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Mercury TMDL for the St. Louis River

mn MINNESOTA POLLUTION
CONTROL AGENCY

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February 4, 2021

Mercury Reductions Before the Statewide TMDL

Federal

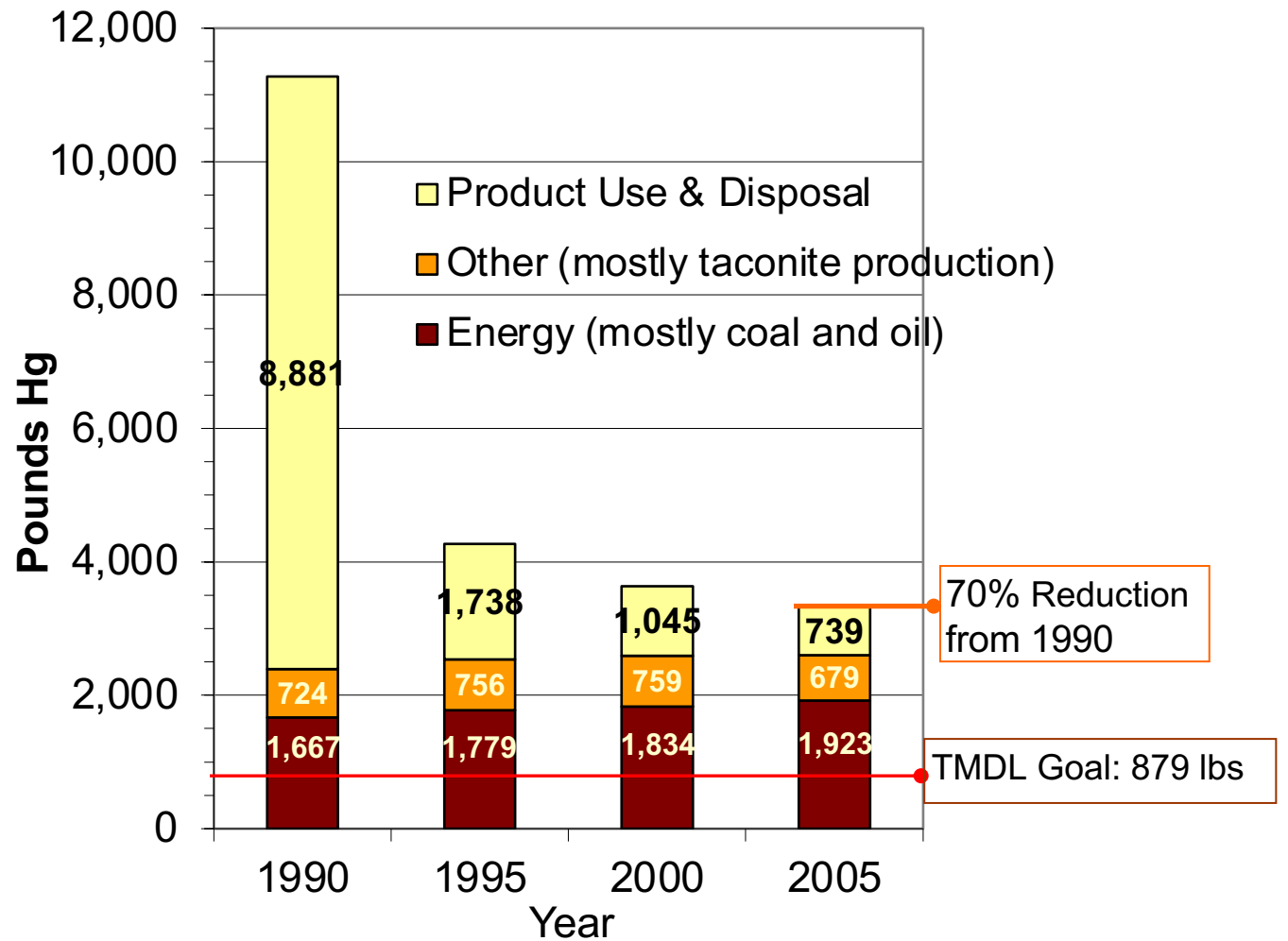
- Latex paint – 2,847 lb
- Snow mold control – 1,486 lb

State

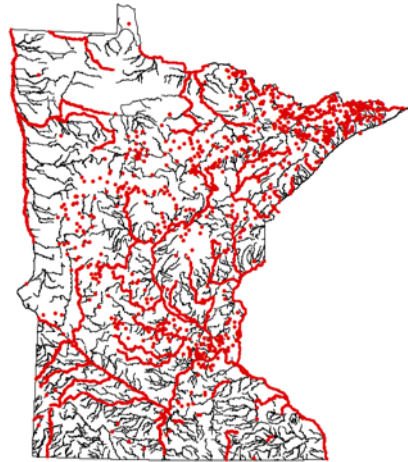
- Disposal restrictions & product bans – 2500 lb
- Waste combustor standards – 851 lb
- HERC activated carbon control – 114 lb

Voluntary

- MN Power lower Hg coal – 70 lb
- MCES sludge incinerator upgrade – 78 lb
- Excel Energy changes – 170 lb



Statewide Mercury TMDL



**MINNESOTA STATEWIDE MERCURY
TOTAL MAXIMUM DAILY LOAD**

Final*
March 27, 2007



Minnesota Pollution Control Agency

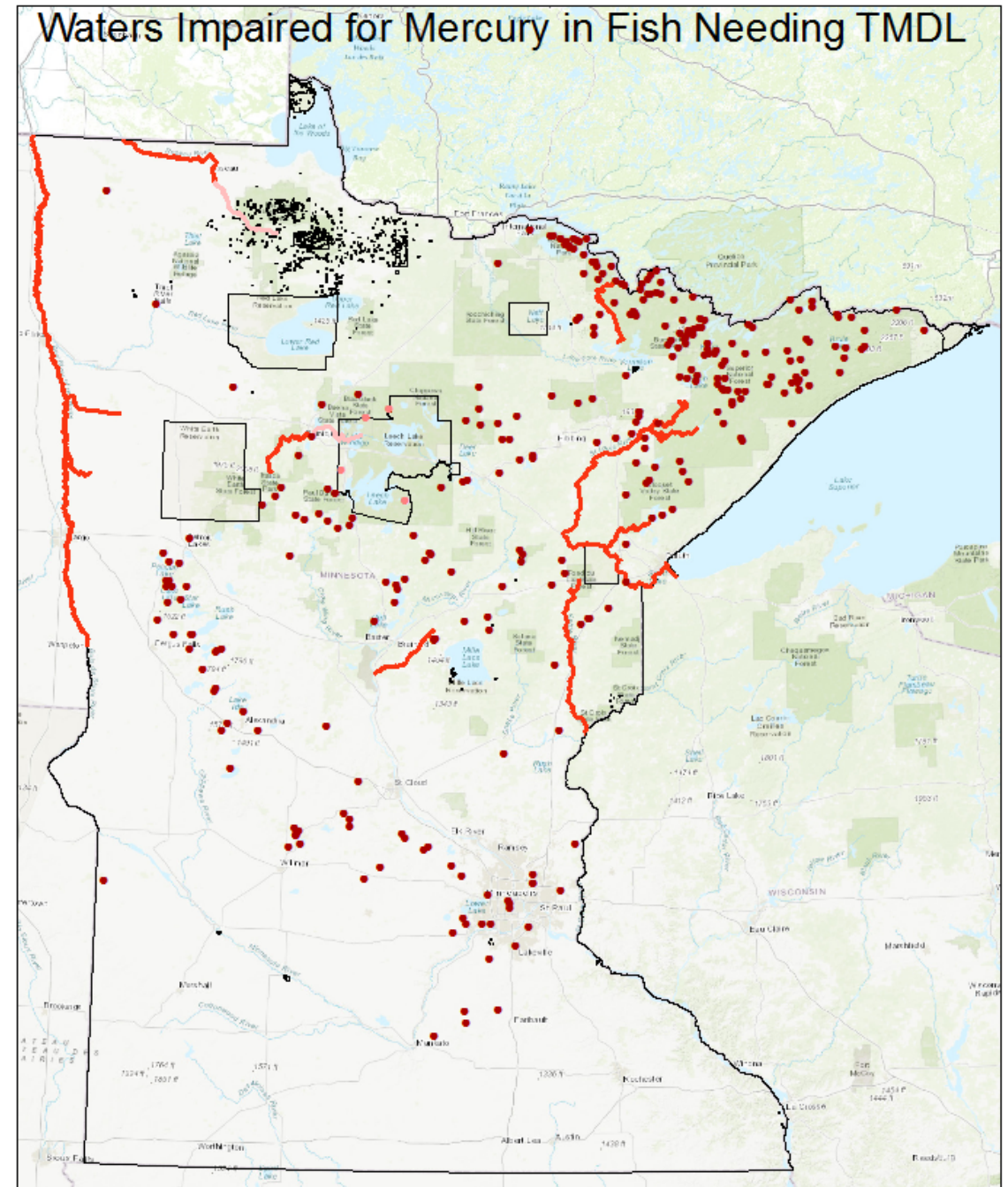
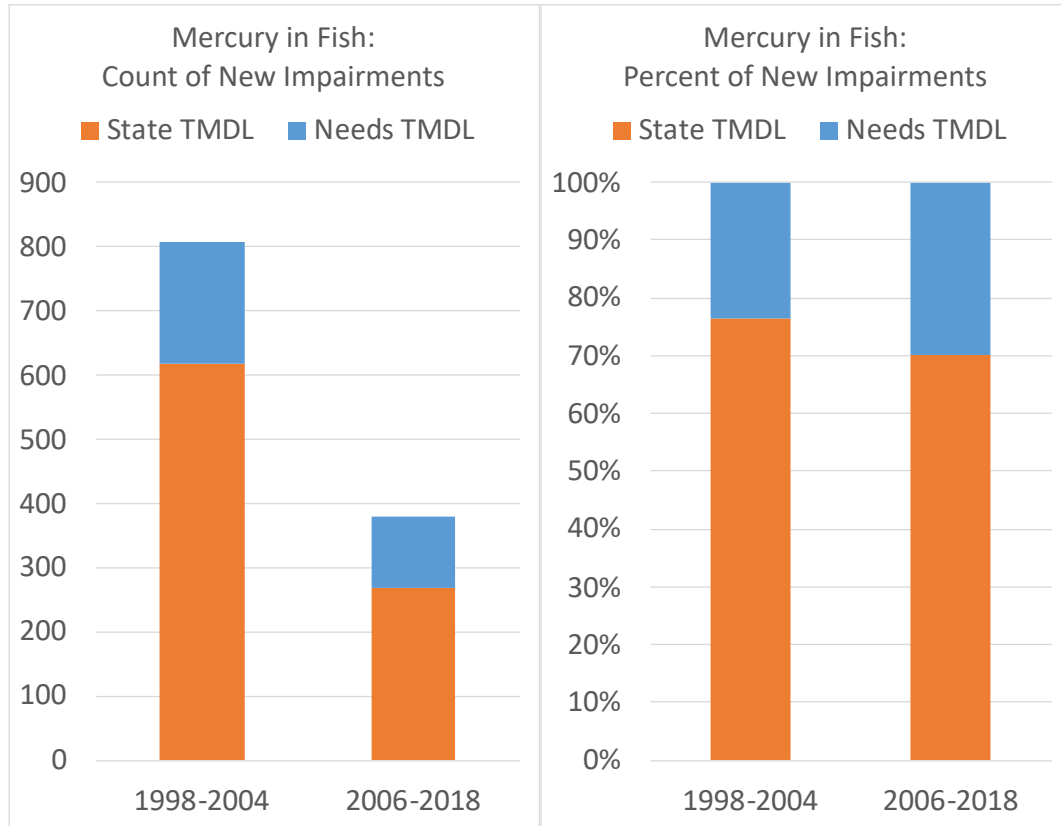
*Approved by US EPA March 27, 2007

	NE	SW
Target fish mercury concentration (mg/kg)	0.2	0.2
Mercury concentration for standard length walleye (90 th percentile)	0.572	0.405
Reduction Factor (RF) =	65%	51%
Anthropogenic RF for Air Emissions =	93%	73%

Original Draft Statewide TMDL included all Hg impaired waters; after public comment, waterbodies > 0.572 mg/kg removed and require their own Hg TMDL

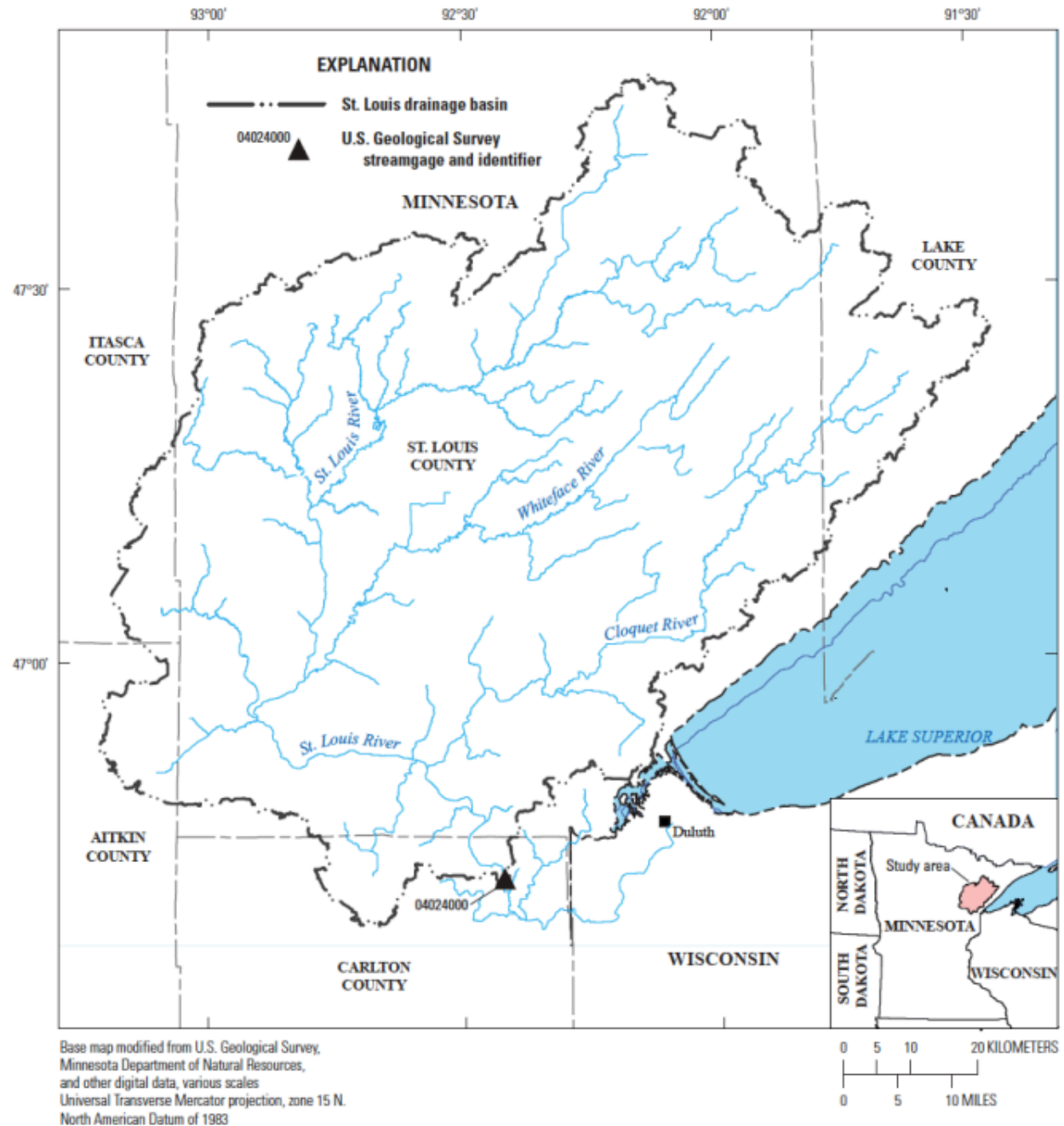
Rivers and Lakes Needing TMDLs for Mercury in Fish

- 90th Percentile Hg > 0.572 ppm
- % Needing TMDL has grown since 2004



St. Louis River TMDL

- St. Louis River + Cloquet River Major Watersheds (HUC8)
- Nemadji River not included – covered by Statewide TMDL
- Template for other MeHg TMDLs



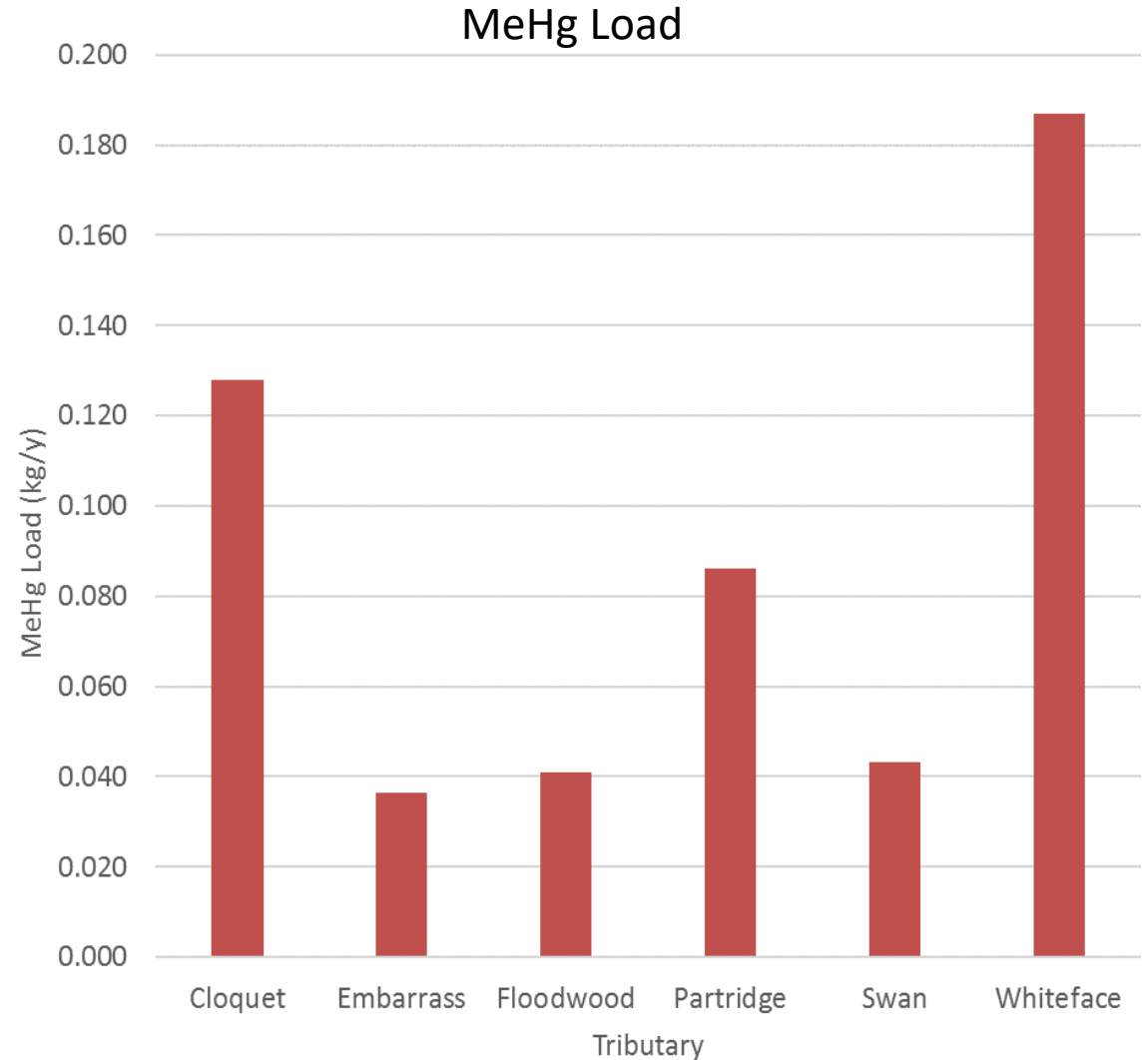
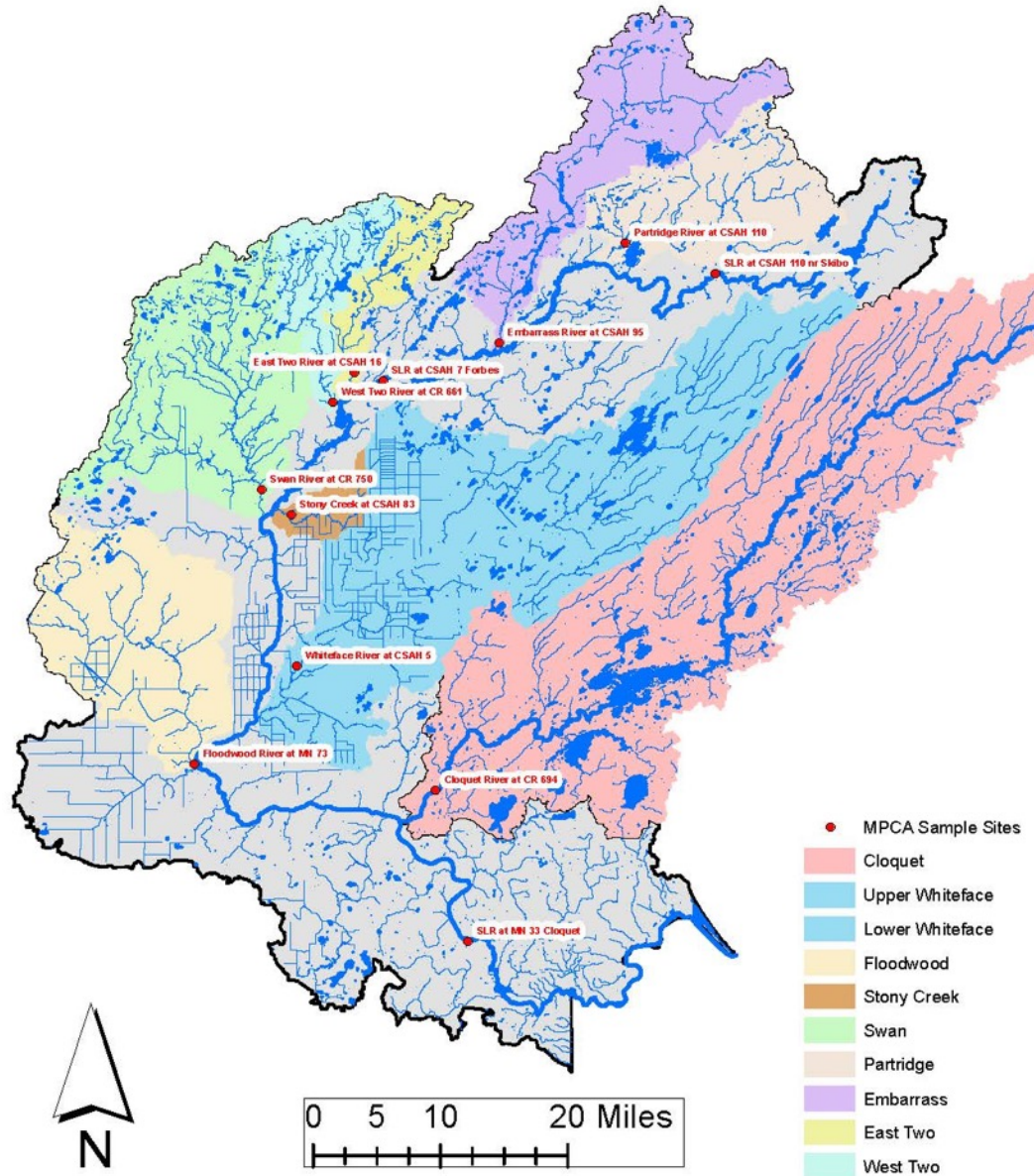
Before the MN Statewide Mercury TMDL: St. Louis River

- St. Louis River Watershed TMDL Partnership (SLRWTP)
- Minnesota Power & EPRI funded development of WARMF-Hg model
- Critiques of WARMF-Hg by MPCA scientists and separately by a peer-review panel (supported by Sea Grant) concluded it would lead to inaccurate conclusions
- SLRWTP suspended activity when MPCA was developing the statewide mercury TMDL

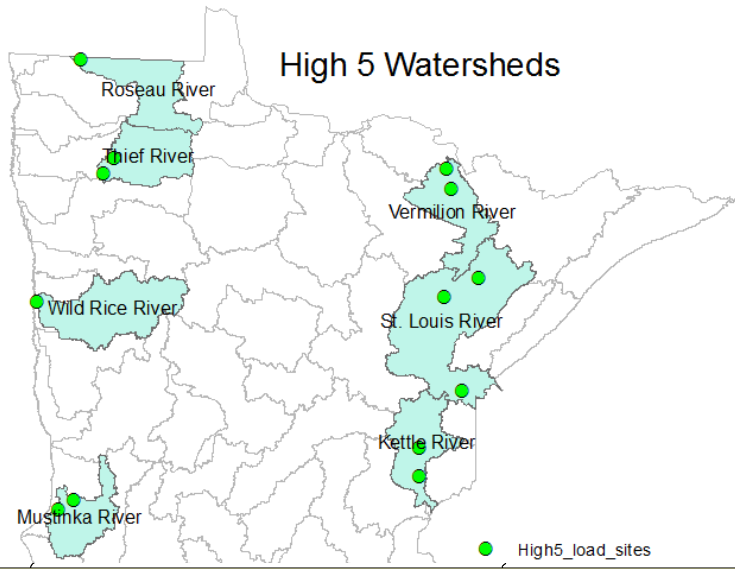
SLR Toxics TMDL (2010 – 2015)

- In 2010, EPA Region 5 initiated TMDL for Hg and organic contaminants
 - EPA contracted RTI to develop TMDL with oversight by EPA, FDL, MN, & WI
 - 3 models for the SLR estuary: hydrodynamic, water quality, and food web
 - 1 model for upper SLR (above FDL dam): WARMF-Hg
- In 2013,
 - WIDNR scientist asked if MPCA scientists supported WARMF-Hg
 - MPCA did not support that Hg model and instead supported a field-based assessment
 - RTI completed their “Phase 1” with a “Road Map” for next steps
 - MPCA & MNDNR conducted mercury loading study using state Clean Water Fund
 - MNDNR, EPA (GLTED), and FDL collected fish throughout the SLR for Hg
- In 2015,
 - EPA Region 5 sponsored field study to support SLRE models (fish, water, sediment, and sediment resuspension study)

2013 Mercury Load Monitoring Study

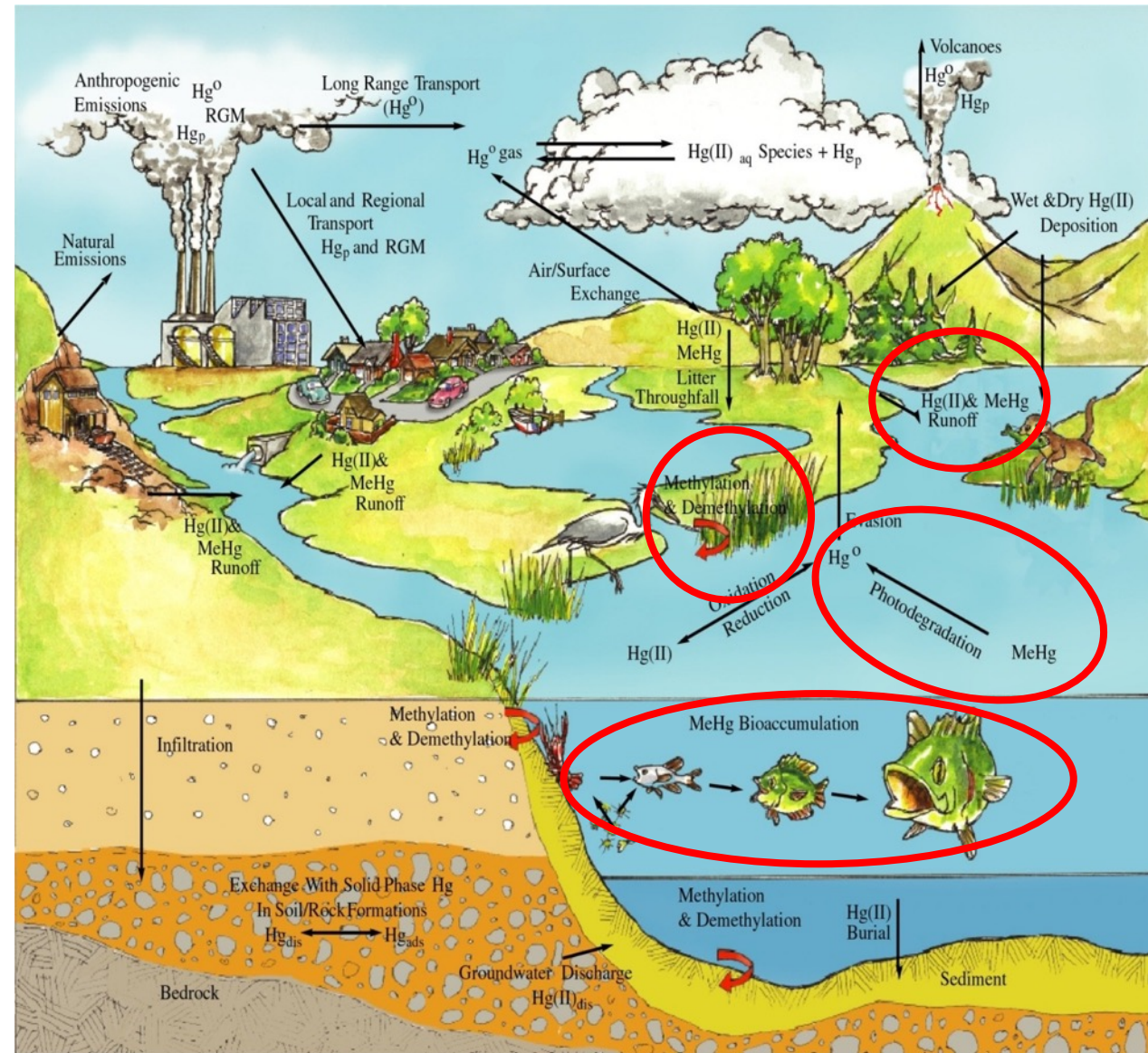
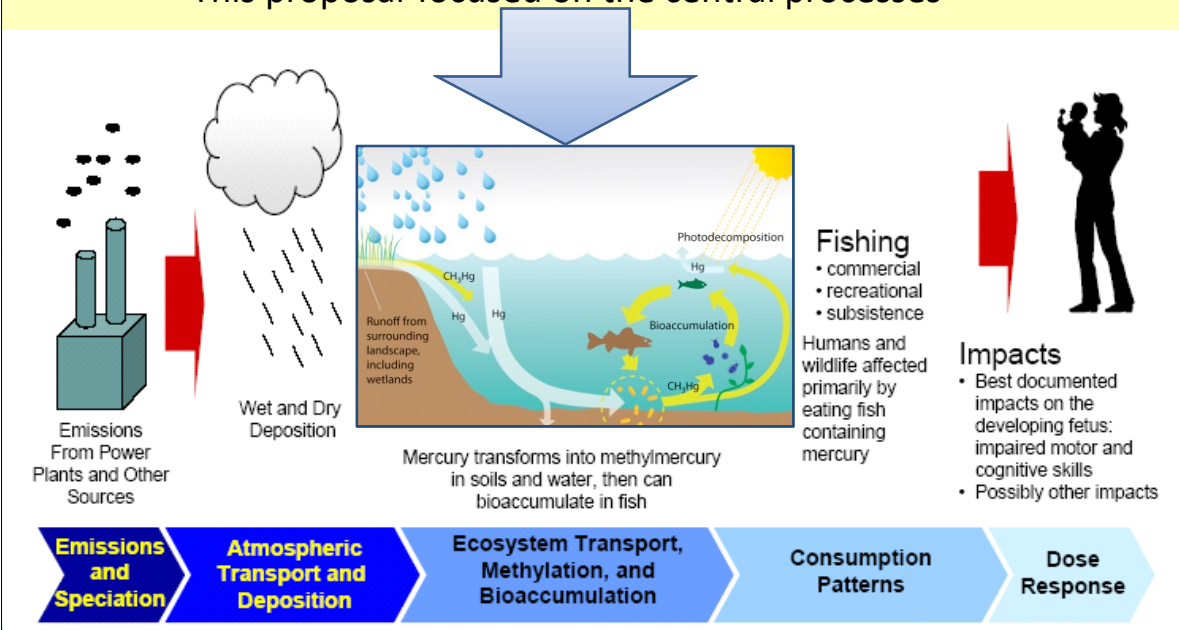


Mercury in Rivers Project

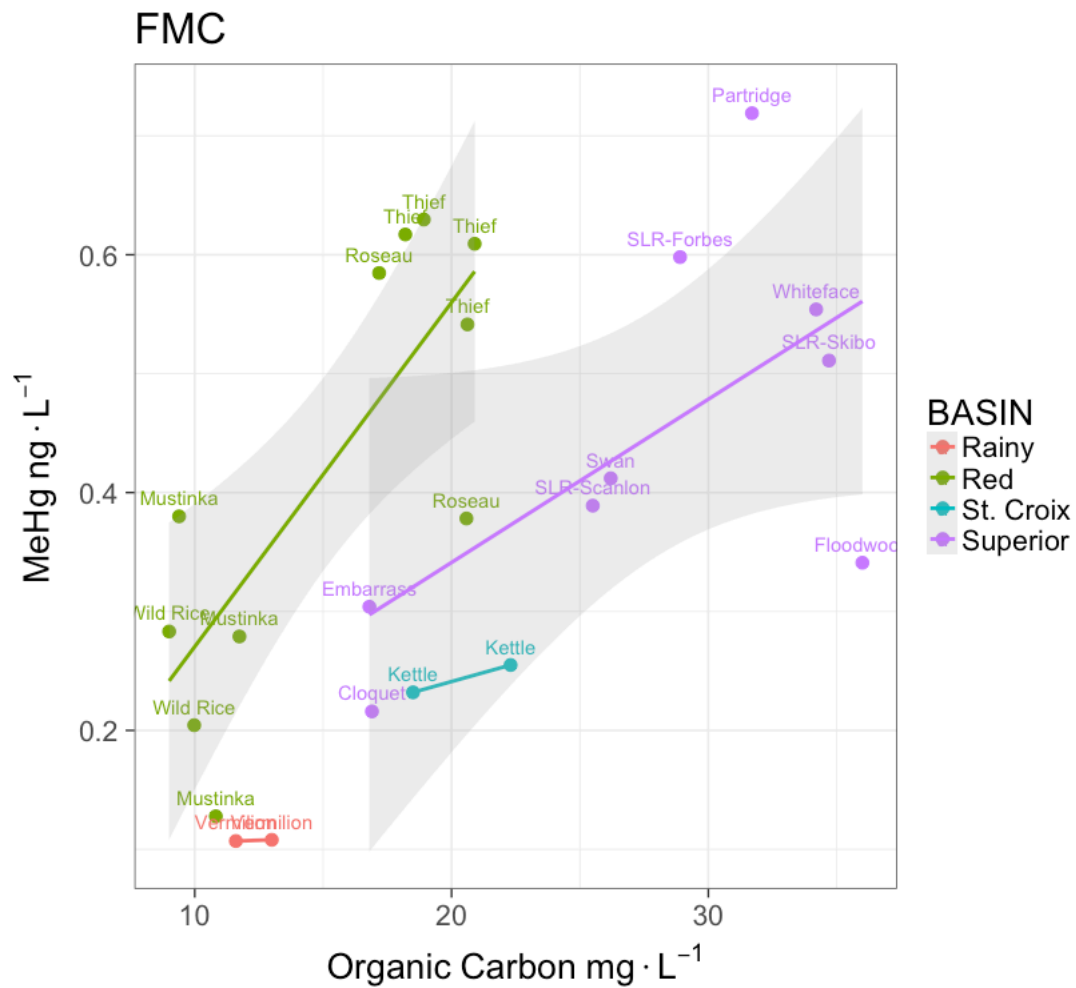


Mercury Exposure Pathway

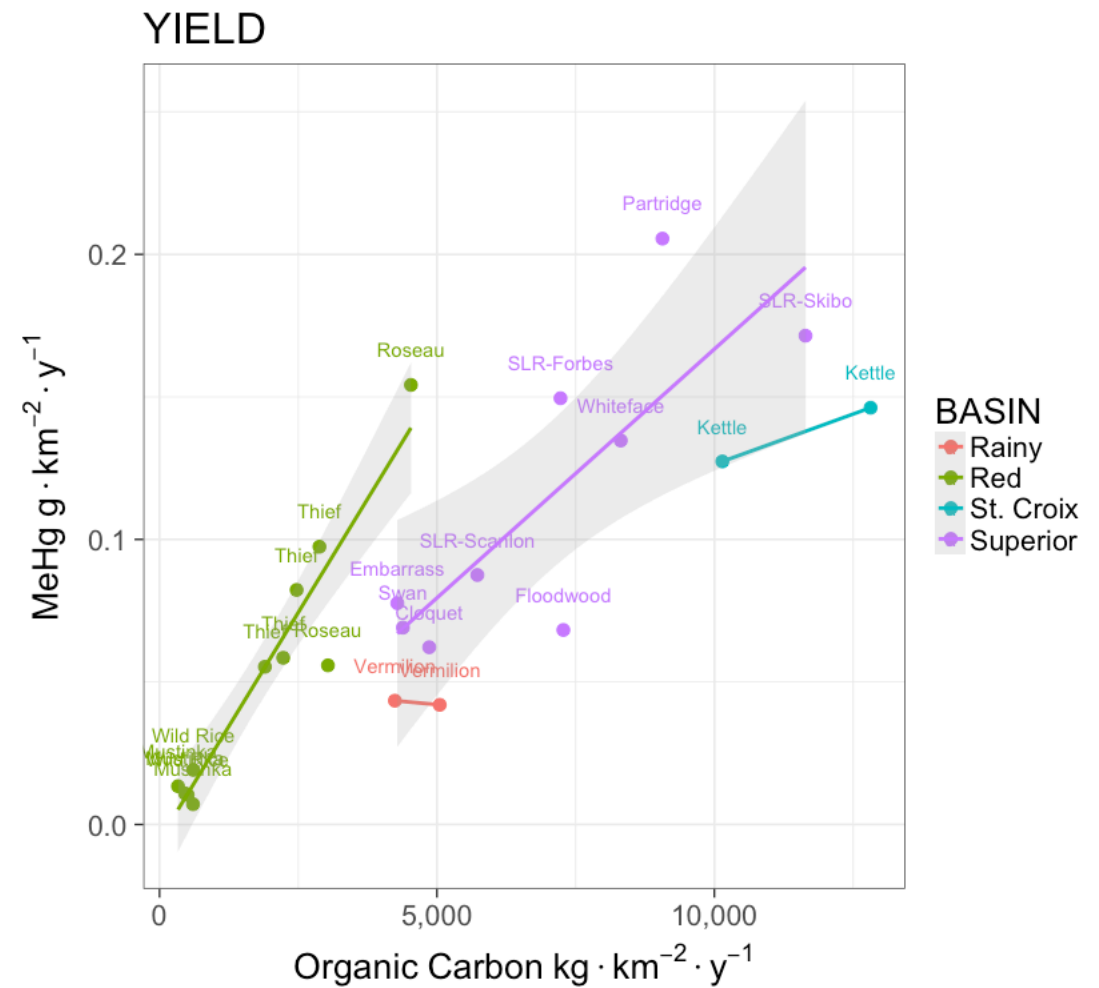
This proposal focused on the central processes



MeHg Transport by Organic Matter (2013-2016)



FMC (flow-weighted mean concentration):
Annual mass / water volume



Yield: Annual mass / drainage area

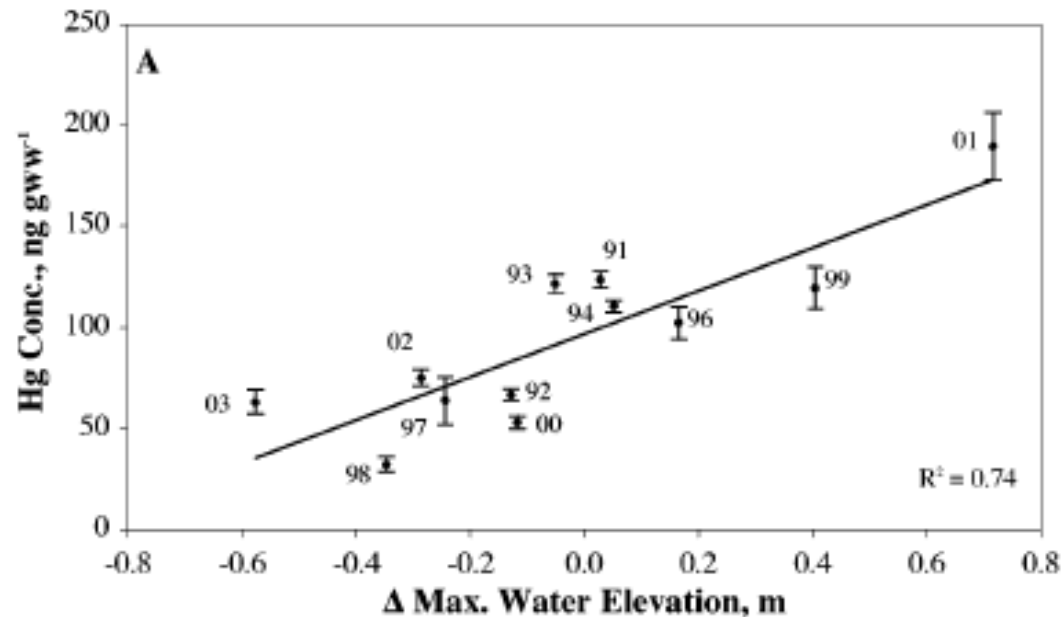
Peatland Ditch Blocking Reduces DOC and Color

- A series of paper from the UK:
 - DOC concentrations and water color were significantly lower in blocked vs. unblocked ditched peatlands (Armstrong et al. 2010. J.Hydrol. 381)
 - Blocked ditches were less flashy and peak flows less severe; less DOC and POC release (Wilson et al. 2011. J.Hydrol 404)
 - Blocked ditches had lighter, less humic, and less decomposed carbon (Wilson et al. 2011. J. Hydrol 409)

Water Level Changes in Peatlands and Lakes

“Hydrologic fluctuations not only serve to release previously sequestered sulfate and HgT from peatlands but may also increase the strength of peatlands as sources of MeHg to downstream aquatic systems...”

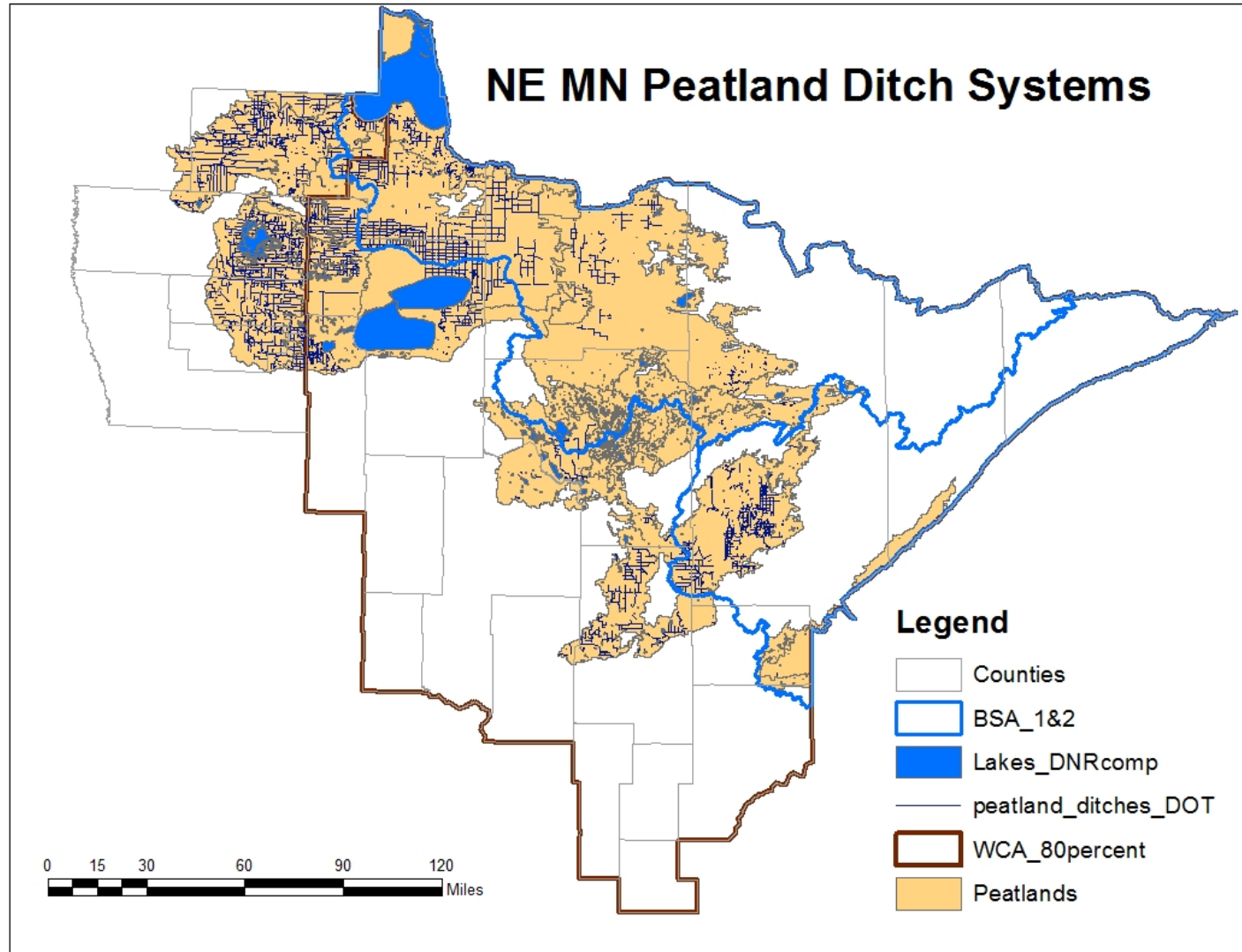
Wasik, J. K. C., D. R. Engstrom, C. P. J. Mitchell, E. B. Swain, B. A. Monson, S. J. Balogh, J. D. Jeremiason, B. A. Branfireun, R. K. Kolka, and J. E. Almendinger. 2015. The effects of hydrologic fluctuation and sulfate regeneration on mercury cycling in an experimental peatland. *Journal of Geophysical Research G: Biogeosciences* 120:1697--1715.



Sorensen, J. A., L. W. Kallemeyn, and M. Sydor. 2005. Relationship between mercury accumulation in young-of-the-year yellow perch and water-level fluctuations. *Environmental Science & Technology* 39:9237-9243.

Sorensen, J. A. 2019. Relationships Between Mercury Concentration in Young-of-the-Year Yellow Perch and Precipitation Depth, Water Level, and Temperature. *Water, Air, & Soil Pollution* 230:83.

Extensive Ditched Peatlands



Total ditched peatlands in
St. Louis River Watershed:
~ 144,000 ac

Source: Mark Gernes, 2013.

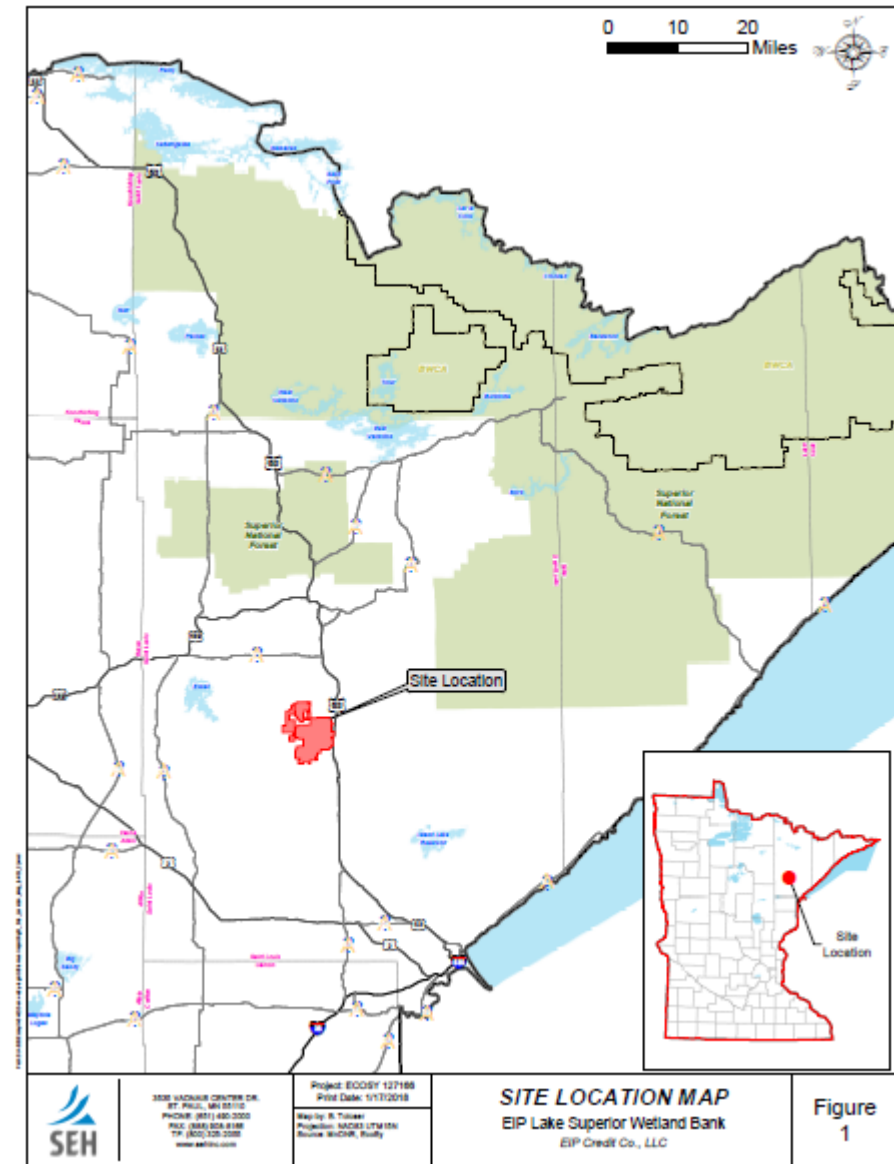
A potential BMP: restoring ditched peatlands

From failed cropland to filled wetland, Sax-Zim bog restoration underway

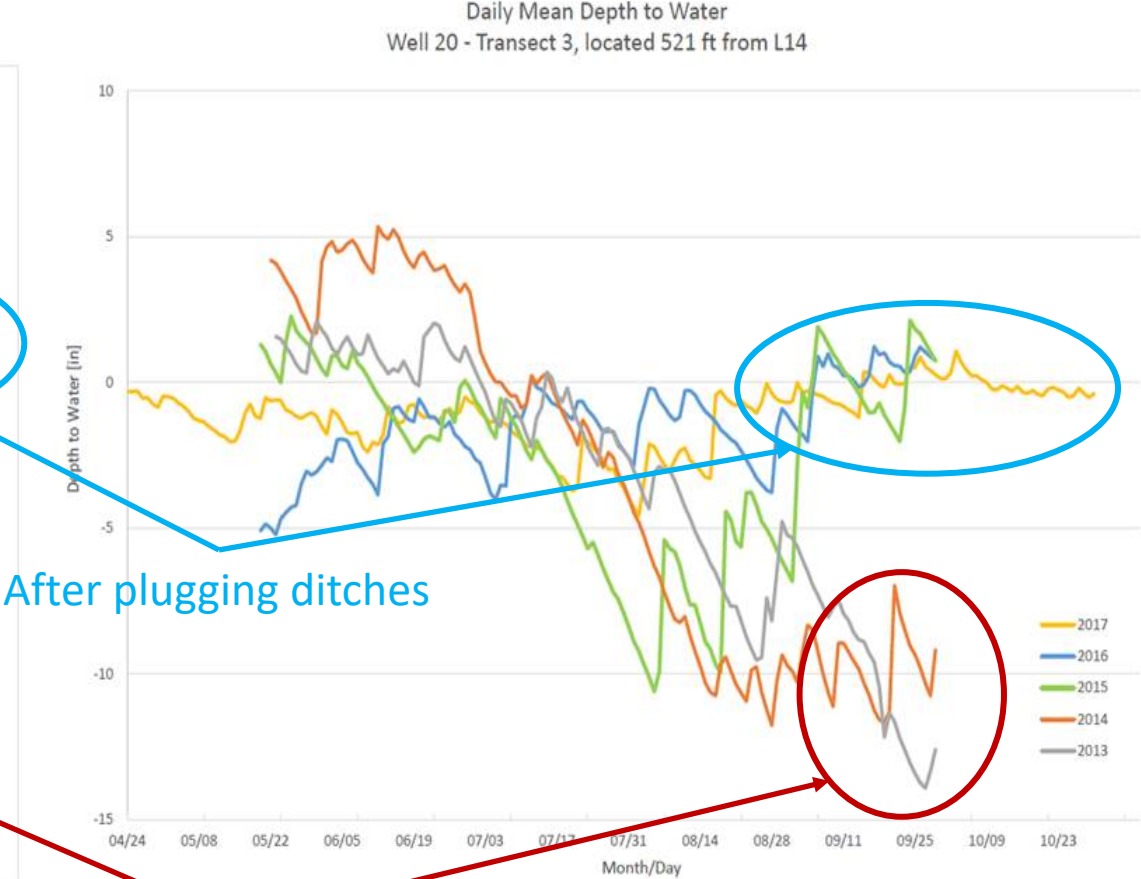
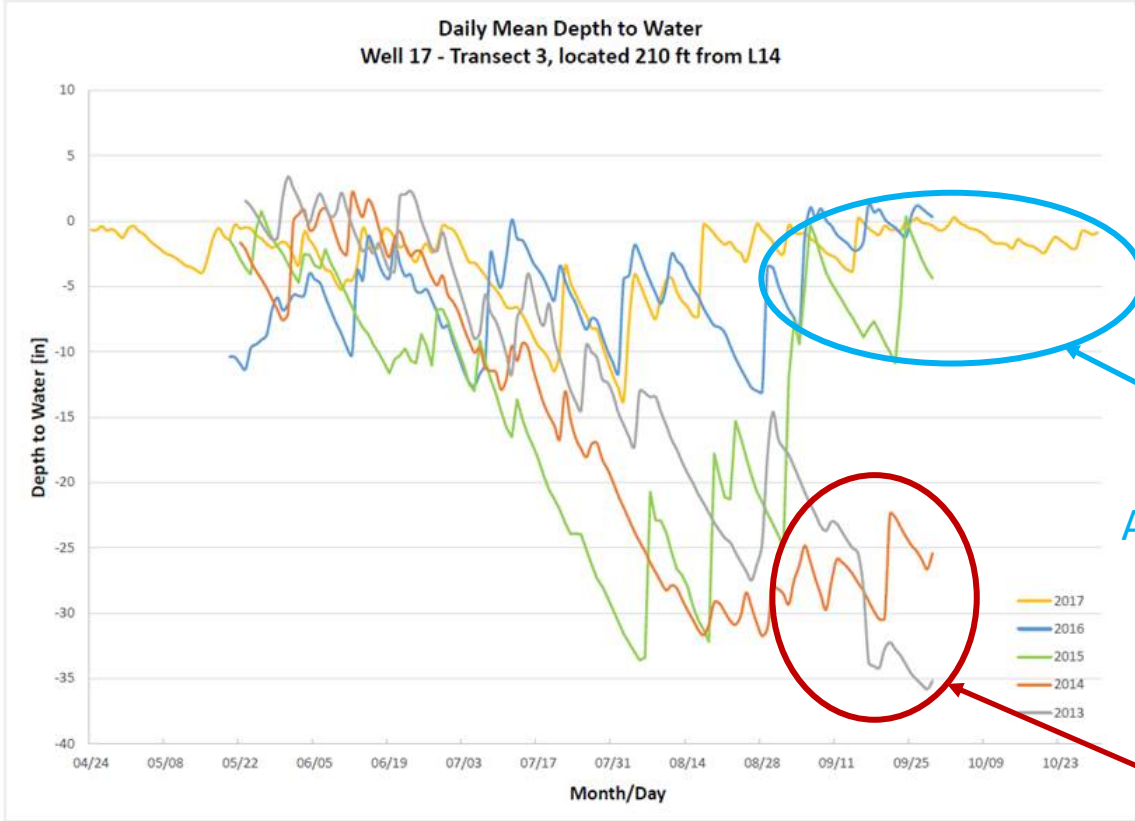
By John Myers on Sep 17, 2015 at 2:05 p.m.



“Ecosystem Investment Partners, or EIP, the Baltimore-based for-profit company that has acquired 23,223 acres, 36 square miles of the Sax-Zim bog area to restore as naturally functioning wetlands.”



Water Levels in Superior Wetland Bank Stabilized

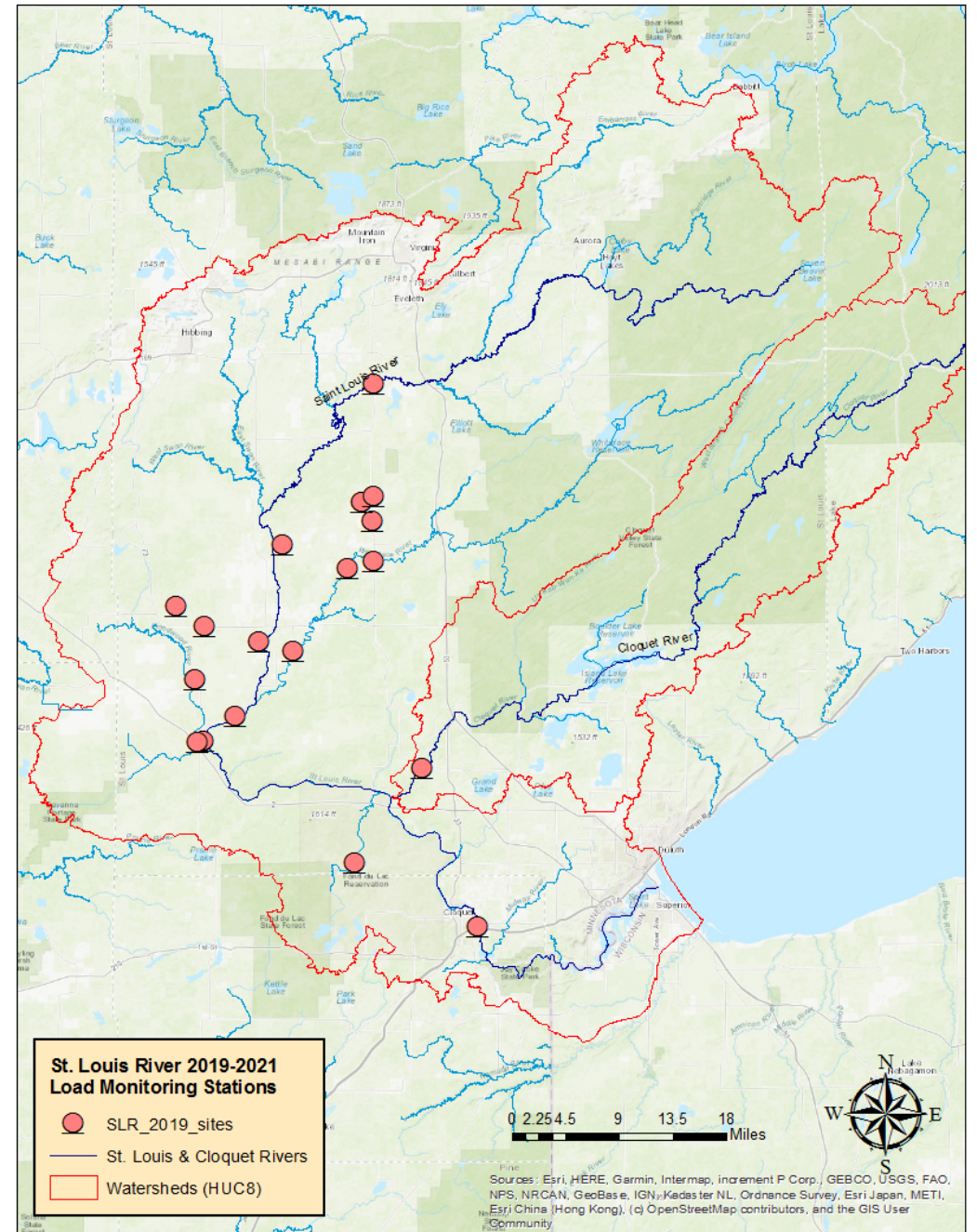


After plugging ditches

Before plugging ditches

Mercury Loading Study: 2019-2021

- USGS (Mark Brigham, Proj. Mgr.)
- Funded by GLRI
- 15 stations, including 2013 river sites
- Compare discharge from peatlands
 - Un-ditched
 - Ditched
 - Restored / plugged ditches



TMDL Road Map

- RTI’s matrix of options to complete mercury TMDL
 - 7 paths varying in time scales (\$)
- MPCA preferred 2 project paths
 - Fieldwork-based Assessment
 - “Simple TMDL Approach”
- First year (2021) focused on compiling data, assessing if more modeling is needed, and proposing specific approach to TMDL

Tasks	Time Scale	Project Paths						
		Continue Current Path to Basic SLR TMDLs	FdL Specific TMDL	Fieldwork Based Assessment	Research for Hg Fate and Transport	Simple TMDL Approach	Intensive TMDL Loading Analyses	Confirmation of Toxic Organic Contaminant Impairments
		YYY	YY	Y	Y	Y	YYYY	Y
1	Field Sampling							
1a	Water column	●	●	●	●	●	●	●
1b	Sediments	●	●	●	●		●	●
1c	Biota	●	●	●	●	●	●	
1d	Point sources	⊙	⊙	●	⊙	⊙	●	⊙
1e	Flow gauge deployment	○		●	⊙		⊙	
1f	"Other" sources (e.g., coal piles)	○		●	⊙		●	○
1g	Soils	○		●	⊙		●	
1h	Stormwater (Duluth)	○		●	○	○	●	⊙
1i	Atmospheric deposition	○		⊙	⊙		●	
2	Laboratory experiments			⊙	●			
3	Point source inventory	●	○	⊙		○	●	
4	Statistical evaluation of observed data	⊙	⊙	●	●	●	⊙	○
5	Scoping plan for non-TMDL actions							○
6	Updated multi-media modeling							
6a	WARMF	●	●				●	
6b	BASS	●	●				●	
6c	EFDC/WASP	●					●	
7	Sensitivity analysis	⊙	⊙				⊙	
8	Uncertainty analysis of model results	○					⊙	
9	Modification of modeling code	○					○	
10	Air deposition scenario modeling	○	○				●	
11	Hydrography network update	⊙	⊙				●	
12	Technical advisory committee(s)	⊙		⊙			●	
13	Stakeholder workshops	⊙		○	○	⊙	⊙	
14	Public outreach	●	●	⊙	⊙	●	●	⊙

Y-YYYY: indicator of time needed for fulfilling project path

- Path Critical
- ⊙ Recommended
- Potential add-on

St. Louis River Mercury TMDL: Next Steps

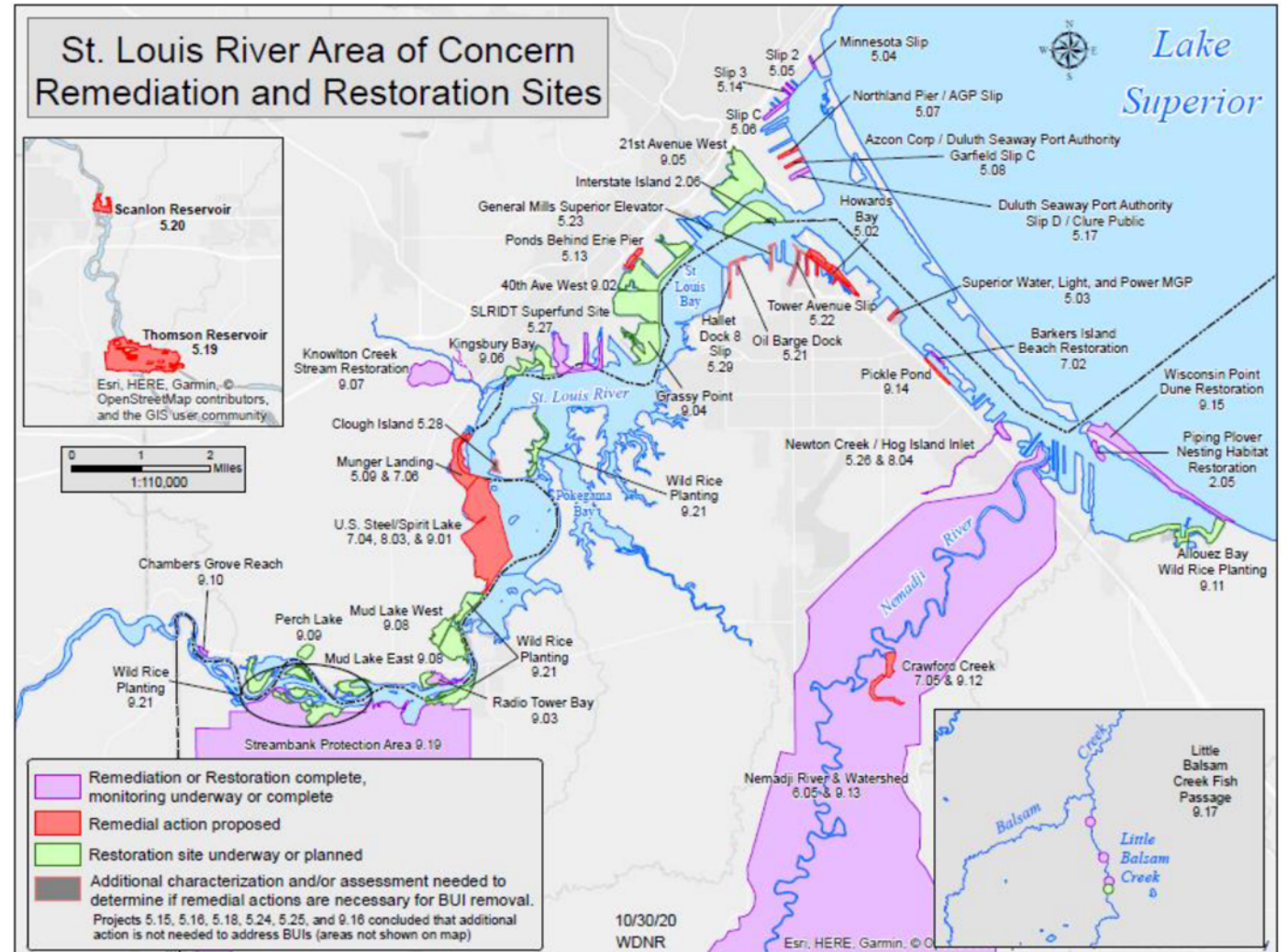
- Coordinate with watershed planning: WRAPS and One Watershed, One Plan
- Establish SLR Hg TMDL Partnership Advisory Committee
- Compile the mercury studies in SLR to evaluate what is known about mercury processes in the watershed
- Re-assess the mercury in fish throughout the SLR for spatial and temporal trends
- Evaluate effect of the blocked ditched peatlands on mercury and methylmercury loading based on 2019-2021 loading study (USGS)
- Determine modeling needs and contract if needed

SLR Hg TMDL: Timeline 2020 - 2023

St. Louis River Mercury TMDL (includes Cloquet River Watershed)	CY 2020		CY 2021				CY 2022			CY 2023					
			SFY 2021/Year 1		SFY 2022/Year 2		SFY 2023/Year 3			SFY 2024					
Tribal Invitation (call/letter)				X											
Advisory Committee Meetings						X	X	X		X	X	X			
Develop Technical Approach			X	X	X	X									
Finalize TMDL Approach							X	X							
Additional Data Collection and Modeling									X	X	X				
TMDL Loads and Reduction Scenarios									X	X	X				
Reasonable Assurance & Implementation Strategy										X	X				
Complete Draft TMDL and Review									X	X	X	X			
Public Presentation of Completed TMDL													X		
TMDL approval													X	X	
Resources: MPCA Staff 0.35 FTE (Bruce Monson, Andrea Plevan, and Tom Estabrooks)			X	X	X	X	X	X	X	X	X	X	X	X	
Resources: Modelling Contract								X	X	X	X				

St. Louis River Estuary Area of Concern (AOC)

- ❖ Defined by US-Canada GLWQA
- ❖ Remedial Action Plan (RAP)
- ❖ Goal: improve so not worse than other areas of the Great Lakes
- ❖ 9 Beneficial Use Impairments (BUI)
- ❖ BUI 1 Fish Consumption Advisories
- ❖ Ongoing studies to understand source of Hg in the fish



<https://www.pca.state.mn.us/waste/st-louis-river-area-concern-resources>

Watershed Planning

- **One Watershed, One Plan (1W1P)**
 - Aligns local plans with state strategies
 - Comprehensive watershed management plans
 - State legislation: §103B.101 and §103B.801
 - Began in late 2020
- **Watershed Restoration and Protection Strategy (WRAPS)**
 - First report published 2018
 - 2nd Round of planning has begun and continuing through 2022

<https://www.southstlouisswcd.org/1w1p/>

<https://www.pca.state.mn.us/sites/default/files/wq-ws4-46a.pdf>



Methylmercury TMDLs

Completed Mercury TMDLs (including date approved by U.S. EPA)

- Clear Lake Mercury TMDL (Central Valley Region, 2003)
- Guadalupe River Watershed Mercury TMDL (San Francisco Bay Region, 2010)
- Los Angeles Area Lakes TMDLs (Los Angeles Region, established by the U.S. Environmental Protection Agency)
- Walker Creek Watershed Mercury TMDL (San Francisco Bay Region, 2008)
- Cache Creek, Bear Creek, and Harley Gulch Mercury TMDL (Central Valley Region, 2007)
- Sacramento-San Joaquin River Delta Methylmercury TMDL (Central Valley Region, 2011)
- San Francisco Bay Mercury TMDL (San Francisco Bay Region, 2008)
- Sulphur Creek Mercury TMDL (Central Valley Region, 2009)

https://www.waterboards.ca.gov/water_issues/programs/mercury/other_programs.html

Thank you!

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