



MINNESOTA POLLUTION  
CONTROL AGENCY

# Habitat Restoration Effectiveness

**St. Louis River AOC**

*Dan Breneman, MPCA, Duluth, MN*

AOC Conference | Cleveland, OH

Thursday, Session C-2, 12 September 2019



[https://www.pca.state.mn.us/water/  
st-louis-river-area-concern](https://www.pca.state.mn.us/water/st-louis-river-area-concern)

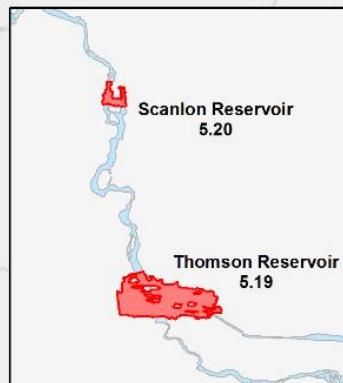
Courtesy Jeff Williams

# Take Home Message

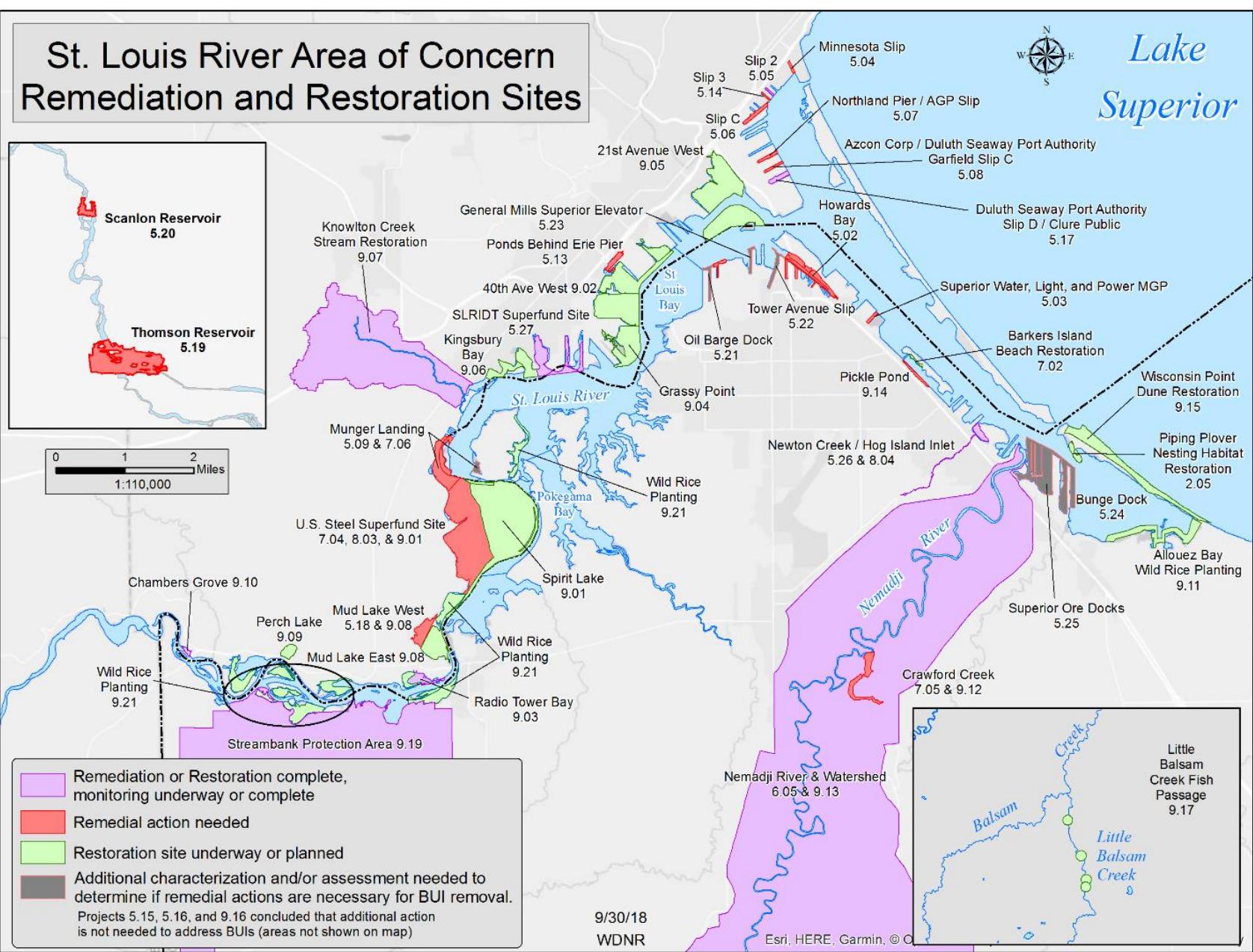
*fundamentals*

1. science-based
2. partnerships
3. “.....within reason.....”

## St. Louis River Area of Concern Remediation and Restoration Sites



0 1 2 Miles  
1:110,000



# Before and After

*defining restoration effectiveness*

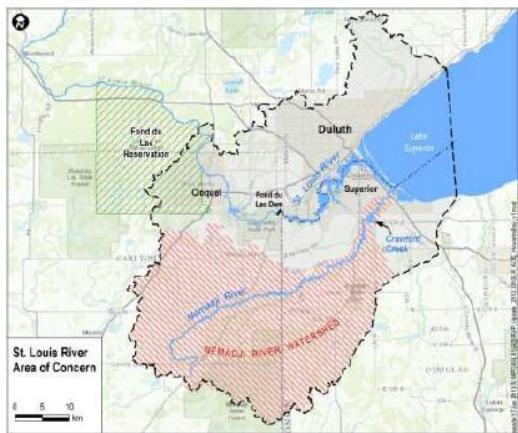
1. Measure existing condition
2. Establish targets  
*(compare alternatives)*
3. Monitor Progress  
*(benefits/cost ratio)*

# Minnesota Guidance Data Collection and Design-basis Approach

## St. Louis River Area of Concern

### Quality Assurance Program Plan for Minnesota Based Projects

January 2015



## Appendix 1

### Managing In-Water Placement of Dredge Material for Habitat Restoration Sites in the St. Louis River Area of Concern

Minnesota Pollution Control Agency



## Appendix 2:

### A Biological, Chemical and Physical Approach to Aquatic Habitat Restoration Decisions in the St. Louis River Area of Concern

Defining Aquatic Ecosystem Restoration Targets by Evaluating Site Conditions

Minnesota Pollution Control Agency



# St. Louis River Estuary Data

- **Sediment Chemistry**

- pore water toxicity,  
bioassays, biochemistry

- **Water Chemistry**

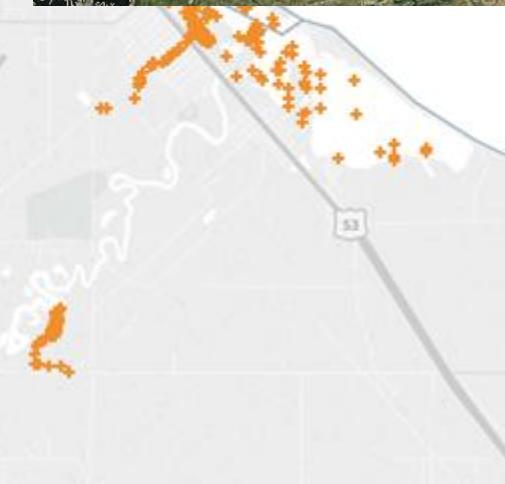
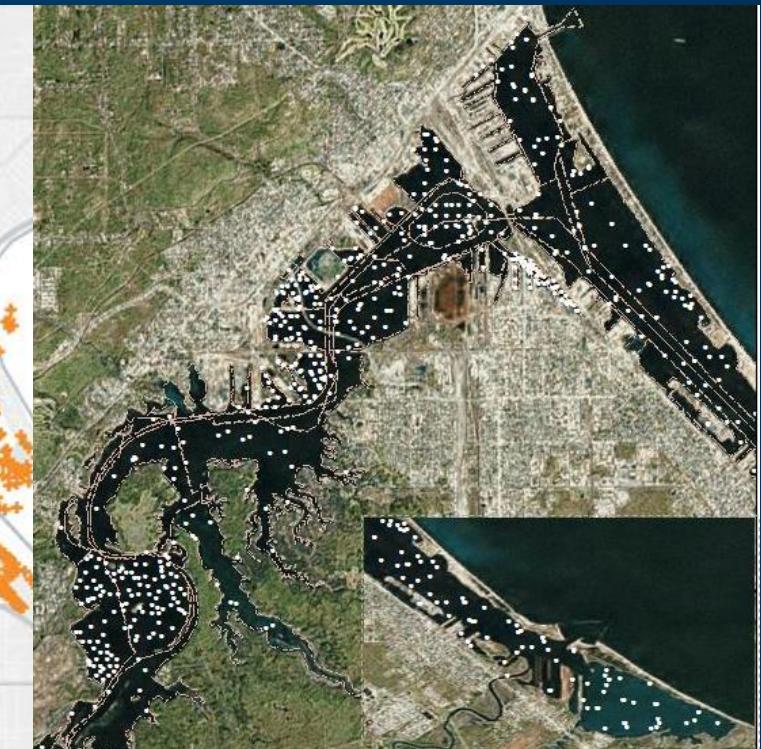
- **Benthic macroinvertebrates**

- **Aquatic vegetation**

Each with > 2,000 stations

- **Physical Measures**

- a. Hydrologic connectivity
- b. Riparian/littoral connectivity
- c. Habitat morphology
- d. Bathymetry/REI
- e. Substrate quality
- f. Larval fish/macrophytes
- g. ESM output



# 1

Assess  
Current  
Condition



Journal of Great Lakes Research 39 (2013) 536–546

Contents lists available at ScienceDirect

## Journal of Great Lakes Research

journal homepage: [www.elsevier.com/locate/jglr](http://www.elsevier.com/locate/jglr)

### Predicting submerged aquatic vegetation cover and occurrence in the Superior estuary

Ted R. Angradi <sup>a,\*</sup>, Mark S. Pearson <sup>a</sup>, David W. Bolgrien <sup>a</sup>,  
Brent J. Bellinger <sup>a</sup>, Matthew A. Starry <sup>b</sup>, Carol Reschke <sup>c</sup>  
<sup>a</sup> U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, 6201 Congdon Blvd., Duluth, MN 55804, USA  
<sup>b</sup> U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, 6201 Congdon Blvd., Duluth, MN 55804, USA  
<sup>c</sup> University of Minnesota Sea Grant Institute, 5013 Miller Trunk Hwy., Duluth, MN 55811, USA



A B S T R A C T

## Journal of Great Lakes Research

journal homepage: [www.elsevier.com/locate/jglr](http://www.elsevier.com/locate/jglr)

### Mapping ecosystem service indicators in a Great Lakes estuarine Area of Concern

Ted R. Angradi <sup>a,\*</sup>, Jonathon J. Launspach <sup>b</sup>, David W. Bolgrien <sup>a</sup>, Brent J. Bellinger <sup>c</sup>, Matthew A. Starry <sup>d</sup>, Joel C. Hoffman <sup>a</sup>, Anett S. Trebitz <sup>a</sup>, Mike E. Sierszen <sup>a</sup>, Tom P. Hollenhorst <sup>a</sup>,  
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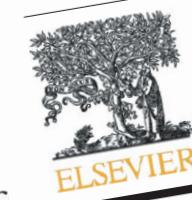
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9/19/2016

#### A B S T R A C T

Estuaries provide multiple ecosystem services from which humans benefit. In Great Lakes Areas of Concern and coastal communities, these systems are often degraded due to a legacy of chemical contamination. This study identifies current and future system benefits that can be used to inform restoration and management decisions.



Journal of Great Lakes Research 42 (2016) 28–38

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### Water quality in the St. Louis River Area of Concern – Lake Superior: Historical and current conditions

Brent J. Bellinger <sup>a</sup>, Mark S. Pearson <sup>a</sup>, Carol Reschke <sup>c</sup>,  
Matthew A. Starry <sup>b</sup>, David W. Bolgrien <sup>a</sup>, Ted R. Angradi <sup>a,\*</sup>  
<sup>a</sup> U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, 6201 Congdon Blvd., Duluth, MN 55804, USA  
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A B S T R A C T

## Journal of Great Lakes Research

journal homepage: [www.elsevier.com/locate/jglr](http://www.elsevier.com/locate/jglr)

### Goals, beneficiaries, and indicators of waterfront revitalization in Great Lakes Areas of Concern and coastal communities

Ted R. Angradi <sup>a,\*</sup>, Kathleen C. Williams, Joel C. Hoffman, David W. Bolgrien  
<sup>a</sup> U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, 6201 Congdon Blvd., Duluth, MN 55804, USA



A B S T R A C T

Waterfront revitalization is a common approach to address environmental problems in Great Lakes Areas of Concern (AOCs) and coastal communities. This study identifies the goals, beneficiaries, and indicators of waterfront revitalization in Great Lakes AOCs and coastal communities.



### Water quality in the St. Louis River Area of Concern – Lake Superior: Historical and current conditions

Volume 43, Issue 1, February 2017, Pages 108–120

## Journal of Great Lakes Research

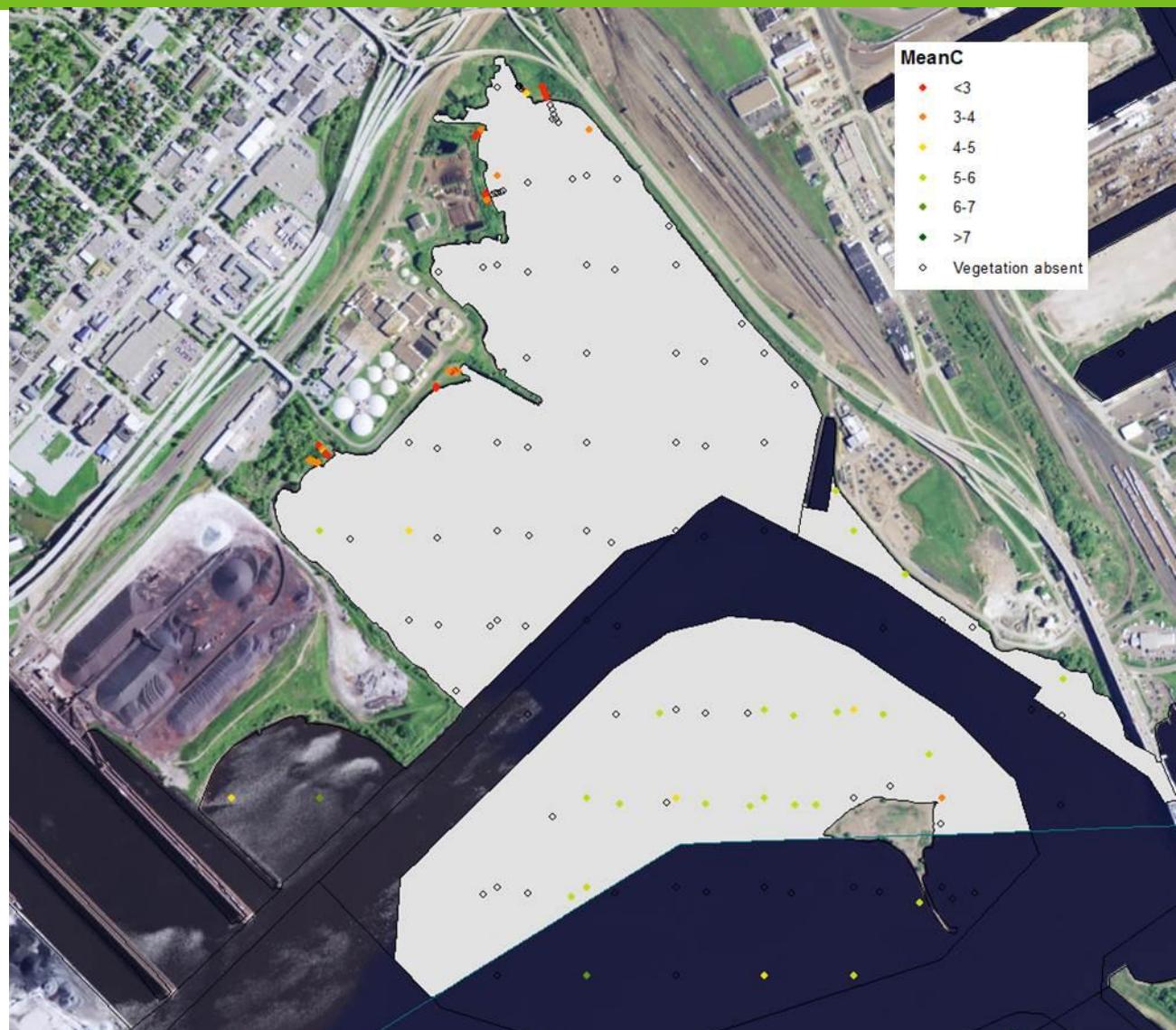
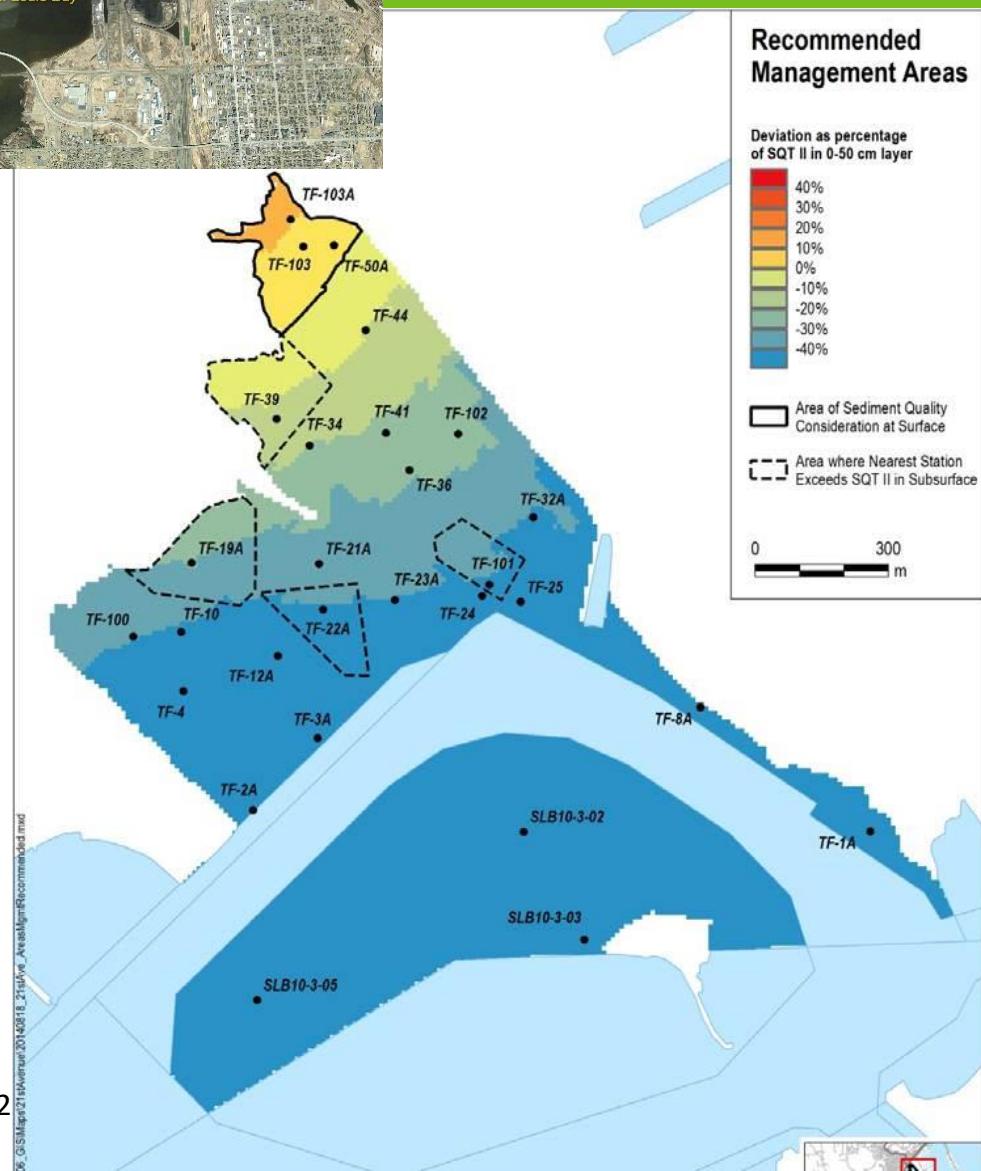
Will M. Bartsch <sup>b</sup>, Anett S. Trebitz <sup>a</sup>, Valerie J. Brady <sup>c</sup>, Jonathon J. Launspach <sup>d</sup>

JGLR-01493; No. of pages: 12; 4C: 7, 8

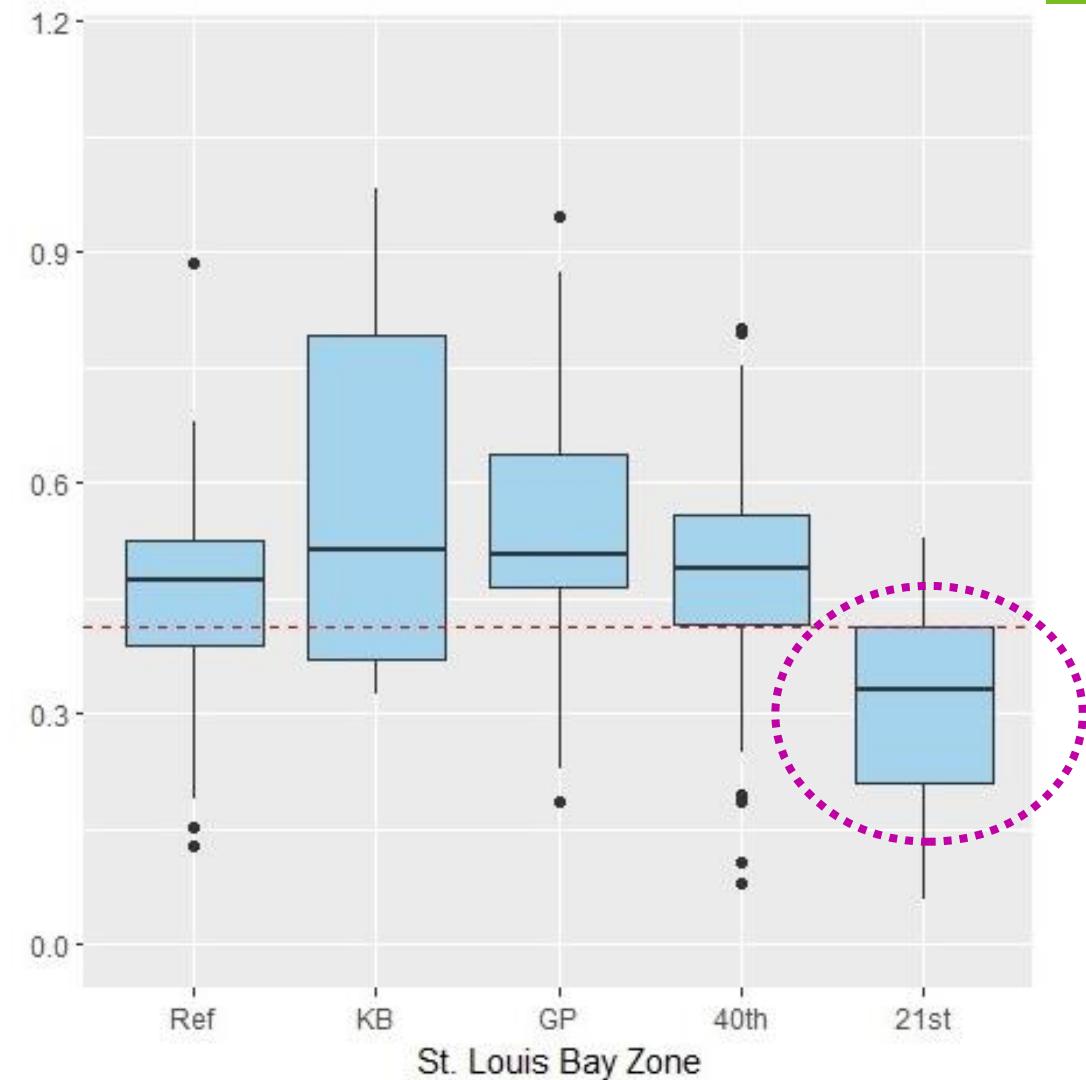
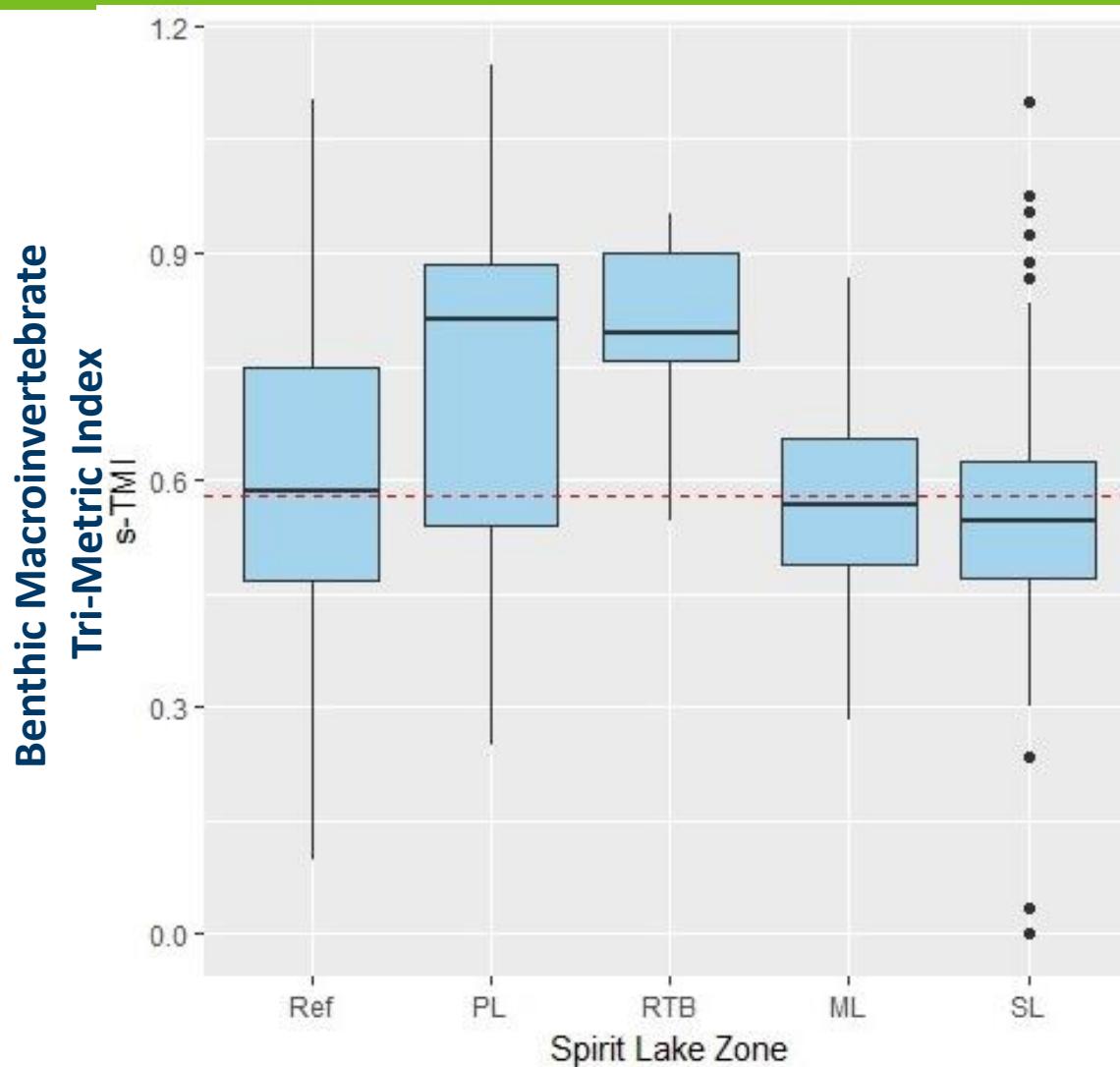




# Pre-construction Environmental Assessment



# Pre-construction Environmental Assessment



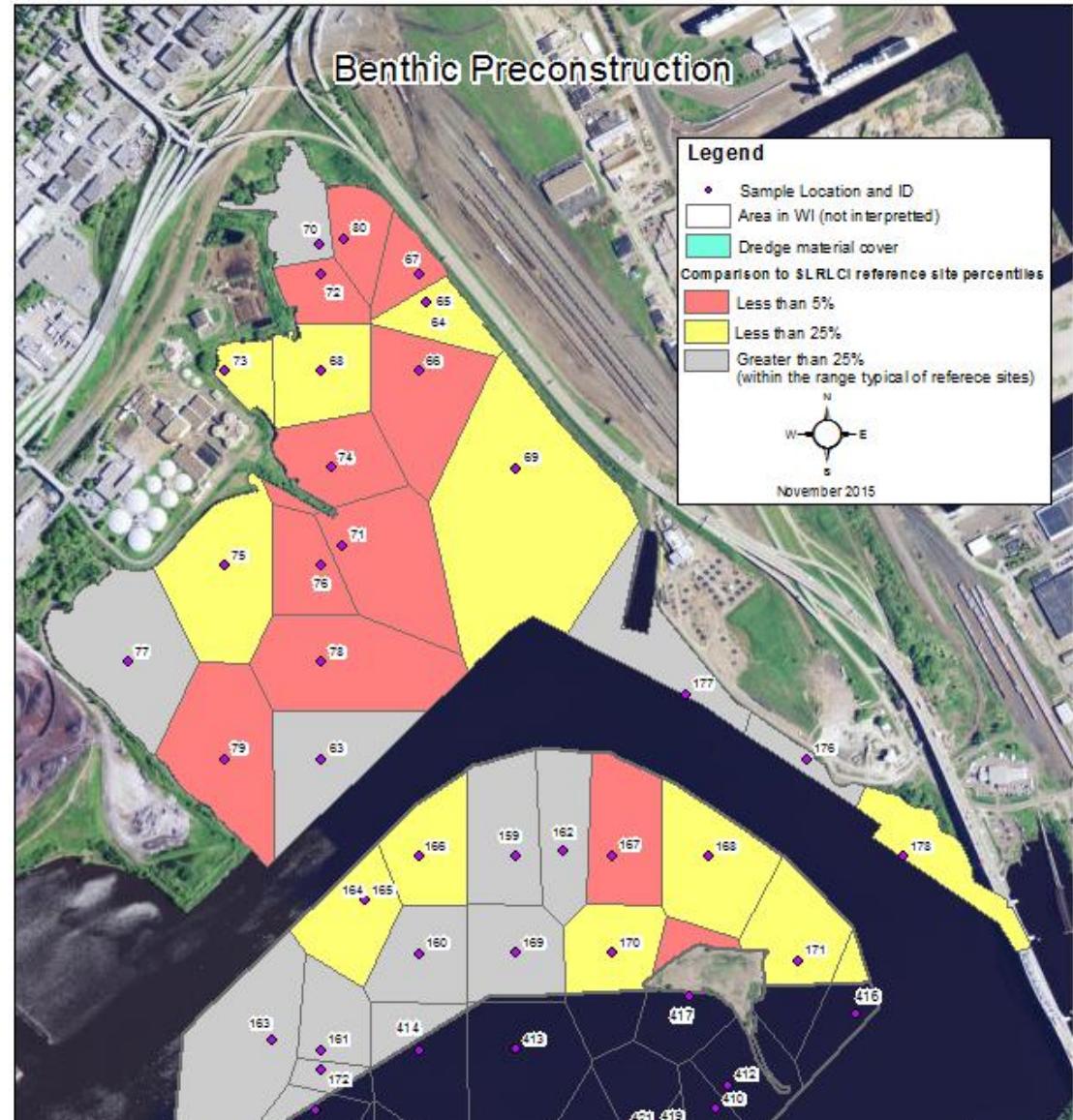
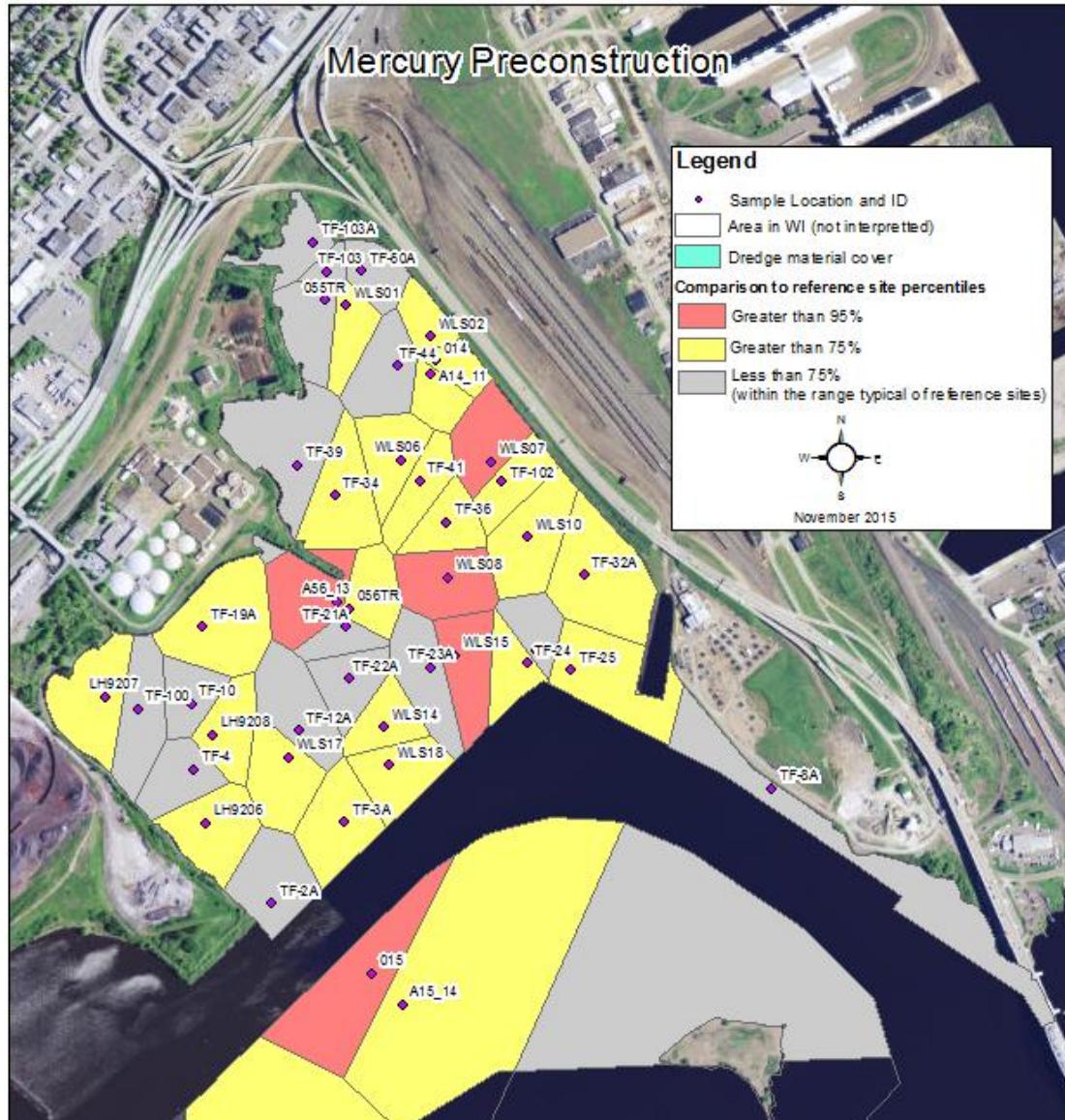
A photograph of a person from the waist down, wearing dark blue jeans and a bright yellow high-visibility vest. They are standing in what appears to be a construction or industrial setting with blurred background elements.

2

Incorporate  
metrics, prioritize  
locations

alternatives  
analysis

# Surface-area Weighted Average of Condition



# Preferred Alternative and Construction Results



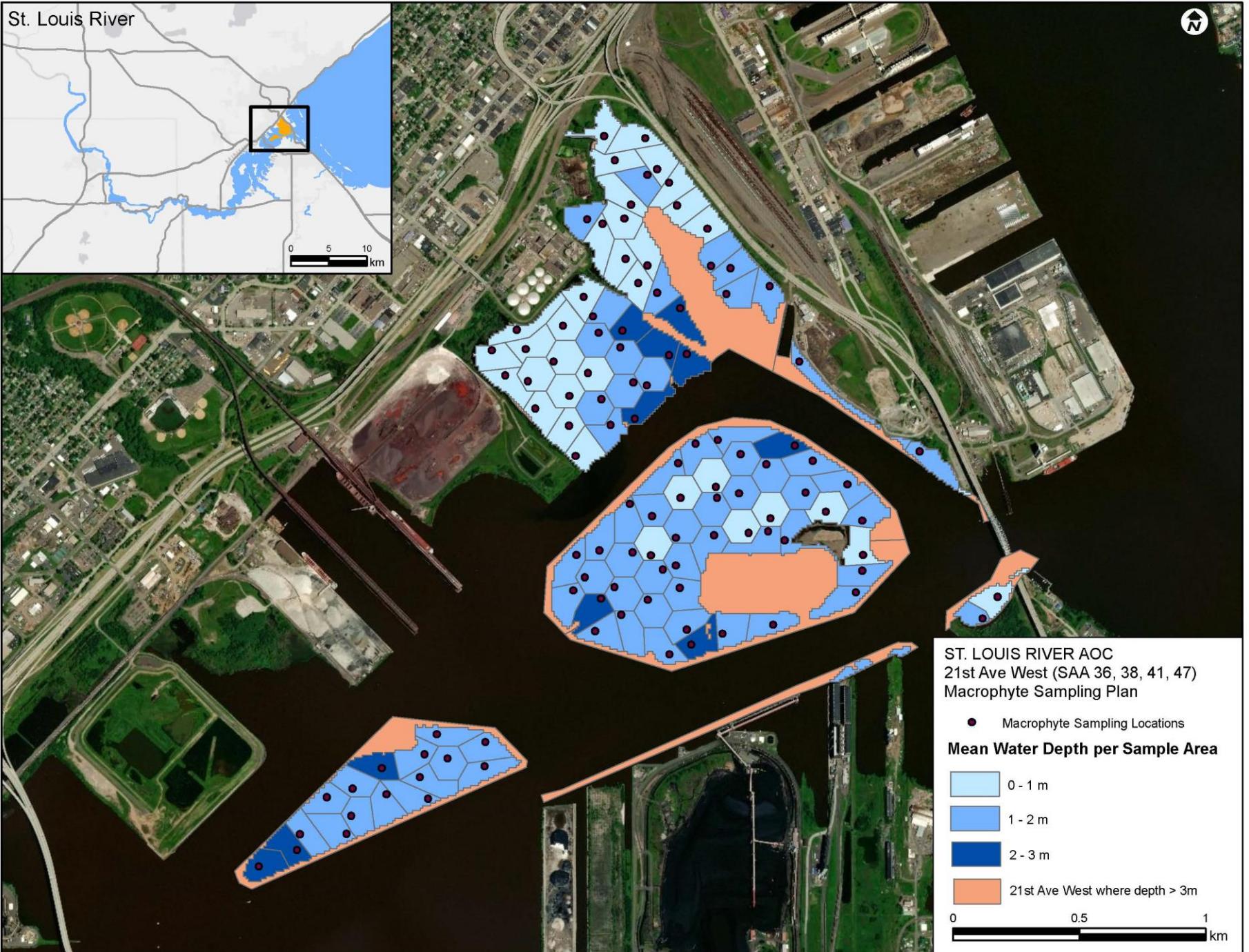
3

long-term

BUI  
removal

monitoring  
and  
maintenance

# Post-construction depth-adjusted SWAc sampling plan



# St. Louis River AOC.... Summary restoration effectiveness (project performance)

- Site-level assessments (physical habitat, sediment chemistry, biological metrics)
- Partnerships
- Before and after collections compared to an established target



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DEPARTMENT OF  
NATURAL RESOURCES



## Great Lakes RESTORATION



# Thank you again!



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