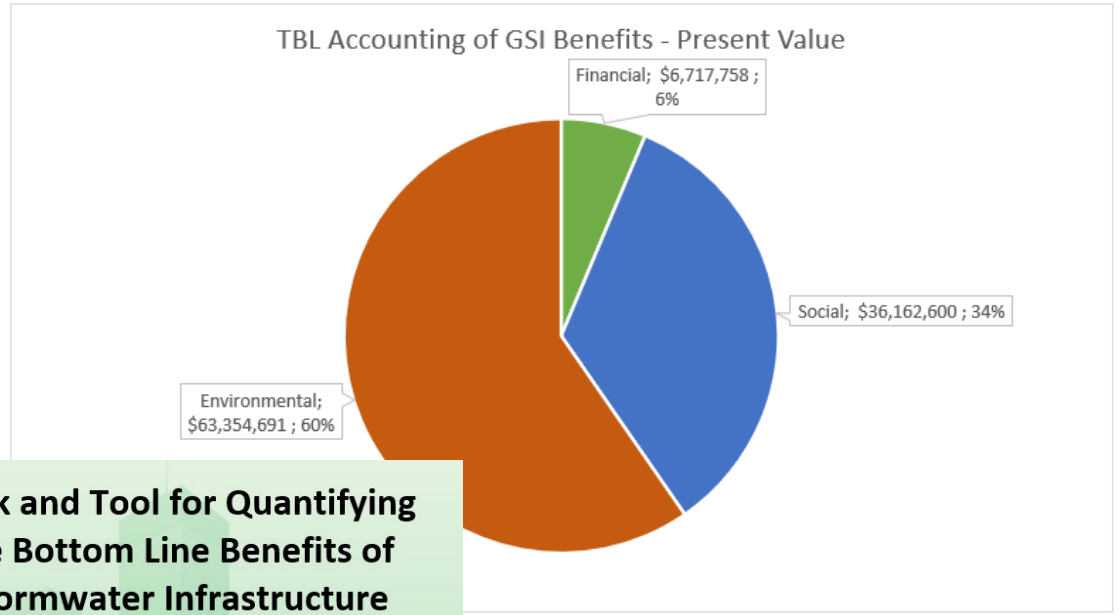

Total Present Value Capital Cost of all Projects: $20.125M

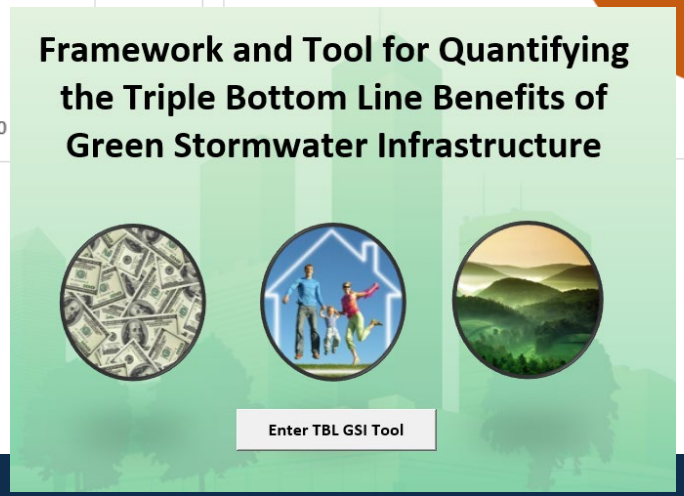
Total Annual Cost of Maintenance at Full Buildout given Present Value: $300k

# Triple Bottom Line (TBL) Analysis

- Evaluate the projects and/or types of GSI in terms of Economic, Social, and Environmental aspects




Total Present Value Benefit of all Projects: $106.2M (5x Return on Investment)

THE Water Research FOUNDATION

# Evaluation Process for City Staff Use to determine Feasibility of GSI in ROW Projects - Tool

| Project Selection Questions | Rating | | | | | Weight |
|---|---|---|---|---|---|---|
| | Yes | Probably | Maybe | Unlikely | No | |
| **Project Schedule and Budget** | | | | | | |
| Is the project construction scheduled for more than 6 months from today | | | x | | | 3 |
| Is sufficient budget or grant funding available to allow a GSI device? | | | x | | | 3 |
| Is the roadway/right-of-way designer on board with adding GSI? | | | x | | | 3 |
| Do you have the necessary staff available to design GSI for this project? | | x | | | | 4 |
| **Project Area Needs** | | | | | | |
| Is the project area highly rated for water quality needs according to GSI Map 1? | x | | | | | 5 |
| Is the project area highly rated to be flood prone according to the GSI Map 2? | | | | | x | 1 |
| Does the project appear in the City's GSI Plan? | | | | | x | 1 |
| Is there interest for GSI here for other reasons not yet listed? | | | x | | | 3 |
| **Project Area Constraints** | | | | | | |
| Does the area have high bedrock or high water table (see Map 5) | | | x | | | 3 |
| Does the area have sandy soils? | x | | x | | | 5 |
| Are buried or overhead utilities buried constraints to the project area?* | | x | | | | 2 |
| Do residents or abutting property owners in favor of GSI? | | x | | | | 4 |

# Evaluation Process for City Staff Use to determine Feasibility of GSI in ROW Projects - Tool

| Green Stormwater Infrastructure for Pavement<br>Does your Project Area Have<br>↓ Best GSI → | Regenerative Stormwater Conveyance | Bioswale | Native Landscaping | Porous Pavement | Remove Pavement | Stormwater Trees |
|---|---|---|---|---|---|---|
| **Unused/Underused Pavement** | | | | | | |
| **Roadways** | | | | | | |
| Min. of 10' between curb and bldg | | | | | | |
| With vegetated islands | | | | | | |
| With Rural Cross-section/ditches | | | | | | |
| Has inverted crown (alley pavement) | | | | | | |
| Scheduled to be repaved only | | | | | | |
| **Parking Areas** | | | | | | |
| With vegetated islands | | | | | | |
| Sloped towards vegetated permimeter | | | | | | |
| Does not drain towards vegetated perimeter | | | | | | |
| Scheduled to be repaved only | | | | | | |
| **Paths and Sidewalks** | | | | | | |

| | Assigned to | Completed date | Reviewed by |
|---|---|---|---|
| **Project Area - Concept Plan** | | | |
| Request site survey including all utilities, property lines, and easements | | | |
| Review WDNR Brrts for soil contamination concerns | | | |
| If concerns from Brrts review, discuss Environmental Phase 1 Evaluation with Project Team | | | |
| Perform hydrology and hydraulic (H&H) calculations for sizing GSI based on chosen design storm | | | |
| Perform initial WinSLAMM model to determine potential TSS and TP removals | | | |
| Prepare Conceptual Engineer's Estimate for Construction Cost and confirm budget | | | |
| Perform initial layout and create Concept Plan. Route to Roadway Design team for review | | | |
| **Preliminary Design** | | | |
| Review roadway design team comments and address | | | |
| Confirm GSI is located at least 3' horizontally from any other utility | | | |
| Discuss proximity to existing trees with City Arborist or Forestry Dept | | | |
| Determine if GSI needs a liner based upon depth to groundwater, contaminated soils, other | | | |
| Perform prelim H&H | | | |
| Review layout to Preliminary Design Plan. Use GSI standard details | | | |
| Perform preliminary WinSLAMM model | | | |
| Determine if project still qualifies for grants, captures the anticipated gallons | | | |
| Review standard specifications to ID which are needed for project | | | |
| Prepare Prelim Engineer's Estimate for Construction Cost and confirm budget | | | |
| Prepare Preliminary Plans and route to Roadway Design Team for review | | | |
| **Final Design** | | | |
| Review roadway design team comments and address | | | |
| Prepare final Plans, Details, Specifications, and Engineer's Construction Estimate | | | |
| Prepare permit documents as needed | | | |
| Prepare public information meeting documents to discuss benefits of GSI | | | |
| Inform City's street maintenance crews of future GSI O&M manual sections | | | |
| **Construction Management** | | | |
| Assist in pre-bid and pre-construction meetings with information on GSI | | | |
| Review questions from field and perform site inspections as needed | | | |
| Prepare as-built information and upload to City's ArcMAP for GSI | | | |
| **Futute O&M and DNR reporting** | | | |
| Inspect GSI at minimum quarterly as directed by GSI O&M Manual | | | |
| Document maintenance needs and costs as appropriate and upload to City' ArcMAP for GSI | | | |
| Update city's DNR TMDL permit compliance with WinSLAMM model updates of GSI | | | |
| **Congratulations! You have been an instrumental part in protecting the health of our valued water resources for the future!** | | | |

# GSI Design Guidance for GSI Projects

- Standard Specifications, Construction Details

**SECTION XXX**

**STORMWATER BIOSWALE**

**PART 1 GENERAL**

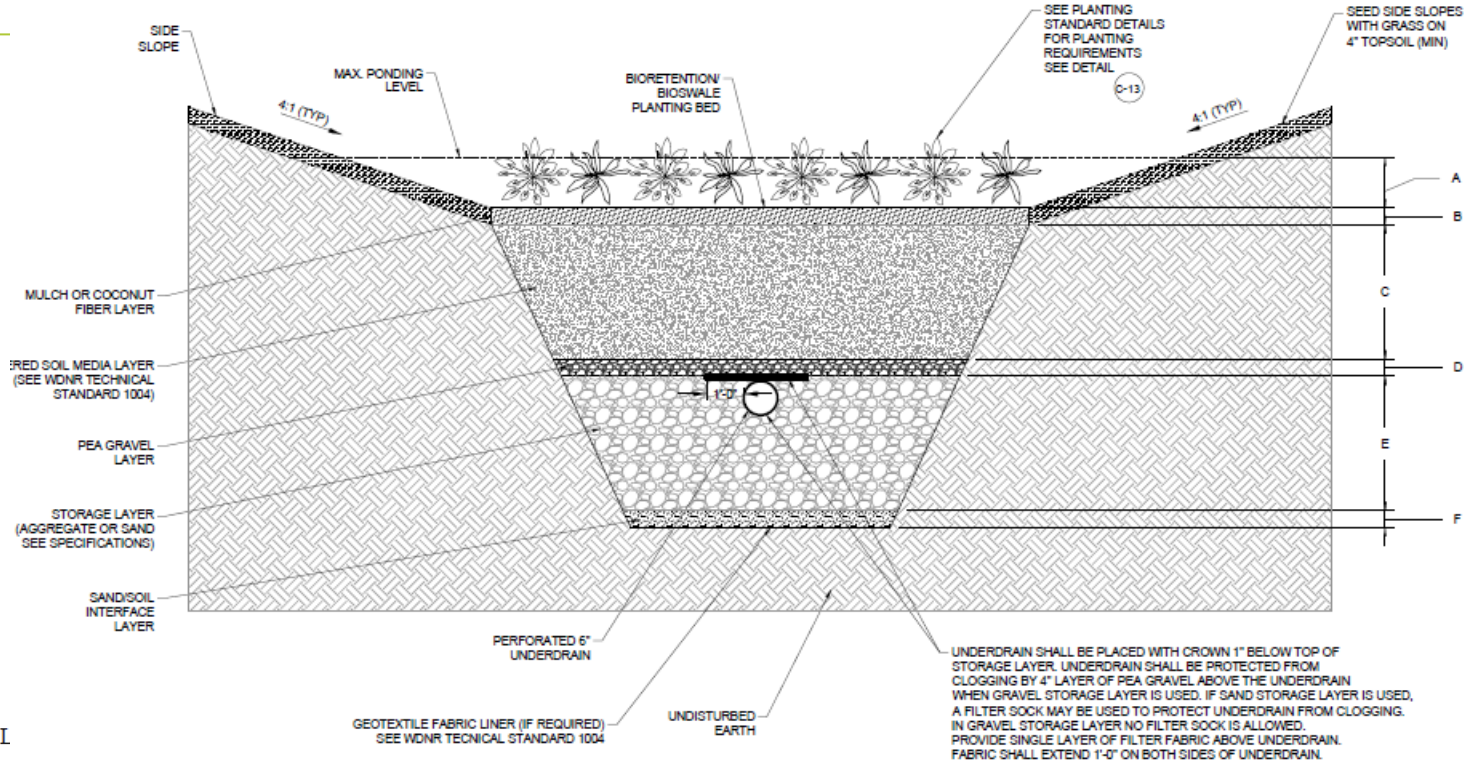
**1.1 SUMMARY**

A. Section Includes:
1. Stormwater Bioswale
2. Erosion Mat
3. Site stormwater drainage piping, fitting and accessories.
4. Cobble Channel Inlet
5. Cobble Drain Inlet

B. Related Sections:
1. Section 303 - EXCAVATION.
2. Section 305 - FILL.
3. Section 306 – GRANULAR BACKFILL.
4. Section 308 – PREPARING THE FOUNDATION
5. Section 313 – EROSION CONTROL.
6. Section 314 – CONSTRUCTION STAKING.
7. Section 404 – TRENCH EXCAVATION, BEDDING AND BACKFIL
8. Section 413 – SEWER PIPE MATERIALS.
9. Section 415 – STORM SEWER PIPES AND LATERALS
10. Section 416 – STORM SEWER TRACH GRATES
11. Section 418 – CULVERT PIPES
12. Section 419 – SEWER STRUCTURES
13. Section 421 – MINI STORM SEWERS
14. Section 422 – MANHOLE REHABILITATION

**1.2 REFERENCES**

A. State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction:
1. Section 310 – Open-Graded Base




C-4 BIORETENTION / BIOSWALE TYPICAL CROSS-SECTION (SLOPED SIDES)

SECTION A

- Maintenance and Operations Guidance

For use by City design and field staff

- Final Plan

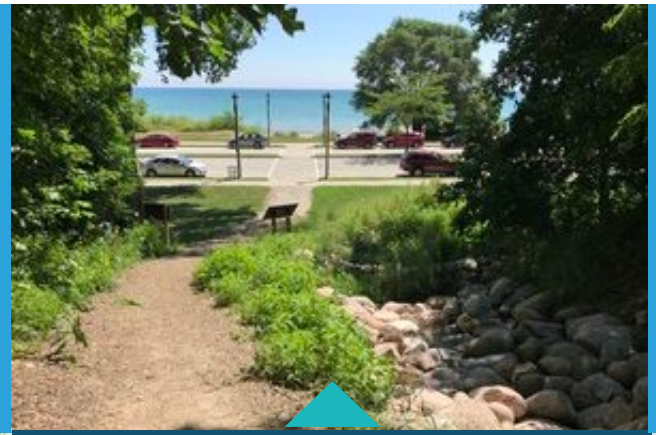
Summarizes all phases and deliverables

# Since Project Completion late 2023, and Next steps

- Approved unanimously by Common Council 11/7/2033
- Training held on Design Process for engineers/designers/construction managers
- Projects for 2024
  - DPW Leadership/Stormwater Utility Manager to evaluate projects to CIP
- Future potential Grants/Funding
  - Local, State, and Federal Grants
  - Partnerships
  - Stormwater Utility Funds

# Questions?

Green Infrastructure for Water Quality and Watershed Management



Grey Infrastructure / Traditional Drainage Design

Watershed Modeling for Quality and Quantity

Facility and GI Inspection and Maintenance

# Thank you!


Thank you!

Carrie Bristoll-Groll| cbristollgroll@aqualisco.com
Office: 414-810-1245