

ST. LOUIS RIVER ESTUARY
Area of Concern to Area of Recovery
A Framework for Delisting
Nelson T. French

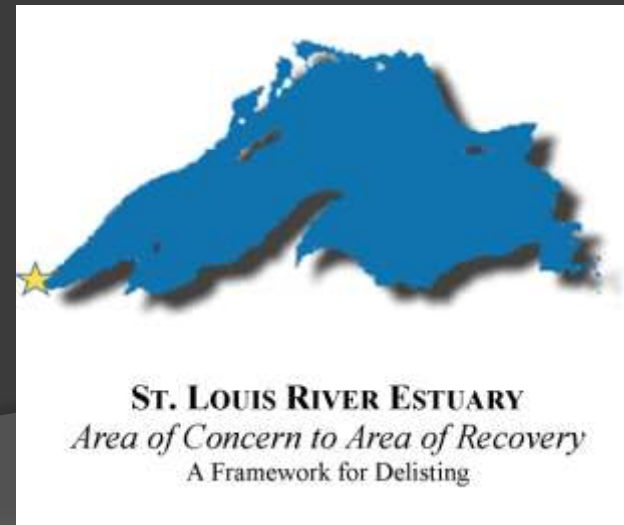
2012 Upper Midwest Stream Restoration Symposium
March 6, 2012
Minneapolis, MN

St. Louis River Estuary Area of Concern to Area of Recovery A Framework for Delisting

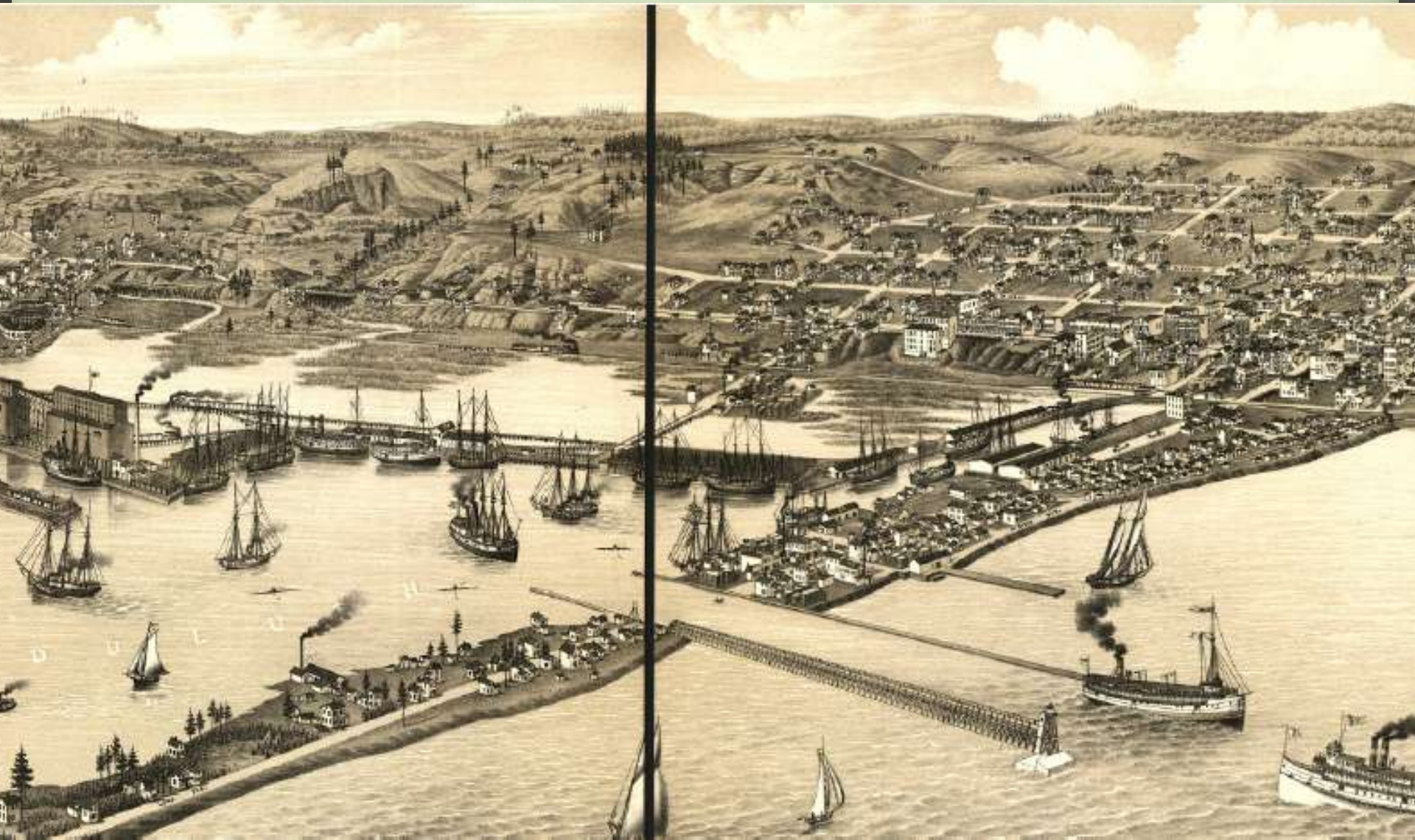


Overview of SLRAOC

- ❖ Past history - a legacy of settlement and development
- ❖ Regulated History – 1972 – 1989
- ❖ Recent History – 1989 – 2010
- ❖ GLRI – 2011 - 2012
- ❖ Future Opportunity – 2012 – 2025...

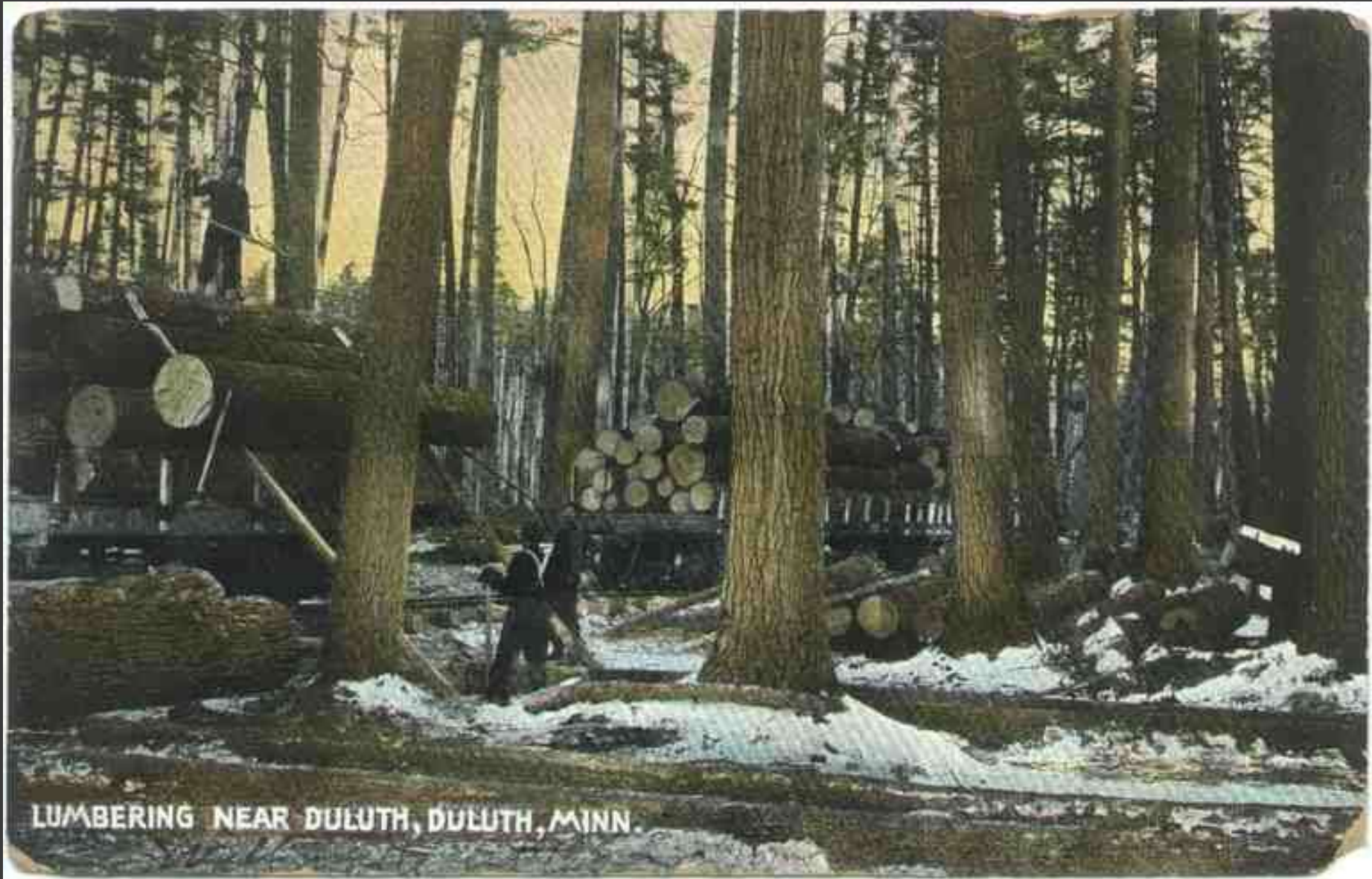


A budding metropolis in 1883...





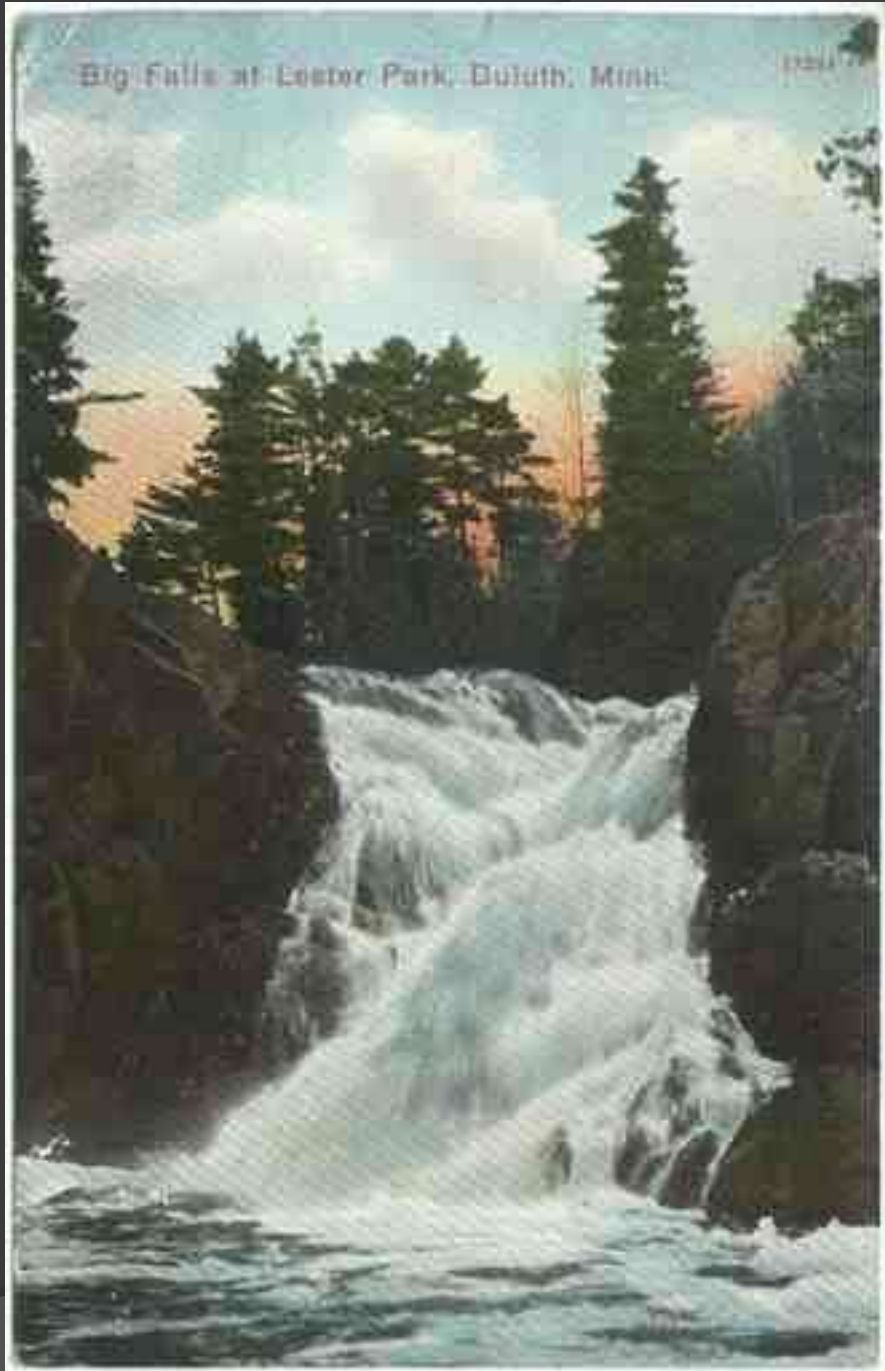
FOND DU LAC (AN OLD TRADING POST 16 MILES FROM DULUTH) DULUTH MINN.



LUMBERING NEAR DULUTH, DULUTH, MINN.



© 1911 THE GREAT NORTHERN PAPER CO. MINN.



Big Falls at Lester Park, Duluth, Minn.

1911

1875H

Dredging in Duluth Harbor, Duluth, Minn.



By 1890 a bustling inland port...



PERSPECTIVE MAP OF THE CITY OF
SUPERIOR, WIS.

FROM A PERSPECTIVE OF AN ANCHORED VESSEL IN THE HARBOR OF SUPERIOR, WIS.

1896 – the bridge is in!



The Twin Ports



St. Louis River AOC circa Present





US Steel Superfund Site







Clean Water Act

Western Lake Superior Sanitary District Came on Line in 1979



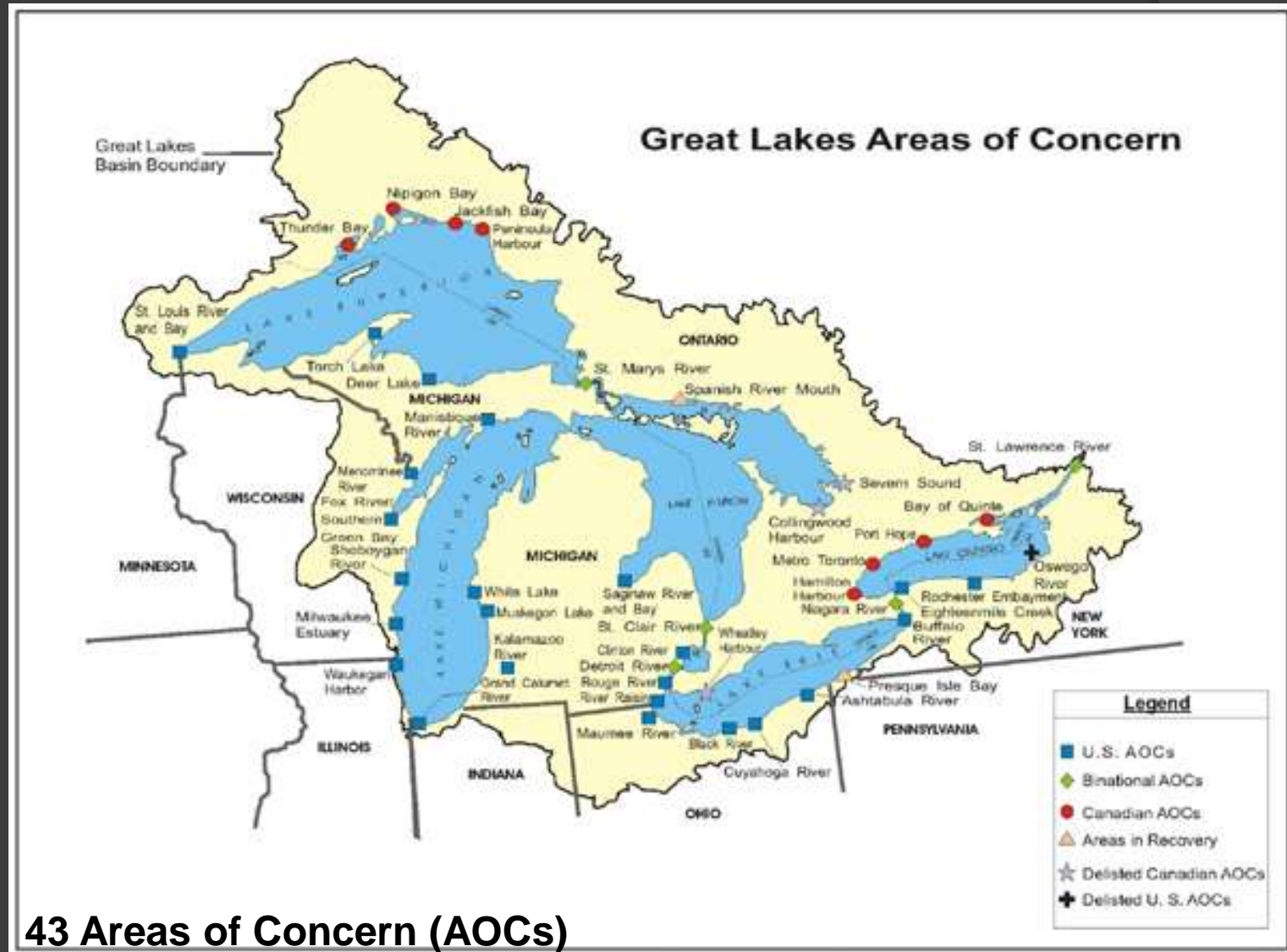
Canada-U.S. Great Lakes Water Quality Agreement



Richard Nixon and Pierre Trudeau sign the historic agreement.

Purpose is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem

- Signed 1972: focus on nutrients; phosphorus in Lake Erie
- Revised 1978: more focus on toxics
- **Revised 1987: introduced Lakewide Management Plans and Areas of Concern**
- Renegotiate 2011: currently being renegotiated

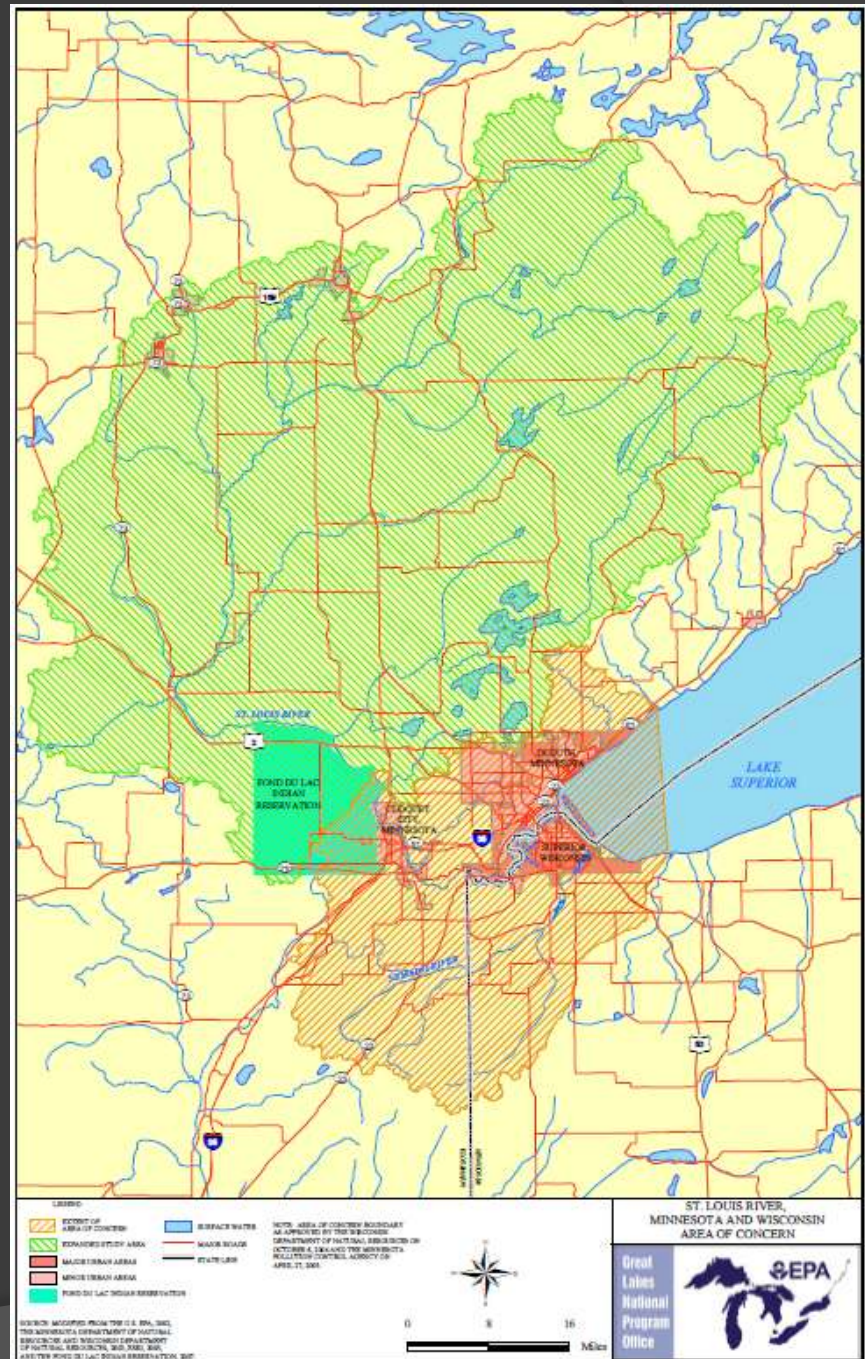


43 Areas of Concern (AOCs)

- 26 located entirely within the United States (1 delisted)
- 12 located wholly within Canada (3 delisted)
- 5 that are shared by Canada and United States

St. Louis River Area of Concern

- The St. Louis River Area of Concern was designated in 1989 and is 1,016.75 square miles in size.
- Minnesota & Wisconsin
- Cloquet, Duluth and Superior
- Fond du Lac Reservation



How Big is the SLR AOC?

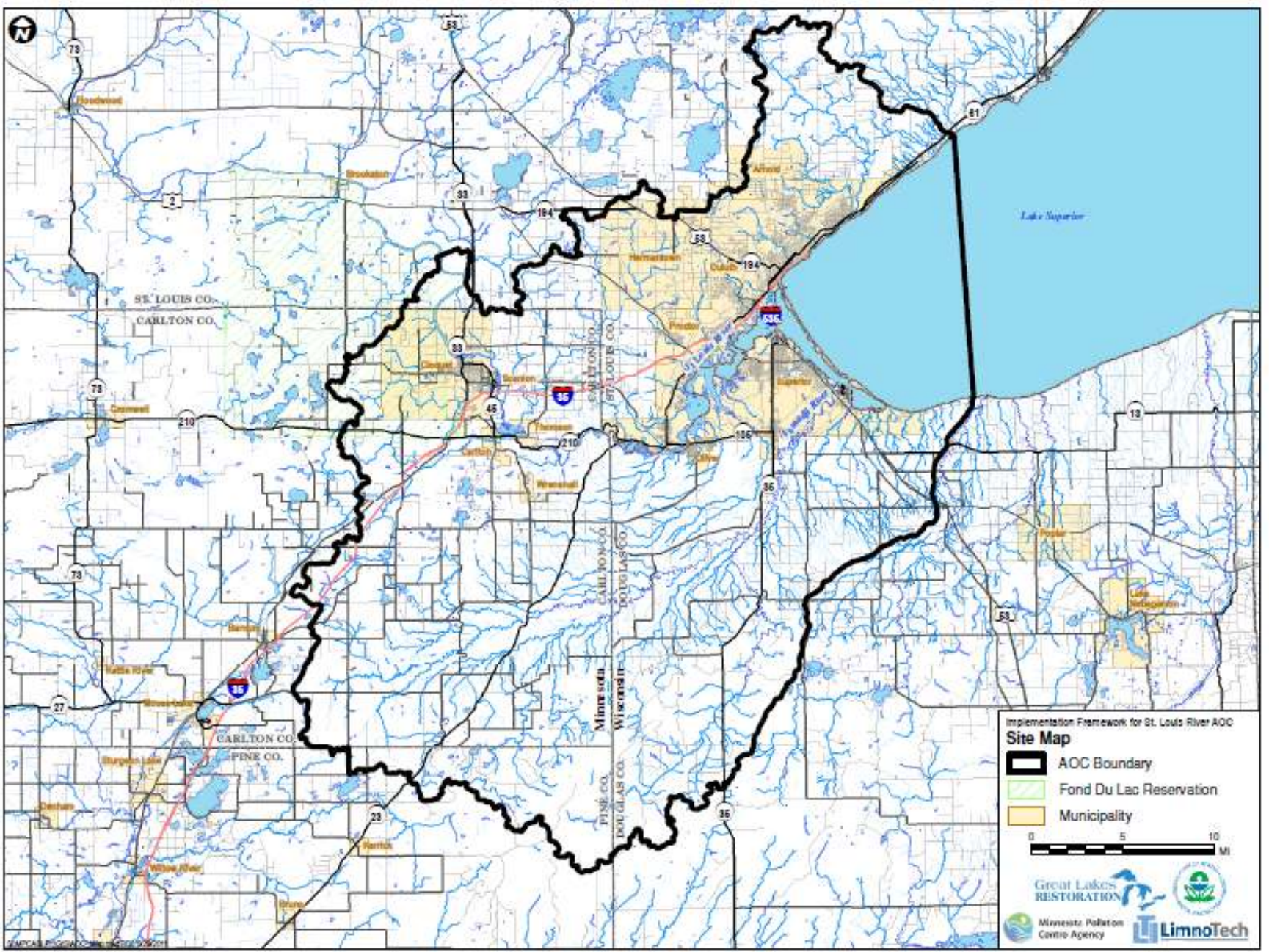
The SLRAOC = 1016.75 SqMi.



Can hold within its area:

- EIGHTEENMILE CREEK AREA OF CONCERN
- MANISTIQUE AREA OF CONCERN
- WAUKEGAN HARBOR
- SHEBOYGAN AREA OF CONCERN
- OSWEGO RIVER AREA OF CONCERN
- BUFFALO RIVER AREA OF CONCERN
- MENOMINEE AREA OF CONCERN
- RIVER RAISIN AREA OF CONCERN
- ASHTABULA RIVER AREA OF CONCERN
- WHITE LAKE AREA OF CONCERN
- TORCH LAKE AREA OF CONCERN
- DEER LAKE AREA OF CONCERN
- KALAMAZOO RIVER AREA OF CONCERN
- MUSKEGON LAKE AREA OF CONCERN
- MILWAUKEE AREA OF CONCERN
- ST. LAWRENCE RIVER - MASSENA AREA OF CONCERN
- GRAND CALUMET RIVER
- FOX RIVER/GREEN BAY AREA OF CONCERN
- ROCHESTER EMBAYMENT AREA OF CONCERN
- ST. CLAIR AREA OF CONCERN
- ROUGE RIVER AREA OF CONCERN

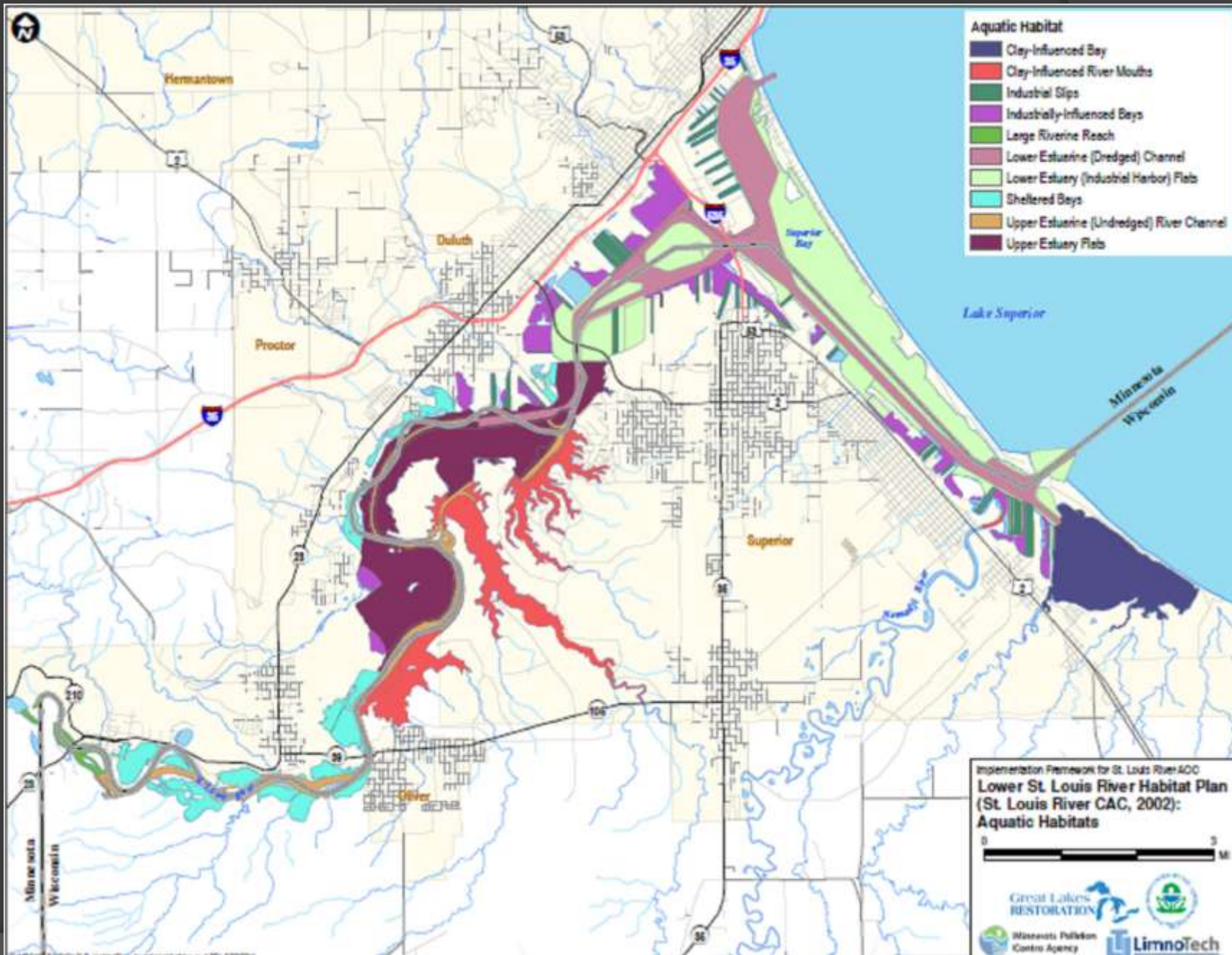
21 AOC's or 652.8 SqMi.




Partnerships

- **St. Louis River Alliance**
- **Minnesota Department of Natural Resources**
- **Wisconsin Department of Natural Resources**
- **Fond du Lac Resource Management**
- **Minnesota Pollution Control Agency**
- **Minnesota Land Trust**
- **United States Fish and Wildlife Service**
- **Minnesota Sea Grant**
- **Natural Resources Research Institute**
- **U. S. Environmental Protection Agency**
- **Western Lake Superior Sanitary District**
- **West Wisconsin Land Trust**
- **The Nature Conservancy**
- **Harbor Technical Advisory Committee**
- **Port Authority**
- **NOAA**
- **St. Louis, Carlton and Douglas Counties**
- **Cities of Duluth and Superior**
- **Murphy Oil, Minnesota Power, Sappi Fine Paper, Hallet Dock, Potlatch Corporation**
- **University of Minnesota Duluth**
- **University of Wisconsin Superior**
- **United States Coast Guard**





A photograph showing two young sturgeon fish in shallow, clear water. The fish are positioned horizontally, with their heads pointing towards the right. They are resting on a bed of dark, wet rocks. The water is dark blue, and the rocks are dark brown and black. The fish have a silvery, metallic sheen and a pointed snout. The text is overlaid on the right side of the image.

In 2011, four young sturgeon were collected in an area below the du Lac dam by tribal biologists, marking the first evidence of sturgeon reproduction in the river in many decades.

***“Working with Minnesotans to protect,
conserve and improve our environment
and enhance our quality of life”***

MPCA Mission Statement

Photo by Doug Robertson

Clean Water Act - 1972

Causes of Impairment – 303d

- Pathogens
- Mercury
- Metals
- Nutrients
- Sediment
- Organic Enrichment/Oxygen Depletion
- pH/Acidity/Caustic Condition
- PCB's
- Impaired biota
- Turbidity
- Temperature
- Pesticides
- Salinity/T Dissolved Solids/Chlorides/Sulfates
- Unknown Cause
- Noxious Aquatic Plants

Great Lakes Water Quality Agreement – Annex II 1987

AOC 14 Beneficial Use Impairments

- ✓ Restrictions on fish and wildlife consumption
- ✓ Fish tumors or other deformities
- ✓ Degradation of benthos
- ✓ Restrictions on dredging activities
- ✓ Beach closings
- ✓ Degradation of aesthetics
- ✓ Loss of fish and wildlife habitat
- ✓ Degradation of fish wildlife populations
- ✓ Excessive Loading of Sediment and Nutrients
 - Tainting of fish and wildlife flavor
 - Bird or animal deformities or reproduction problems
 - Restrictions on drinking water consumption, or taste and odor problems
 - Degradation of phytoplankton and zooplankton populations
 - Added costs to agriculture or industry

BUI 1: Fish Consumption Advisories

Beneficial Use Target: There are no Area of Concern-specific fish consumption advisories issued for the St. Louis River by the State of Wisconsin or the State of Minnesota. Tissue concentrations of contaminants of concern in representative samples of resident fish are not significantly elevated from regional background samples.

BUI 2: Degraded Fish & Wildlife Populations

Beneficial Use Target: In consultation with their federal, tribal, local and nonprofit partners, state resource management agencies concur that diverse native fish and wildlife populations are not limited by physical habitat, food sources, water quality, or contaminated sediments.

BUI 3: Fish Tumors and Deformities

Beneficial Use Target: Incidence rates of contaminant-related internal and external tumors and deformities in resident benthic fish species, including neoplastic or pre-neoplastic liver tumors, do not exceed incident rates from unimpaired areas elsewhere in the Great Lakes basin.

BUI 4: Degradation of Benthos

Beneficial Use Target: The benthic community in historically degraded areas (ie, chemically, biologically, or physically degraded areas) of the AOC does not significantly differ from unimpacted sites of comparable characteristics within the AOC. Benthic community characteristics including native species richness, diversity, abundance, and functional groups will be considered when comparing sites.

BUI 5: Restrictions on Dredging

Beneficial Use Target: All contaminated sediment hotspots within the AOC have been identified and implementation actions to remediate contaminated sites have been completed. There are no special handling requirements of material from routine navigational dredging due to contamination originating from controllable sources within the AOC.

BUI 6: Excessive Loading of Nutrients and Sediments

Beneficial Use Target: Nutrient and sediment levels have not been shown to impair water quality and habitat, and do not restrict recreation, including fishing, boating, or body contact in the estuary and within western Lake Superior based on the following criteria;

- discharge permits are in compliance
- total phosphorus limits
- no exceedances of water quality standards attributable to wastewater overflows

BUI 7: Beach Closings & Body Contact

Beneficial Use Target: Sources of stormwater and wastewater discharges to the St. Louis River AOC have been identified and measures to reduce the risk of human exposures to disease causing microorganisms have been implemented. There are no body contact advisories due to the presence of harmful chemicals at contaminated sites. No water bodies within the AOC are included on the 303(d) lists due to controllable sources.

BUI 8: Degradation of Aesthetics

Beneficial Use Targets: There are no verified persistent occurrences of objectionable properties in the surface waters of the St. Louis River Estuary during the previous five year period. “Persistent occurrences” are defined as objectionable properties that occur more than two times per year and are greater than ten days in duration.

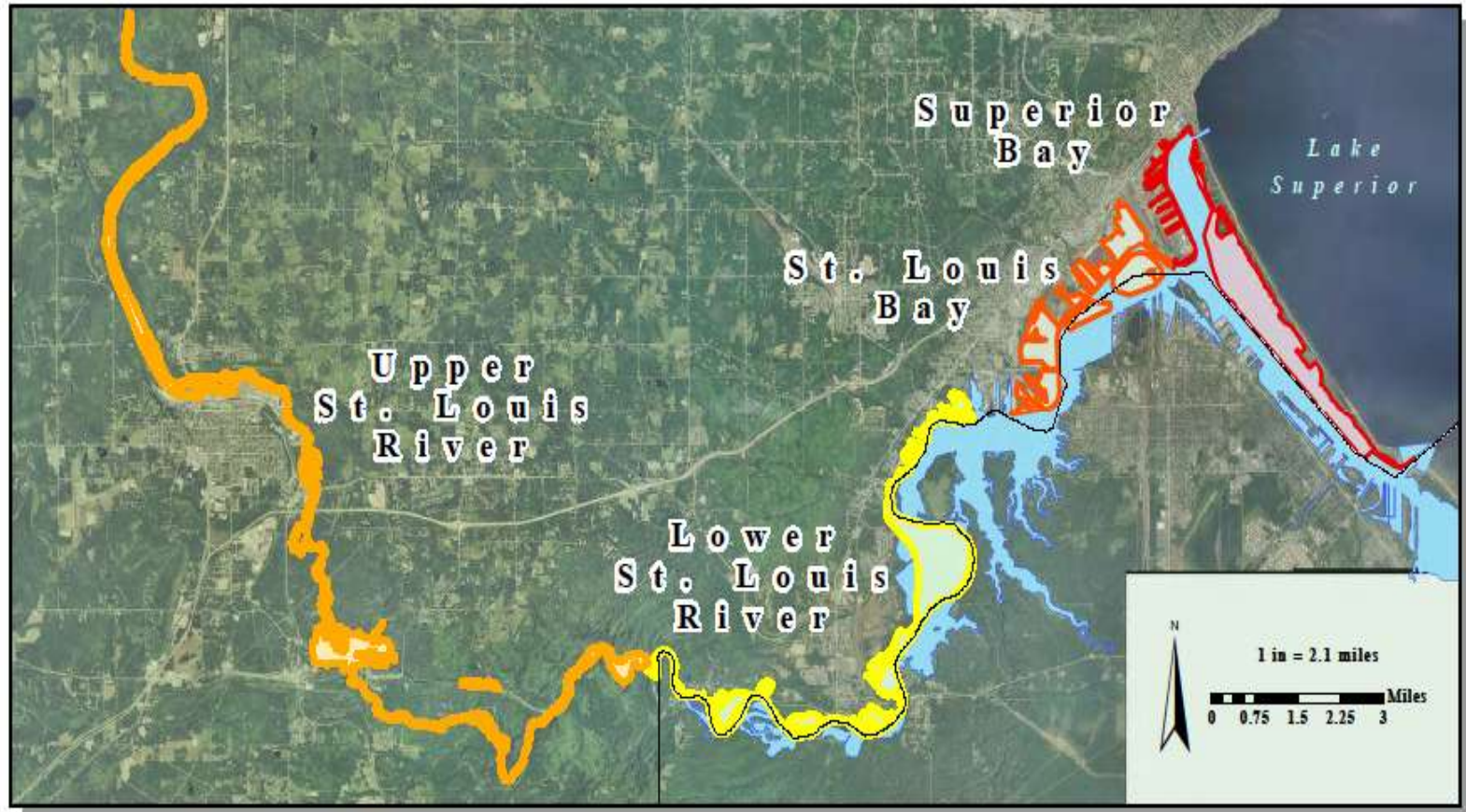
BUI 9: Loss of Fish & Wildlife Habitat

Beneficial Use Target: State resource management agencies concur, in consultation with their federal, tribal, local, and nonprofit partners, that a reasonable amount of fish and wildlife habitat, given the presence of industrial development in the estuary, that is currently degraded is enhanced, rehabilitated, and protected against further loss of habitat.

(includes interim guides for contamination, AIS, restoration of habitat)

St. Louis River Area of Concern

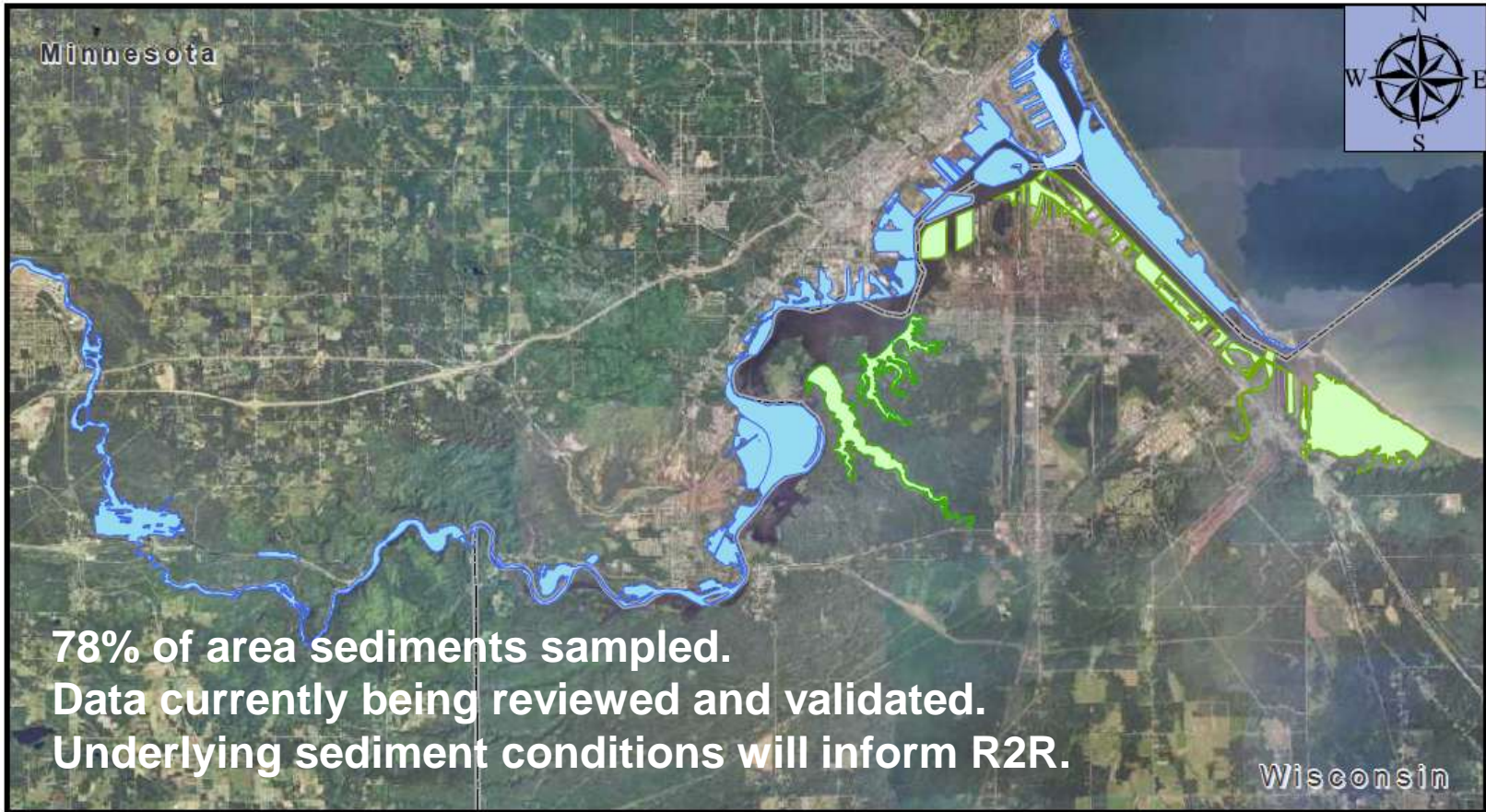
Sediment Characterization Sites



Size: 5,810 acres
Contaminated Sediment
Estimated Volume: 17,526,825 cu. yd.
Estimated Cost: \$1.75 - \$17.5 B

Sediment Characterization

St. Louis River Area of Concern



 **Minnesota** (~6692 acres)

 **Wisconsin** (~2635 acres)

Additional sediment assessment will likely be required for each individual site remediation to restoration project

Created by: Brittany Story, MPCA; 2008 Aerial Photo Courtesy of LMIC. Completed: 8/2011



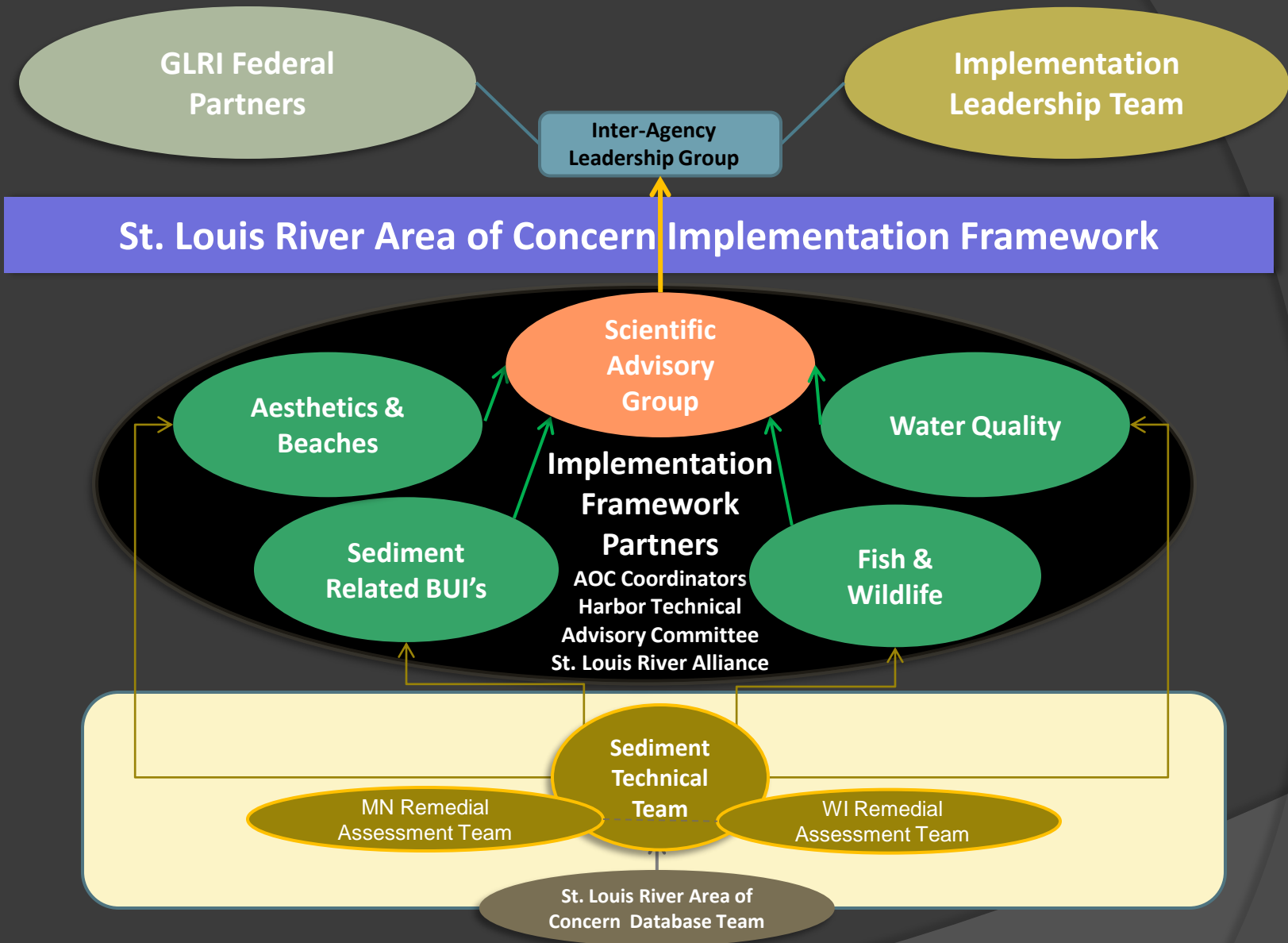
**Minnesota Pollution
Control Agency**



Implementation Framework

Key Goals

- Develop a comprehensive, stakeholder vetted plan for recovery and delisting AOC
- Identify, prioritize, and define high priority Remediation to Restoration (R2R) projects
 - → Be ready for action
- Track progress – Measurable Indicators
- Enable local partners to advance strategically aligned projects



Holistic Approach to Prioritized Actions

Stressors/Sources

Beneficial Use Impairments

2011  2025



Major Implementation Framework Project Elements

- BUI Blueprints
 - Historic Conditions
 - Current Conditions
 - Path to Delisting
- Model of sources/stressors/BUIs
- Set of Measureable Indicators
- Prioritized Actions and R2R plans
- Roadmap to Recovery and Ultimate Delisting



Data Projects and Status

Database

- Sharing data with NOAA through QM
 - Most of our previous efforts have been scattered
- Building a St. Louis Bay MN/WI Database
 - Weekly lead conference and a new technical team being

New Data/Recent Studies

- Superior Bay/21stAve
- St. Louis Bay/40th Ave
- Lower St. Louis River
- Upper St. Louis River

GIS/Data Analysis

- Environment Canada's (SeQI) sediment Quality
 - Used to calculate Tier 1 and Tier 2 @ 6inch and 1M depths base on
- ND Substitution analysis
- New MN/WI Level 1 and Level 2 polygon effort

Future/Current Projects

- TMDL Studies
 - Amity Creek, Miller Creek
- Hg & Toxics TMDL studies,
- PAH in coal tar sealants

NEW SLRAOC DATA SYSTEMS TEAM



Phase V
MPCA

- State Wide
- Not Public

Query
Manager
NOAA

- Great Lakes
Wide
- Public

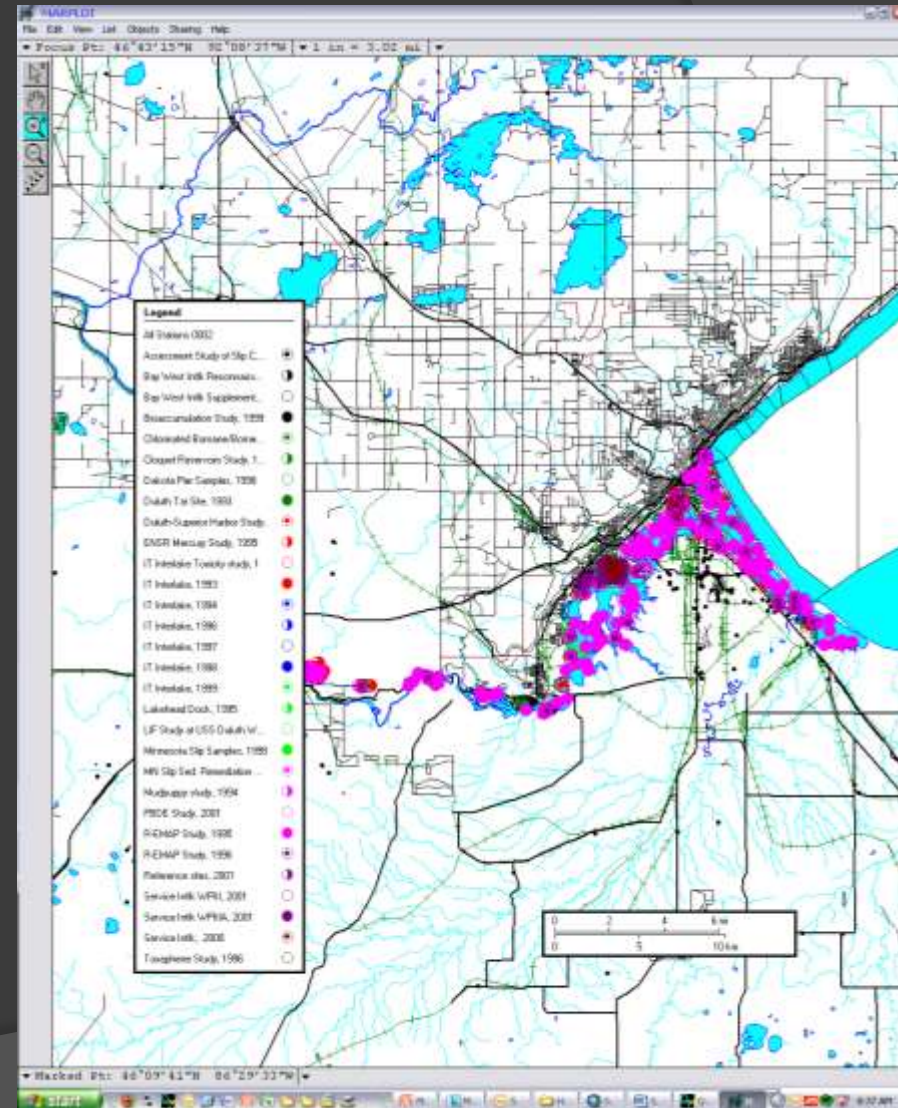
GL Sed.
EPA
GLRI

- Not Public
- Used By EPA
for
Assessments

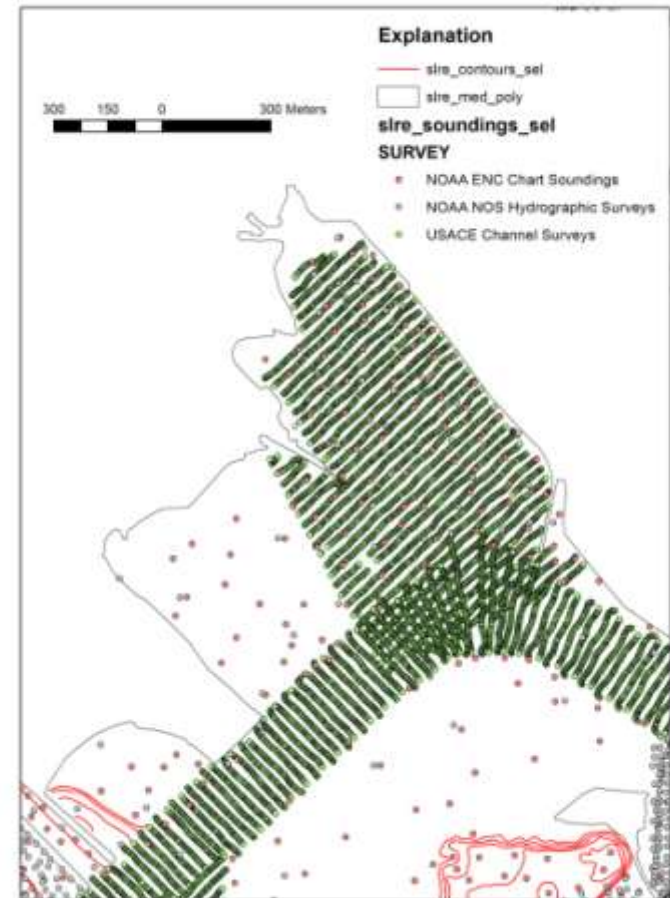
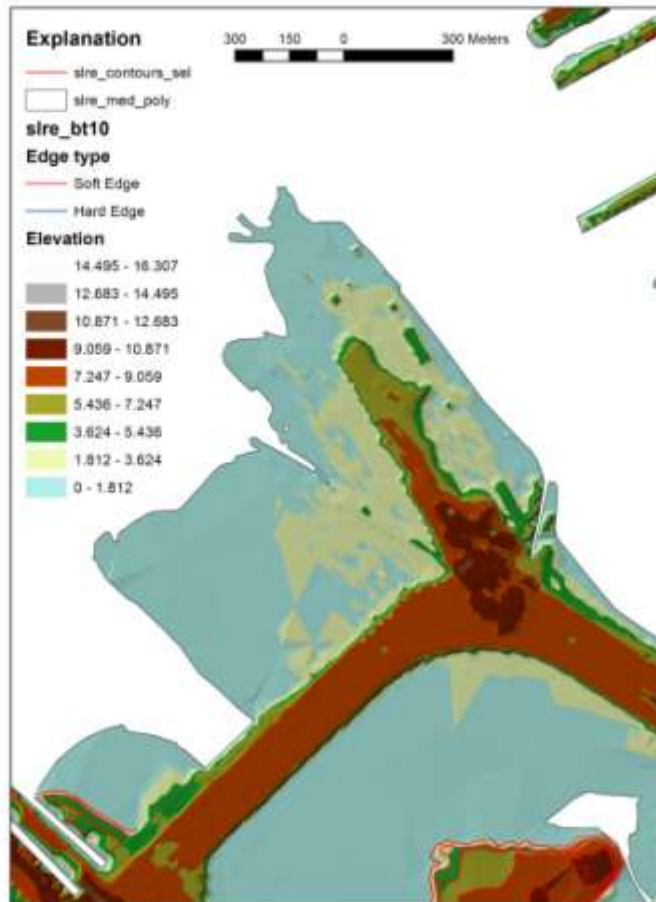
EQIS
MN

- Long term
home

Polygon and Mapping Work



Bathymetry – AOC Wide



SeQI Analysis

seq140.Ave 0-1.Lave.xls [Compatibility M...]

Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number

A8

Home Data Report IOC Adjustment Getting Started The SeQI

Load Canadian Sediment Quality Guidelines (CCME, 2002)

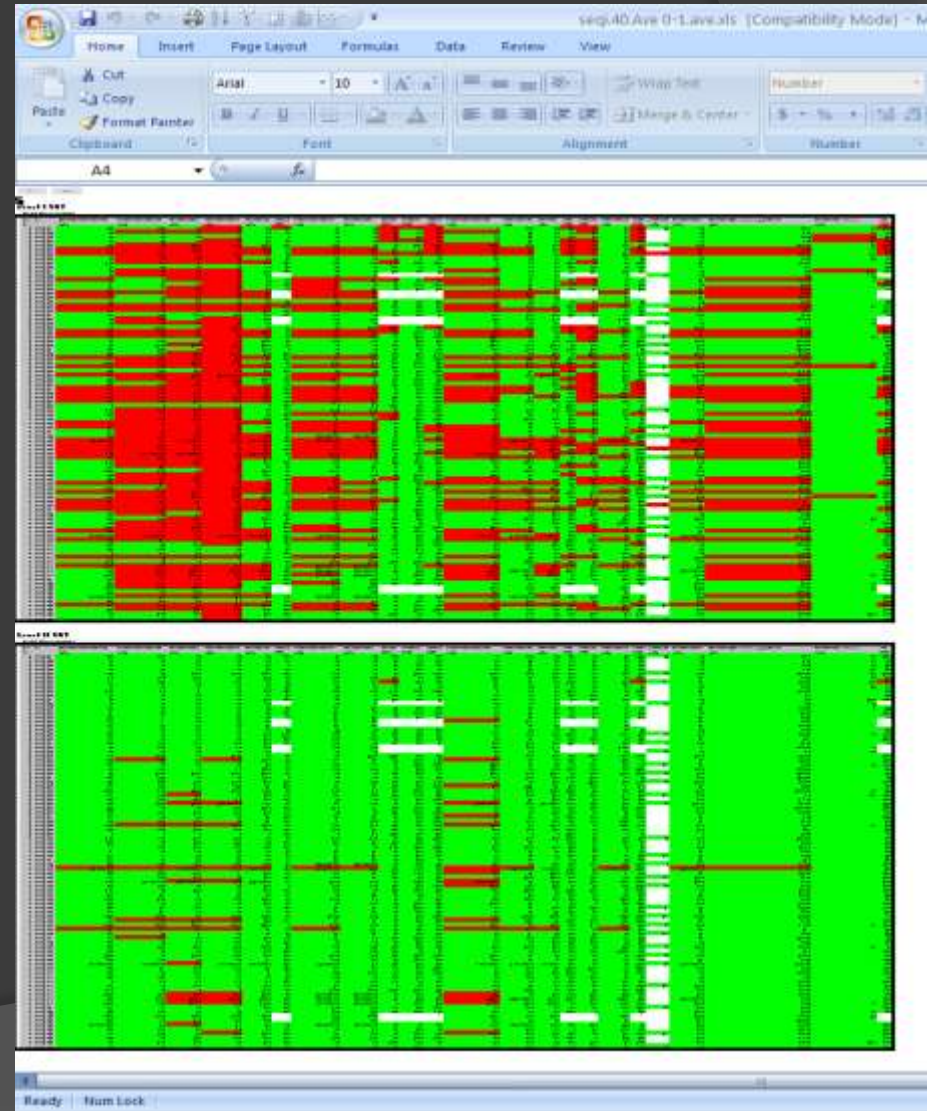
References Freshwater Marine

User-Defined Guideline List

Save Load Help

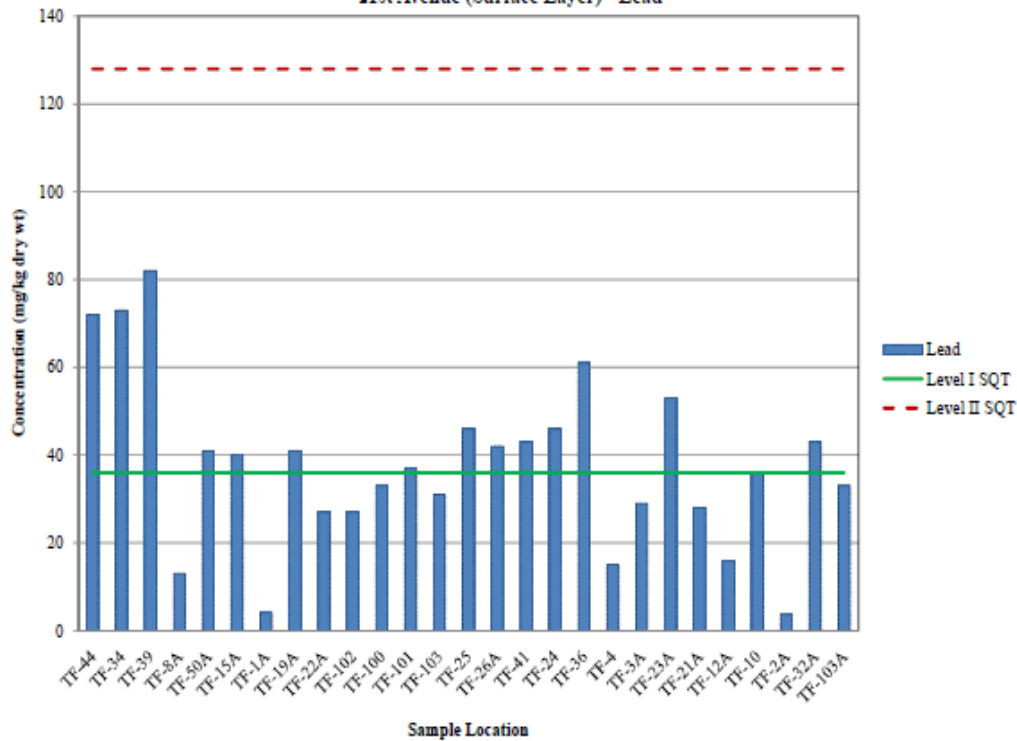
Variables	Symbol	Units	Level I SQT Value	Level II SQT Value
1 1,2-BENZPHENANTHRACENE		µg/kg	170	1300
2 2-Methylnaphthalene		µg/kg	20	200
3 Acenaphthene		µg/kg	6.7	89
4 Acenaphthylene		µg/kg	5.9	130
5 Anthracene		µg/kg	57	850
6 Arsenic	As	µg/kg	9.8	33
7 Benzo(a)anthracene		µg/kg	110	1100
8 Benzo(a)pyrene		µg/kg	150	1500
9 Cadmium	Cd	µg/kg	0.99	5
10 Chromium	Cr	µg/kg	43	110
11 Copper	Cu	µg/kg	32	150
12 Dibenz(a,h)anthracene		µg/kg	33	140
13 Fluoranthene		µg/kg	420	2200
14 Fluorene		µg/kg	77	540
15 Lead	Pb	µg/kg	36	130
16 Mercury	Hg	µg/kg	0.18	1.1
17 PAHs - Naphthalene		µg/kg	180	560
18 Nickel	Ni	µg/kg	23	49
19 PAHs - Pyrene		µg/kg	200	1500
20 PAHs - Phenanthrene		µg/kg	200	1200
21 Total PAHs 17		µg/kg	1600	23000
22 Polychlorinated biphenyls (total)	tPCB	µg/kg	60	680
23 Zinc	Zn	µg/kg	120	460
24				
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Ready Num Lock

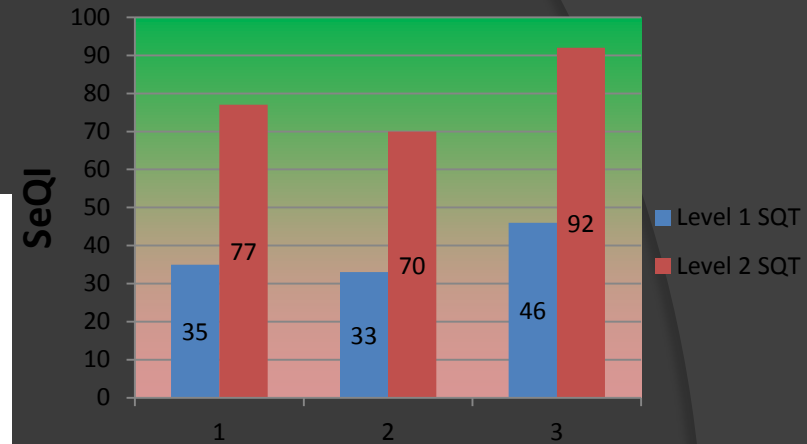


SeQI Analysis

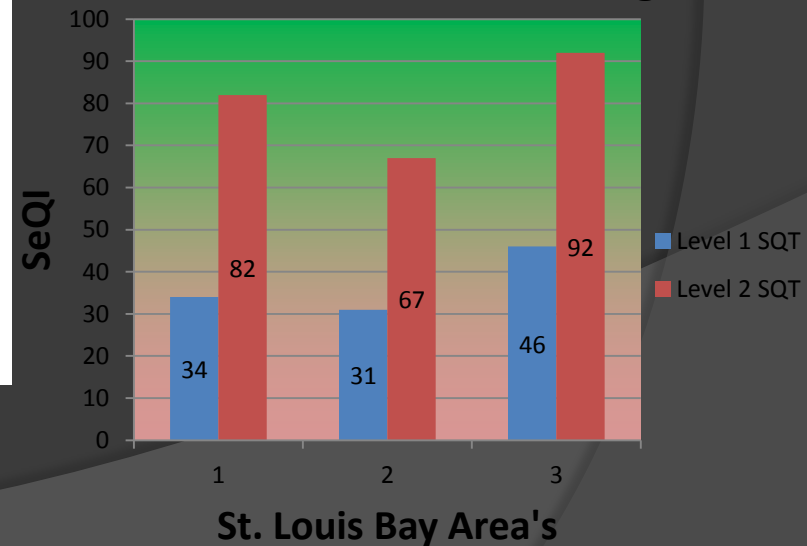
Figure 2-e
21st Avenue (Surface Layer) - Lead



0-6 Inches Cores



0-36 Inches Cores Average



BUI Blueprint: Definition of the BUI and Purpose of the Blueprint

Identification of Sources and Stressors

Measurable
Indicators

Historic
Conditions

Current
Conditions

Information
Gaps

Sequential List of Prioritized Actions

Project
#1



Project
#2



Project
#3



Project
#4



Project
#X

Limiting Factors for Implementation

Timeline: Estimates Corresponding to Prioritized Actions

Monitoring: Tracking Progress using Measurable Indicators

B
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Remediation

Assurance that the base of the food web maximizes diversity and allows for optimum native fish and wildlife populations

+

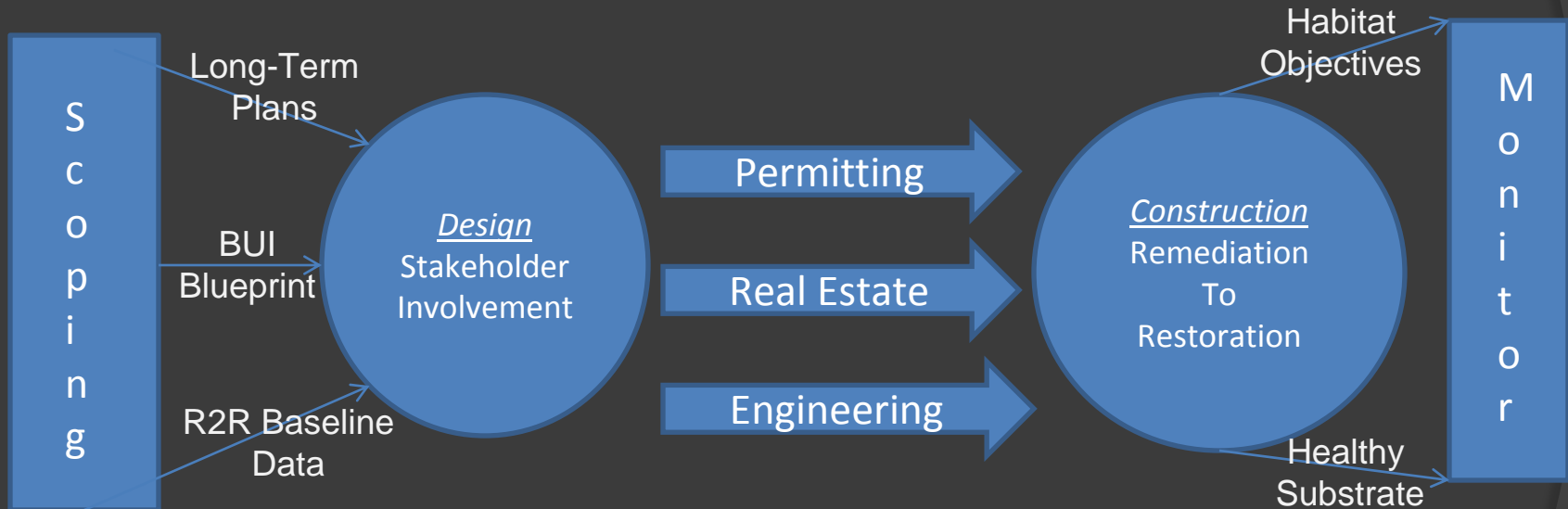
Merging restoration objectives within remedial best management alternatives

Healthy Estuarine Habitat

Restoration

Simplified R2R Process

Remediation to Restoration Process Template



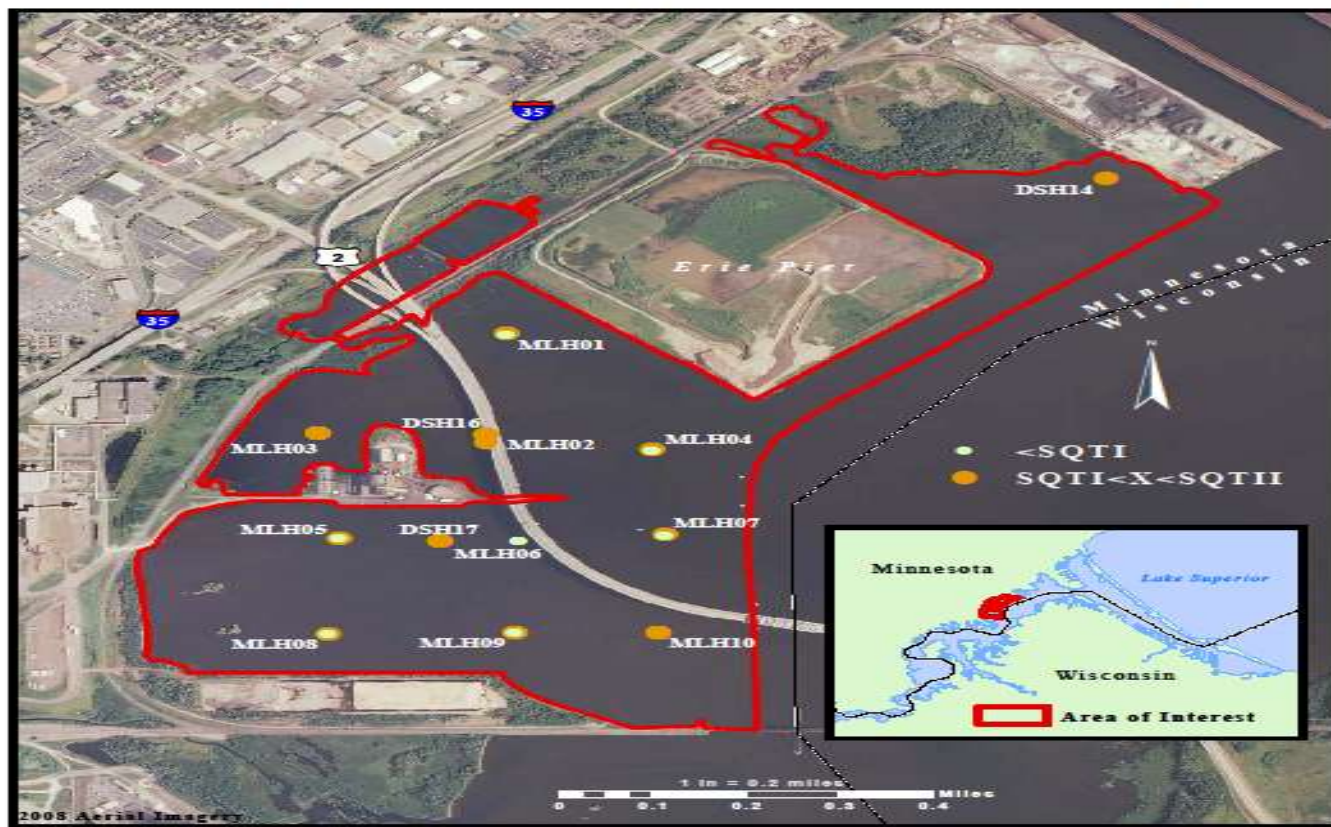
Funding Identified

Delisting Progress

← Partner Continuity Throughout Entire Process →



Erie Pier to Coffee Ground Remediation - Restoration Stretch



Sample	Analyte Tested	Concentration	Exposure Level
MLH01	Mercury	0.34	<SQTII<SQTIII
	Total PAH 13	77.49	<SQTII<SQTIII
	Mercury	0.0359	<SQTII
	Total PAH 13	302	<SQTII
MLH02	Mercury	0.044	<SQTII
	Total PAH 13	527.5	<SQTII
	Mercury	0.16	<SQTII
	Total PAH 13	2201	SQTII<X<SQTIII
MLH03	Mercury	0.71	SQTII<X<SQTIII
	Total PAH 13	2807	SQTII<X<SQTIII
	Mercury	0.36	SQTII<X<SQTIII
	Total PAH 13	2872	SQTII<X<SQTIII
MLH04	Mercury	0.5	SQTII<X<SQTIII
	Total PAH 13	6043.5	<SQTII
	Mercury	0.015	<SQTII
	Total PAH 13	145	<SQTII
MLH05	Mercury	0.49	SQTII<X<SQTIII
	Total PAH 13	7024.5	SQTII<X<SQTIII
	Mercury	0.02	<SQTII
	Total PAH 13	19.4	<SQTII
MLH06	Mercury	0.03	<SQTII
	Total PAH 13	729	<SQTII
	Mercury	0.006	<SQTII
	Total PAH 13	85,445	<SQTII
MLH07	Mercury	0.52	SQTII<X<SQTIII
	Total PAH 13	6966	SQTII<X<SQTIII
	Mercury	0.011	<SQTII
	Total PAH 13	38.25	<SQTII

Sample	Analyte Tested	Concentration	Exposure Level
MLH08	Mercury	0.23	SQTII<X<SQTIII
	Total PAH 13	253	SQTII<X<SQTIII
	Mercury	0.007	<SQTII
	Total PAH 13	8.4	<SQTII
MLH09	Mercury	0.45	SQTII<X<SQTIII
	Total PAH 13	997.6	SQTII<X<SQTIII
	Mercury	0.039	<SQTII
	Total PAH 13	43.75	<SQTII
MLH10	Mercury	0.17	<SQTII
	Total PAH 13	4139	SQTII<X<SQTIII
	Mercury	0.29	SQTII<X<SQTIII
	Total PAH 13	3166	SQTII<X<SQTIII
DSH14	Mercury	0.016	<SQTII
	PCB	18	<SQTII
	Mercury	0.083	<SQTII
	PCB	17	<SQTII
	Mercury	0.072	<SQTII
	PCB	7.5	<SQTII
	Mercury	0.077	<SQTII
	PCB	6.6	<SQTII
	Arsenic	2.5	<SQTII
	Copper	18.3	<SQTII
DDT	0.005	<SQTII	
Chadren	0.14	<SQTII	
Lead	0.23	<SQTII	
Mercury	0.08	<SQTII	
PCB	29	<SQTII	
Total PAH 13	1456	<SQTII	
Toxaphene	19	SQTII<X<SQTIII	

Sample	Analyte Tested	Concentration	Exposure Level
DSH16	Mercury	0.237	SQTII<X<SQTIII
	PCB	34	<SQTII
	Mercury	0.159	<SQTII
	PCB	104	SQTII<X<SQTIII
	Mercury	0.316	SQTII<X<SQTIII
	PCB	28.5	<SQTII
	Mercury	0.034	<SQTII
	PCB	14	<SQTII
	Arsenic	1.17	SQTII<X<SQTIII
	DDT	31.1	<SQTII
DSH17	Mercury	3.63	<SQTII
	Chadren	1	<SQTII
	Lead	6.81	<SQTII
	Mercury	0.152	<SQTII
	PCB	89.3	SQTII<X<SQTIII
	Total PAH 13	1139	<SQTII
	Toxaphene	3.7	SQTII<X<SQTIII
	Mercury	0.043	<SQTII
	PCB	15	<SQTII
	Mercury	0.014	<SQTII
PCB	8.7	<SQTII	
Arsenic	23.3	SQTII<X<SQTIII	
Copper	22.3	SQTII<X<SQTIII	
Lead	73.8	SQTII<X<SQTIII	
Mercury	0.457	SQTII<X<SQTIII	



Minnesota Pollution Control Agency

2003 Air Photo



Historic values

- River Flats
- Sheltered Bays
- Abundant Aquatic Vegetation
- Abundant Benthic Invertebrates
- Fish Spawning & Rearing
- Shorebird Nesting & Feeding

Suspected Limiting Factors

- Contaminated Sediments
- Industrial Substrates
- Excessive Wind Fetch
- Shoreline Hardening



1861 Hearing Map

Example Schematic Plan for Habitat Restoration



Implementing BUI Removal and AOC Delisting Process St. Louis River Estuary

- **2011-2012: Establish Implementation Framework**
 - * Determine remedial actions achievable within the AOC
 - * Identify funding mechanisms for implementing partnerships
 - * Create workplan with connections between restoration and AOC goals
- **2012-2020: Prioritization of Remediation and Restoration Projects**
 - * Establish restoration pathways and specific projects that will address the beneficial use impairments in the AOC
 - * Define partners, timelines, funding and work plan phasing and implementation
 - Seek long term funding commitments federal, state and local
- **2012-2020: Restoration of Subwatersheds and River Stretches**
 - * Initiate work plans that will accomplish restoration goals within the estuary
 - * Leverage funds to fulfill BUI Removal and AOC Delisting Projects
(Remediation/Restoration)
- **2012-2025: Monitor and Evaluate Progress/Continued Restoration**
 - * Establish monitoring plans for key sites in relation to overall AOC health
 - * Develop a chemical, biological and physical analysis for quantification of delisting the AOC
 - * Evaluate BUI's and submit BUI removal documents
- **2020-2025: Recovery - Beneficial Use Impairment Removal - Delisting**
(Estimated Total Cost: \$300 million - \$1 billion)



