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The Poplar River Story: Changing the Fate of One of Minnesota's Outstanding Natural Resources

2019 TRIECA Conference **March 21, 2019**

Jay Michels, CPESC
Partner/Project Manager
Emmons & Olivier Resources, Inc.

Introductions

A collaborative group of environmental and design professionals passionate about protecting our waters, restoring healthy ecosystems, and enhancing our community's unique sense of place.

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watersheds & water resources

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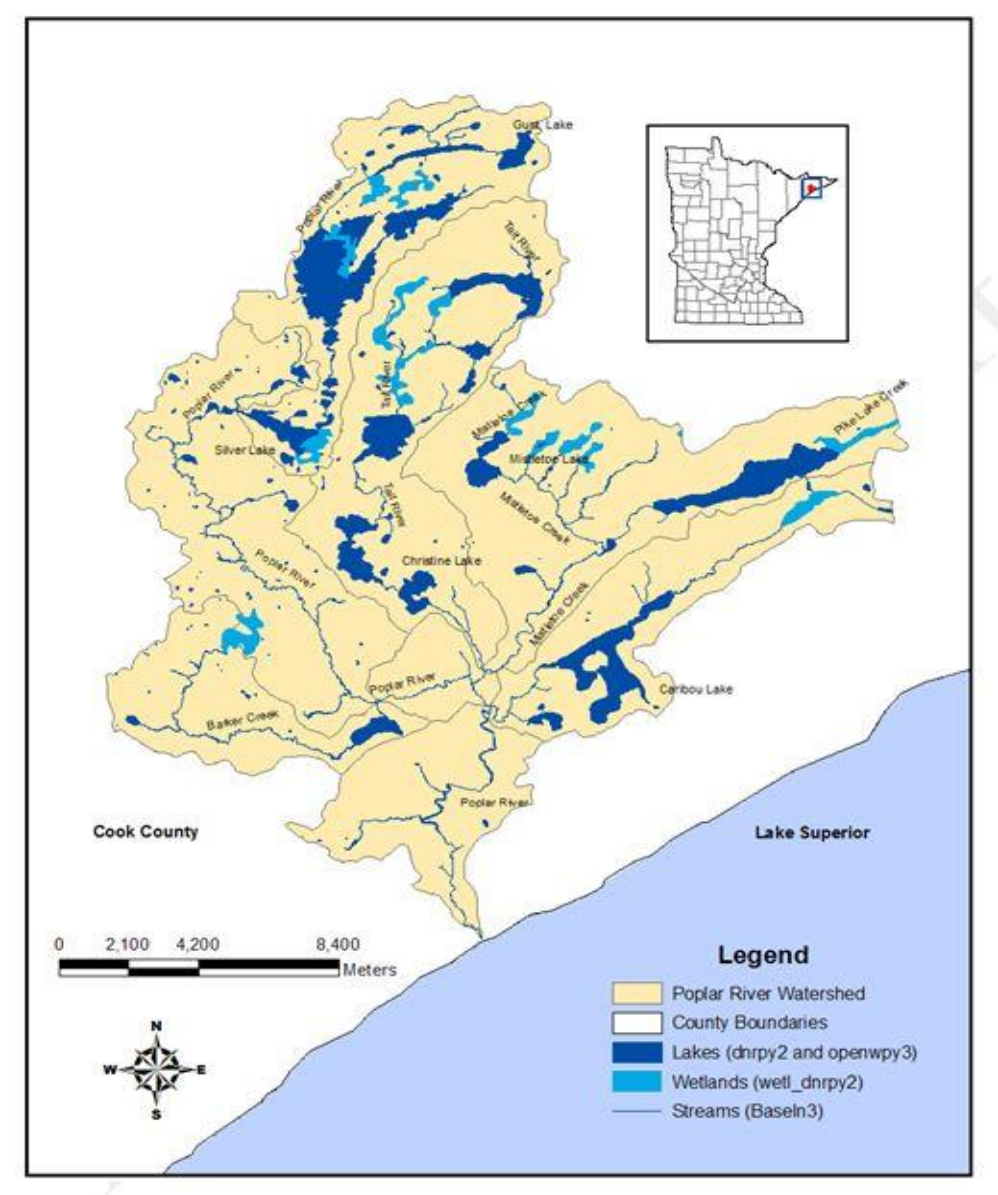
TIME
The Good Life In Minnesota
Gov. Wendell Anderson


https://vimeo.com/124979852

The Setting


Gust Lake
Poplar River
Tait River
Silver Lake
Mattetse Creek
Mattetse Lake
Pike Lake Creek
Christine Lake
Caribou Lake
Baker Creek
Cook County
Lake Superior
0 2,100 4,200 8,400
Meters
N
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E
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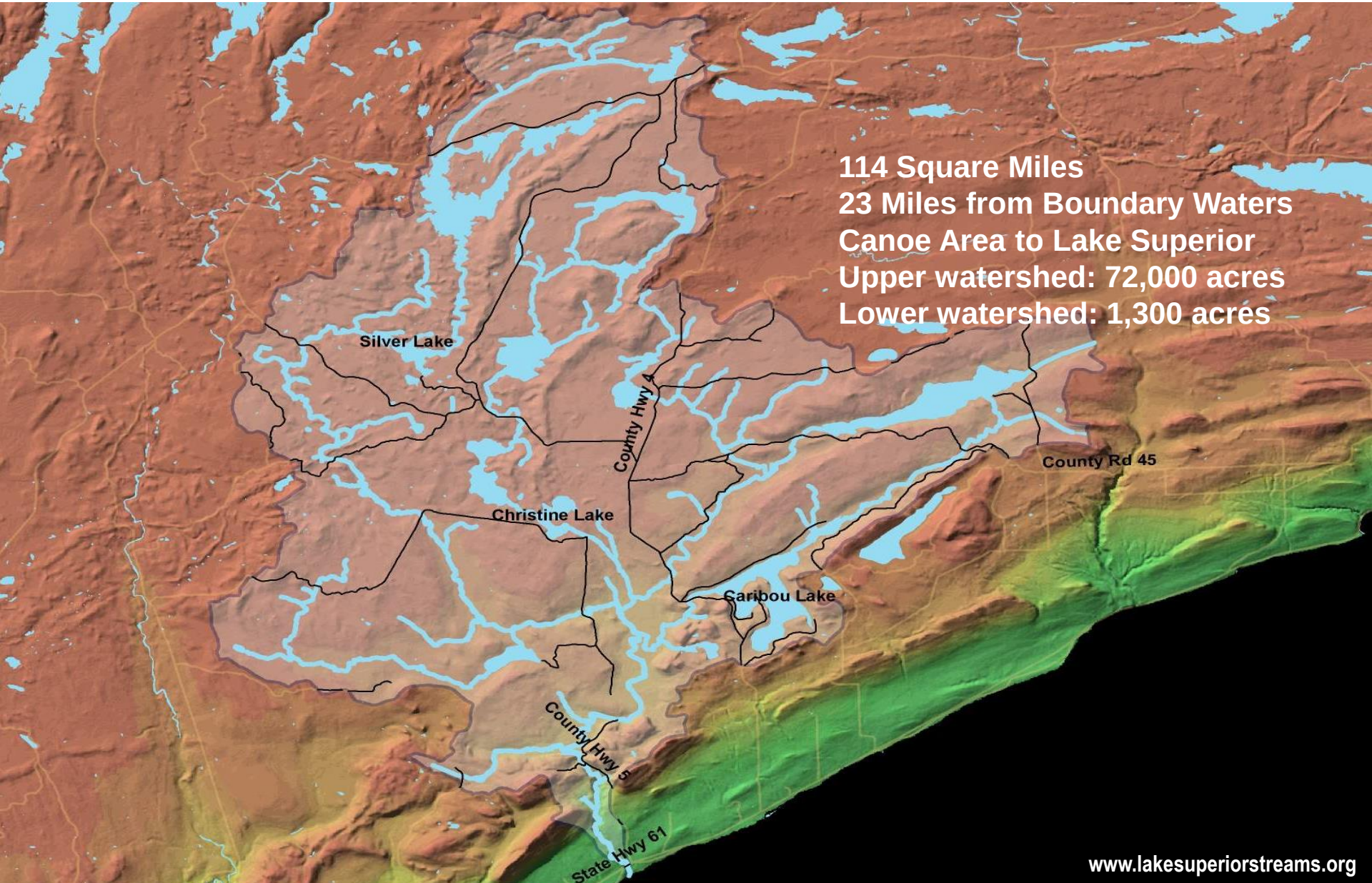
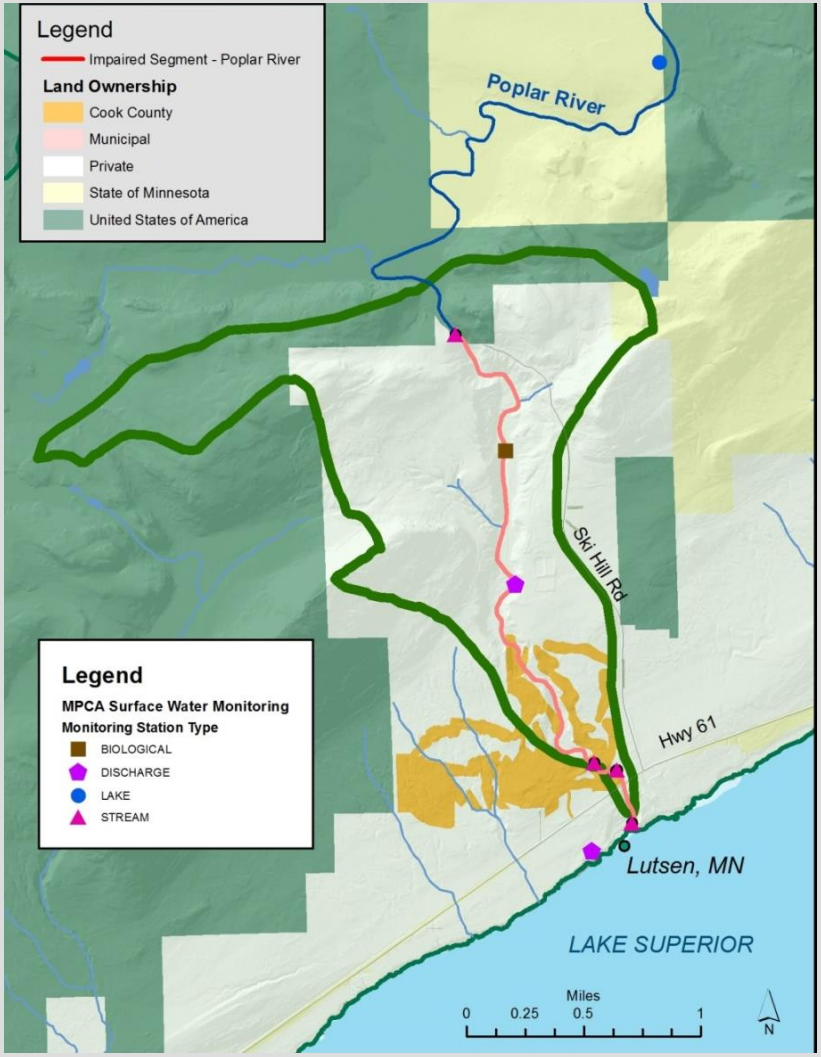
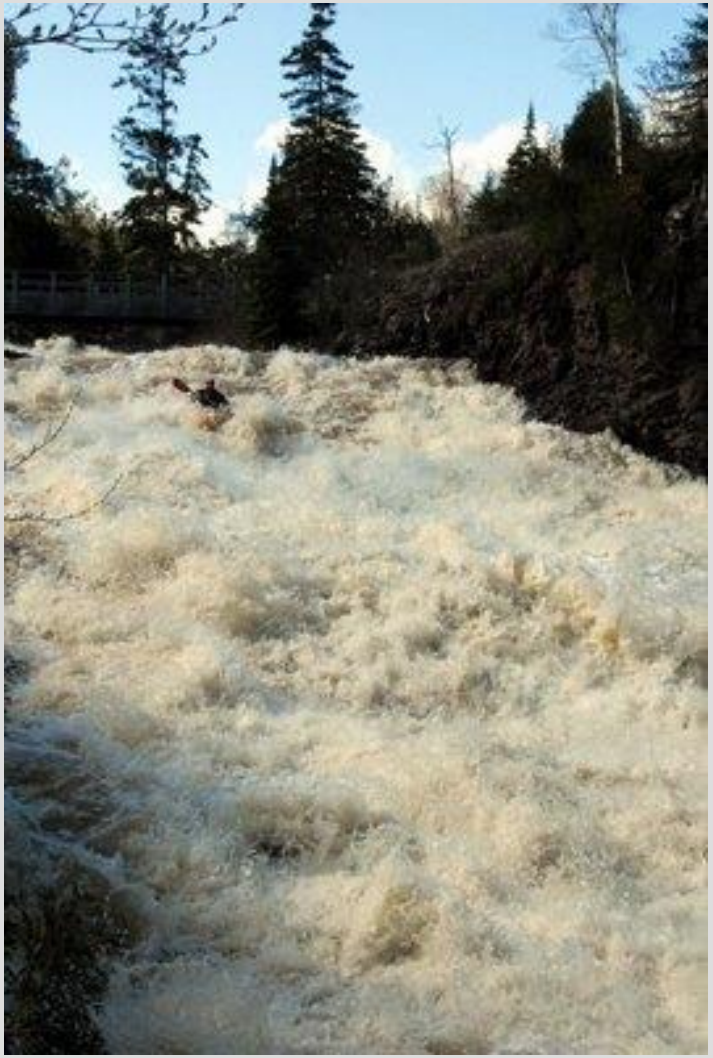
Legend
Poplar River Watershed
County Boundaries
Lakes (dnrpy2 and openwpy3)
Wetlands (wetl_dnrpy2)
Streams (Baseln3)

The Watershed

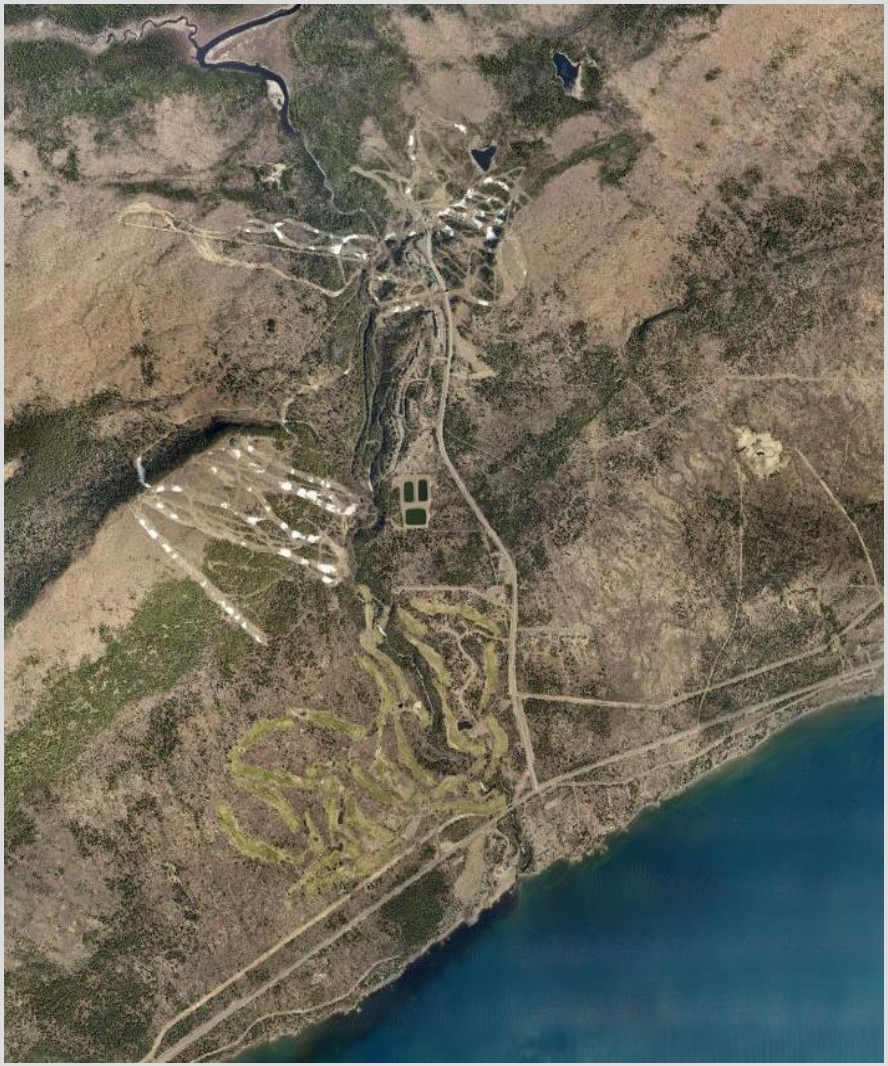


The Watershed





The Watershed



The Watershed

The Timeline

2001	2005	2009	2013	2017
North Shore Pollutant Load Study				
	Environmental Report - SE Group/NAWE			
	Alternative Urban Areawide Review – Cook County			
	Poplar River Management Board			
		Poplar River Turbidity Assessment – RTI/URS		
		Macroinvertebrate and Habitat Study – NRRI/UMD		
			Poplar River Sediment Source Assessment – U of M	
			Water Appropriation Environmental Review - DNR	
			Lower Poplar River Watershed Sediment Source Assessment – U of M	
			Turbidity TMDL	
	BMP Implementation			
				De-list for turbidity ?

Studies, Reports and Plans

2005	Environmental Report; prepared by North American Wetland Engineering for Lutsen Mountains
2006	Lower Poplar River: Alternative Urban Areawide Review; Cook County, MN
2008	Poplar River Turbidity Assessment; by RTI International for U.S. Environmental Protection Agency
2008	Poplar River Macroinvertebrate and Habitat Study; by Natural Resources Research Institute
2010	Poplar River Sediment Source Assessment; by University of Minnesota
2011	Lower Poplar River Watershed Sediment Source Assessment; by U of MN for MPCA
2012	Revision of Lower Poplar River Watershed Sediment Source Assessment & updated WEPP model 2013 Poplar River Watershed, Total Maximum Daily Load (TMDL) Impairment; by MPCA
2014	Poplar River Water Quality Restoration, Implementation Plan for Turbidity Reduction by MPCA
2015	BANCS Assessment of channel erosion in 4.2 miles of Poplar River and Tributary; by Cook SWCD/(TSA3)
2015	Lower Poplar River Watershed Flowpath Erosion Assessment; By Cook SWCD and TSA3
2016	Lake Superior North Watershed Assessment and Monitoring by MPCA

Conclusions

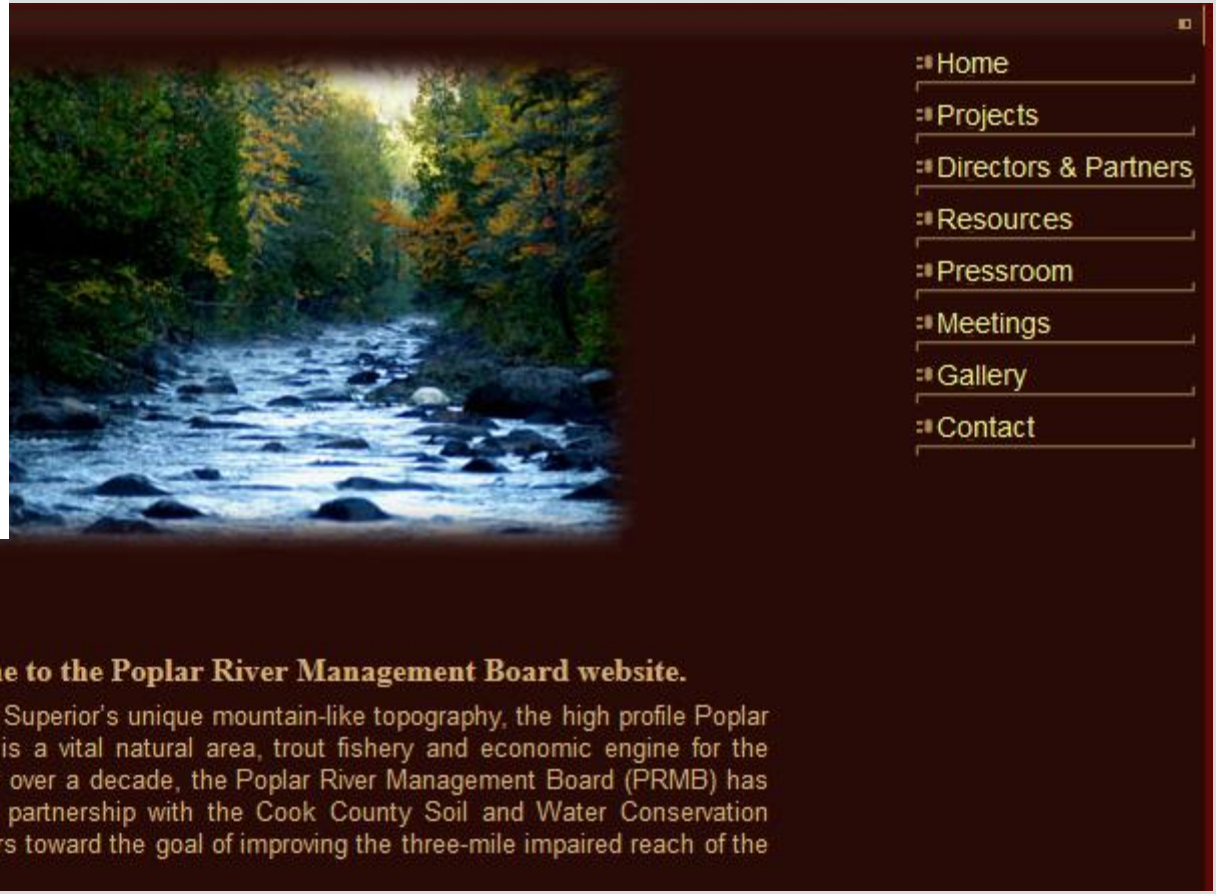
Table 6. Summary of sediment deliver estimates for various sediment sources in the Lower Poplar River watershed for three studies.

Sediment Source	NAWE (tons/yr)	RTI (tons/ac/yr)	RTI (tons/yr)	UofM (tons/ac/yr)	UofM (tons/yr)
Developed	179	0.8	25	0[&]	0[&]
Forest		0.32	280	0.006[&]	5[&]
Golf		0.25	15	0.07[&]	6[&]
Ski		4.03	661	0.98 – 3.93[&]	143 - 575[&]
Roads		--	--	0.72[**]	35[**]
Ravines	--	--	225[==]	--	243[==]
Slumps, overland flow erosion		--	48[&&&]	61.7[&&&&]	284[&&&&]
Slumps, mass wasting			726[&&]	27.7[===]	188[===]
Channel incision		--	53	0	0
Upland channels	--	--	--	--	312[&]
Total		N/A	1,985[%]	N/A	938 – 1,370

The Mega Slump

Get Organized

The PRMB members represent over 90% of the private land in the lower watershed, which ensures landowner cooperation with projects. Since 2005, both public and private dollars have helped to leverage multiple grants that have been successfully awarded and managed within the



Poplar River Management Board

Landowners formed PRMB to:

Develop broad partnership with stakeholders: SWCD, MPCA, MDNR, others

Develop good science to understand the impairment

Raise funds to implement solutions

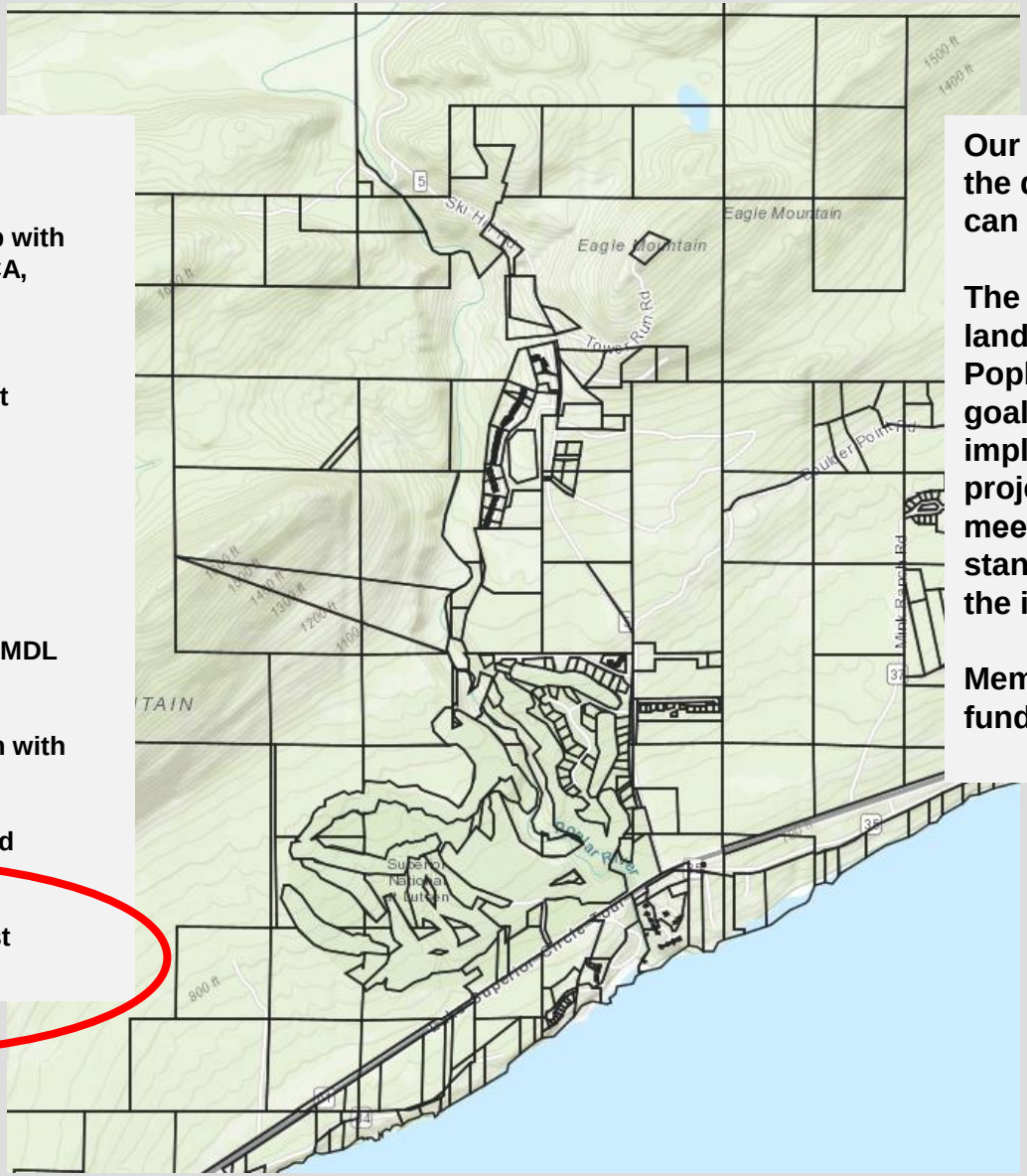
Be proactive

Implement solutions in parallel with TMDL study, not after it

Vehicle for communication with MPCA re TMDL

Vehicle for public input and participation

Be one of the first to de-list



Our goal is to <u>understand</u> what the data represents so that we can use it most effectively.

The Board consists of landowners along the lower Poplar River with the specific goal of identifying and implementing conservation projects and practices that will meet the MPCA's water quality standards and be removed from the impaired waters list.

Members contribute annually to fund research and administration.

Lutsen Mountains works to protect the Poplar River

Public Invited to Poplar River Informational Meeting

May 21, 2007

Tuesday, June 7, 6:30 to 7:30 p.m.
Cathedral of the Pines
760 Caribou Trail, Lutsen, MN
Contact: Dave Stark, Cook County Soil & Water Conservation District

The Cook County Soil and Water Conservation District (SWCD) will host the first of several proposed public meetings June 7 to discuss the Minnesota Pollution Control Agency (MPCA) study of the Poplar Riverís possible pollution sources. The meeting will be held at Cathedral of the Pines, located at 760 Caribou Trail in Lutsen from 7 to 9 p.m. This meeting was originally scheduled for March 1, but was cancelled due to snow.

MPCA water quality monitoring results indicated turbidity levels exceeding state standards. As a result, the Poplar River was added to the Minnesota Pollution Control Agencyís (MPCA) list of impaired waters in 2004. Once a water body is added to this list, the MPCA is required to determine its Total Maximum Daily Load. The TMDL is the maximum amount of a pollutant or pollutants the water body can receive and still meet water quality standards.

The SWCD is serving as the local resource agency for the project and has subcontracted the University of Minnesota Duluthís Natural Resources Research Institute for biological sampling and Minnesota Sea Grant for outreach and education. Presentations on how this effort links to other river-related activities such as the imegaslumpî erosion-control project initiated by the Poplar River Management Board will be discussed. A U.S. Environmental Protection Agency contractor is working with MPCA and will complete the majority of the studyís technical work. The EPA contractor will provide an overview of this work and discuss the TMDL process.

Share 1

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mountain-like
River watershed is a
economic engine for the North Shore. It runs through the

Management Board (PRMB), lea
partnership with the Cook Cour
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research

River and Lake Superior. PRMB, the Cook County SWCD, the Minne
stakeholders identified and implemented $1.7 million in conservati
addressed the most significant sources of sediment and is giving ri

Sediment reduction work continues on Poplar River

Staff reports

The Ullr Tightline project is the largest of four Great Lake Commission grant projects intended to reduce sediment into the Poplar River at Lutsen Mountains. Engineers estimate that the project will reduce sediment by 90 tons per year and will be able to handle a 100- year rain storm. Above:

This last construction season saw the completion of two more significant sediment reduction projects by the Poplar River Management Board (PRMB) in collaboration with the Cook County Soil and Water Conservation District (SWCD).

"With the completion of these projects, we continue to make significant and measurable progress in reducing sediment in the Lower Poplar River," said Tom Rider, president of the Poplar River Management Board.

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MPCA) Impaired Rivers List because
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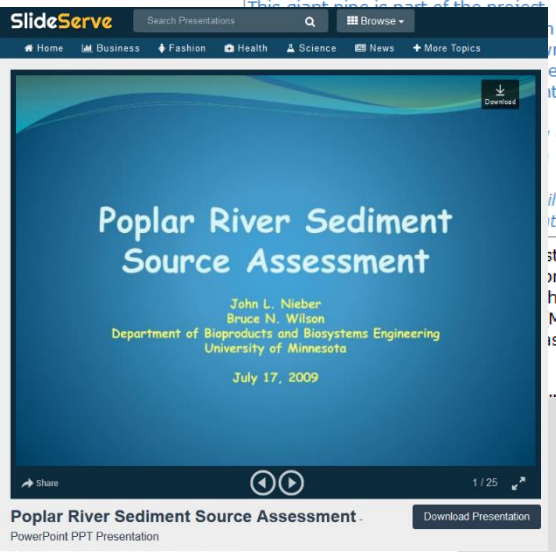


Investments

Poplar River Management Board Investments:

- **Brule Tightline -- $156,272**
- **Eagle Mountain Stormwater system -- $83,871**
- **Elimination/Revegetation – 50% of trails/roads -- $42,650**
- **Stormwater improvements to roads -$54,265**
- **PRMB cash contributions --$124,950**
- **GLC grant match Ullr Tightline 2011/others 2012-13 -- $147,000**
- **2014 Targeted Watershed match --$265,000**

Total PRMB: $874,008

Public Investments in Poplar River:

- **2006 Coastal Program Grant – Megaslump Study -- $30,000**
- **2007 CWL Grant – Megaslump & other projects -- $350,000**
- **2009 GLC Grant – Ullr Tightline -- $30,000**
- **2010 GLC Grant -- $687,000**
- **2014 BWSR Targeted Watershed Grant -- $829,000**

Total Public: $1,926,000

The Mega Slump

The Design Team

Design Team

EOR water ecology community

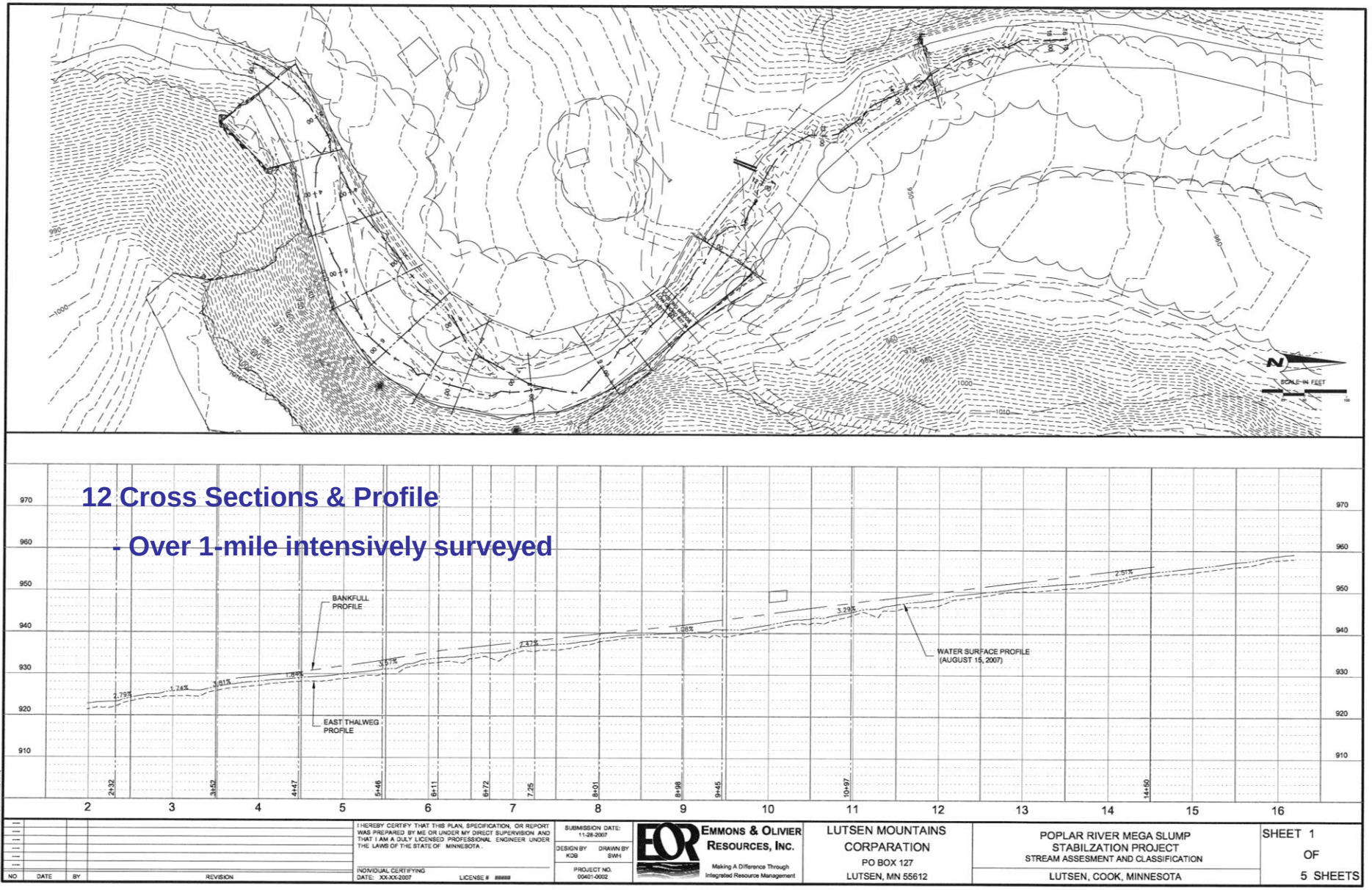
GTE Gale-Tec Engineering,Inc

R2D

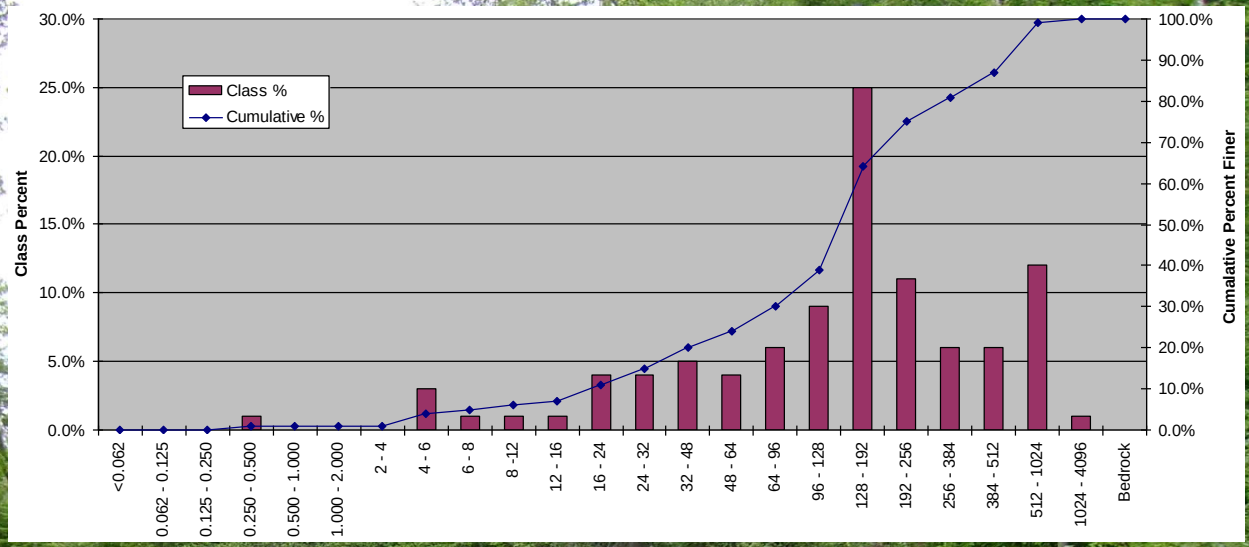
Technical Input

Cook, Lake & South St. Louis SWCD
USFS
BWSR
MPCA
MnDNR
USACOE
USFWS
UofM & NRRI
NRCS

REACH ASSESSMENT – profile & cross sections



REACH ASSESSMENT – bed material



REACH ASSESSMENT - conclusions

Conclusions

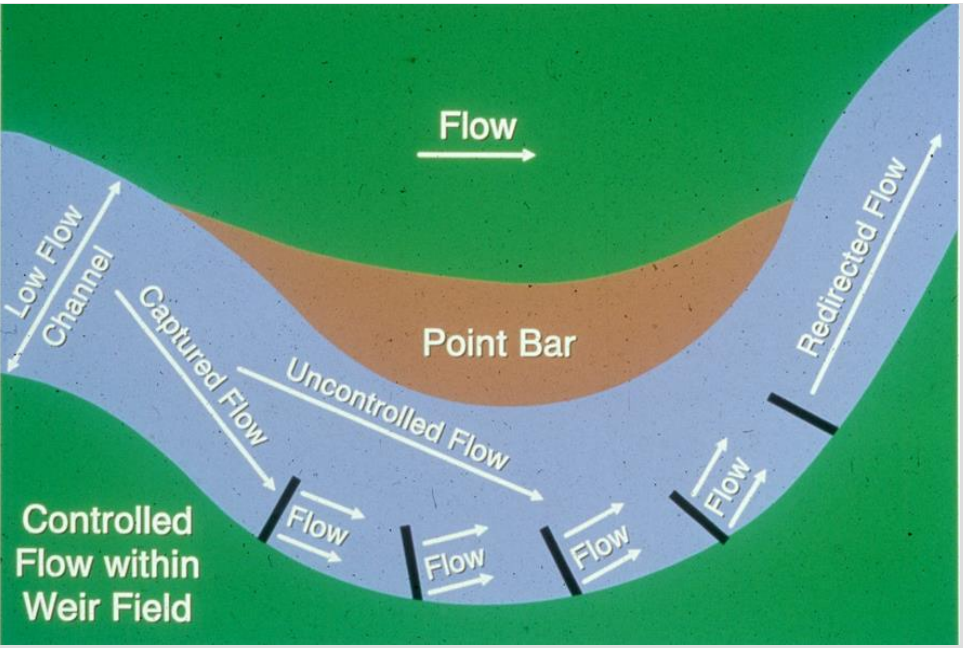
- 'B3' Stream Type

- No accelerated degradation

- Lateral progression occurring

- Side channel accessed during bank full flows

DESIGN – bendway weir



What is it?

Water Training Device

ANGLED-upstream 20 degrees from perpendicular (70 degrees from the bank)

LENGTH-determined by how much river flow needs to be controlled & by future thalweg location

HEIGHT- lower than any flow that can erode the bank, usually +/- 1 ft of the bankfull water surface elevation

DESIGN – bendway weir

How does it work?

Moves scour & thalweg

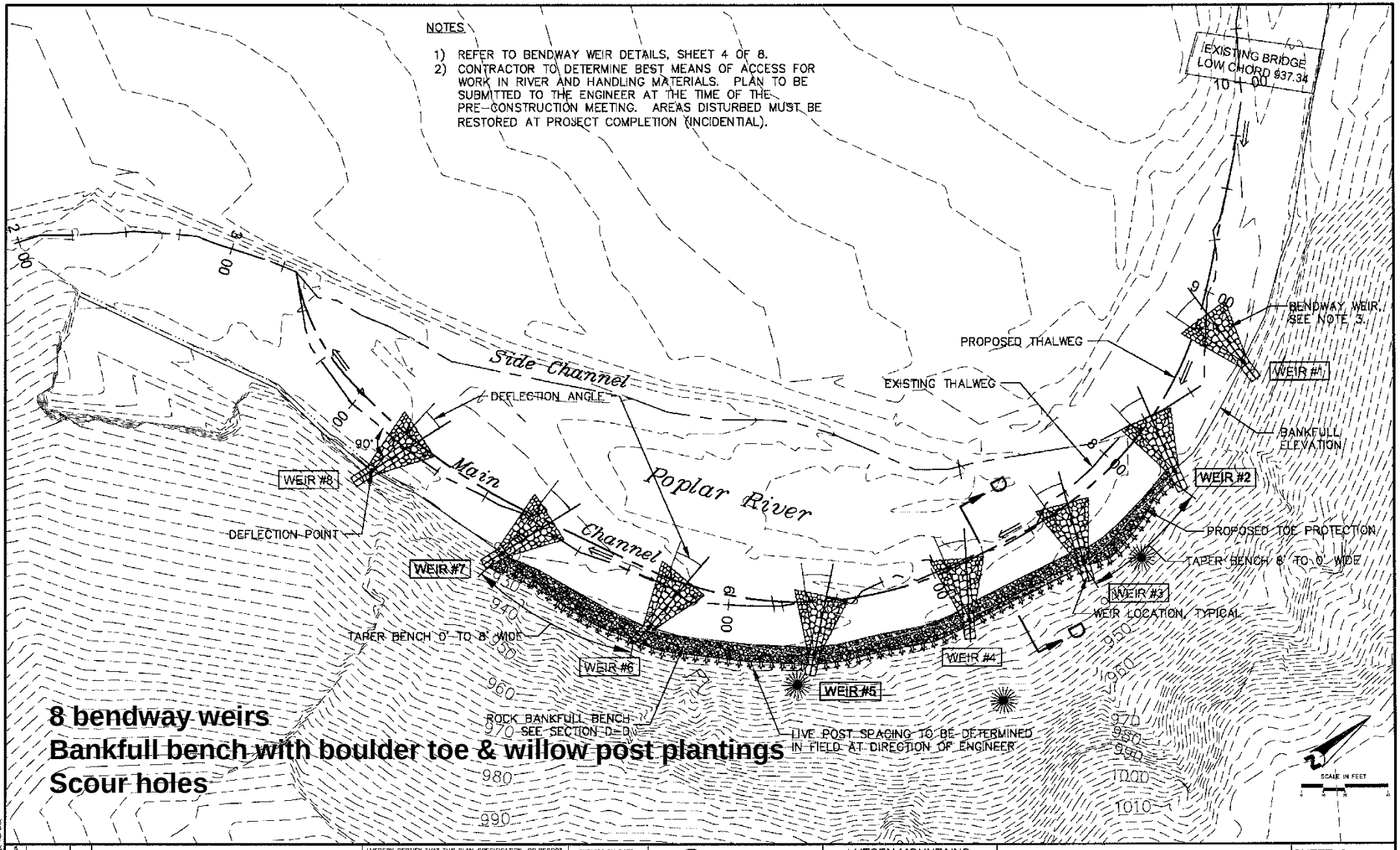
Reduces velocities within the weir field & at toe of bank

Water flowing over the weir is redirected at an angle perpendicular to the longitudinal axis of the weir

With weirs angled upstream, the erosive flow is directed away from the outer bank & toward the inner part of the bend

Secondary currents (Helical Flow) in bend are broken up

APPROACH – lateral stabilization



8 bendway weirs
Bankfull bench with boulder toe & willow post plantings
Scour holes

NO	DATE	BY	REVISION
6			
5			
4			
3			
2			
1			

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
DECLAN OLIVIER
DATE: 05-22-2008
LICENSE # 23837

SUBMISSION DATE: 05-22-2008
DESIGN BY: KDB
DRAWN BY: SWH
PROJECT NO: 03401-0002

Emmons & Olivier Resources, Inc.
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Oakdale, MN 55128
Tele: 651.770.8448
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P O BOX 127
LUTSEN, MINNESOTA 55612

POPLAR RIVER MEGA SLUMP STABILZATION PROJECT
TOE STABILIZATION OVERVIEW
LUTSEN, COOK COUNTY, MINNESOTA

SHEET 3 OF 8 SHEETS

BLUFF ASSESSMENT

Contributing Factors:

- **Streambank Erosion**
- **Surface Run-on**
- **Surface Run-off**
- **Subsurface Saturation**
- **Wastewater Outfall**
- **Natural Slumping**

BLUFF ASSESSMENT - Streambank Erosion

Lower half of slump had large shelf , indicating slide may have been caused by toe failure following a major rain event that caused the BWCA blowdown July 4th, 1999.

BLUFF ASSESSMENT - Surface Run-on

BLUFF ASSESSMENT - Subsurface Saturation

BLUFF ASSESSMENT - Wastewater Outfall

BLUFF ASSESSMENT – Conclusions

Defend toe of slope to eliminate streambank erosion

Eliminate surface run on through berm and grade adjustment

Look for opportunities to manage contributing watershed

CONSTRUCTION – Before July 7, 2007

CONSTRUCTION – August 5, 2009

CONSTRUCTION – August 5, 2009

Step 1- Clear a path on the left side for the entire length of channel

Access in middle of the channel, work will be completed from both ends to the middle

CONSTRUCTION – Bendway Weir

CONSTRUCTION – Bendway Weir

Deeply planted willows oriented perpendicular to flow will act as a "living dike", slowing near-bank flow velocities

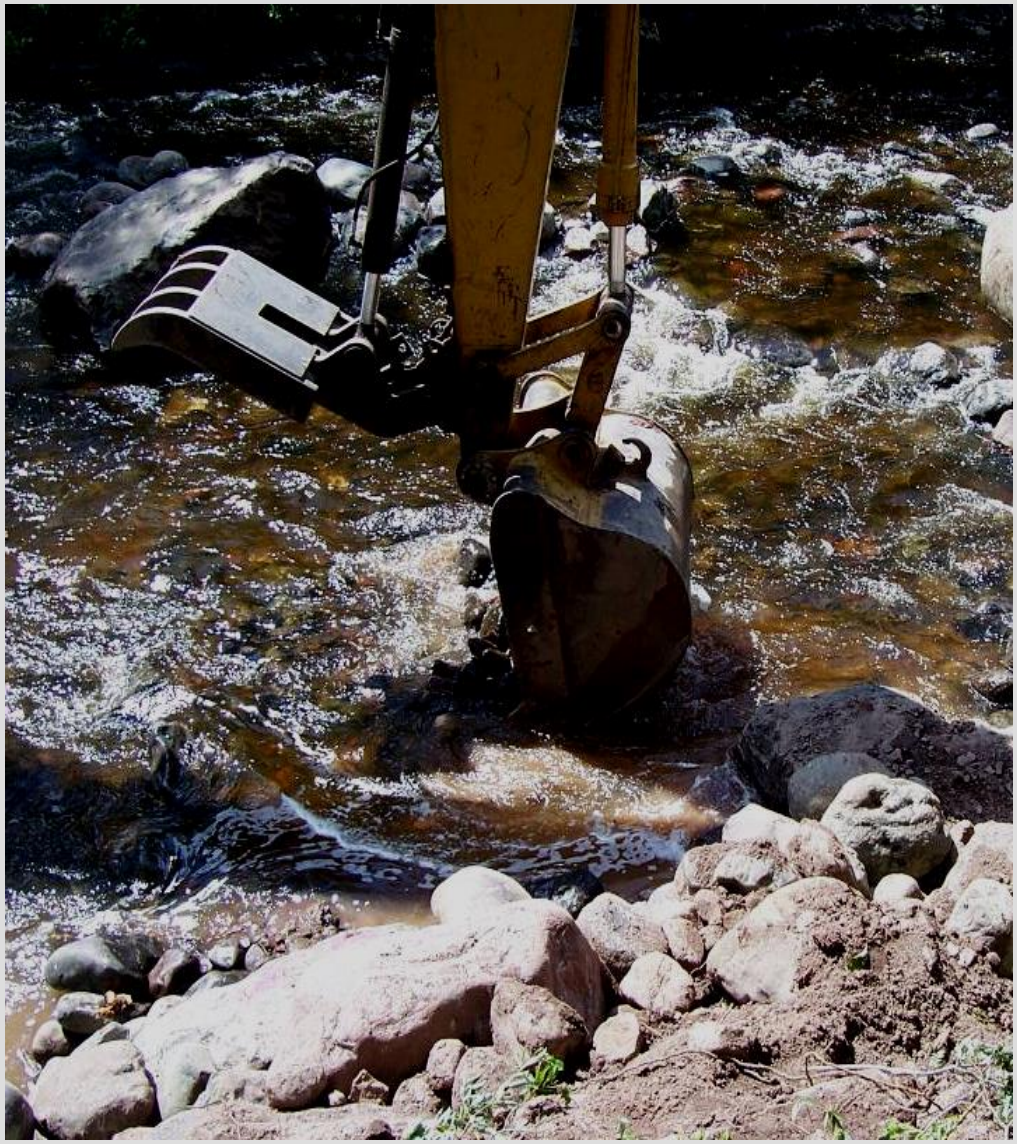
CONSTRUCTION – Bendway Weir

Once willows are in place, keyways are constructed using large quarry rock with “choke” stone from stream to fill voids

CONSTRUCTION – Bendway Weir

Upstream angle of bendway weir is set 20% upstream from perpendicular

CONSTRUCTION – Bendway Weir



Streambed excavated

to allow for installation of bendway weir

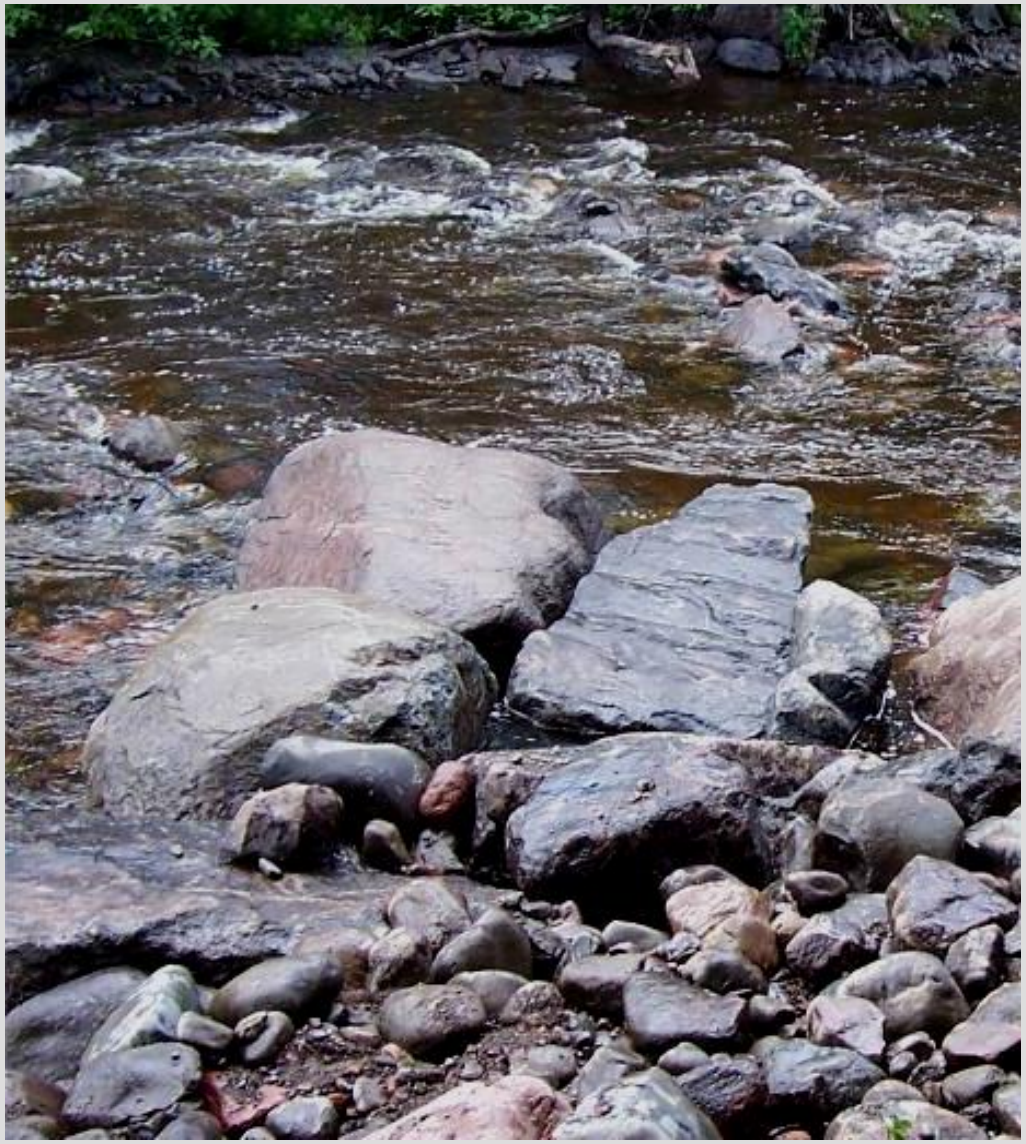
CONSTRUCTION – Bendway Weir

1st bendway weir stone abuts to keyway

CONSTRUCTION – Bendway Weir

Each weir built with double row of stone

CONSTRUCTION – Bendway Weir



Completed weirs range from 15’-22’ long with pool dug at stream end to align thalweg off the end of each weir

CONSTRUCTION – Bendway Weir

Boulders placed on upstream and downstream side of weir to smooth flow transition over weir

CONSTRUCTION – Bendway Weir

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Toe Protection

CONSTRUCTION – Random Boulder Field

CONSTRUCTION – Random Boulder Field

CONSTRUCTION – Random Boulder Field

CONSTRUCTION – August 8, 2009

POST CONSTRUCTION – May 9, 2010

POST CONSTRUCTION – May 9, 2010

POST CONSTRUCTION – May 9, 2010

POST CONSTRUCTION – June 6, 2010

PROJECT COSTS

Stream Restoration Bid
$83,990.00

Stream Restoration Installed
$35,694.00

Edwin E. Thoreson Crew:

Greg Gastecki-PM
Mike Nelson
Gene Hagen
Mark Thum
Rick Carriveau
Jerry Donek
Gary Schlienz
Cameron Sjoberg
Jesse Backstrom

Slope Practices

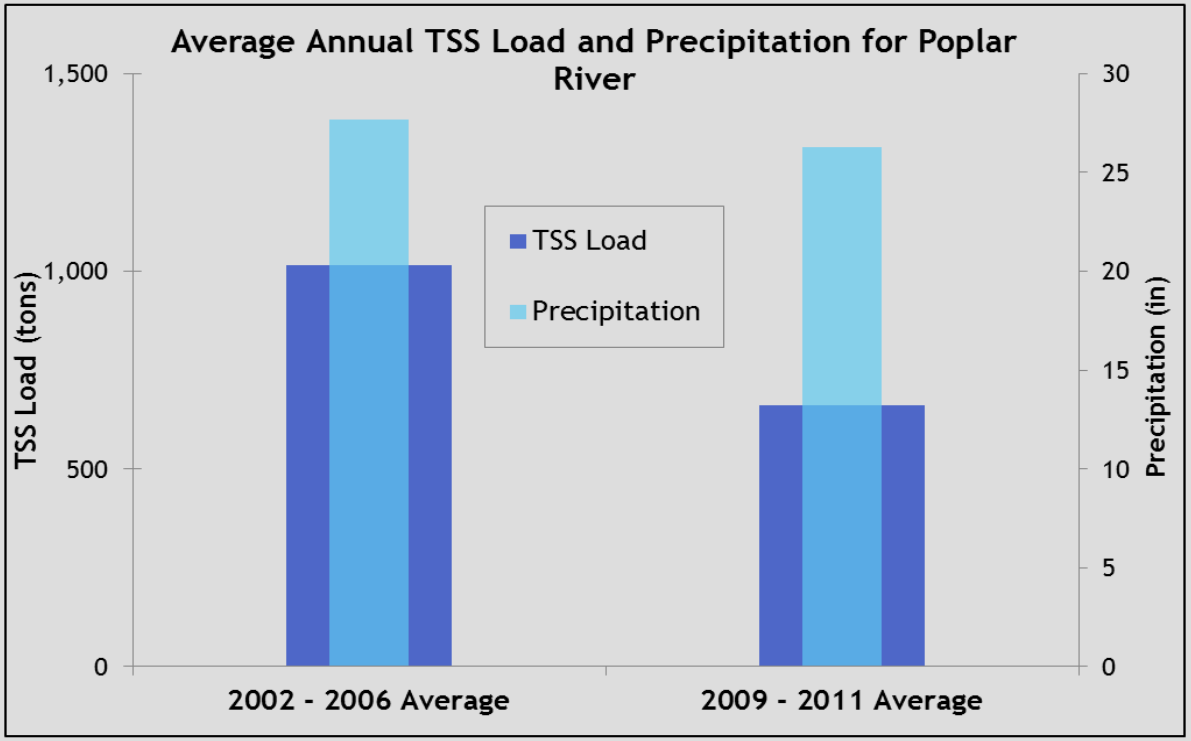
Trailside Ditch Stabilization, Riprap and Reseeding - After
Ullr Mountain

A 500-foot section of the Ullr Mountain Trail was stabilized with riprap and reseeding.

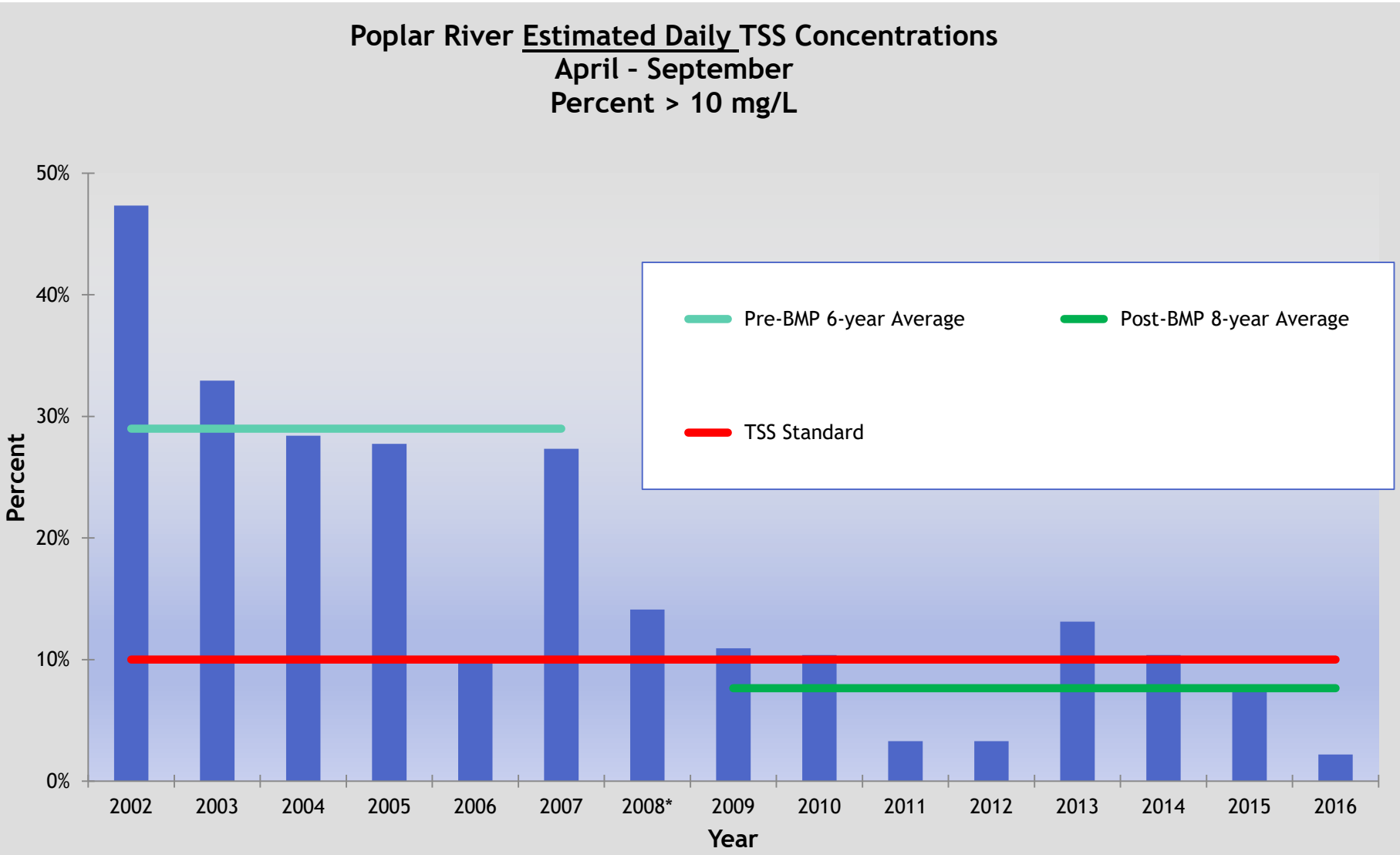
The Beginning of the End

The calculated annual total suspended solids (TSS) loads are lower in recent years than in the first half of the decade.

- **2002 - 2006 about 1,000 tons per year average load**
- **2009 - 2011 about 660 tons per year average load**
- **Suggests 35 percent decrease**
- **Average annual precipitation fairly similar (26.3 versus 27.7 inches).**
- **Expect continued decrease in sediment loading**



The Beginning of the End



*2008 is probably too small/low given that several events were missed.

The Beginning of the End

TSS Standard Exceedances Data Summary				
		2002 - 2007	2009 - 2016	
Year	% > 10 mg/L	Pre-BMP 6-year Average	Post-BMP 8-year Average	TSS Standard
2002	47%	29%		10%
2003	33%	29%		10%
2004	28%	29%		10%
2005	28%	29%		10%
2006	10%	29%		10%
2007	27%	29%		10%
2008*	14%			10%
2009	10%		8%	10%
2010	12%		8%	10%
2011	4%		8%	10%
2012	3%		8%	10%
2013	11%		8%	10%
2014	10%		8%	10%
2015	8%		8%	10%
2016	2%		8%	10%
Pre-BMP 6-year Average 29%				
Post-BMP 8-year Average	8%			

The Happy Ending to the Story

Findings of the MPCA review committee

- **"From 2005 through 2017, landowners in the immediate watershed of the impairment have completed a lengthy list of BMP work. This included near-channel BMPs to mitigate eroded streambanks and ravines, and upland BMPS to mitigate a host of erosion sites. The result has been significant improvements in TSS concentrations. While the nominal percentage of exceedances of the standard has remained above 10% at site S004-406; the measurements were taken for the purpose of load monitoring, and are hence biased towards rain events and not representative of overall conditions. The additional use of hydrologic monitoring data and FLUX modeling, however, allows the accurate estimation of daily TSS concentrations and provides a very good basis for assessment of water quality related to the attainment of the TSS standard.**
- **Exceedances of the standard, calculated in this manner, have decreased from an average of 29% in years 2002-2007 to an average of 8% in years 2009-2016 (the most recent year for which such calculations are available).**
- **"Delisting is recommended."**

Thank You

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Jay Michels
jmichels@eorinc.com
www.eorinc.com

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