Clean Water Council 2025 Field Tour

The Clean Water Council (Council) makes budget and policy recommendations to the legislature and governor. Every two years, the Council participates in a field tour for the purpose of providing members with an in-depth look at specific challenges, opportunities, or geographies as it relates to their work. The 2025 Tour is taking place in three watersheds within the Upper Mississippi River Basin—the Upper Mississippi Headwaters, Leech Lake, and Crow Wing.

As the headwaters to the Mississippi River, protection and restoration activities in this area provide opportunities to improve or preserve downstream water quality all the way to the Gulf. Much of the land in this area is forested, and much of it is already protected. Adding protections to or restoring priority acres and shorelines in this area now can reduce the need for restoration in the future and provide benefits for ecosystems and communities, including the protection of drinking water quality.

The Council is guided by state statute and its strategic plan. Within the strategic plan is the following relevant language for this tour:

- Vision: All Minnesotans value water and take actions to sustain and protect it.
    - Goal 1: Build capacity of local communities to protect and sustain water resources.
        - Action: Support local efforts to engage lakeshore property owners and private landowners
            - Measure: Protection of 100,000 acres and restoration of 100,000 acres in the Upper Mississippi River headwaters basin by 2034.

By hearing firsthand from local implementers of Clean Water Fund (CWF)-support projects and experiencing the landscape, participants will increase their understanding of the measure above. The field tour will also provide ample opportunity to explore connections between CWF- and non-CWF-supported efforts and help clarify the role of the Council in pursuit of its desired outcomes.

This packet contains largely background information to supplement what is shared by presenters. Several pages have been incorporated from the Legislative Subcommittee on Minnesota Water Policy's 2024 Tour booklet.

Monday, September 15, 2025

- 1:00 **Welcome, Tour Overview**
- 1:10 **White Earth Nation history and current stewardship**
    - Renee Keezer, White Earth Nation Natural Resources Division
- 1:25 **Brief geologic context for the area**
    - Jim Stark, Legislative Subcommittee on Water Policy
    - Crystal Mathisrud, Hubbard County Soil and Water Conservation District
- 1:40 **One Watershed, One Plan Panel**
    - Moderator: Jeff Hrubes, Board of Water and Soil Resources
    - Panelists, including:
        - Marta Springer, Crow Wing Soil and Water Conservation District
        - Dana Gutzmann, Cass County Soil and Water Conservation District
        - Darren Newville, East Otter Tail Soil and Water Conservation District
        - Brent Rud, Beltrami Soil and Water Conservation District
- 2:40 **Break**
- 2:55 **Straight River and Pineland Sands**
    - Peter Jacobson, Retired Minnesota DNR Fisheries Scientist
    - Jim Stark, Legislative Subcommittee on Water Policy
- 3:35 **Vanishing Shorelines**
    - Jeff Hrubes, Board of Water and Soil Resources
    - Paul Radomski, Minnesota Department of Natural Resources
    - Sami Selter, Minnesota Lakes and Rivers Advocates
- 4:15 **Day 1 concluding remarks, prep for Day 2**
- 4:30 **Break**
- 5:00 **Dinner**

Tuesday, September 16, 2025

- 8:20 **Bus departs**
    - Presentation on bus: Evolution of protection in the watershed
        - Ruurd Schoolderman, Minnesota Land Trust
        - Peter Jacobson, Retired Minnesota DNR Fisheries Scientist
- 9:00 **Itasca State Park: Headwaters reflective stop**
    - Connie Cox, Minnesota Department of Natural Resources
    - Anna Fairbanks, Minnesota Department of Natural Resources
- 10:05 **MAWQCP Certified Farm visit at New North Farm**
    - Brian Ingmire, New North Farm and Minnesota Department of Agriculture
    - Jim Lahn, East Otter Tail Soil and Water Conservation District
    - Stefan Meyer, Farm to Forest Coop
- 10:40 **Presentation on bus: MAWQCP at R. D. Offutt Company**
    - Jen Maleitzke, R. D. Offutt Company
- 11:00 **Kabekona Lake: Reaching the 75% protection threshold**
    - Annie Knight, Northern Waters Land Trust
    - Ruurd Schoolderman, Minnesota Land Trust
- 11:30 Lunch at the WoodShed in Laporte
- 12:30 **Presentation on bus: Cass County Chloride reduction efforts**
    - Dana Gutzmann, Cass County Soil and Water Conservation District
- 1:15 **Ten Mile Lake: Shoreline restoration**
    - Ryan Carlson, Cass County Soil and Water Conservation District
    - Dr. Bruce Carlson, Ten Mile Lake Association
    - Steve Adams, Ten Mile Lake Association
    - Christie Dailey, Property Owner
- 1:55 **Birch Lake: Stacked benefits of protection**
    - Ryan Carlson, Cass County Soil and Water Conservation District
    - Peter Jacobson, Retired Minnesota DNR Fisheries Scientist
    - Mark Larison, Birch Lake Association
- 2:40 **Minnesota Heritage Forest: Bus presentation and brief reflective stop**
    - Annie Knight, Northern Waters Land Trust
- 3:10 **Debrief on bus**

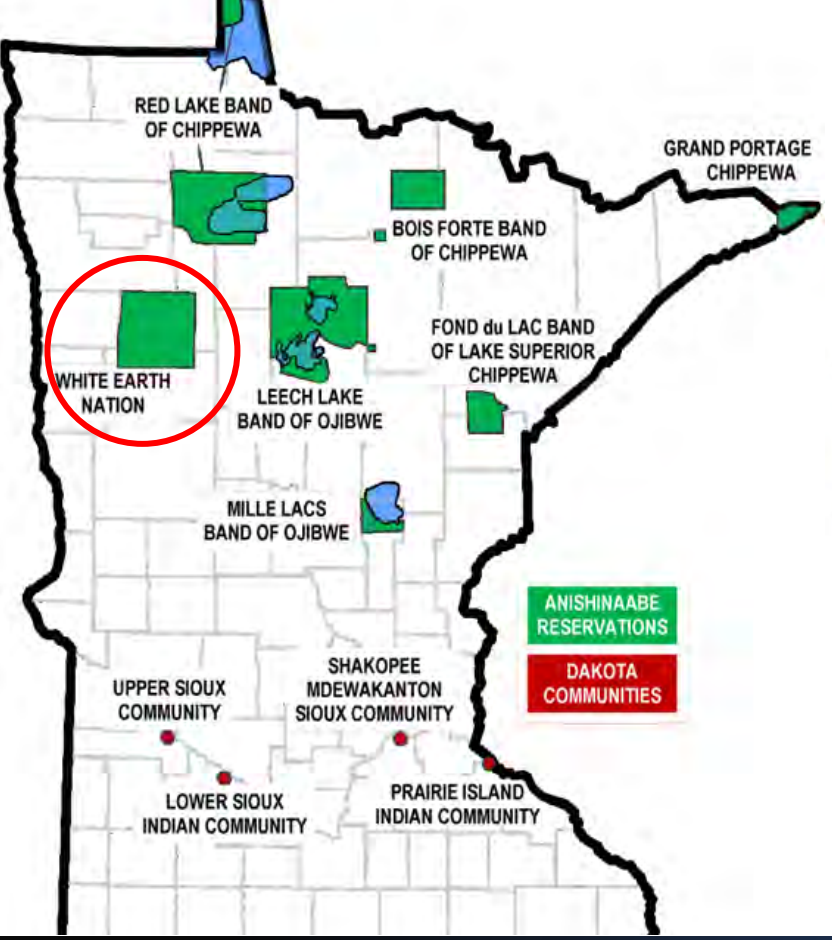
White Earth Natural Resources

Dustin Roy

Divisional Director

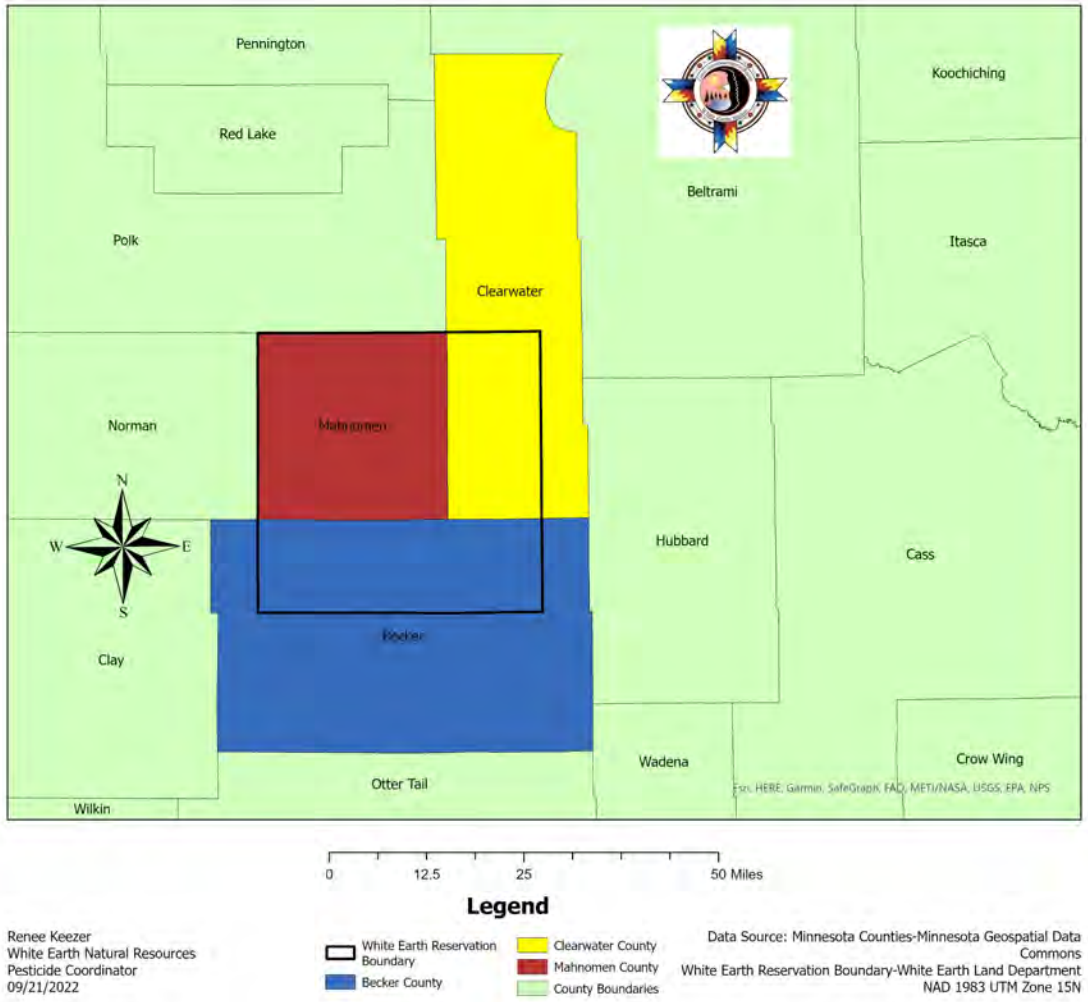
Renee Keezer

Water Resources Manager



White Earth Band of the Minnesota Chippewa Tribe

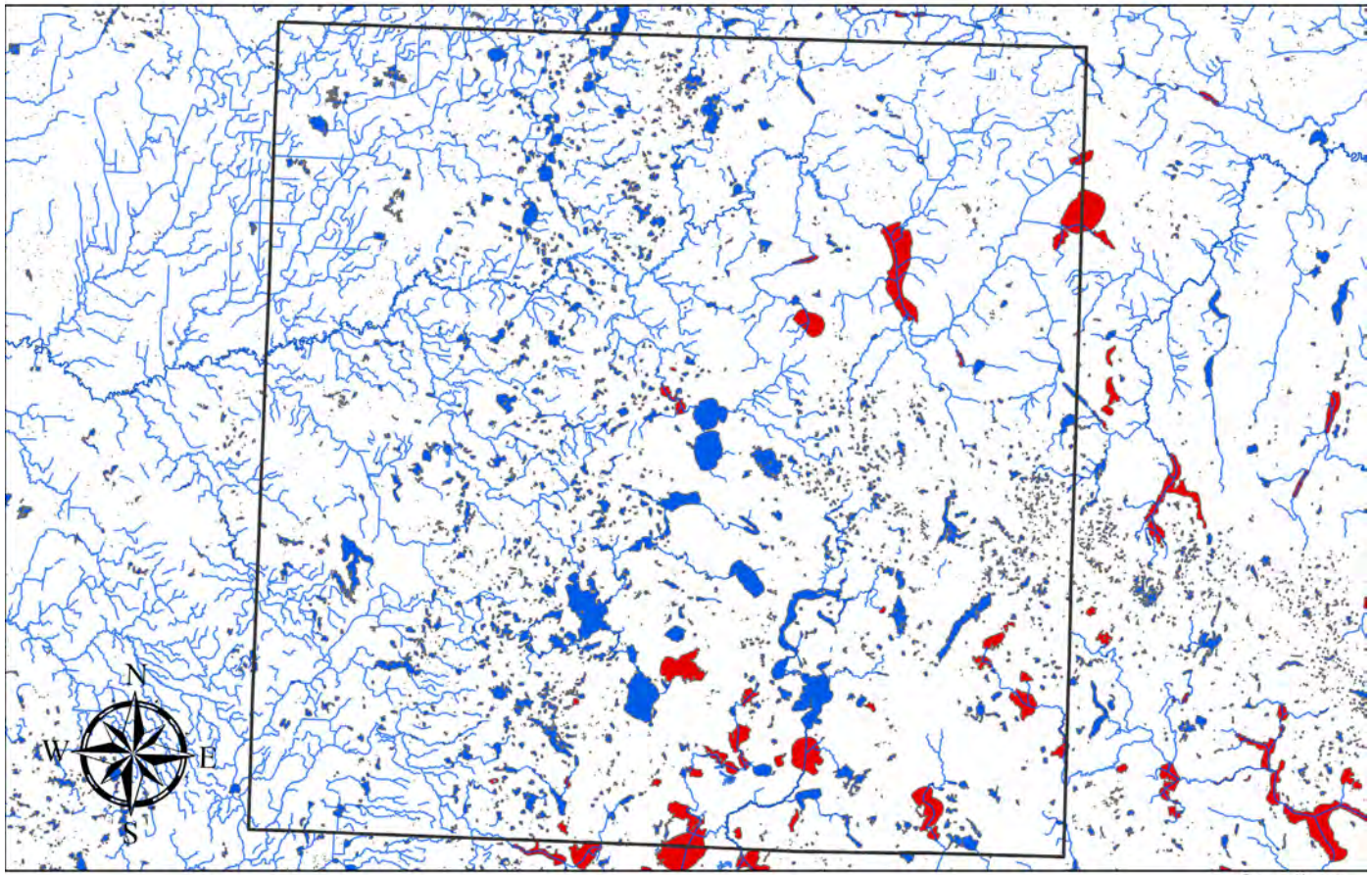
White Earth County Map



Renee Keezer
White Earth Natural Resources
Pesticide Coordinator
09/21/2022

Data Source: Minnesota Counties-Minnesota Geospatial Data Commons
White Earth Reservation Boundary-White Earth Land Department
NAD 1983 UTM Zone 15N

White Earth Waterbodies and Waterways



Legend

- White Earth Reservation Boundary
- Rivers and Streams
- Wild Rice Lakes
- Water bodies

Renee Keezer
White Earth Natural Resources
Pesticide Coordinator
Hydrology and wild rice lake data-MN geospatial Data Commons
06/24/2022

White Earth Reservation Snowmobile Trails

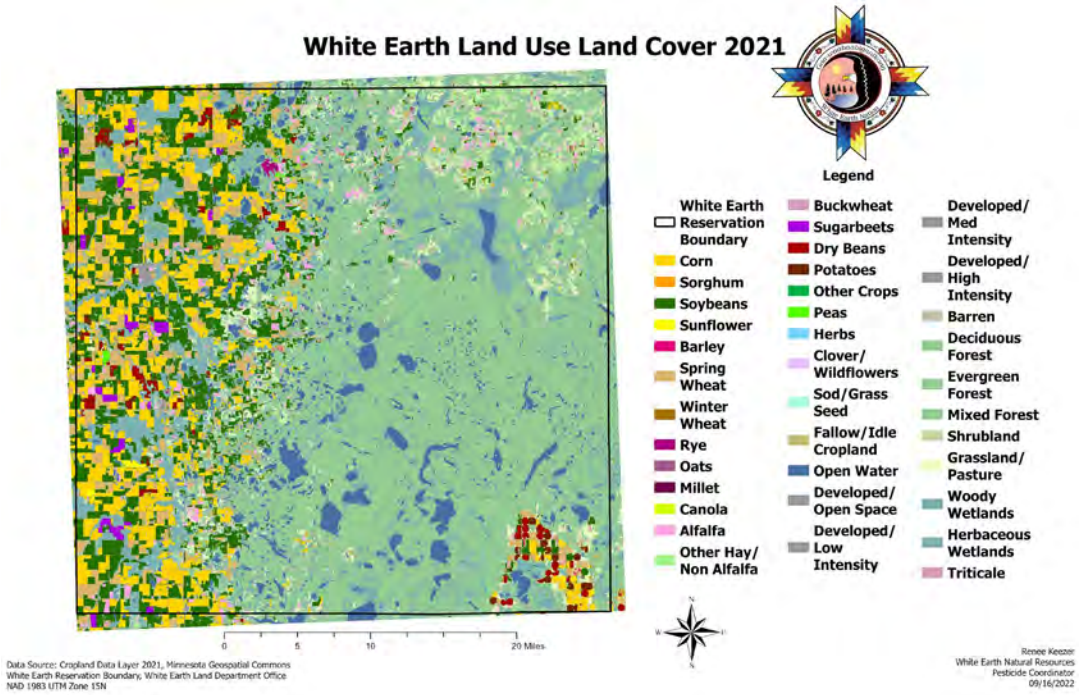
N

Data Source: White Earth Boundary-White Earth Department of Natural Resources Land Office
Snowmobile Trails Data-MNGEO Minnesota IT Service Geospatial Information Office

0 5 10 20 Miles

Renee Keezer
White Earth Department of Natural Resources
Pesticide Coordinator

Image: **WATER WAY** Shannon Wadena and his son, Shannon Jr. (right), work their canoe across Upper Rice Lake near Bagley, Minnesota. © Jenn Ackerman and Tim Gruber https://www.nature.org/en-us/magazine/magazine-articles/ojibwe-wild-rice-harvest/



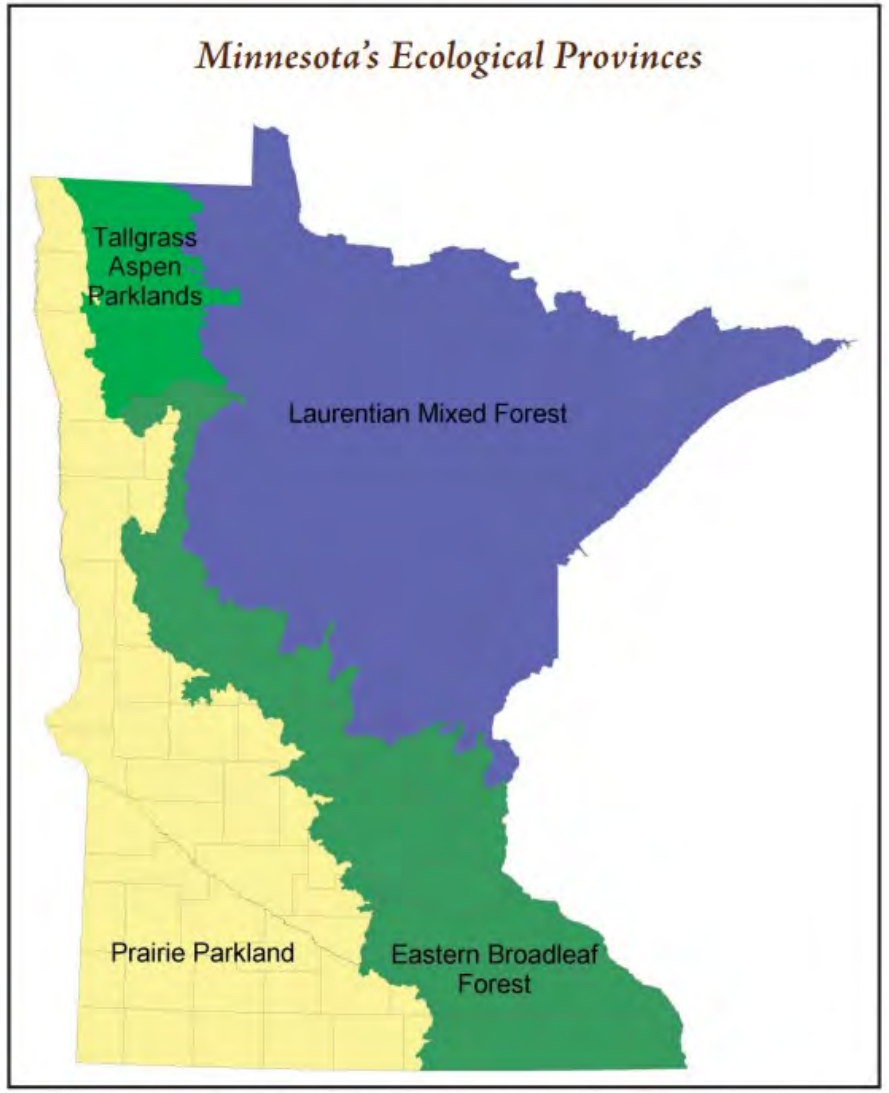
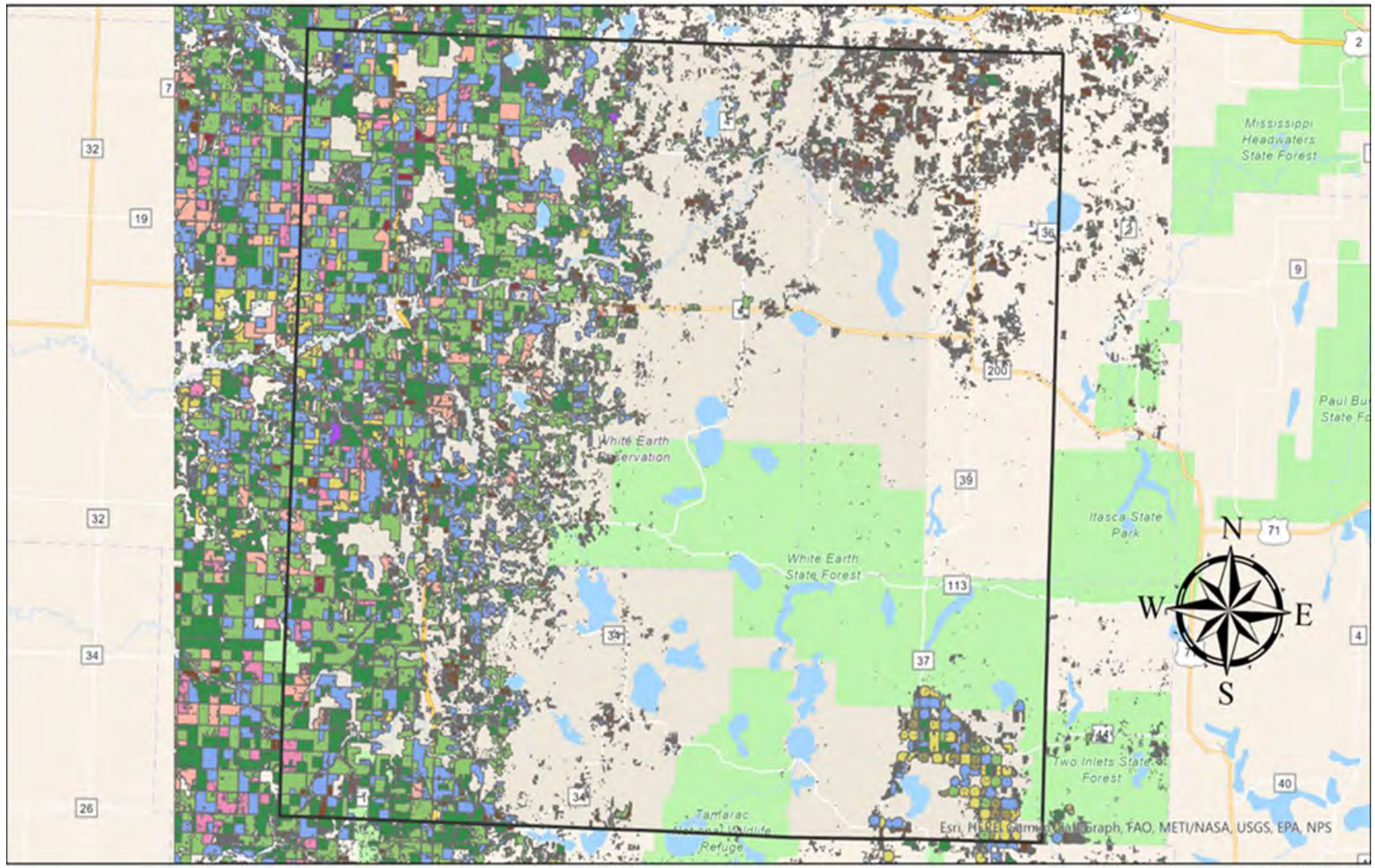


Figure 1: Minnesota is fortunate to contain parts of four major ecological provinces, with a resulting greater diversity of wildlife species than many similarly-sized neighboring states. Credit: Terry Brown, University of Minnesota.

Agriculture in White Earth



Legend

White Earth Reservation Boundary

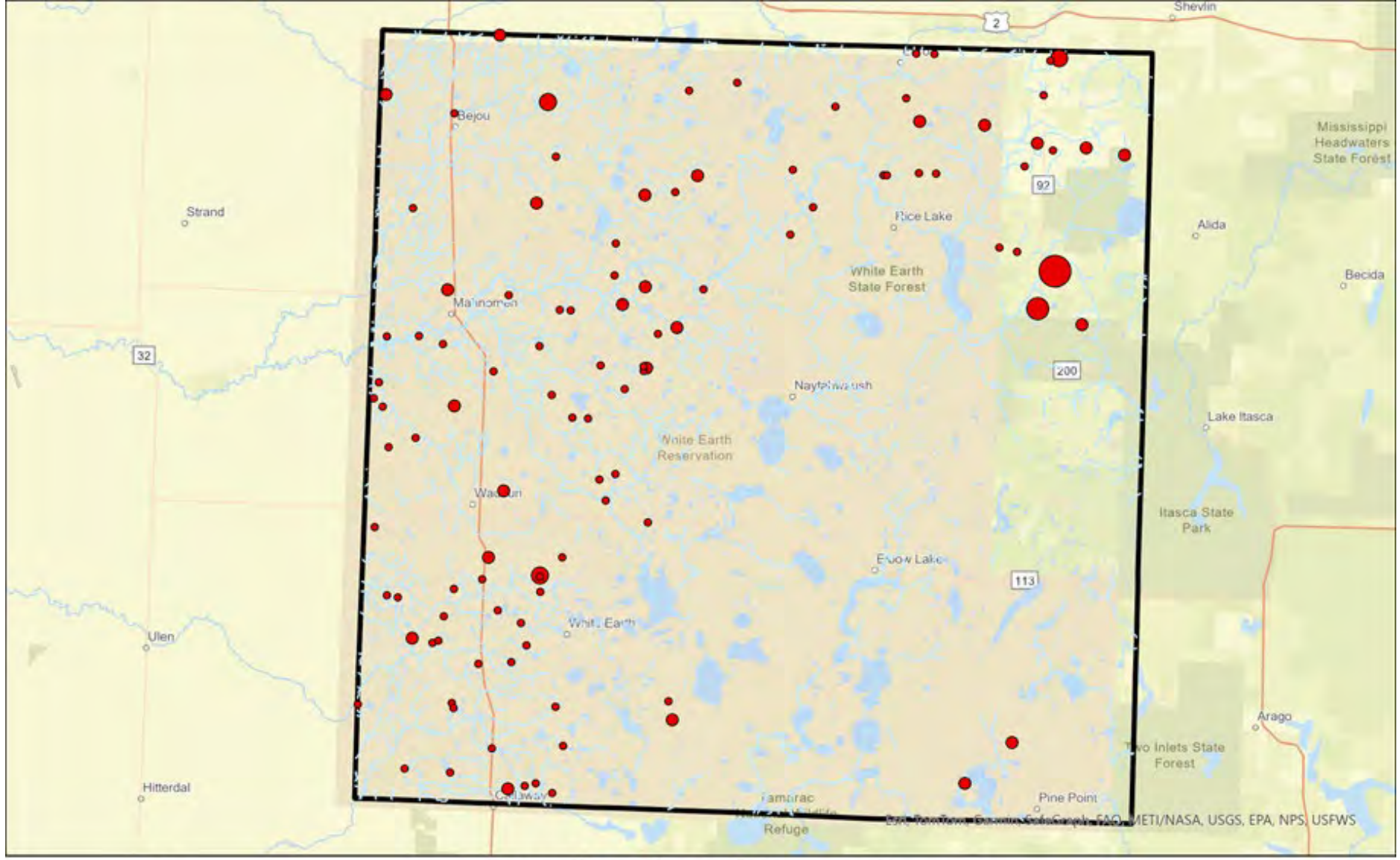
Cropland 2020

CLASS_NAME

- Alfalfa
- Barley
- Buckwheat
- Canola
- Carrots
- Clover/Wildflowers
- Corn
- Dry Beans
- Fallow/Idle Cropland
- Flaxseed
- Grapes
- Millet
- Mustard
- Oats
- Peas
- Potatoes
- Radishes
- Rye
- Sod/Grass Seed
- Sorghum
- Soybeans
- Spring Wheat
- Sugarbeets
- Sunflower
- Sweet Corn
- Triticale
- Winter Wheat
- <all other values>

Renee Keezer
White Earth Natural Resources
Pesticide Coordinator

MN Geospatial Data Commons:
Cropland Data 2020
UTM Zone 15 NAD1983
07/19/2022



N
W E
S

Feedlots in White Earth

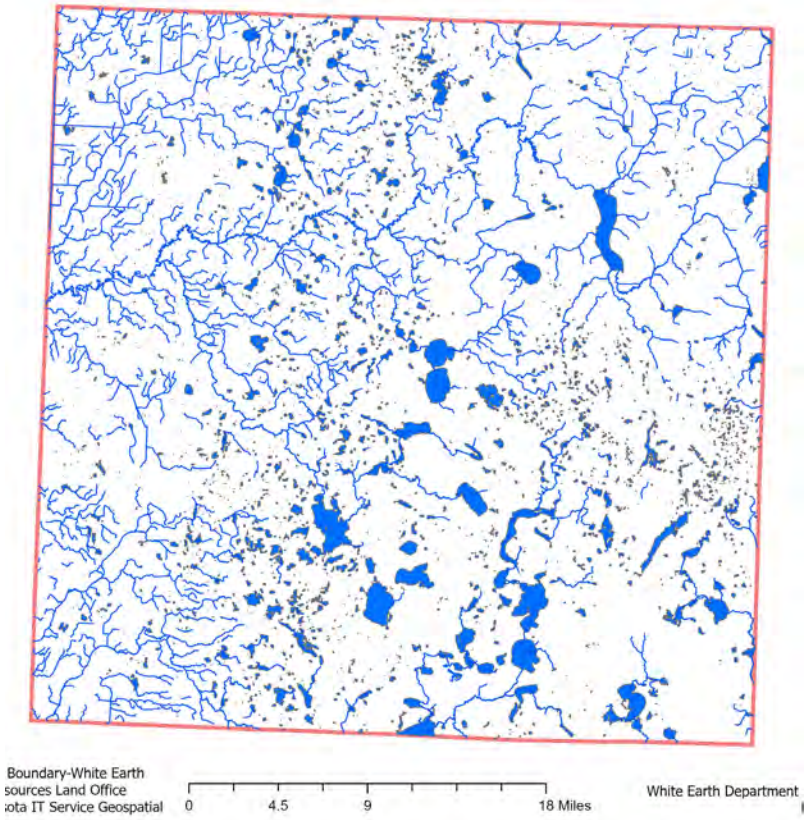
0 5 10 20 Miles

Legend

Waterways
Reservation_Boundary
Waterbody

Feedlots
animal_cou
0 - 196
197 - 850
851 - 2750
2751 - 62000
62001 - 124000

White Earth Natural Resources
Gulf Hypoxia Program
Renee Keezer
Projection: 1983 NAD UTM 15N
Data Source: Geospatial Data Commons
White Earth Land Office



Management of Water Resources

Contact

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Introduction: Human and Geologic Context

Presenters:

Jim Stark, LCC Subcommittee on Water Policy

Crystal Mathisrud, Hubbard County SWCD

Introduction: People of Land, Water and Legacy – Our Inheritance

To Be Minnesotan – Link to Clean Water, Land and Legacy

- People of land and water
- People of action
- People who seek to live and grow in line with their values while creating objects and ideas of value

It is essential that we provide support for people to take action in regards to managing land and water, not only for the function of the system, but also to maintain our unique identity as Minnesotan's

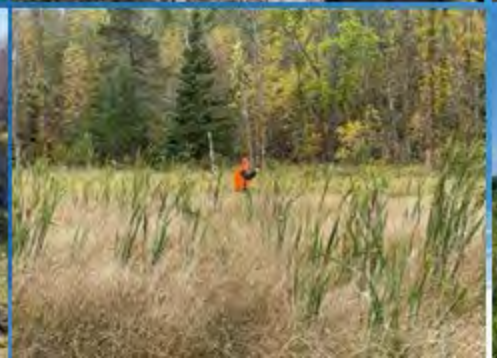
Taking Action According to Our Values
Identify Needs and Provide Support to Grow









Stewardship Action CWF Direct

- Partnership with DNR Forestry and Consultants: land protection and management outreach, stewardship plans and project support
- Partnerships with SWCDS, BWSR and Local groups: shoreland, stormwater and agricultural project implementation. 1w1p planning

Partnerships, Leveraged Funds and Service Matter in Identifying & Reaching a Shared Vision.

HCSWCD MISSION

The purpose of the Hubbard County Soil and Water Conservation District is to conserve protect and enhance the soil and water resources of Hubbard County by providing leadership education and assistance

- **Meet landowners where they are at**
- **Provide information and resources to empower people to take action**
- **Provide support and access to programs and funding for projects whether SWCD is the on ground implementor or not**

Habitat Water Quality Water Quantity Soil Health Community

Lakes Streams Forests Wetlands Agriculture Urban

Ground Water

- Hubbard County
- LCCMR
- HCCOLA
- DNR
- MPCA
- MDH
- MDA
- NACD
- OHF -Lessard
- MGLP
- US Forest Service
- Townships
- 4-H, FFA
- UM Extension
- BSU
- Audubon
- Trout Unlimited
- Deer Hunters Association
- Area Schools
- Community Members and Landowners
- MHB
- Wild Turkey Federation
- Howg Gas
- EPA
- NWLT
- MLT
- TNC
- MFA
- Conservation Fund
- US Fish and Wildlife
- Ice Racers
- MN Lakes and Rivers
- Itasca Mantrap
- Beltrami Electric
- Coca Cola & NEI

Introduction: Geology of the Mississippi Headwater

Information Sources:

Jeff Broberg MNWOO Director

Staff from the MGS and the DNR

minnesota
well owners organization

Imagine a day where everyone has safe water.

Jeff Broberg

MNWOO Director

Glacial history of the last 2 million years defines Minnesota's land and waters.

150 years of mapping of the sediments, rocks and waters and is essential for water management.

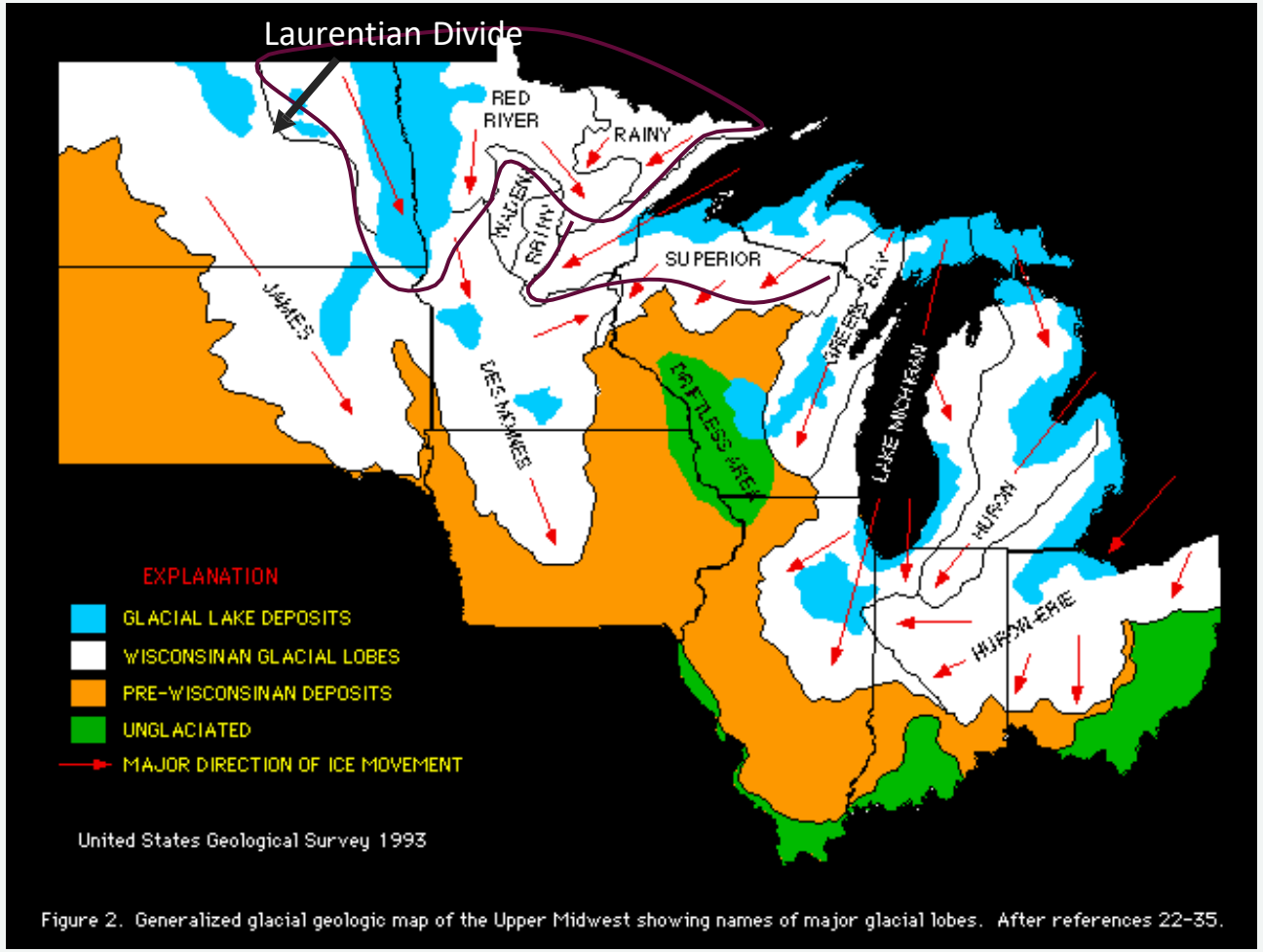
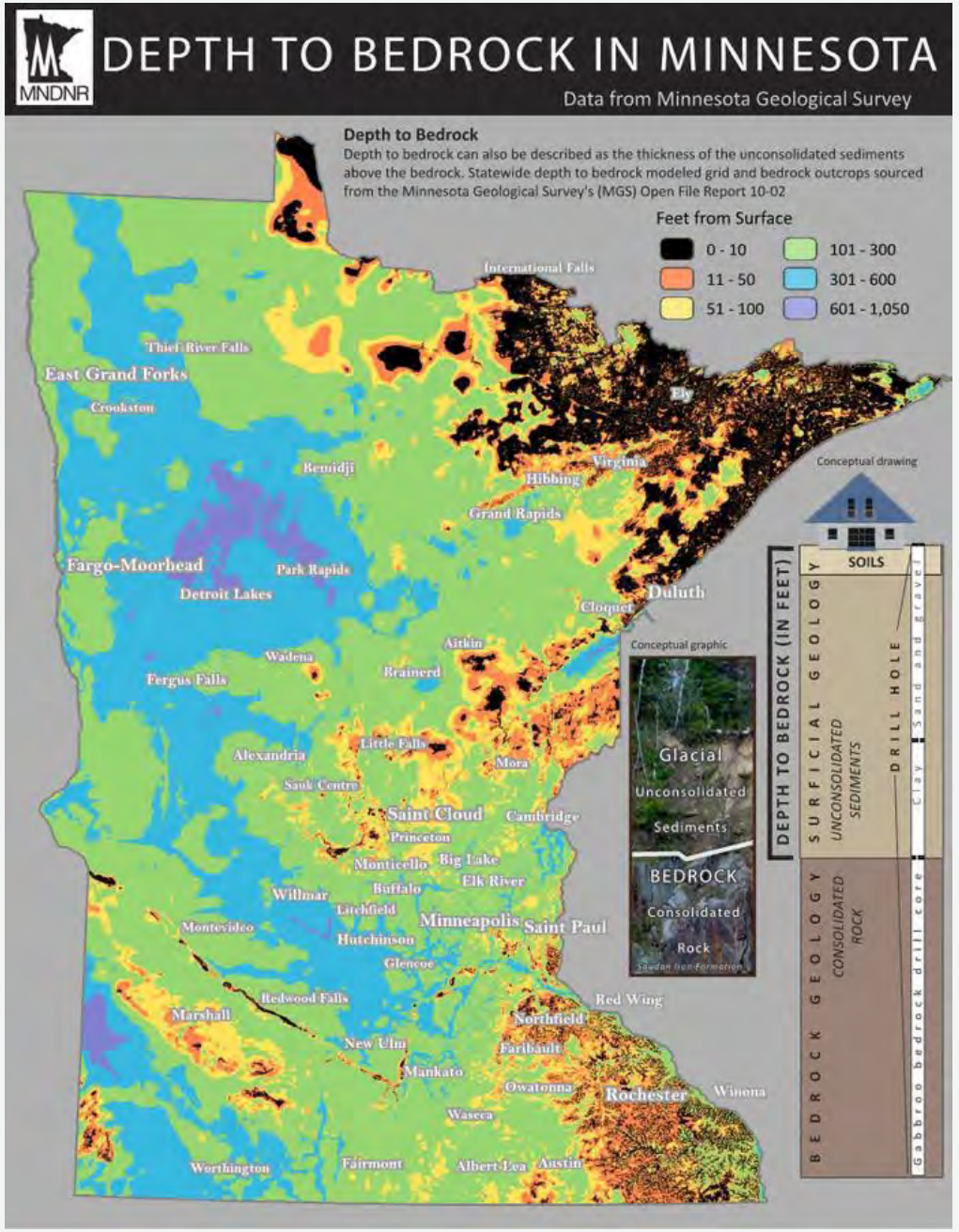


Figure 2. Generalized glacial geologic map of the Upper Midwest showing names of major glacial lobes. After references 22-35.

Geology explains aquifer types and groundwater properties

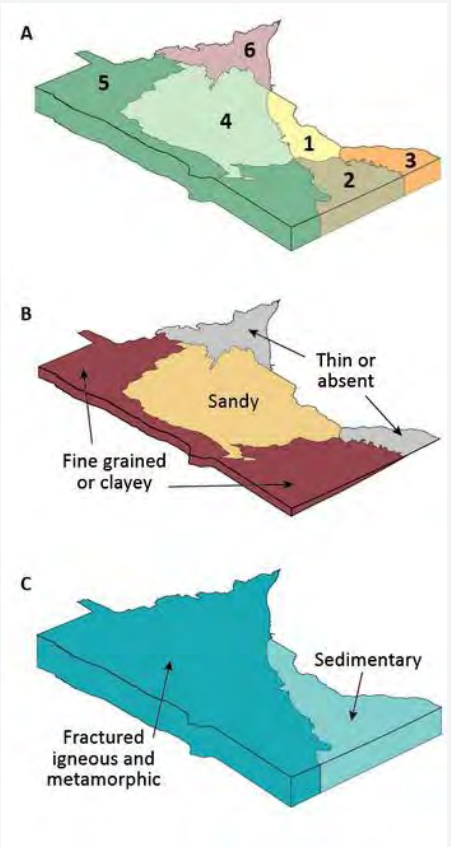
Unconsolidated sediment (e.g., clay, sand, gravel) deposited by glaciers, streams, and lakes;

Bedrock (e.g., limestone, granite) comprising a wide range of rock types and ages



MN GEOLOGIC SURVEY MAPS THE ROCKS THAT DEFINE AQUIFERS, MNDNR MAPS THE HYDROLOGY

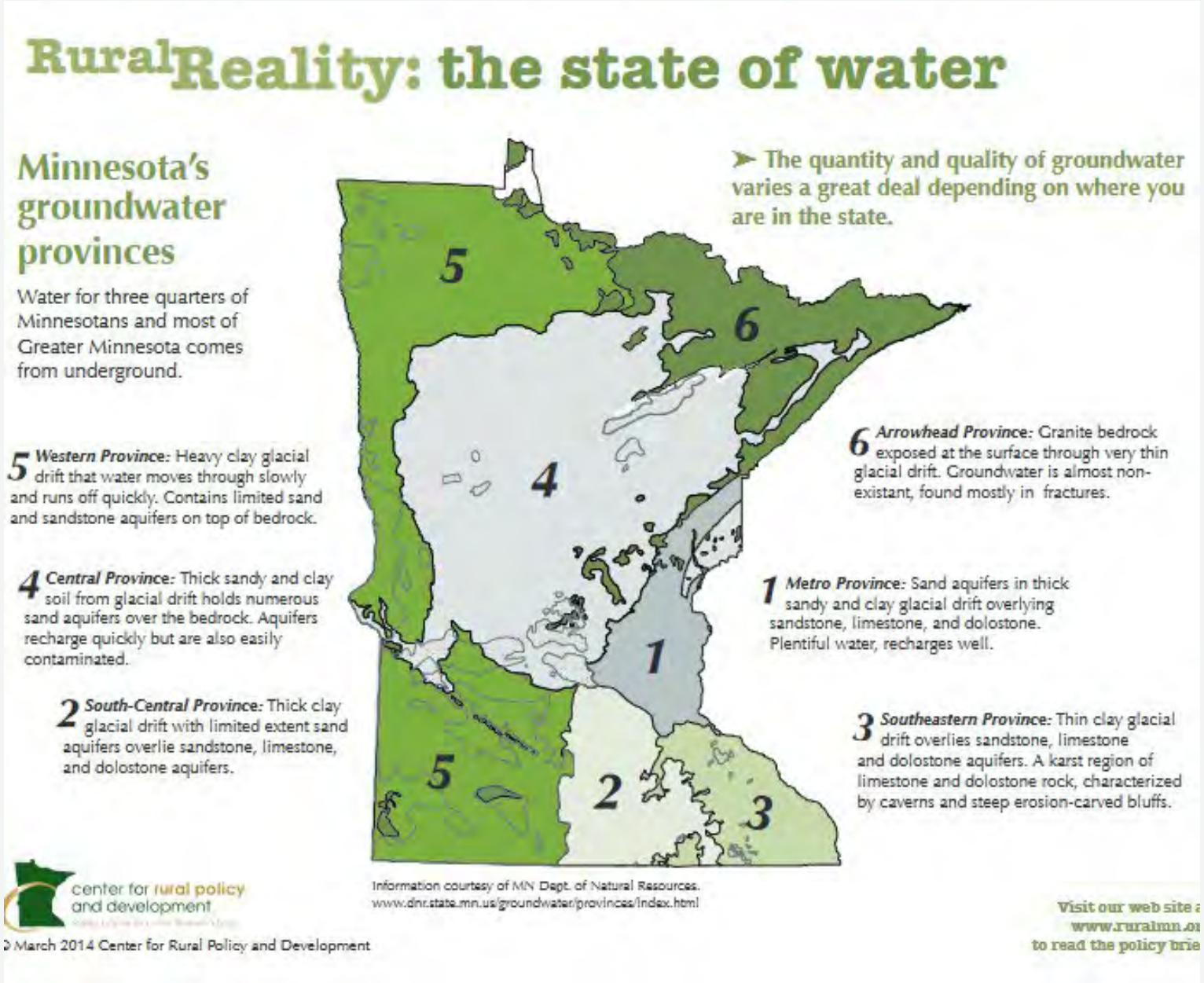
150 years of detailed geologic mapping put to use



Minnesota's Diverse Sources of Drinking Water

Minnesota has six Groundwater Provinces.

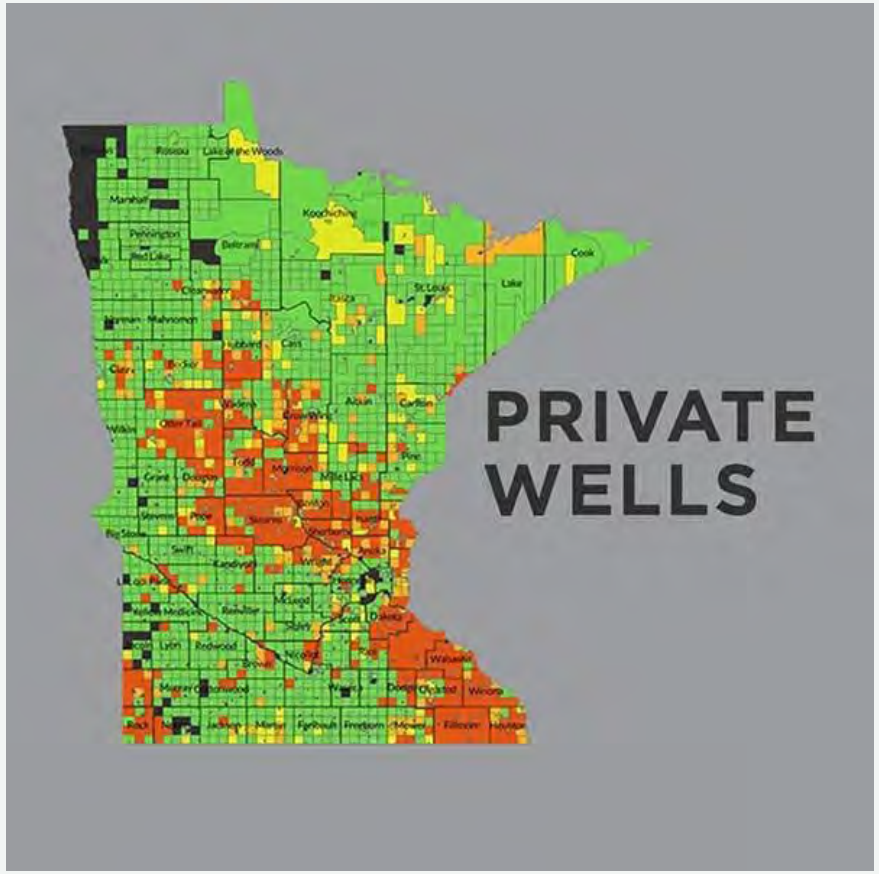
25% of Minnesotans are Private Well Users (PWUS), 75% are connected to community water systems.

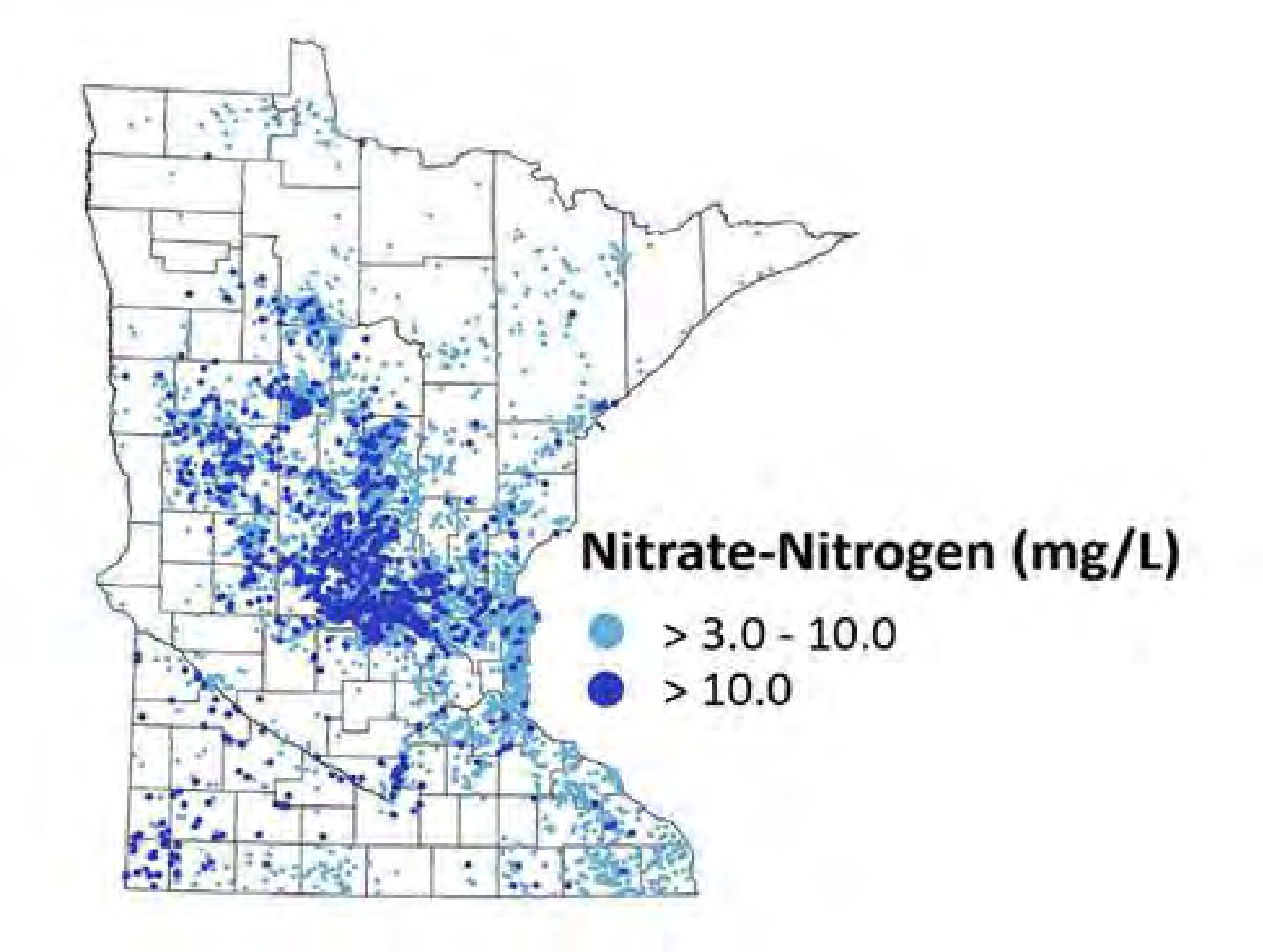


Minnesota's Central Sand Region

Headwaters of the Mississippi River
Many lakes
shallow depths
Groundwater connection to lakes and streams

Nitrates—One of many water issues in sandy soils




Nitrate-Nitrogen (mg/L)
> 3.0 - 10.0
> 10.0

Understanding the details– County Geological Atlas Program

Part A: Geology-- MGS

Plates

1. Data-base map
2. Bedrock geology
3. Surficial geology
4. Quaternary stratigraphy and sand distribution models
5. Bedrock topography, depth to bedrock

Part B: Groundwater-DNR

Atlas report

- Pollution sensitivity
- Aquifer characteristics
- Groundwater flow

Plates

1. Groundwater chemistry
2. Hydrogeologic cross sections

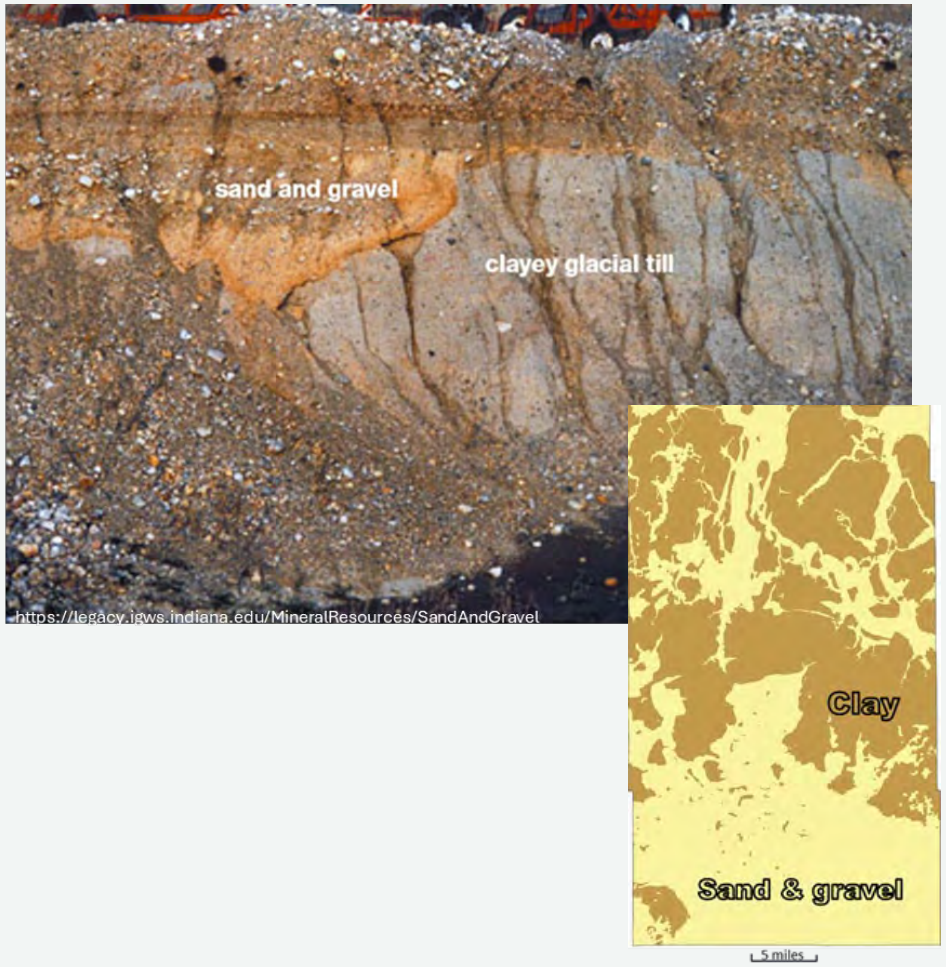
Minnesota Legislature

Counties

LCCMR

Clean Water Council

Geologic Resources



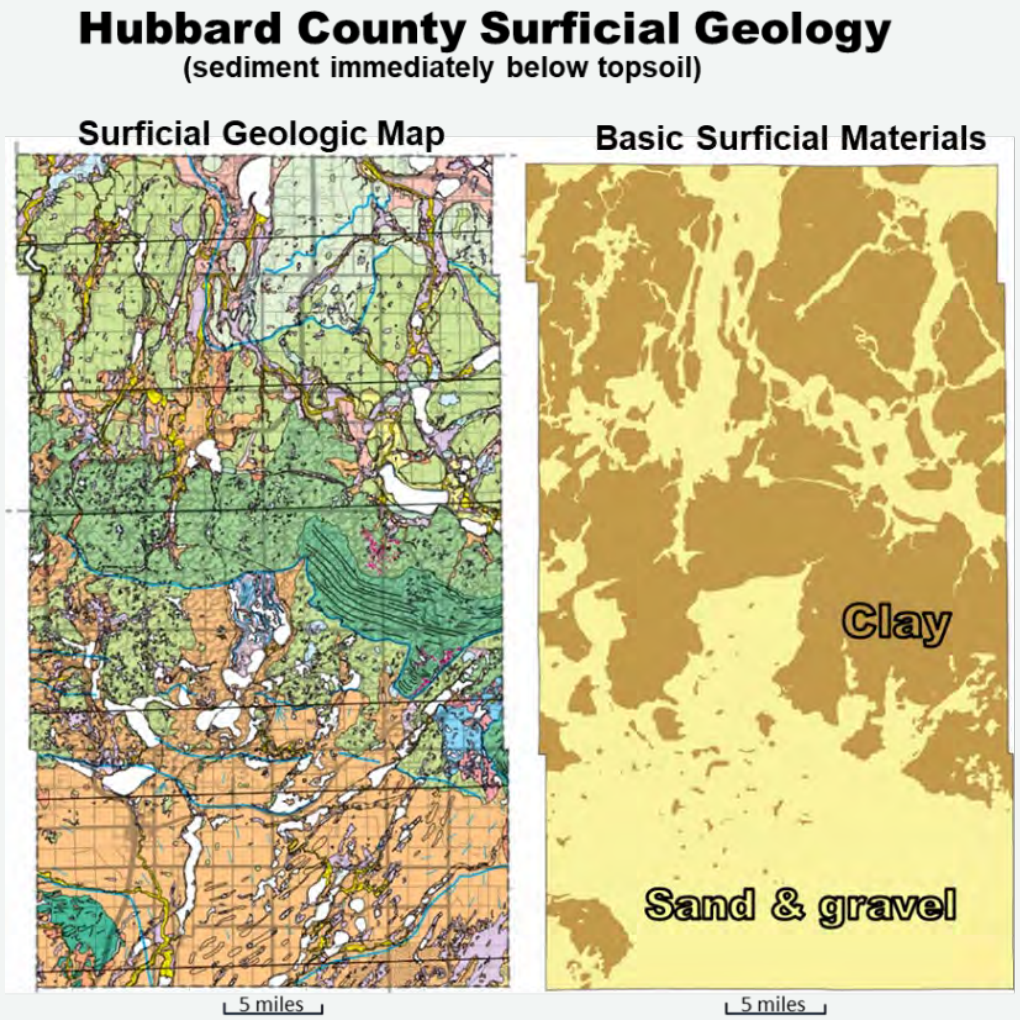
Maps show the distribution of:

- Rocks
- Sediment
- Resources

This distribution allows us to:

- Predict where to find
- Plan how to use
- Protect groundwater and surface water

Geologic Maps



Geologic maps show:

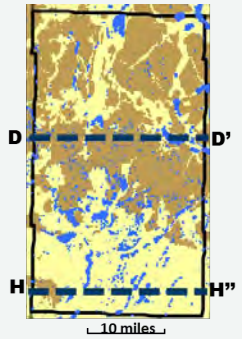
Roads

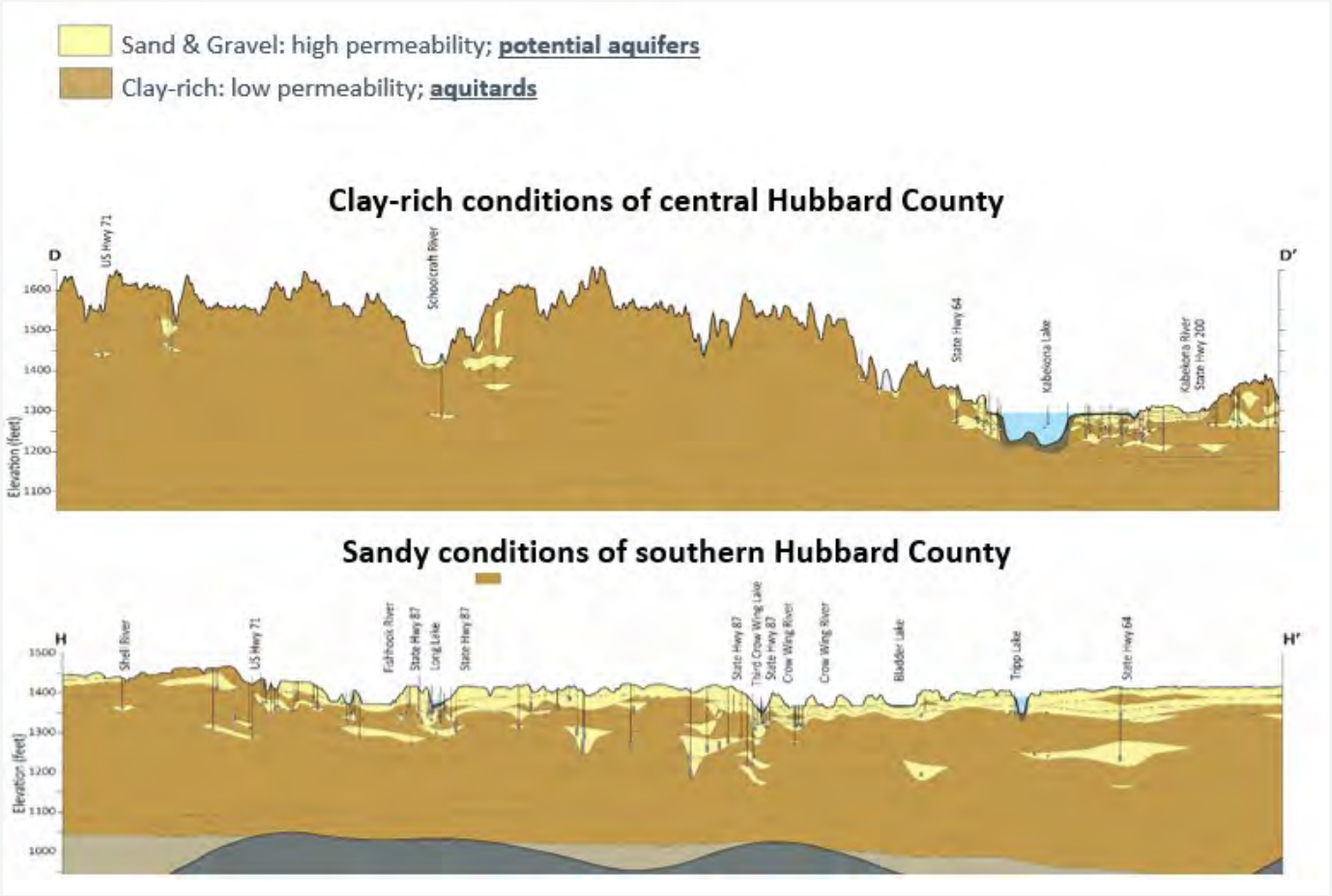
Lakes and rivers

Rocks or sediments

Geologic Mapping for Groundwater Atlases

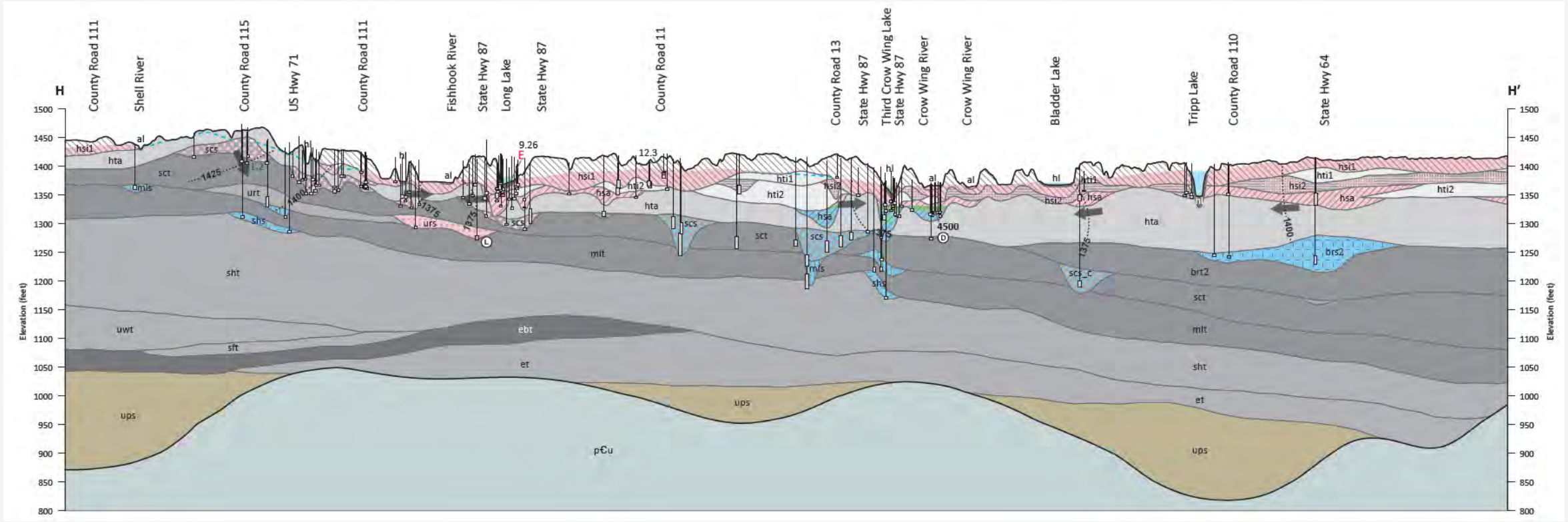
Cross sections: profiles of Hubbard County geology at depth





Hydrogeologic Cross-Sections: H-H′

The sandy surface of southern Hubbard County

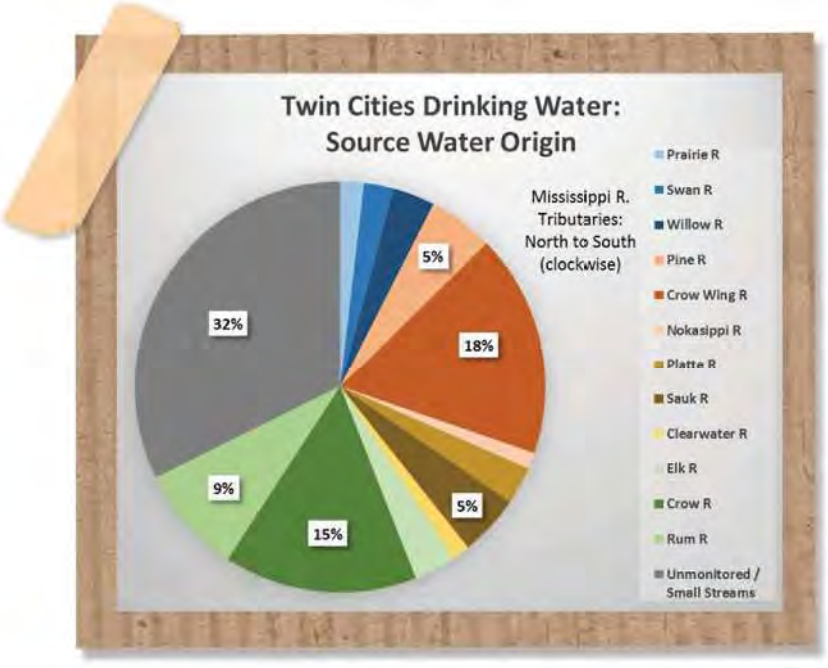


Thanks, and Question?

ALMOST NO WATER FLOWS IN TO MINNESOTA, IT ALL FLOWS OUT

Minnesotans are stewards of many waters. The map shows our state broken into counties, (the white lines) by major watershed, (the various blue sections) The upper Mississippi basin, (Highlighted in green) and by water flow (the orange, red,and yellow groups).

The Mississippi River begins its winding journey to the Gulf of Mexico as a mere 18-foot wide knee-deep river in Itasca State Park. From here the river flows north to Bemidji, where it turns east, and then south near Grand Rapids. It will flow a total of 694 miles before working its way out of Minnesota.



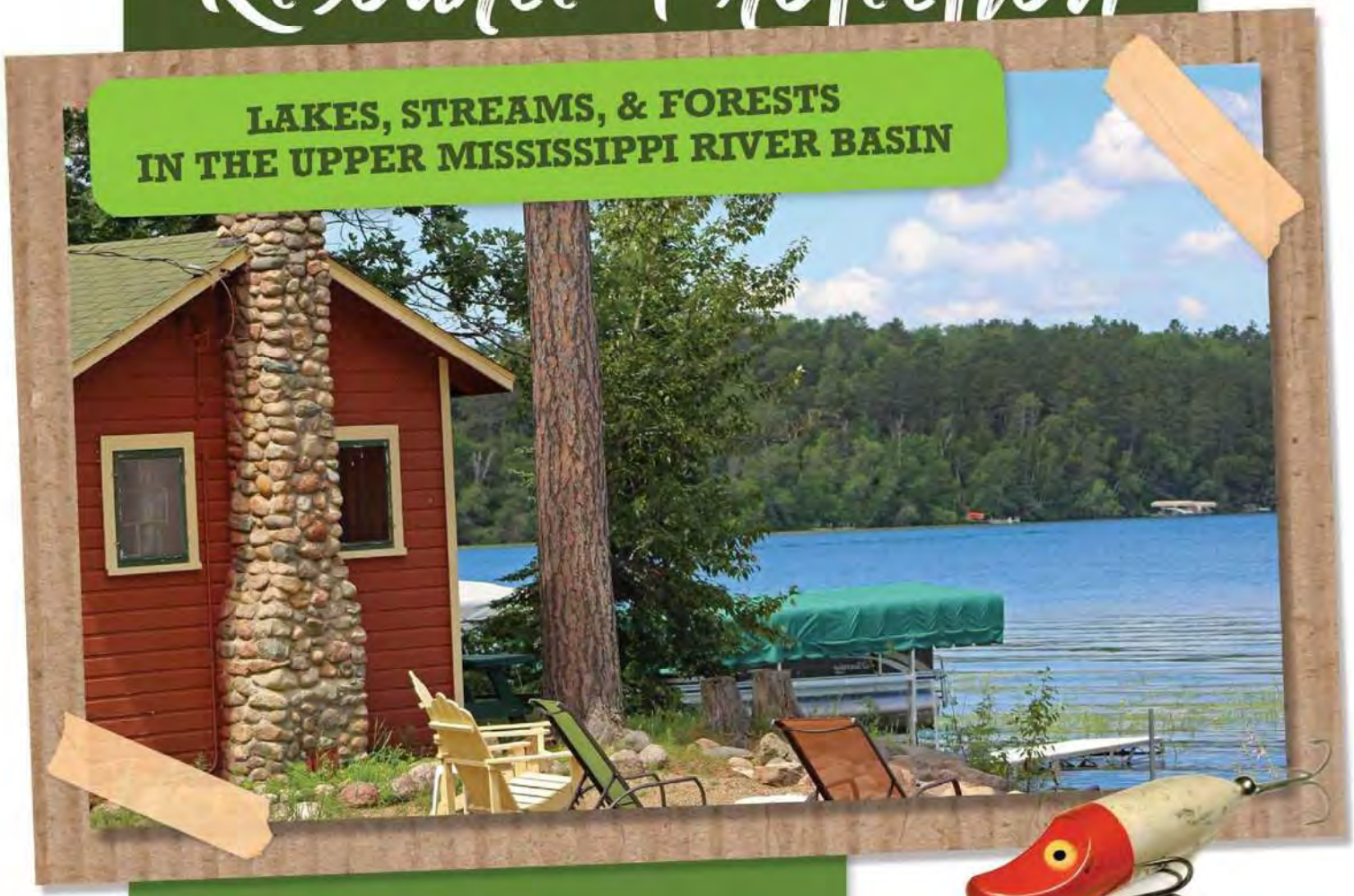
"Drink up!"
YOUR CLEAN WATER HAS BEEN PROVIDED BY THE UPPER MISSISSIPPI BASIN!

SOURCE-WATER

The upper Mississippi basin serves as Minnesota's largest source-water. It is the primary water source for the cities of St. Cloud, Minneapolis, and St. Paul.

Resource Protection

LAKES, STREAMS, & FORESTS IN THE UPPER MISSISSIPPI RIVER BASIN



Forested lands provide clean water because the excess stormwater is absorbed into the land like a ***giant sponge***. The more trees, shrubs, and native vegetation the land holds, the more stormwater runoff it can absorb. Excessive stormwater is harmful when it runs directly into lakes and rivers because it carries sediment, toxins, and overloaded amounts of nutrients like phosphorus, which can damage fish and wildlife habitat.

An ounce of prevention is worth a pound of cure and the cost for protection is much less than the cost of restoration.

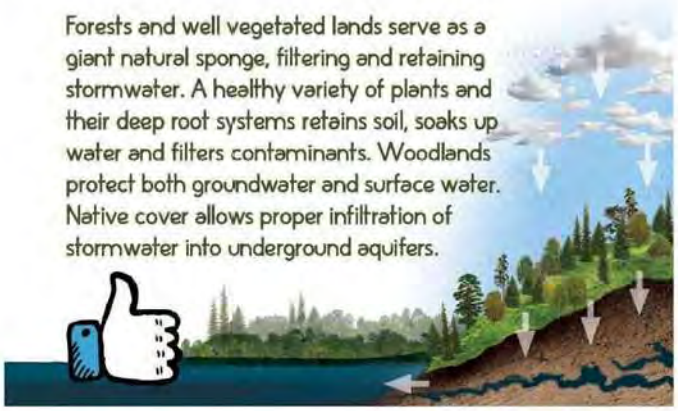
Lands can be used and protected at the same time. Protection does not mean lands cannot be lived on, used or even managed for timber.

> "Water, in all its uses and permutations, is by far the most valuable commodity that comes from the forest land that we manage, assist others to manage, and/or regulate."
>
> *- Policy Statement, National Association of State Foresters*

Protect forests, protect water

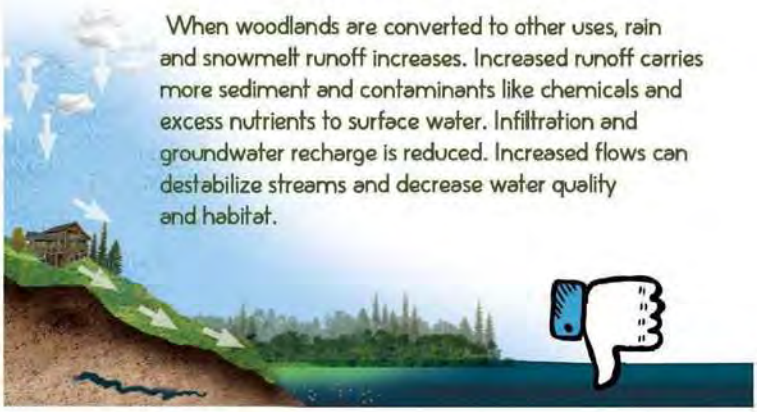
Forested Lands Retain Water

Forests and well vegetated lands serve as a giant natural sponge, filtering and retaining stormwater. A healthy variety of plants and their deep root systems retains soil, soaks up water and filters contaminants. Woodlands protect both groundwater and surface water. Native cover allows proper infiltration of stormwater into underground aquifers.



Developed Lands Shed Water

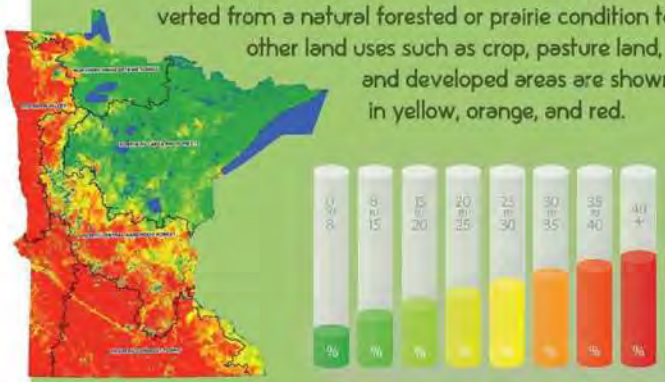
When woodlands are converted to other uses, rain and snowmelt runoff increases. Increased runoff carries more sediment and contaminants like chemicals and excess nutrients to surface water. Infiltration and groundwater recharge is reduced. Increased flows can destabilize streams and decrease water quality and habitat.



Land use, habitat, & water quality

Habitat and water quality are dependent on the percentage of use on the land or "Disturbance".

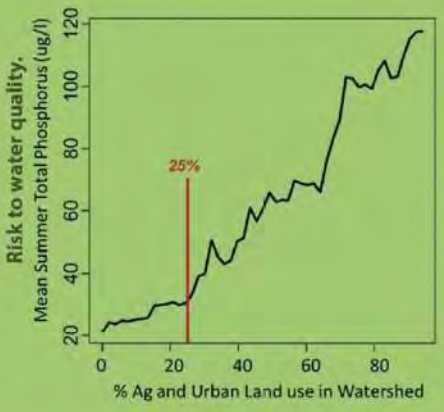
Statewide percentages of lands that have been converted from a natural forested or prairie condition to other land uses such as crop, pasture land, and developed areas are shown in yellow, orange, and red.



The magic number is 25%

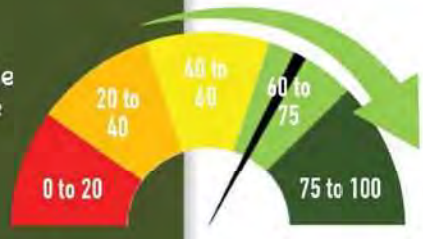
Watershed land cover was analyzed for over 1,200 fishing lakes in Minnesota. Increased runoff brings excess phosphorus to lakes, which cause harmful algae blooms.

The phosphorus concentration in lakes goes up dramatically when more than 25% of the watershed is disturbed.



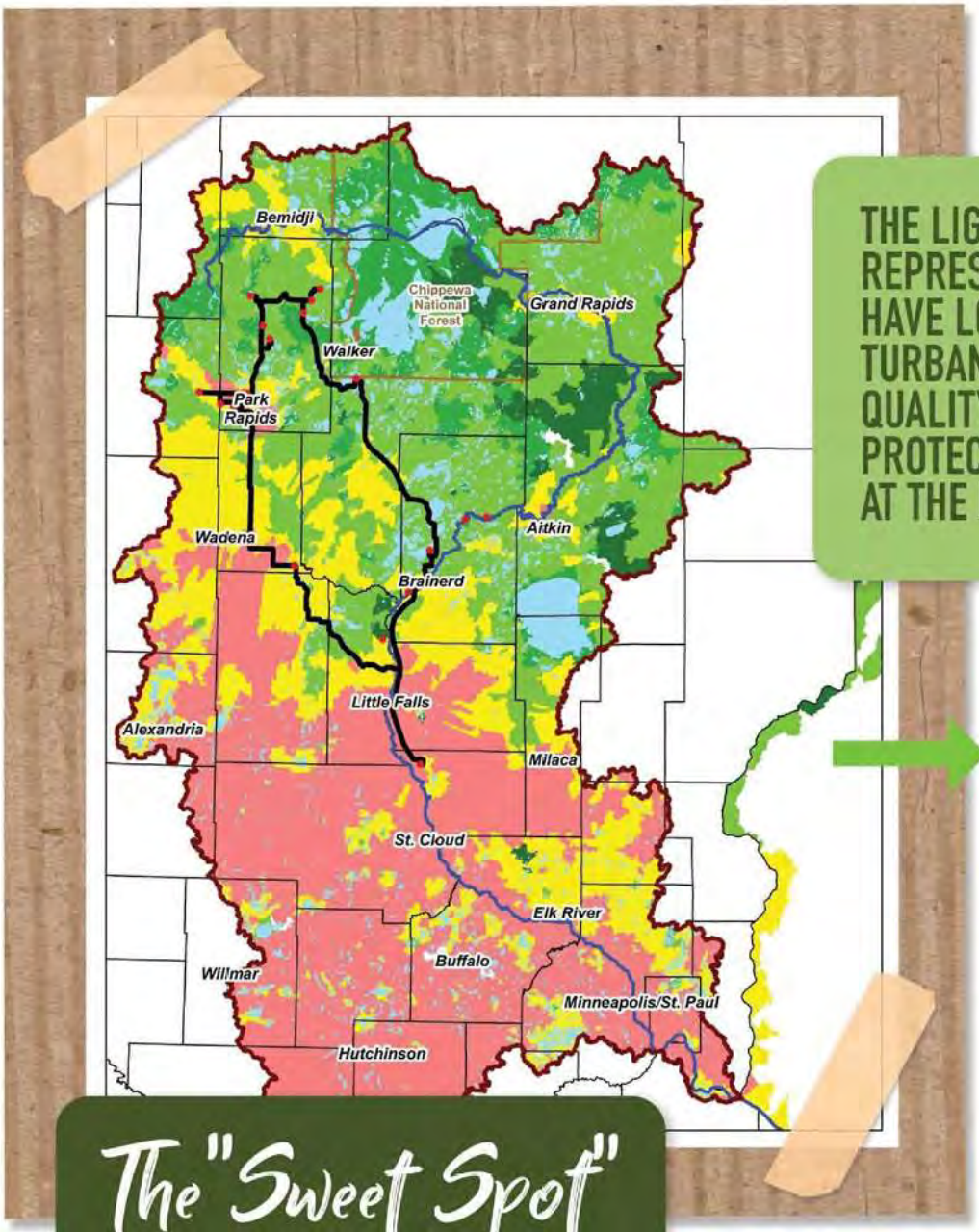
THE GOAL IS TO PROTECT 75%

The dial on the right shows the overall risk / health percentage of a lake or watershed. The goal is always to move the needle to higher levels of land protection for the sake of the lake or watershed.



Productive & protected!

Protection does not mean lands can not be lived on, used, or even managed for timber. Working woodlands can be both productive and protected.



The "Sweet Spot"

THE LIGHT GREEN AREA REPRESENTS LAKES THAT HAVE LOW LEVELS OF DISTURBANCE & GOOD WATER QUALITY , THUS WE CAN PROTECT THE MOST HABITAT AT THE LEAST EXPENSE.

- Little to no disturbance or land use conversion
- Low disturbance. The protection "Sweet Spot"!
- Intermediate disturbance. Declining water quality.
- Mostly disturbed lands. Poor water quality.

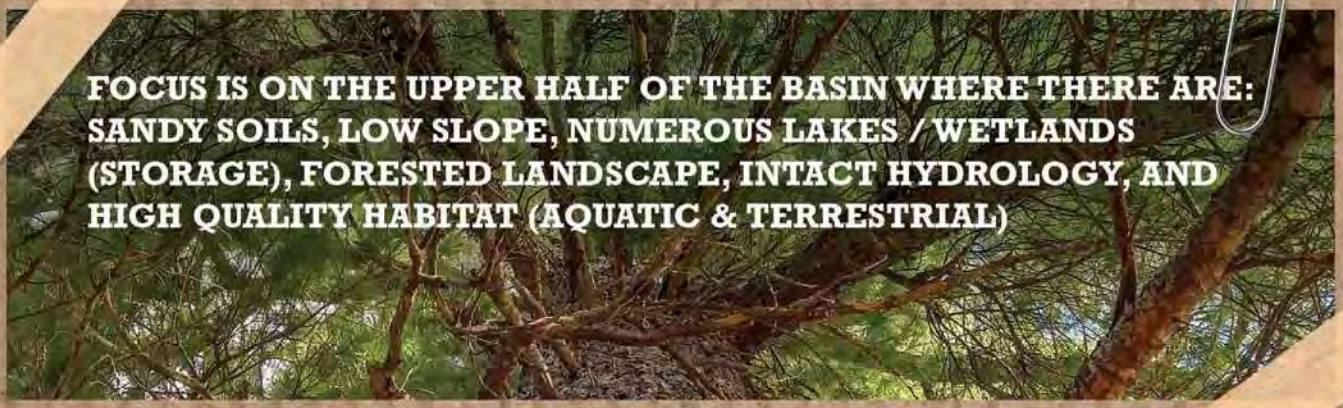
PROTECTION

The lands indicated by dark green have already met the protection goal. But the light green zones are great candidates for increased protection. The cost to protect these wooded tracts are 10 to 15 times less expensive than to restore disturbed lands!

RESTORATION

Land restoration, in regard to lake and stream habitat and water quality, is a difficult and costly endeavor. As mentioned above, it's far more cost effective to protect high-quality waters than to attempt to restore degraded watersheds.

Designed for Protection



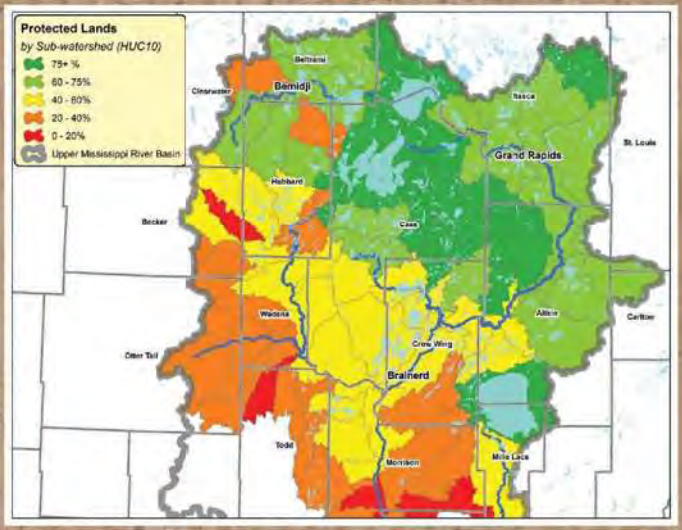
FOCUS IS ON THE UPPER HALF OF THE BASIN WHERE THERE ARE: SANDY SOILS, LOW SLOPE, NUMEROUS LAKES / WETLANDS (STORAGE), FORESTED LANDSCAPE, INTACT HYDROLOGY, AND HIGH QUALITY HABITAT (AQUATIC & TERRESTRIAL)

CHALLENGES:

- Oof the most complicated ownership patterns of private, county, state, and federal, & tribal land in the US.
- 4000+ lakes (how to prioritize)

WHERE TO START:

The light green portions shown on the map & in the chart are the "sweet spot" where we maximize ***return on investment.*** The most acres of the highest quality fish & wildlife habitat for the fewest dollars.



Major Watershed	Watershed Acres	Forest Lands (ac)	% Forested*	% Protected	Strategy
Leech Lake River	857,971	560,736	65.4%	79.1%	Vigilance
Mississippi River - Grand Rapids	1,332,798	979,498	73.5%	76.2%	Vigilance
Mississippi River - Headwaters	1,228,889	799,294	65.0%	72.5%	Sweet Spot!
Pine River	500,887	338,948	67.7%	65.6%	Sweet Spot!
Mississippi River - Brainerd	1,076,300	539,590	50.1%	52.1%	Further to go
Crow Wing River	1,268,959	667,797	52.6%	46.3%	Further to go
Rum River	1,013,794	322,607	31.8%	45.8%	Further to go
Long Prairie River	565,078	135,945	24.1%	33.5%	Limited
Redeye River	572,069	143,895	25.2%	31.2%	Limited
Mississippi River - Sartell	656,115	138,344	21.1%	26.4%	Limited
Mississippi River - St. Cloud	717,376	128,179	17.9%	25.6%	Limited
Sauk River	666,750	68,068	10.2%	21.6%	Limited
North Fork Crow River	644,320	87,281	13.5%	<20%	Limited
South Fork Crow River	944,854	33,848	3.6%	<20%	Limited
Mississippi River - Twin Cities	818,100	68,776	8.4%	<20%	Limited

* Includes woody wetlands

2008 - 2020
Setting the Stage for Success

- Alternative Shoreland Management Standards 2005
- Large Lake Reports BWSR 2008
- Watershed Protection for Fish Habitat DNR 2010
- Crow Wing County Water Plan 2013
- Watershed Restoration and Protection Strategies MPCA 2013
- Start of One Watershed One Plan, RAQ 2015/2016

CLEAN WATER LAND & LEGACY

Both the Clean Water Council and Lessard-Sams Outdoor Heritage Council were established by the Legacy Amendment passing in 2008.

The Clean Water Land & Legacy Amendment generates revenue for clean water & habitat related projects, which are reviewed and allocated by the Lessard-Sams Outdoor Heritage Council (LSOHC) and Clean Water Council.

CLEAN WATER LAND & LEGACY AMENDMENT

Habitat and Water Quality Protection: Successful Protection Efforts in the Upper Mississippi Basin

SUCCESSFUL LSOHC PROJECTS:

Camp Ripley Buffer Program (ACUB) $15 M (+ $50 M Federal)

Wild Rice (6+ Phases): $9 M

Mississippi Headwaters Board (6 Phases): $22 M

Pine-Leech Watershed Protection: $4 M

Forest Landscape Stewardship Pnal (DNR)

Funding $$: SFIA, 2C, DNR Forest Legacy Easements, Cost-Share

CLEAN WATER ACT 1971

- Impaired Waters/Restoration Focus
- No Protection Methods!

PROTECTION METHODOLOGIES:

- Large Lake Screening (2008)
- 75% Watershed Goal: DNR Fisheries
- Crow Wing County Water Plan (2013)
- "RAQ" Parcel Targeting (2016)

ONE WATERSHED ONE PLAN

Leech, Pine, Rum, Redeye, Miss. Headwaters, Sauk, Crow (North fork)

PRIORITY LAKES/WATERSHEDS

Larger, Unimpaired, High Quality <75% Protected (at risk)

TARGETED IMPLEMENTATION TO LANDOWNERS

Present the "Toolbox", Landowners Choose!

SUCCESSFUL CLEAN WATER COUNCIL PROJECTS:

Pine River: $3 M
Crow Wing River: $3 M
Rum River: $3 M

WRAPS (MPCA)
GRAPS (MDH)

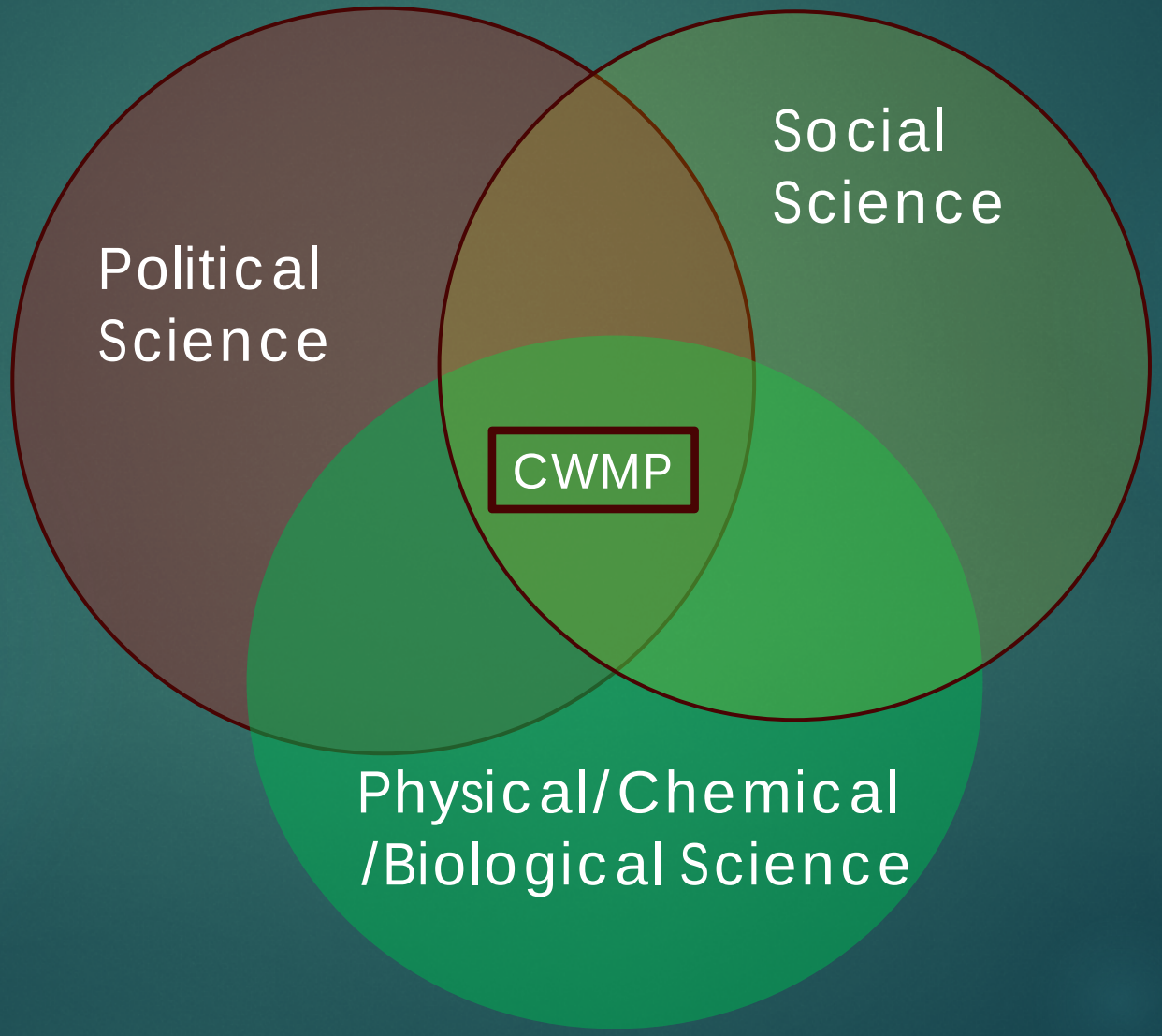
1W1P Watershed Based Funding, Increased SWCD Capacity $$

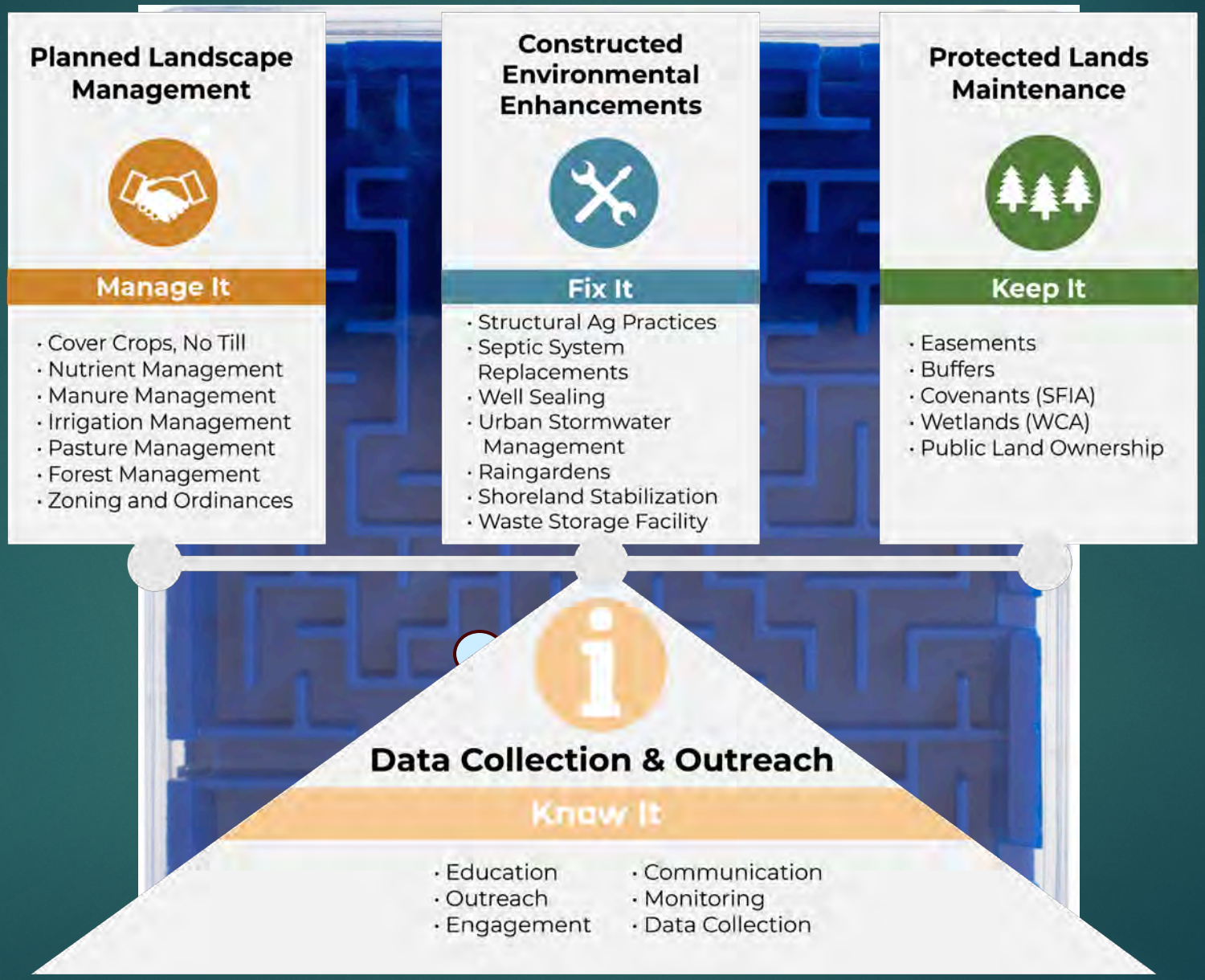
Local Perspectives on Watershed Management

- Dana Gutzmann-Cass County SWCD---Leech Lake River
- Marta Springer—Crow Wing SWCD—Crow Wing River
- Darren Newville—East Otter Tail SWCD- Crow Wing River
- Brent Rud—Beltrami County---Missississippi Headwaters

Jeff Hrubes- Board of Water and Soil Resources

Comprehensive Watershed Management Plans

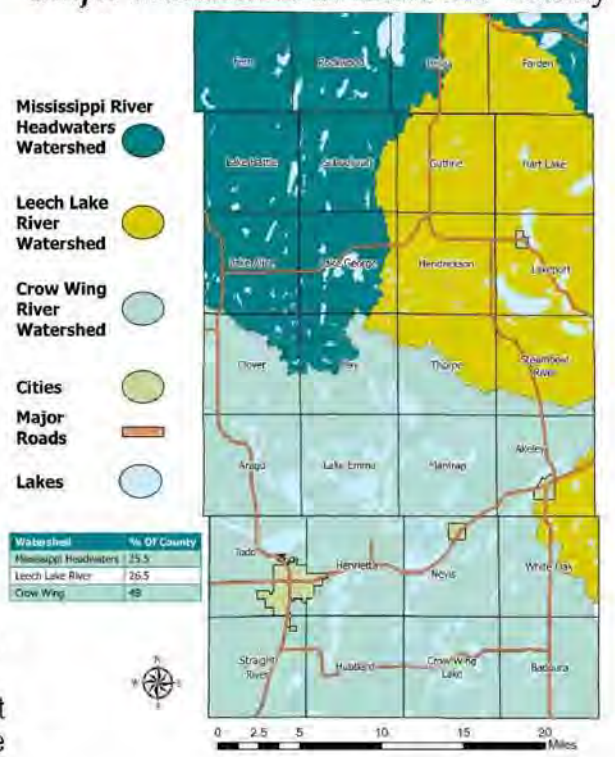



Planned Landscape Management
Manage It
· Cover Crops, No Till
· Nutrient Management
· Manure Management
· Irrigation Management
· Pasture Management
· Forest Management
· Zoning and Ordinances
Constructed Environmental Enhancements
Fix It
· Structural Ag Practices
· Septic System Replacements
· Well Sealing
· Urban Stormwater Management
· Raingardens
· Shoreland Stabilization
· Waste Storage Facility
Protected Lands Maintenance
Keep It
· Easements
· Buffers
· Covenants (SFIA)
· Wetlands (WCA)
· Public Land Ownership
Data Collection & Outreach
Know It
· Education
· Outreach
· Engagement
· Communication
· Monitoring
· Data Collection

One Watershed One Plans have become an important way for SWCDs to access Clean Water Funds. Once plans are completed for each major watershed, the Board of Soil and Water Resources distributes these funds to SWCDs to implement the required conservation actions outlined in the plans. **The funds also provide a significant way to leverage other funding sources.**

For example, Hubbard SWCD recently obtained a substantial Section 319 grant from the US Environmental Protection Agency that will allow us to greatly expand our conservation efforts in the Steamboat River Watershed. Another significant grant from LCCMR will fund lake conservation work on a number of high priority lakes. These external funding sources allow us to multiply Clean Water Funds and greatly expand our capacity to do conservation work in the county.

Major Watersheds in Hubbard County



Leech Lake River Watershed Highlights

- **Steamboat River Watershed EPA Section 19 Grant.** Hubbard County SWCD received a substantial Section 319 grant from the US EPA that will allow us to leverage state Clean Water Funds for conservation work in the Steamboat River watershed.
- **Necktie River Restoration.** Minnesota DNR has identified a large stretch of the Necktie River that was ditched over 100 years ago as a significant source of sediments to the stream. We are working with our state partners to fund a project to restore the original meanders of the stream and remove ditch spoils from the old channel.
- **Forest Conservation Easements.** Outdoor Heritage Funds have allowed Hubbard SWCD to acquire conservation easements for important forested parcels from willing landowners. These forested parcels will remain forested and provide water quality benefits to the watershed, while still allowing landowners to manage and harvest timber.
- **Potlatch Parcel Acquisition**. Hubbard SWCD has worked with the Minnesota DNR, Hubbard County Lands Department, Northern Waters Land Trust, and The Conservation Fund in the acquisition of remaining Potlatch parcels in the watershed and add them to the county and state public lands portfolio.

Mississippi River Headwaters Watershed Highlights

- **Forest Conservation Easements.** Outdoor Heritage Funds have allowed the Mississippi Headwaters Board (MHB) to acquire conservation easements for important forested parcels from willing landowners along the Mississippi River Corridor. Hubbard SWCD has provided local information on high priority parcels to MHB.
- **Forest Stewardship.** Clean Water Funds have been useful for funding significant forest stewardship planning with private landowners in the watershed. Professional foresters work with these landowners to provide advice on how to best manage their forests and inform them about significant conservation programs such as property tax incentives and conservation easements.

Crow Wing River Watershed Highlights

- **Groundwater is a critically important issue in this watershed. Intensive irrigated agriculture pumps large volumes of water from the Pineland Sands Aquifer and nitrate leaching is a major concern in the glacial outwash sands. A significant amount of forest lands has recently been converted to irrigated agriculture in Hubbard and surrounding counties.**
- **Drinking Water Protection. Testing by the Hubbard SWCD continues to find private wells contaminated with nitrate. Critically important agricultural BMPs will need to be implemented on a large scale to reduce the leaching of nitrate in irrigated fields.**
- **Lakeshore buffers will also need to be an important focus because of the high density of cabin and lake homeowners in the many lakes of the watershed such as Fish Hook, Potato, Big Sand, and Long.**
- **Improve Stream Connectivity.** Work with county and state road departments to improve culvert design during road projects to improve passage of fish and other aquatic organisms.

One Water One Plan Leech Lake River Watershed Fact Sheet

March 1, 2018

The Leech Lake River Watershed is in the heart of Minnesota's premier lake country and contains many pristine natural resources. Here are some highlights of this watershed:

- **1,335 square miles in the northern part of the Upper Mississippi River Basin**
- **277 river miles and over 750 lakes**
- **The forests, lakes, streams, and wetlands support an abundant amount of fish and wildlife habitat**
- **It provides a substantial amount of clean drinking water for communities downstream along Mississippi River including St. Cloud, Minneapolis, and St. Paul.**

What is the Leech Lake River One Watershed One Plan (LLR1W1P)?

An implementation plan that aligns with local water planning on major watershed boundaries with strategies that work toward prioritized, targeted, and measurable goals. The implementation plan prioritizes cost effective activities that address the largest threats in the watershed and provide multiple benefits for the environment.

The vision statement of the LLR1W1P is:

"Woods, water, wildlife, and people; a healthy watershed that supports a vibrant economy."

What will the plan focus on?

Determining the best ways to protect our surface and groundwater resources now and in the future.

It will address the following and their impacts on water quality:

- **Lakes**
- **Wetlands**
- **Ground water**
- **Cities & Townships**
- **Streams**
- **Drinking water**
- **Forests**
- **Cropland & working lands**

In partnership with local agencies, communities, cities, townships, and lake associations we will identify threats and outline strategies to protect sensitive areas and manage forests for long term health.

Four Values were identified in this watershed, based on local input from the communities, lake associations, and other agencies. These Values are: Natural World, Climate and Risk, Quality of Life, and Leadership.

Concerns in the Leech Lake River Watershed.

Where are we in the process of the 1W1P?

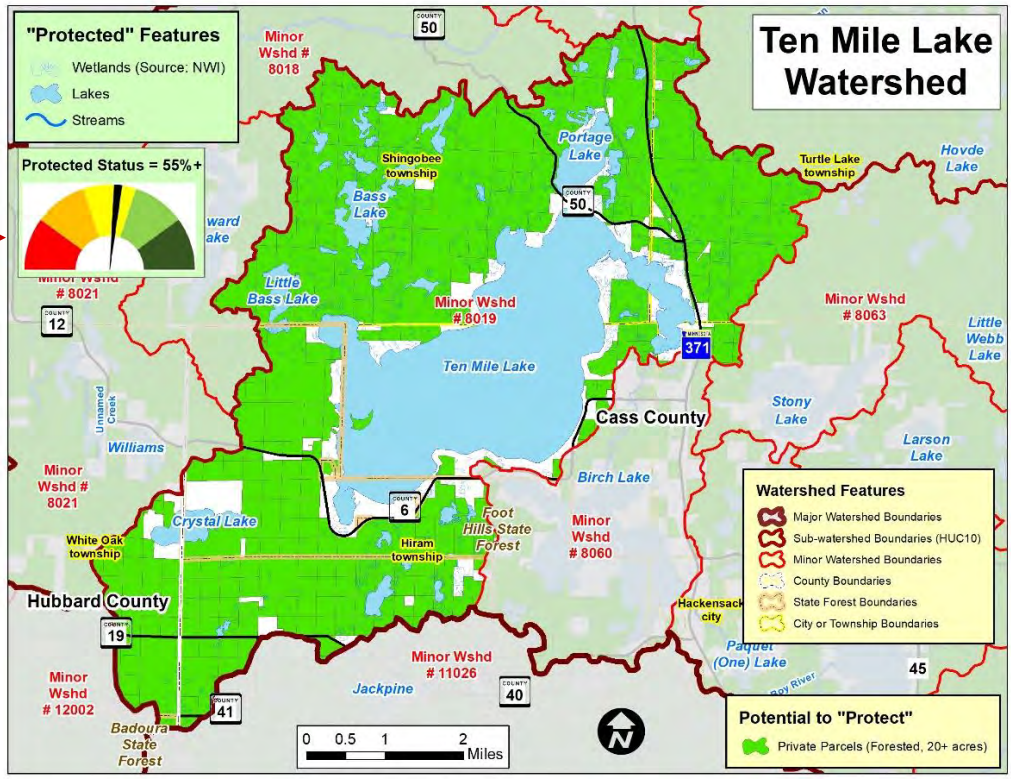
- **Gathered local input on Values**
- **Identified and prioritized Values**
- **Assessing the ability of each partnering organization to implement identified strategies and goals**
- **Conducting outreach to townships, cities, lake associations, & citizens/residents**

For this process to be effective we need everyone to work together as a team. Additional opportunities to provide input will be available throughout the process. If you would like to be more involved, have any questions, or want to share your concerns please contact:

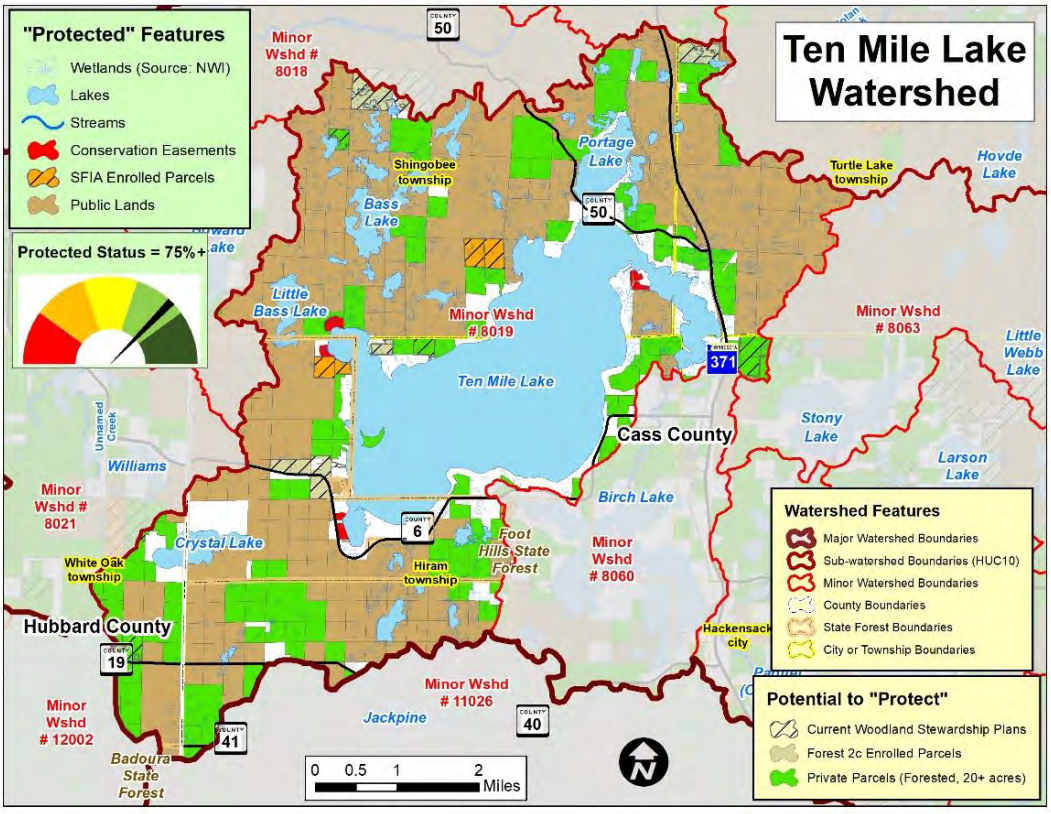
Kelly Condiff: Cass County Environmental Services, 218-547-7246, kelly.condiff@co.cass.mn.us
Julie Kingsley: Hubbard County SWCD, 218-732-0121, Julie.kingsley@mn.nacdnet.net
Lindsey Ketchel: Leech Lake Area Watershed Foundation, 218-547-4510, lindsey@leechlakewatershed.org

Although these map examples below are minor watersheds, the purpose is to show you that when people work together we can make a difference.

Protection Status of Ten Mile Lake Watershed 20 years ago.



Protection Status of Ten Mile Lake Watershed Today



Imagine the possibilities that could happen if we worked together to protect all the Leech Lake River Watershed!

Project Partners

Crow Wing County Minnesota

Cass County Minnesota — Still More To Explore!

Todd County Minnesota

Becker County, MN

Todd County SWCD

Crow Wing Soil & Water Conservation District

Cass SWCD — Cass Soil & Water Conservation District

Hubbard County Soil & Water Conservation District

Wadena County

Becker Soil & Water Conservation District

Wadena Soil & Water Conservation District

Hubbard County Est. 1883 Minnesota

For questions or cost share to implement practices, please contact your local partners:

- Becker SWCD: 218-846-7360
- Cass SWCD: 218-547-7399
- Crow Wing SWCD: 218-828-6197
- Hubbard SWCD: 218-732-0121
- Todd SWCD: 320-732-2644
- Wadena SWCD: 218-632-4201

View the plan online!
Scan this QR code to visit the plan's website

Funded by

Clean Water Land & Legacy Amendment

Crow Wing River Watershed

Vision Statement

The Crow Wing Watershed was a historic transportation route and provided the necessities of life for generations. Today, we blend agriculture, forestry, tourism, and the lake community to protect our story and preserve resources for future generations.

Watershed Highlights

- The Crow Wing River Watershed is a patchwork of high-quality lakes and rivers, forests, wetlands, and agricultural land.
- It covers 2,000 square miles within Becker, Cass, Crow Wing, Hubbard, Todd, and Wadena counties. The main towns include Menahga, Park Rapids, Pequot Lakes, Lake Shore, Nisswa, and Staples.
- It contains over 400 lakes and 1,600 miles of streams, including Gull Lake and the Park Rapids area lakes.
- The White Earth Reservation is within the watershed, on the northeast corner.

Plan Highlights

- Implementation of this plan is voluntary, and outreach, cost share, and incentive programs will be used to assist with voluntary implementation on private lands (see map below).
- A Landscape Stewardship Plan was developed in parallel with this watershed plan that helped prioritize forest protection and management for water quality and habitat improvement.
- The Planning partners set 8 goals during the planning process. The goals and their outcomes are highlighted below. Funding from the Clean Water Land and Legacy Amendment will be provided for plan implementation.

10-Year Plan Goals

Agricultural Land Management

Goal: **27,100 acres** of agricultural Best Management Practices (BMPs).

Outcome: Improved surface water quality and soil health.

Drinking Water Protection

Goal: **13,400 acres** of groundwater protection agricultural BMPs, and seal 150 wells.

Outcome: Improved groundwater quality and soil health.

Land Protection

Goal: Permanently protect **23,800 acres** (i.e. Sustainable Forest Incentive Act, easements, and acquisitions).

Outcome: Protected water quality and habitat.

Forest & Plant Health

Goal: **95,000 acres** of forestry management and **500 forest management plans**.

Outcome: healthy forests that protect water quality and are resilient to climate variability & invasive species.

Shoreland Management

Goal: **two miles** of lakeshore/ riparian enhancement.

Outcome: Improved water quality and shoreland habitat.

Nutrient Reduction

Goal: **Reduce phosphorus** in lakes and protect them from degradation. For individual lake goals, see the plan.

Outcome: Improved and protected water quality.

Connectivity Enhancement

Goal: Replace **10 barriers** to fish passage (dams, road crossings, culverts).

Outcome: Improved water quality and fish habitat.

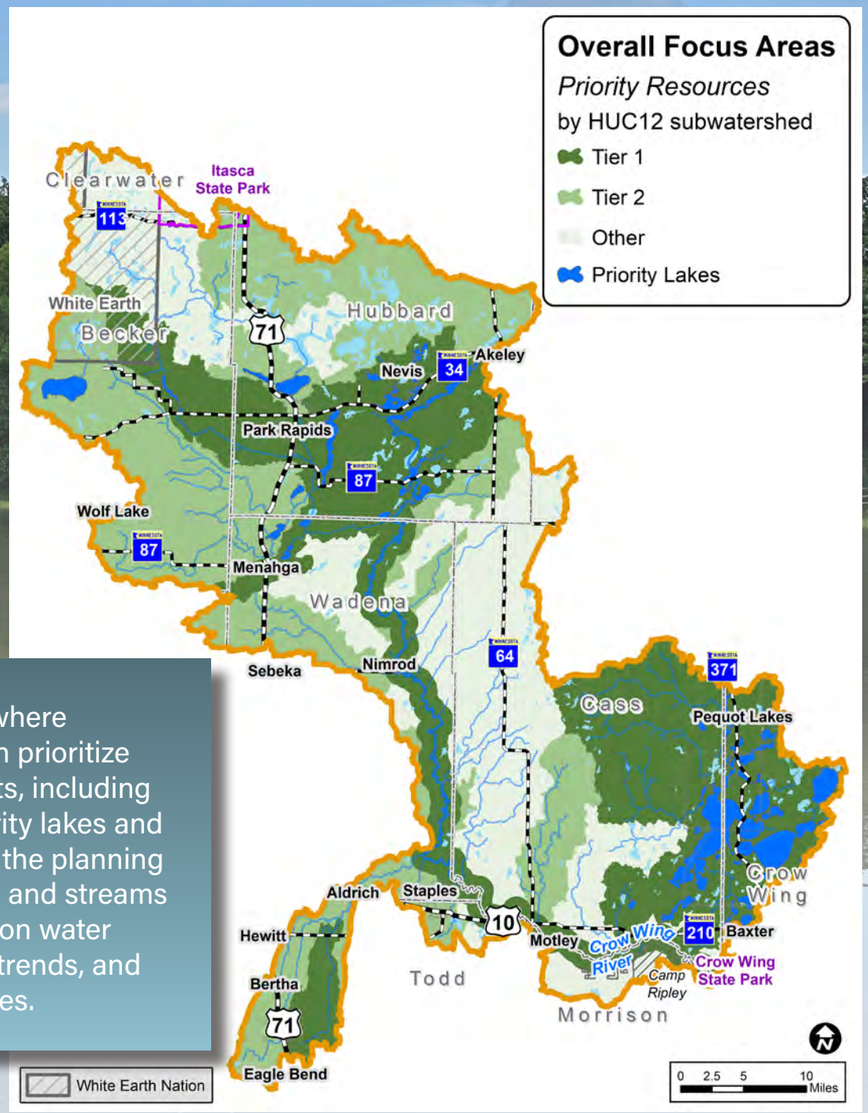
Resiliency

Goal: **Build resiliency** into all projects implemented where possible (cover crops, stormwater management, forest protection).

Outcome: Improved water quality and resilience to climate variability.

Where to Focus Work

This map highlights where planning partners can prioritize implementation efforts, including private land and priority lakes and streams identified by the planning partners. These lakes and streams were selected based on water quality impairments, trends, and development pressures.



The Mississippi River Headwaters Watershed Comprehensive Plan is intended to be used by the Mississippi River Headwaters Watershed community, including local government units, non-profits, citizen groups, County Commissioners, and Soil and Water Conservation District supervisors for comprehensive, voluntary resource conservation implementation. It is not a complete repository of information, and further information can be found in cited documents or on the Plan website, www.headwatershed.org.

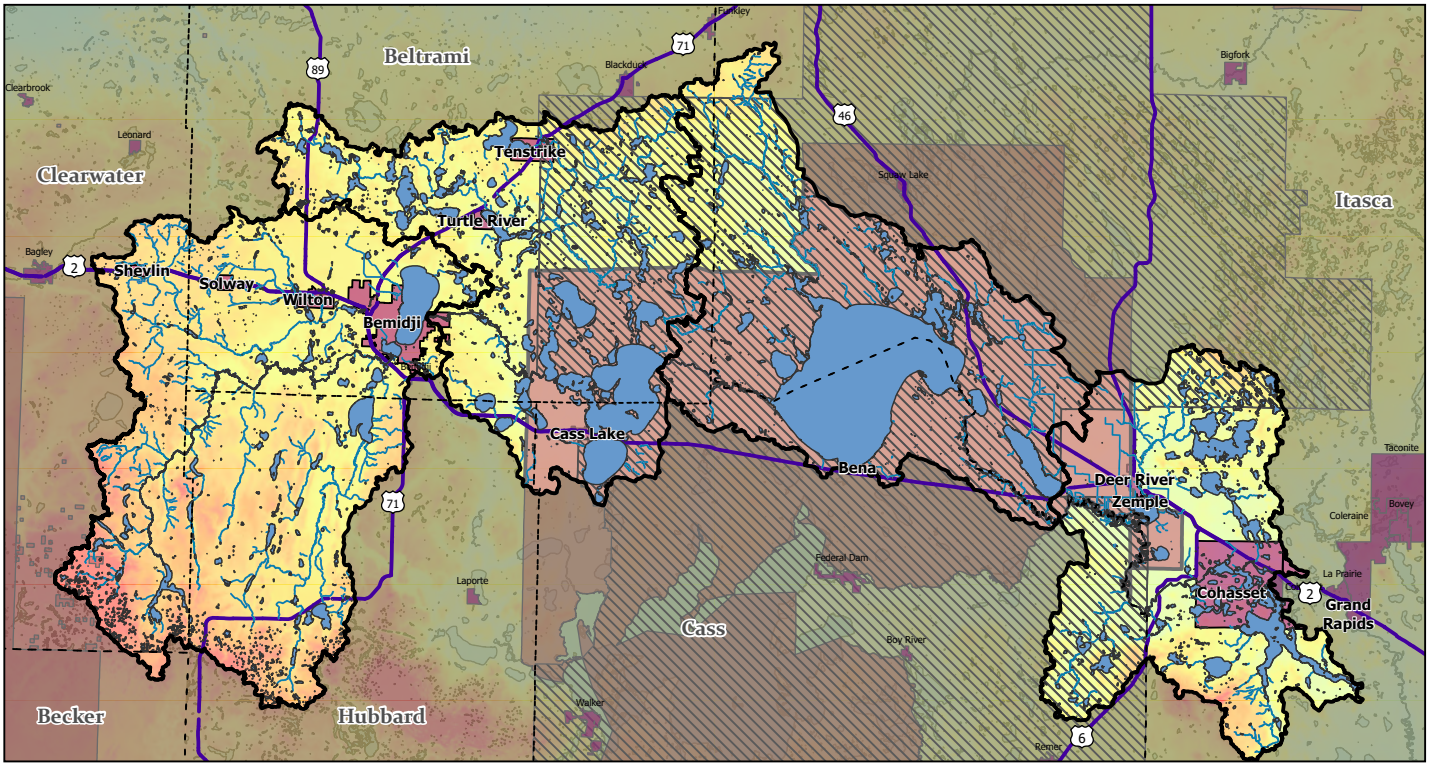
Executive Summary

This Plan was developed in accordance with the One Watershed, One Plan (1W1P) program guided by the Minnesota Board of Water and Soil Resources (BWSR). There are ten local governments that entered into a Memorandum of Agreement (MOA) to develop this Plan, which included officials and staff from Soil and Water Conservation Districts and counties including Beltrami, Cass, Clearwater, Hubbard, and Itasca. Each local government has a representative appointed to the Policy Committee, which is the decision-making authority for the planning and implementation effort. Additional representatives and citizens made up the Advisory Committee, including local non-profit organizations, lake associations, cities, townships, state agencies, the Leech Lake Band of Ojibwe, the United States Forest Service, and the Natural Resource Conservation Service. These partners all played critical roles in developing the Plan framework, prioritization, outcomes, and overall review.

When developing our Plan vision, all of the partners recognized that protecting and improving water resources depends on people, communities, and society putting science, technology, and engineering into practice. Early on in the planning process, the Policy and Advisory Committees had joint meetings to develop the vision, determine our values, and give voice to this planning document, as depicted in Figure E.1.

Figure E.1 Planning framework.

Map E.1 Mississippi River Headwaters Watershed.



The Mississippi River Headwaters Watershed (Watershed) has numerous surface water resources, which include 685 river miles and 180,375 lake acres. The abundance of water resources includes some of Minnesota's largest lakes, including Cass Lake and Lake Winnibigoshish. The Watershed is a popular tourist destination, offering exceptional fishing, hunting, camping, and other recreational opportunities. It is perhaps best known as the birthplace of the mighty Mississippi River, which flows 2,552 miles through ten states before emptying into the Gulf of Mexico.

The Watershed encompasses 1,228,810 acres, of which 53% are publicly owned. Most of these public lands are located in the central part of the Watershed in the Chippewa National Forest. Forests make up 42% (512,638 acres) of the land cover and lakes and wetlands make up 46% (564,312 acres). Because over 80% of the Watershed is forested or covered by water, it has maintained a level of biological integrity, with only two of the 122 lakes assessed failing to meet state water quality standards. The abundance and quality of forests, lakes, and wetlands are critical components of the local economy, which is driven by the forest industry and tourism. However, the Watershed is not without its threats, mainly due to increasing disturbed land cover as a result of agriculture and impervious area expansion. Within the Watershed, agriculture accounts for 10% of land use, while impervious areas make up 3%. There are increasing development trends around area lakes as well as around the cities of Grand Rapids and Bemidji. Additionally, 31,061 acres of forests, mostly in the western portion of the Watershed, have been converted to another land cover type since 2001.

The issues of concern for the Watershed were identified and prioritized with input from the general public, Advisory Committee, Policy Committee, and review of existing local plans and reports. A comprehensive list of key information and actions was grouped into nine separate issues of concern identified in the planning process:

- Lake Stewardship - Increased land use pressures adjacent to lakes and subsequent drainage areas to lakes have altered the habitat in the near-shore area and can have substantial negative impacts on water quality.
- Forest Stewardship - High-quality water resources found and enjoyed throughout the Watershed are the result of a largely intact, diverse forest landscape. Land use changes can lead to forest fragmentation and potential negative water quality impacts.
- Agriculture Stewardship - Depending on how agricultural lands are managed, they could potentially be major sources of sediment, nutrients, and chemicals for surface and groundwater.
- Urban Stewardship - Unmanaged or poorly managed land development can have adverse impacts on groundwater recharge and the quality and quantity of stormwater runoff.
- Environmentally Sensitive Lands - Terrestrial and aquatic habitats that are biologically diverse and sensitive can be threatened by future potential changes in land disturbances and/or development.
- Subsurface Sewage Treatment System Management - Poorly functioning or failing waste management systems are threats to human health and the environment through increased pathogens, nutrients, and chemicals that leach into surface and groundwater resources.
- Water Course Stewardship - Human activity has disrupted and disconnected some stream segments, affecting habitat, water quality, and species movement.
- Drinking Water Stewardship - Residents within the Watershed use groundwater as their primary drinking water resource. There is an elevated vulnerability of drinking water becoming contaminated from both natural and human causes due to the composition of soils and surficial aquifers.
- Invasive Species Management - New species introductions or unimpeded infestations have a negative impact on the local economy, natural environment, and recreational benefits.

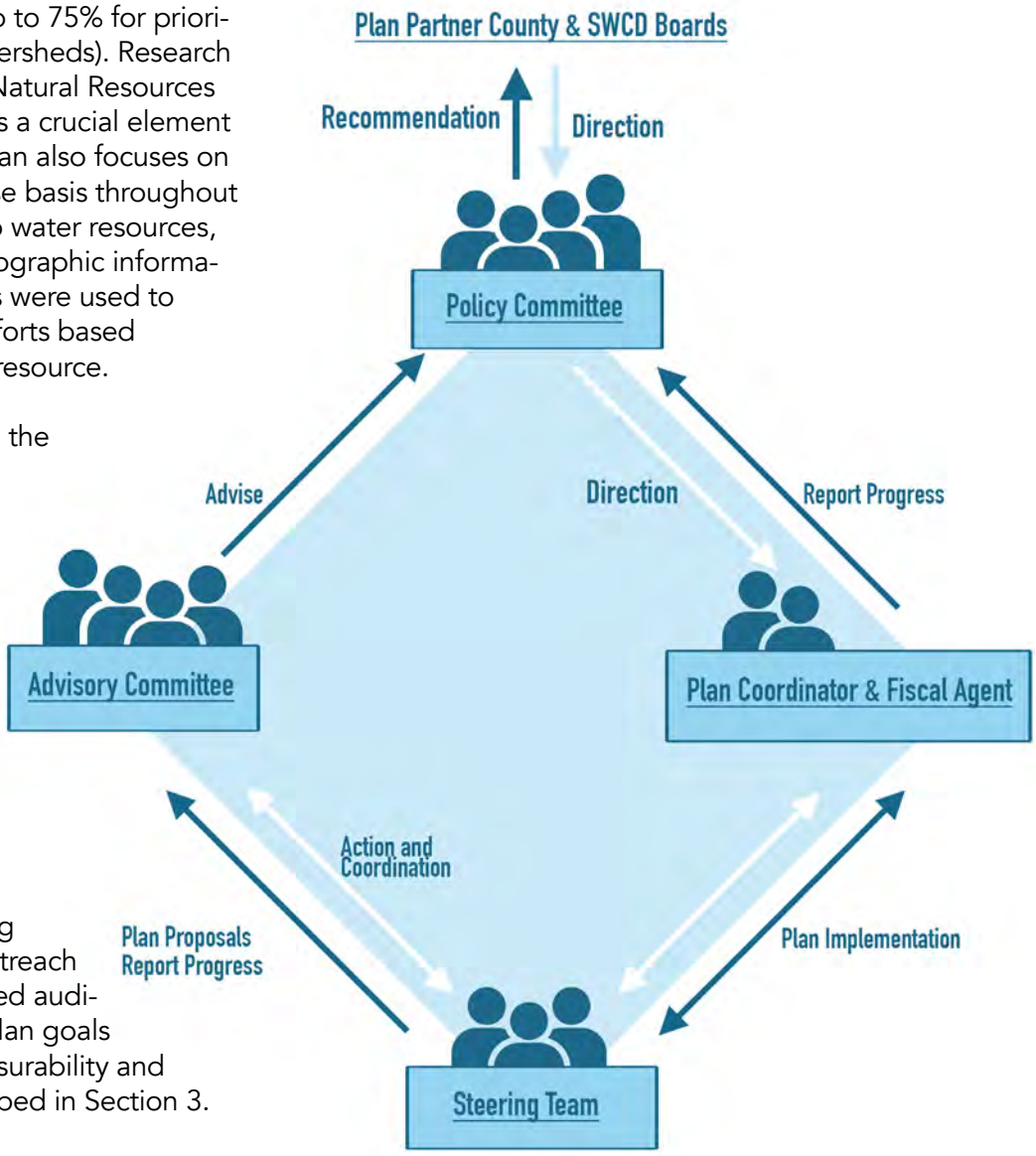
The planning process included two community engagement events: one in Bemidji and the other in Grand Rapids. Current Watershed information was presented at these events, but their main focus was to solicit public input early in the process. At each event large maps with various resources were laid out so participants could find where they lived and talk about the issues and opportunities for that area. In addition, we conducted a public survey at each event as well as online, allowing for input from people who could not attend either of the events. Based on the responses from the public and Advisory Committee, issues of concern for the Watershed were identified and prioritized as shown in Figure E.2.

Figure E.2 Issue priority categorization.

To prevent the decline of high-quality natural resources, a major component of the Plan will be maintaining current forest cover up to 75% for prioritized lake drainage areas (lake watersheds). Research by the Minnesota Department of Natural Resources (DNR) has identified forest cover as a crucial element in protecting water quality. This Plan also focuses on issues developed on a case-by-case basis throughout the Watershed based on impact to water resources, termed resource stewardship. Geographic information and multi-criteria data analysis were used to identify priority implementation efforts based on risk and value attributes of the resource.

The measurable goals identified in the Plan focus on protecting forests, habitat, wild rice waterbodies, and the Mississippi River while restoring riparian areas and reducing stormwater in priority lake watersheds. The implementation actions are a range of conservation tools including planning, best management practices, and protection programs like easements and tax incentive programs. Other actions and programs include acquiring monitoring and study data and conducting outreach and education programs to targeted audiences. Table E.1 is a summary of Plan goals and implementation actions. Measurability and action outcomes are further described in Section 3.

Figure E.3 Mississippi River Headwaters Watershed Comprehensive Plan governance structure.



All of the Plan elements will be executed based on a Joint Powers Collaboration (JPC) that emphasizes the shared responsibility for all aspects of the Plan. Local partners intend to work cooperatively to implement Plan actions and coordinate through a structure illustrated by Figure E.3, with participating local government unit (LGU) representatives providing direction for shared implementation. The pace of progress when implementing Plan activities depends on the availability of funds. Staff representatives from each of the JPC members will coordinate the implementation of Plan activities and collaborate to obtain the grants and funding necessary to implement the Plan. The JPC members will meet regularly to ensure progress is being made toward achieving the goals of the Plan. An annual meeting between the Advisory Committee and members of the public will be held so JPC members and staff can provide updates on plan progress and obtain input and recommendations regarding governance, implementation, and funding concerns.

Table E.1 Summary of Plan implementation actions and how they relate to goals in the Watershed.

Primary Issues

Summary of Goals	Examples of Implementation
Lake Stewardship: Restore lakeshore habitat and reduce phosphorus loading.	• Rain gardens, rain barrels, and drainage management • Install riparian buffers • Install bio-engineering practices along the shoreline
Forest Stewardship: Increase forest best management practices and number of protected acres, retain contiguous blocks of forestlands, and minimize forest fragmentation.	• SWCD tree program • Forest stewardship planning • SFIA, 2c, and conservation easements
Agriculture Stewardship: Improve soil health through best land management practices on cultivated and pasture lands.	• Soil testing • Sustainable grazing management • Agricultural Water Quality Certification Program • Cover crops, reduced tillage, and nutrient management
Urban Stewardship: Increase understanding of stormwater delivery to priority resources and enhance management of stormwater runoff and chlorides.	• Curb cut rain gardens, tree boxes, and native planting areas • Review of current infrastructure • Upgrades to road salt management and equipment

Secondary Issues

Summary of Goals	Examples of Implementation
Environmentally Sensitive Lands: Improve protection of prioritized habitat.	• Riparian vegetation best management practices • Wild rice easements • Native pollinator plantings
Subsurface Sewage Treatment System Management: Reduce private wastewater impacts to local drinking water and priority surface waters.	• Local voluntary inventories • Voluntary assessments • Zero-interest loan program
Water Course Stewardship: Improve aquatic habitat connectivity and enhance local road and access management.	• Dam replacement • Road salt management • Culvert inventory and replacement • Installation of long-term monitoring gauges

Tertiary Issues

Summary of Goals	Examples of Implementation
Drinking Water Stewardship: Protect drinking water resources through proactive testing, education, and information.	• Well sealing • Well testing • Flooded well test kits
Invasive Species Management: Enhance coordination of local aquatic and terrestrial invasive species programs.	• Creation of a cooperative weed management area • Pest management BMPs


Straight River Near Park Rapids
Jim Stark

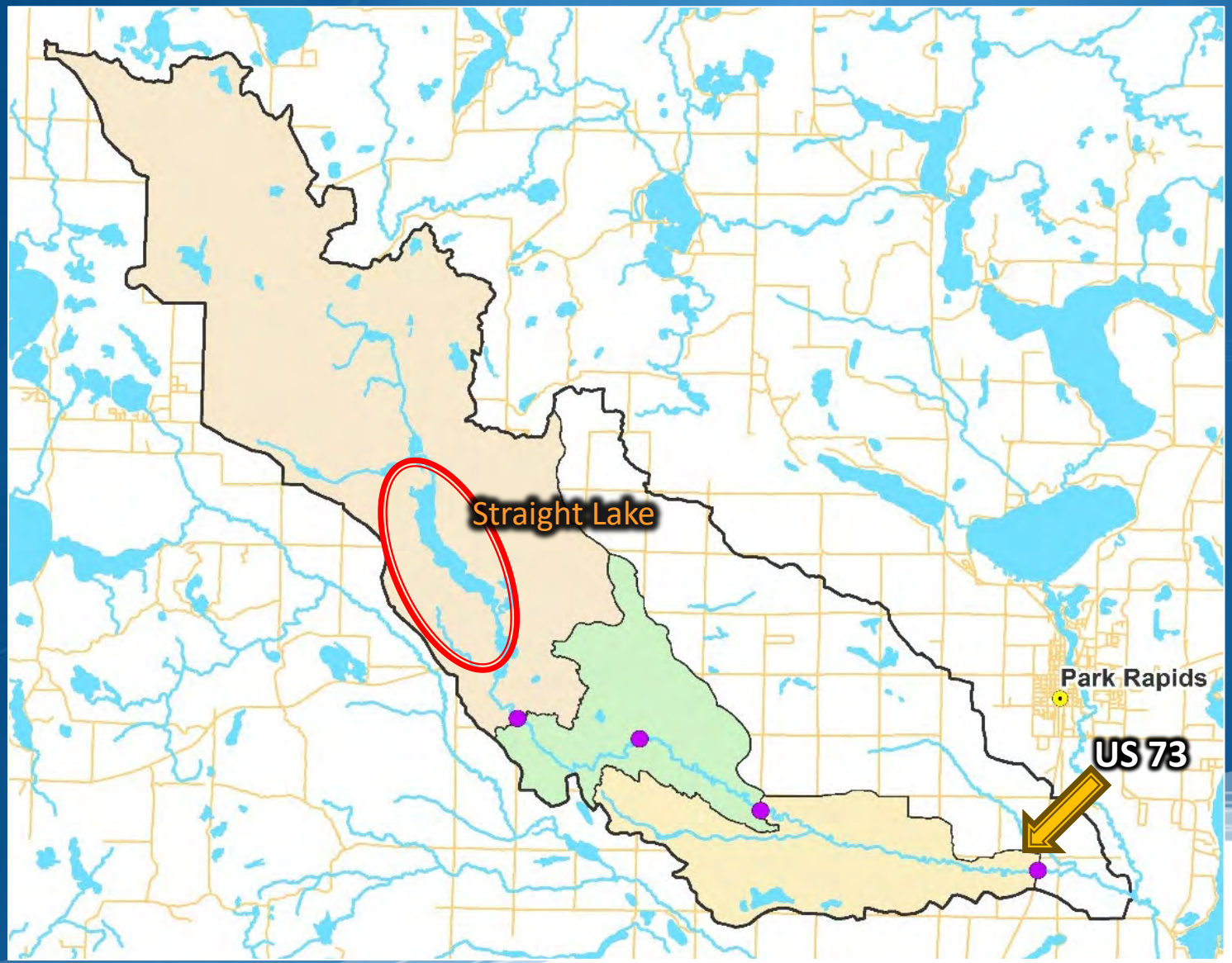
The River

- River is unique in many ways
- Sandy soils limit runoff
- Base flow dominates streamflow
- The river is cooled by groundwater flow
- Historically a great trout

Agriculture in the Park Rapids Prairie

- Historically, dry land farming– dairy, hay and wheat-Park Rapids Prairie
- In the 1970s, USGS study suggested sufficient water for irrigation (Pinelands Sands Study)
- Drought in the mid-1970s
- 1960/70 : Irrigation technology allowed conversion of prairie to irrigated agriculture
- Corn, potatoes and beans
- Offutt corporation

Straight River Watershed



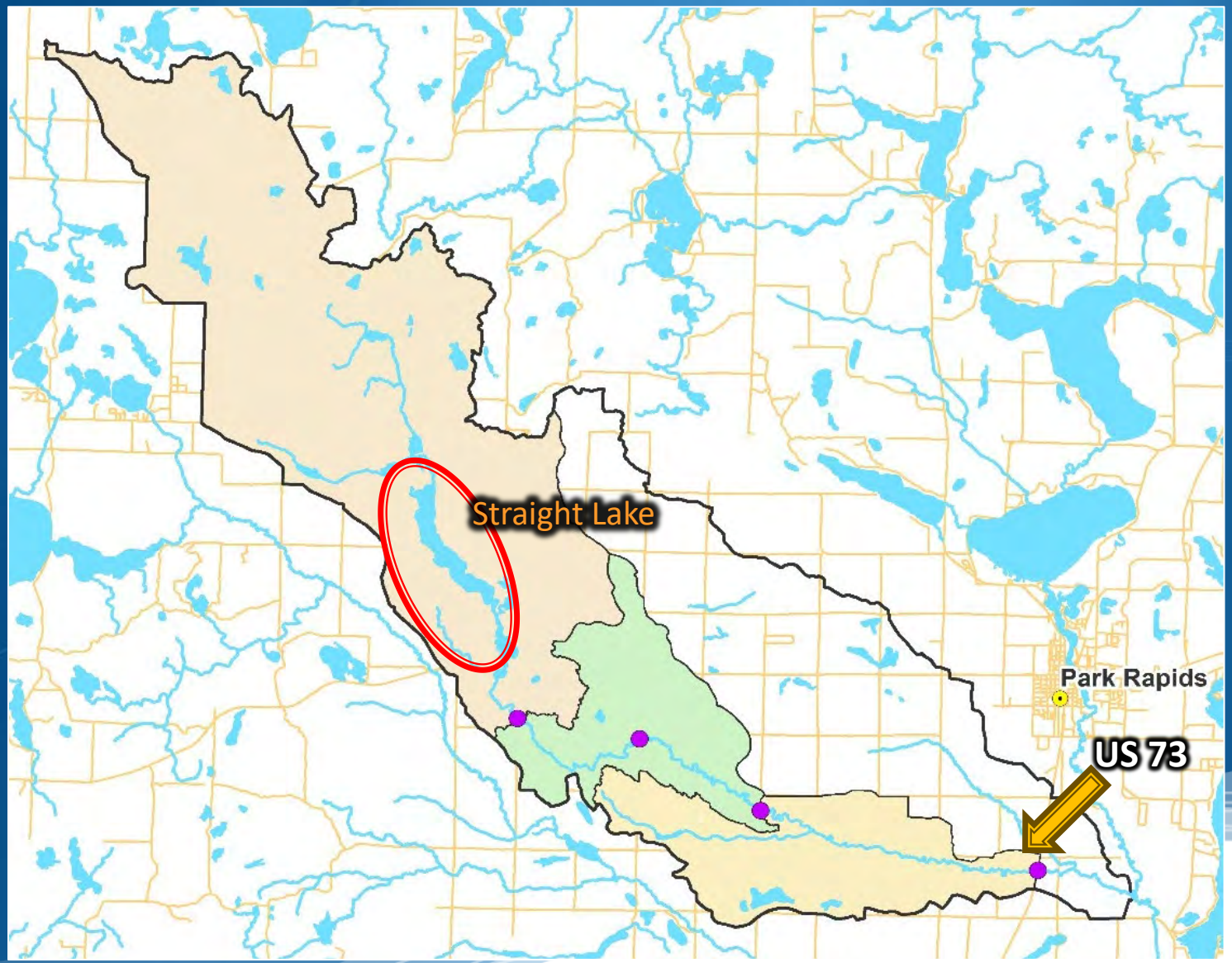
Drought of late 1980s

- Significant drought affected much of the state
- Threatened Twin Cities water supply
- As a result, irrigation increased along the River
- Concerns grew over streamflow depletion
- Concerns also about stream temperature and habitat, impairing trout habitat

Stream/Aquifer Study

- DNR/USGS/LCMR study– late 1980s
- Increased stream gage network
- Conducted exploratory drilling
- Installed nested wells– vertical flow
- Continuous monitoring of water and aquifer levels, stream flows and temperatures
- Aquifer tests
- Groundwater modeling

Straight River Watershed



Cross Section-complex Geology

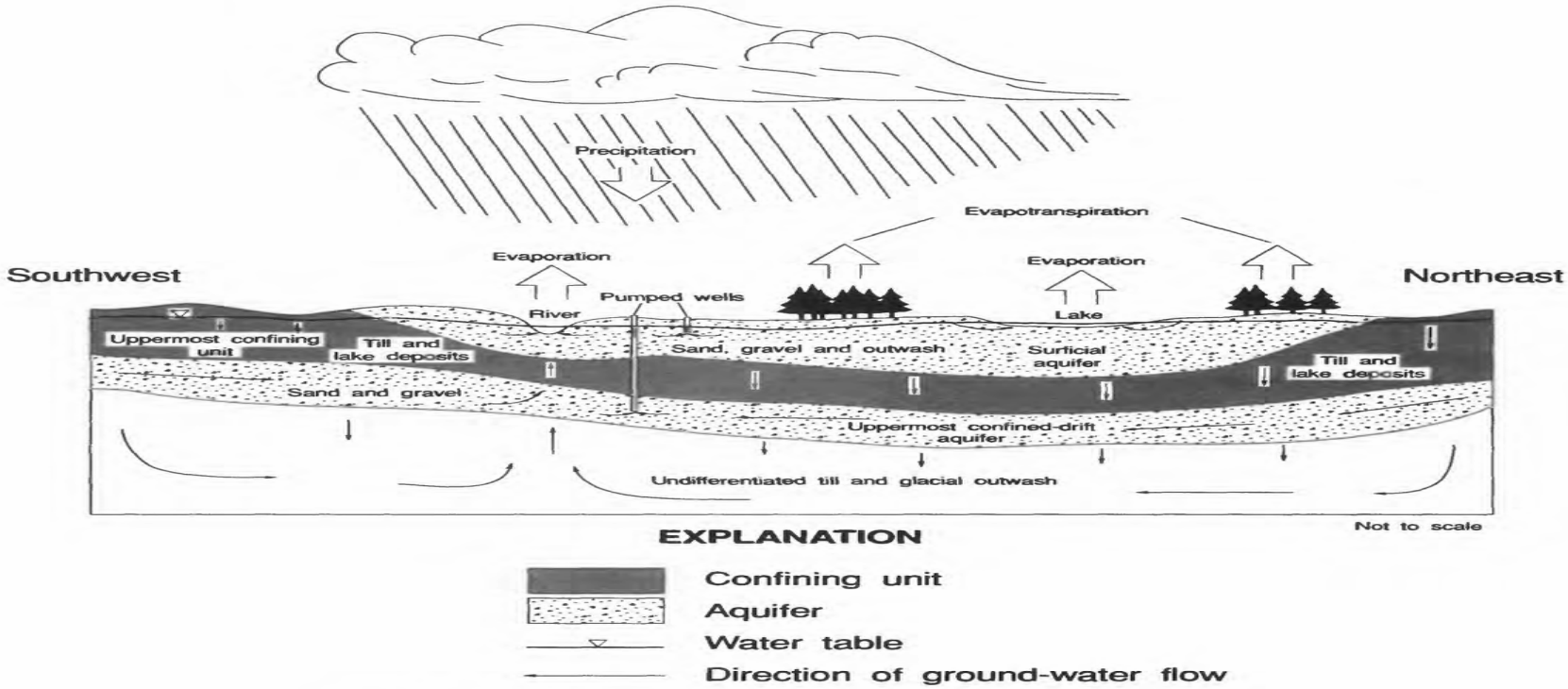


Figure 2.--Generalized hydrologic system of the Straight River investigation area.

Model Grid

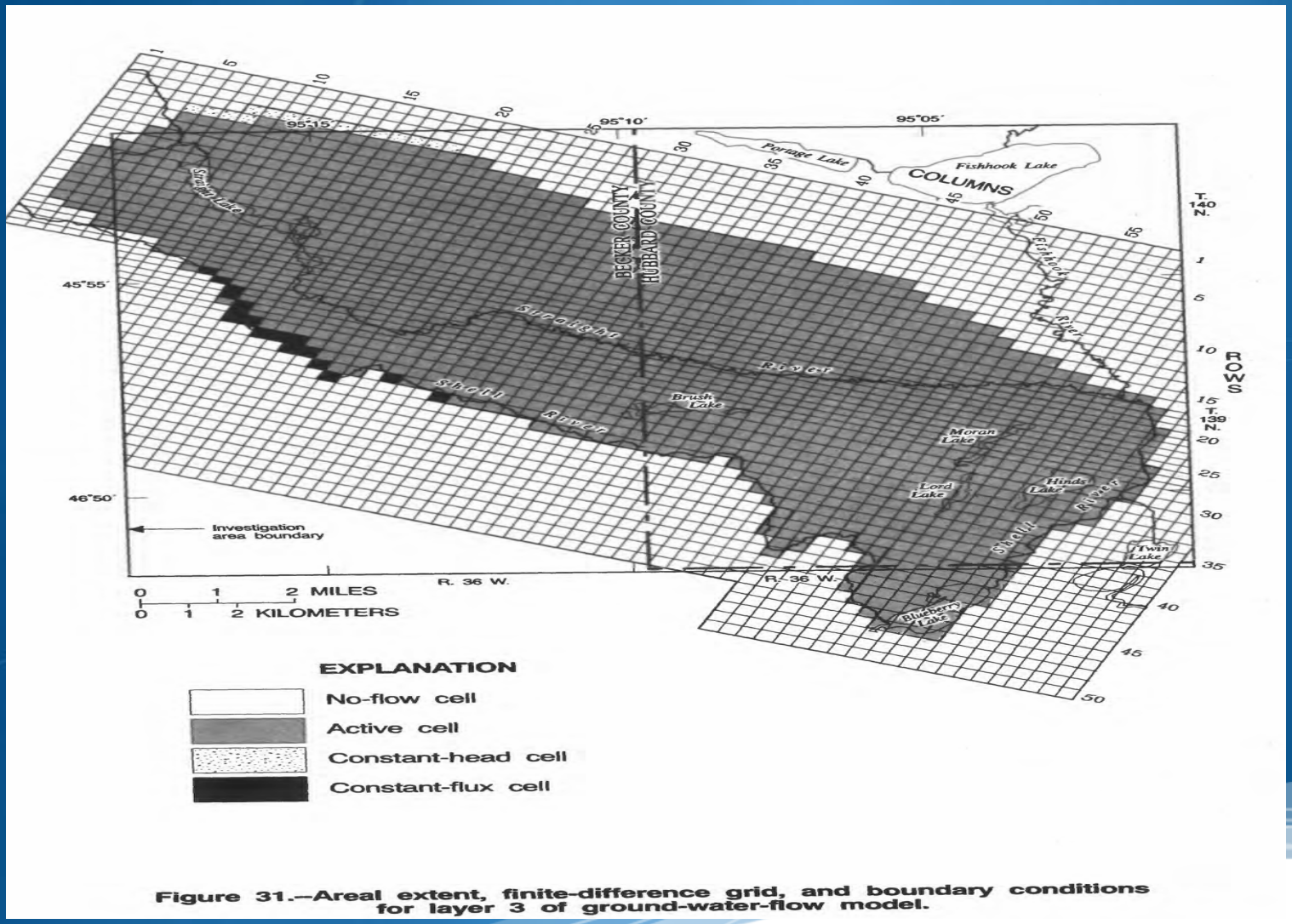


Figure 31.—Areal extent, finite-difference grid, and boundary conditions for layer 3 of ground-water-flow model.

Groundwater Dominates the River Flow

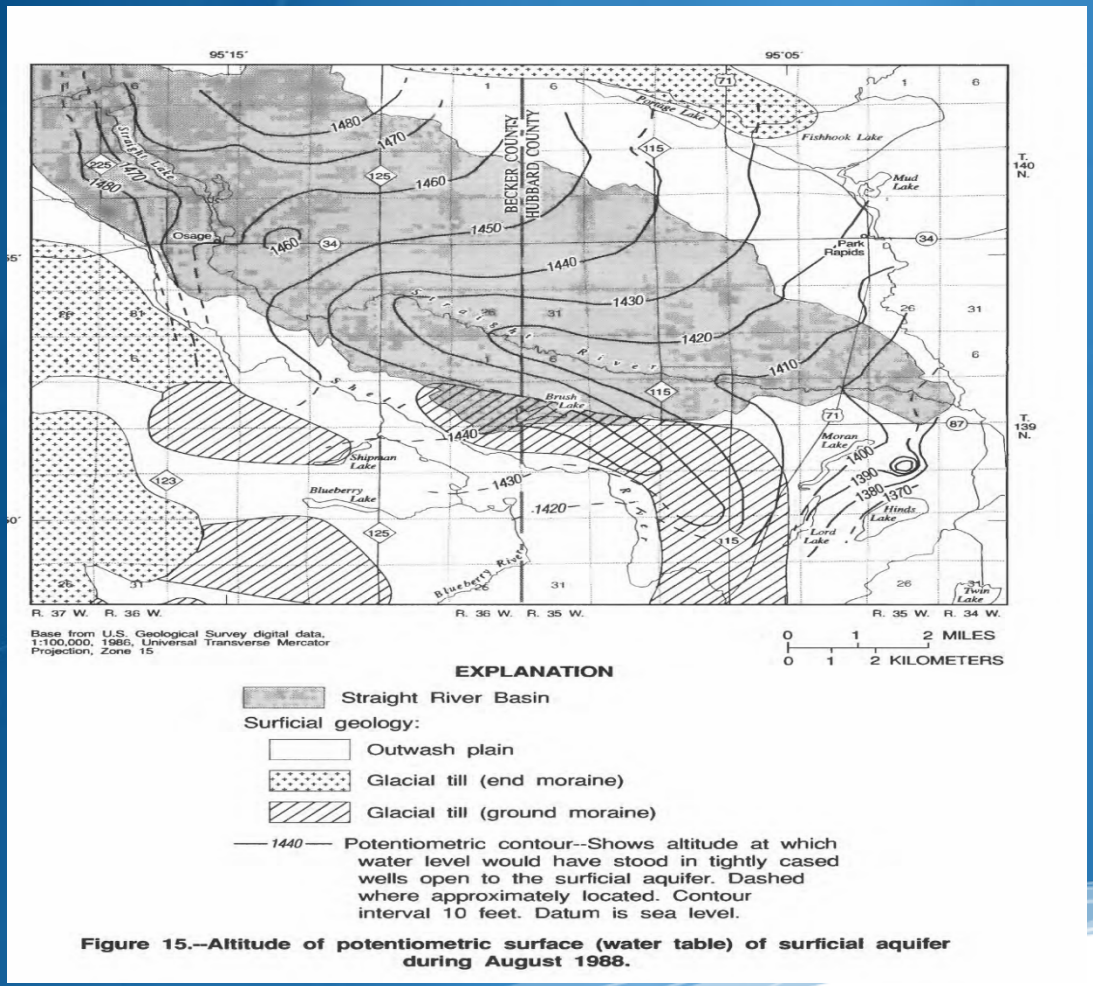


Figure 15.--Altitude of potentiometric surface (water table) of surficial aquifer during August 1988.

Water Budgets

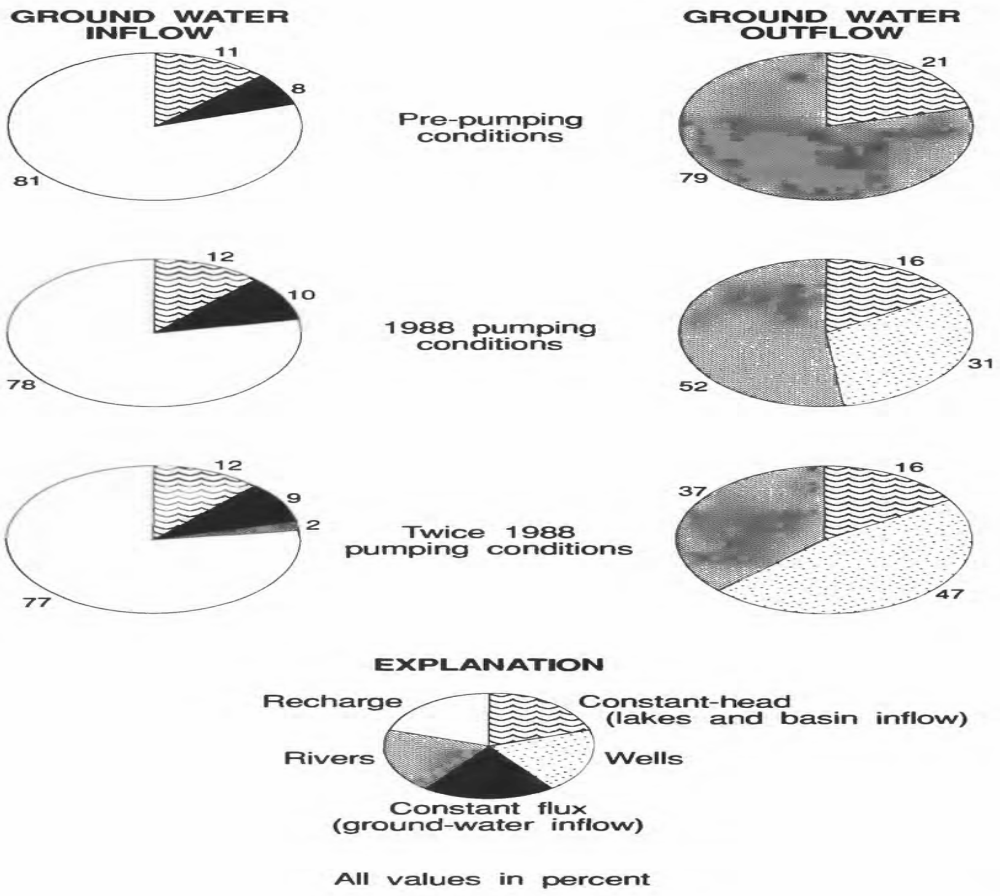


Figure 28.--Model-calculated, ground-water inflow and outflow for simulations representing pre-development, 1988, and hypothetical (doubling of 1988 ground-water withdrawal) rates of ground-water withdrawal from the investigation area.

Changes in River Temps due to Irrigation

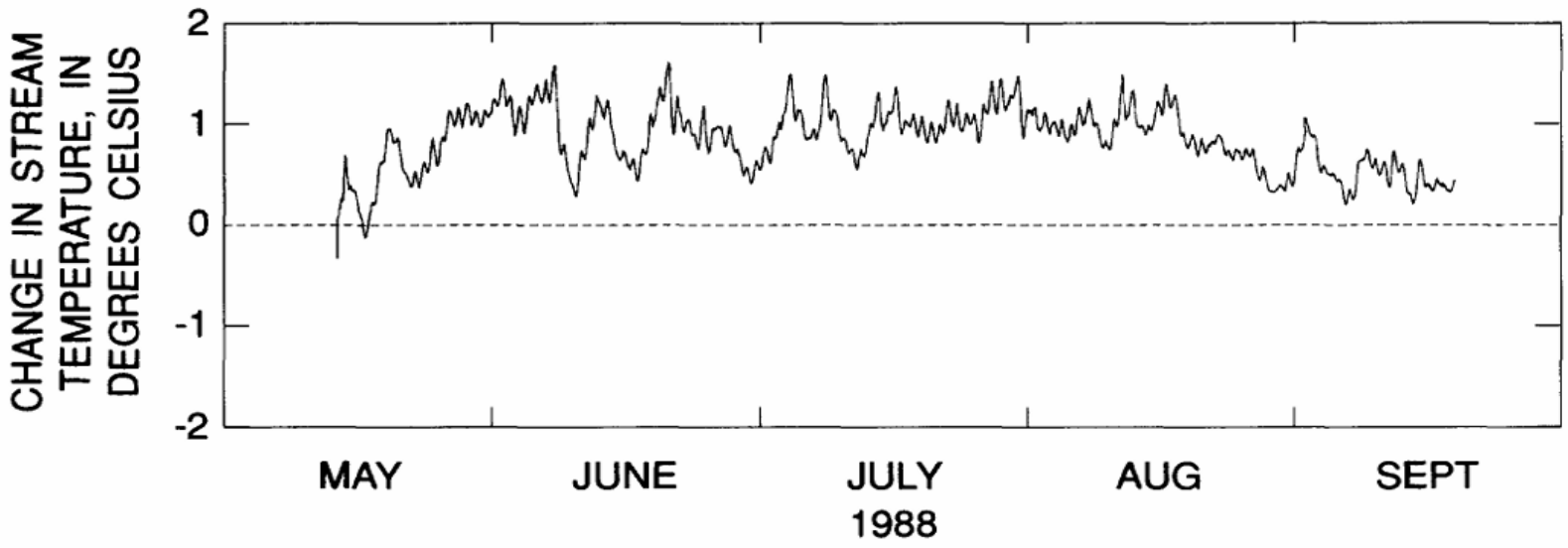


Figure 33.--Change in model-simulated temperature of Straight River at U.S. Highway 71 (site F) during May through September 1988, resulting from reduced base flow due to irrigation withdrawal of ground water, Straight River, Minnesota.

Study Results

- Irrigation is increasing
- Increased withdrawals have potential to reduce streamflow and to increase stream temperature
- Rate of streamflow gain decreases downstream
- Nitrates in GW were greater then the MPCA limits in some areas
- Sustained irrigation rates, like 1988/89 could decrease streamflow and increase river temperatures by as much as 2.7 degrees F

Since the 1990s

- Analysis has continued- DNR
- DNR has stakeholder process for the Groundwater Management Area process
- Additional monitoring/modeling/ analysis

GW Management Area Findings

- GW baseflow provides 93-97 % of streamflow
- Summer streamflow show no significant declines
- Aquifer water levels are stable
- Previous irrigation may have reduced streamflow
- Specific locations have reduced baseflow
- Shallow and deeper aquifers are connected
- Water generally is ample for irrigation except in some areas near the river
- Nitrates exceed drinking water standards in some areas and pesticide breakdown chemicals are present in some wells


Pete Jacobson

Water Quality Challenges and Potential Solutions for the Straight River and Pineland Sands Aquifer

Peter Jacobson
Minnesota Department of Natural Resources (retired)

Clean Water Council

September 15, 2025

Renowned and Special Trout Stream

Wadena Pioneer journal

Hatch Magazine – Tom Hazelton

INFORUM

Big brown trout, anglers find refuge on Minnesota's Straight River

As the fertilized eggs drop into the water, so do the mayflies. It's there they die, either swept downstream or into the waiting mouths of voracious brown trout. It's as if the mayfly's entire existence is for this one brief moment of feeding fish in the dark.

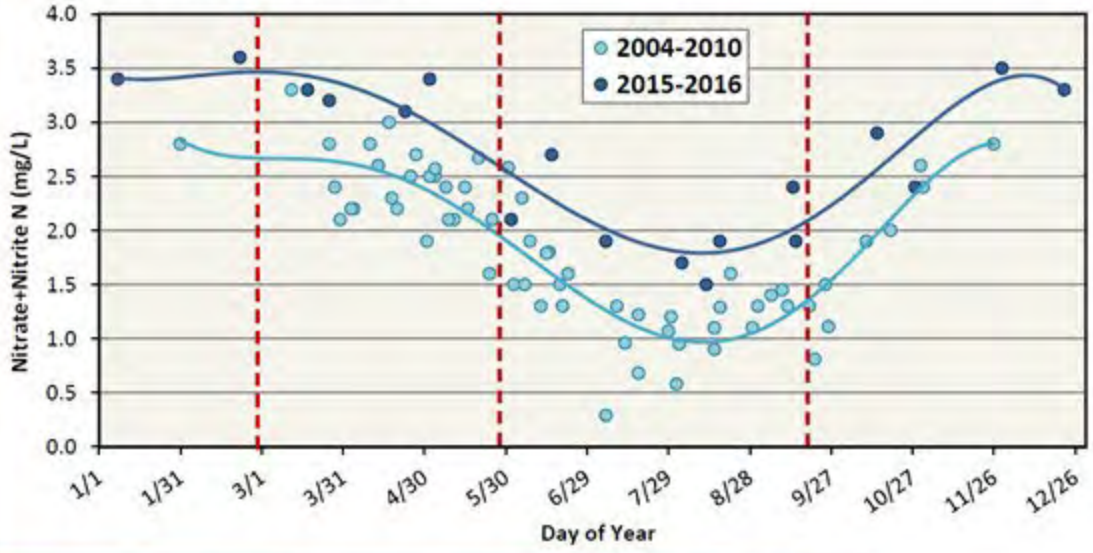
Bill Evarts, a Minnesota DNR fishery specialist prepares to fish the Straight River in June. Michael Johnson/Pioneer Journal

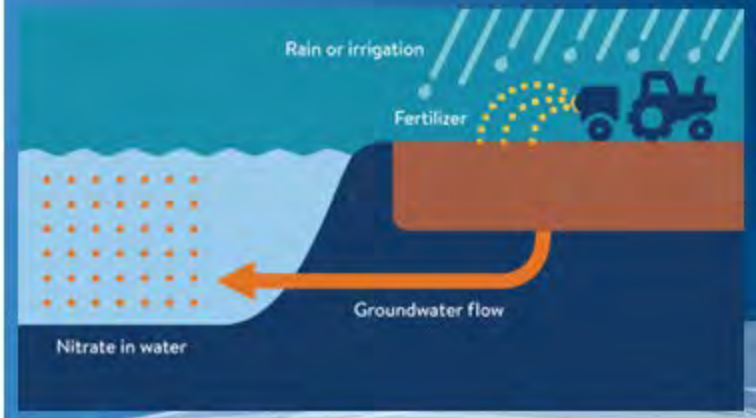
Need for Better Understanding the Effects of Nitrate on the Straight River Ecosystem

- Dissolved oxygen and periphyton biomass responses to stream nitrate loading
- Trout population responses to increasing nitrate stream concentrations – important for SE MN as well

Figure 14. Filamentous algal growth on a vertical pipe, part of stream gaging equipment at 2016.

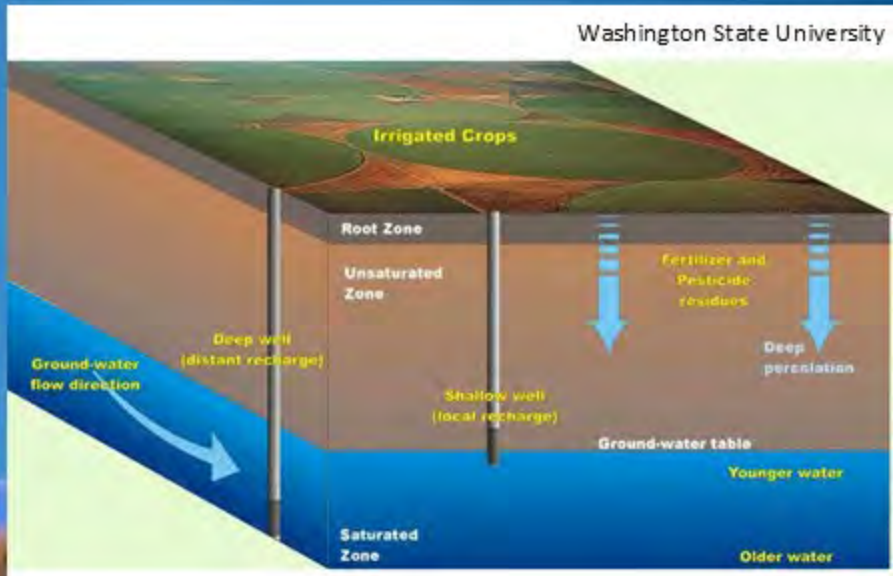
Figure 26. Significance testing of the first two datasets, broken into two time periods, each having many data points, (1) March 1 - May 31 and (2) June 1 - September 26.





Information Needs for Conservation Practice Implementation

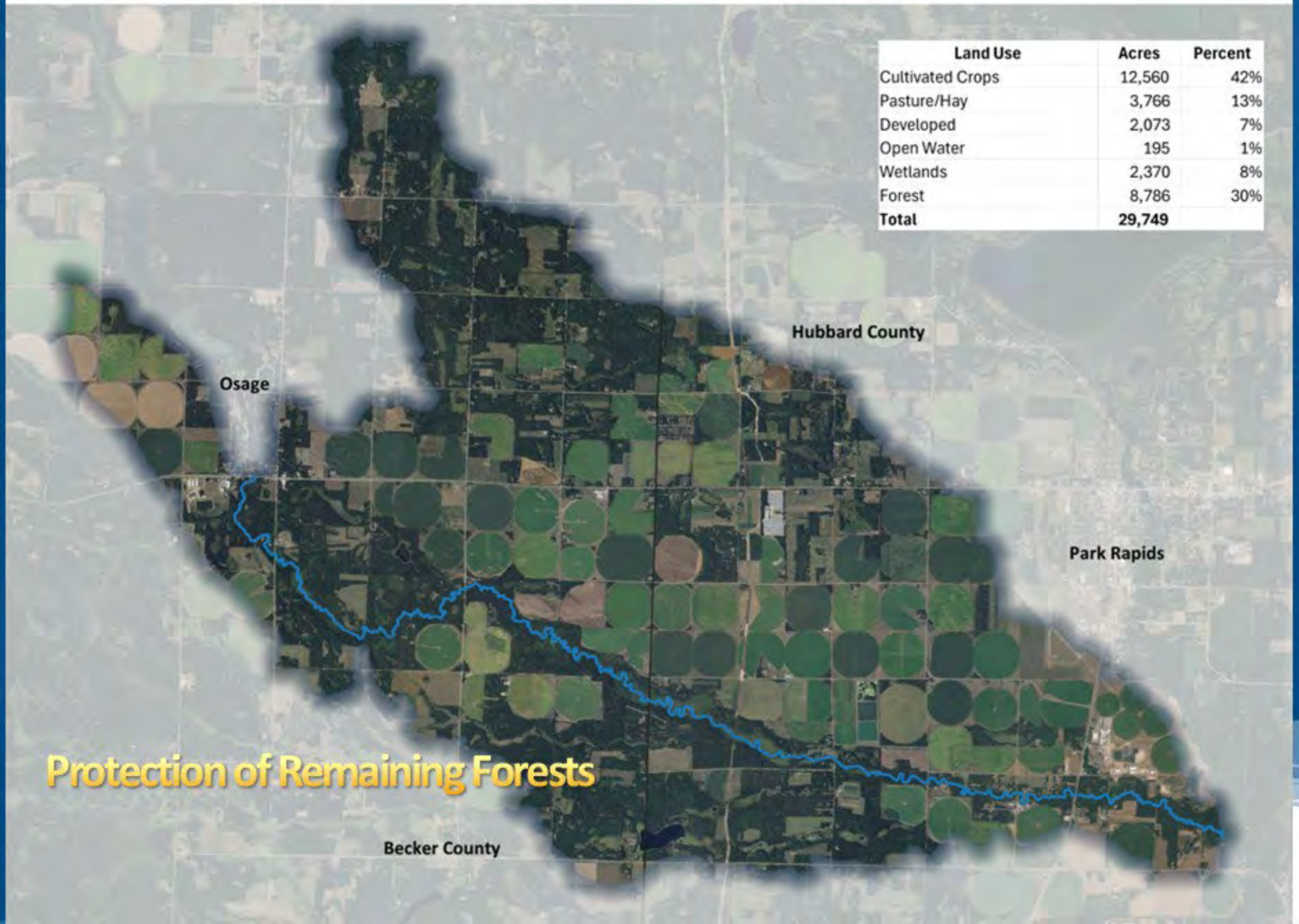
- Aquifer and stream nitrate loading responses to ag BMPs and alternative agronomic practices
- Specific and quantitative BMP/alternative practice recommendations tied to nitrate loading reductions
- Challenging, but doable technical analyses



Alfalfa – U of M

Minnesota Irrigation Program – U of M

Straight River Subwatershed



Land Use	Acres	Percent
Cultivated Crops	12,560	42%
Pasture/Hay	3,766	13%
Developed	2,073	7%
Open Water	195	1%
Wetlands	2,370	8%
Forest	8,786	30%
Total	**29,749**	


Thank you!

Forest Conservation

Straight River Groundwater Management Area

The Pineland Sands aquifer is the source for one of the finest trout streams in Minnesota – the Straight River south of Park Rapids. Spring-fed by groundwater, the stream runs cold and clear, even in the hottest part of the summer, and is treasured by trout anglers throughout Minnesota.

The aquifer also supports an important irrigated agricultural industry that provides a critical foundation for the local economy of the Park Rapids area, including a large French fry plant. Unfortunately, the deep, glacial outwash sands that allow great quantities of precipitation to soak into the ground also allow contaminants such as nitrate nitrogen to leak into the aquifer. Many private drinking water wells in the area exceed the nitrate threshold for human health concerns. In addition, Minnesota PCA has deemed the Straight River as impaired for dissolved oxygen, likely the result of increasing nitrate concentrations.

We continue to see conversions of forest lands to irrigated agriculture, which increases the withdrawal of water from this critical aquifer and further threatens drinking water in private wells and the water quality in the Straight River. The vast majority of land within the management area is private (98.3%), with only 517 acres of land in public ownership. Fortunately, the Hubbard and Becker County SWCDs work directly with private forest landowners in the groundwater management area. Funding private forest conservation easements would be a valuable tool for protecting the remaining forests and ensuring the long-term sustainability of this critically important aquifer to the region and the state.

Significant investments will be required to protect these remaining forests. Clean Water, Outdoor Legacy, Environment and Natural Resources Trust, and legislative funds could provide the critical funding required to maintain and protect this important resource for the benefit of citizens and private industry for many years to come.

STRAIGHT RIVER GEOLOGICAL CONTEXT

The Straight River sand plain is underlain by an extensive surficial aquifer consisting of glacial outwash. This aquifer is part of a large surficial aquifer system, called the Pineland Sands (Helgesen, 1977), which underlies 770 square miles in Becker, Cass, Hubbard, and Wadena Counties. Confined drift aquifers underlie most of the area. The Straight River sand plain extends about 11 miles west of Park Rapids. Agriculture between Park Rapids and Osage is mostly potato farming. Many of the French-fried potatoes served in the Midwest come from farms in this area. Success of this agricultural enterprise is dependent on center-pivot irrigation, which has had a substantial effect on local groundwater levels and temperatures.

Just to the west of Osage, the Alexandria moraine and southern extent of the Itasca moraine abruptly rises from the flat outwash surface. There remains considerable uncertainty as to the specific boundary between the Itasca and Alexandria moraines (Hobbs and Goebel,1982); the route is interpreted here as passing primarily over the Itasca moraine but occasionally over northern extensions of the Alexandria moraine.

The Straight River flows approximately 19 miles from its source in Becker County to its mouth at the confluence with the Fishhook River in Hubbard County, and is part of the drainage basin of the Crow Wing River in the Mississippi River drainage system. A dam at Osage stabilizes and raises the level of Straight Lake. This dam, constructed in the 1930's, also controls and stabilizes streamflow below Straight Lake. The river has no tributaries, and its flow is derived from groundwater discharge, discharge from Straight Lake, and a small amount of overland runoff.

The Straight River is a trout stream with cold, clear water. According to state officials (Dennis Ernst, Minnesota Department of Natural Resources, written commun., 1990), the stream is one of the most productive trout-fishing streams in Minnesota. Streams designated as trout streams in Minnesota are regulated by the DNR to help protect the quantity and quality of the water. The Straight River is similar to many streams in the upper Midwest that flow through and receive groundwater discharge from glacial outwash. Ground and surface water are closely related in the Straight River Watershed. Infiltration through the permeable soils is rapid when the soils are free of frost, resulting in substantial recharge to highly transmissive surficial aquifers that are hydraulically connected to the stream.

The surface drainage to the Straight River, about 75 square miles in area, is underlain by highly transmissive confined and surficial sand and gravel (drift) aquifers. Flow of the Straight River is sustained by discharge from these aquifers, especially during periods of no rainfall. Brook trout (Salvelinus fontinalis) were common in the Straight River as late as the 1940's, but are now absent (Dennis Ernst, oral commun., 1990). The temperature of streams is critical because brook trout do not thrive in water where the temperature exceeds 20°C (degrees Celsius) for extended periods. The Straight River presently is too warm a habitat for brook trout. Brown trout (Salmo trutta) were introduced into the Straight River in the 1940's and are abundant in the stream (Dennis Ernst, oral commun., 1990). The stream produces some of the largest brown trout in Minnesota. Like brook trout, the most important environmental factor that determines suitable habitat for brown trout is water temperature. Brown trout, however, can survive in warmer water than brook trout (Raleigh and others, 1986). The maximum, near-lethal water temperature for brown trout is 27°C, and optimum temperatures for growth and survival range from 12 to 19°C. During the summer of 1988, temperature and streamflow in the Straight River approached conditions that are lethal for brown trout.

After the drought of 1988-89, the LCCMR funded a study of the Straight River. The study was conducted by the USGS and the DNR. The purpose of the study was to examine the potential effect of irrigation on the quantity, quality, and temperature of ground and surface water in the area. The report found that in 1974 there were five irrigation wells in the area. By 1988 (a relatively dry year) there were 48 irrigation wells screened in drift aquifers. About 2.3 billion gallons of ground water were withdrawn from these wells for irrigation from May through August 1988. During the same period, total discharge near the mouth of the Straight River was about 4.0 billion gallons. Most irrigation was within 2 mi (miles) of the Straight River.

The report also describes hydrologic conditions in the Straight River Watershed, including ground and surface water quantity and quality. The report presents an estimate of the effects of groundwater withdrawal for irrigation on groundwater and on surface water. Specifically, this report describes: (1) the variability in streamflow and groundwater levels, (2) stream and groundwater quality, (3) stream-aquifer interaction, and (4) the effect of irrigation on the quantity and quality of groundwater and of the Straight River. The report concluded that irrigation could cause prolonged or permanent changes in the direction or magnitude of groundwater flowing toward the stream. The temperature of stream water could increase as the amount of cold groundwater flow discharging to the stream is reduced. Decreased stream discharge also could result in a lesser thermal mass and thus the stream could be more susceptible to warming from solar radiation. Increased stream temperature also could result from a warming of ground water discharging to the stream because warm irrigation return flow to the aquifer. Anecdotal information indicates that water temperature

of the Straight River had increased. Data on stream temperature, however, were not well documented prior to this investigation, and few stream-discharge or water-quality measurements of the stream had been made. Agricultural chemicals applied to the land could percolate to the shallow groundwater system. These chemicals could then migrate with groundwater flow as dissolved constituents and discharge to the stream. These water quality factors could affect the ability of the stream to maintain a stable trout population.

Straight River and the Pineland Sands Aquifer – Hubbard SWCD Perspective

The Straight River is one of the finest trout streams in Minnesota. Spring-fed by the Pineland Sands Aquifer, the stream runs cold and clear, even in the hottest part of summer. The stream is especially known for growing large brown trout and is a destination for anglers from throughout Minnesota.

The Pineland Sands Aquifer is one of the largest aquifers in Minnesota, covering portions of Becker, Cass, Hubbard, and Wadena counties. The aquifer supports important irrigated agriculture that provides a critical economic foundation for local economies of the Park Rapids area. Unfortunately, the deep, glacial outwash sands that allow great quantities of precipitation to soak into the ground also allow contaminants such as nitrate nitrogen to leak into the aquifer.

Hubbard SWCD is the primary local entity that implements water quality projects throughout the county, including groundwater protection. The District works with private forest and agricultural landowners to ensure that water quality is conserved for generations into the future.

Current Issues and Concerns

• Nitrate contamination of private drinking water wells. Hubbard County SWCD provides water testing to residents with private wells. Unfortunately, concentrations of nitrate nitrogen in many of the private wells that draw groundwater from the Pineland Sands Aquifer exceed the 10mg/l threshold for human health concerns.

- Increasing trend of nitrate concentrations in the Straight River. Monitoring of stream water quality by the Minnesota PCA has shown elevated concentrations of nitrate nitrogen in the Straight River. These concentrations are orders of magnitude higher than other streams in the area not impacted by irrigated agriculture.

- Dissolved oxygen impairment for the Straight River. The Minnesota PCA has designated the Straight River as impaired for dissolved oxygen. High concentrations of nitrate nitrogen are likely stimulating excessive growth of filamentous algae in the stream which reduces dissolved oxygen concentrations as it decays.

- Reductions of summer baseflows in the Straight River. The Minnesota DNR notes that a number of high-capacity irrigation wells nearest to the Straight River are likely reducing the summer baseflow by more than 15%. The reduction in cold, groundwater baseflow may have detrimental effects on trout populations in the stream.

- Continued conversions of forest land to irrigated agriculture. Further losses of forest land to irrigated agriculture continue to increase demands on an intensively-used aquifer and likely result in additional contamination by nitrate nitrogen.

Potential Solutions

- Alternative cropping rotations. Inserting lightly-fertilized crops such alfalfa and other perennials into crop rotations with heavily-fertilized corn and potatoes significantly reduces loss of nitrogen fertilizer into the aquifer. Many producers are using some alfalfa in their crop rotations, but programs that incentivize this practice would further increase use.

- Cover crops. Cover crops have been shown to scavenge residual nitrogen in the soil after harvest and reduce loss into the aquifer. A critical issue is how to establish cover crops this far north after harvest of late-season crops such as corn. Greater efficiencies in irrigation schedules and precision irrigation that only uses enough water for crop needs hold promise for reducing the overall demand for groundwater use. Larger producers are already using precision irrigation methods, but the approach can continue to be refined.

• Opportunities in fields and wells closest to the Straight River. The irrigation wells and fields closest to the Straight River would be an ideal location to implement practices that would reduce groundwater use and nitrogen fertilizers.

• Provide forest stewardship planning for private woodland owners. Landowners benefit from forest stewardship planning done by professional foresters. Opportunities for income from timber harvest and conservation benefits can be specifically highlighted for landowners.

Recommendations

• Request that state agencies (MDA, MDH, MPCA, DNR) convene a local advisory team to explore solutions for nitrate contamination of groundwater in the Pineland Sands Aquifer. The team could be modeled after the advisory group assembled by the Minnesota DNR for addressing groundwater use in the Straight River Groundwater Management Area.

• Encourage Minnesota PCA to complete a TMDL (Total Maximum Daily Load) for the Dissolved Oxygen Impairment on the Straight River. A thorough TMDL recommendation would allow SWCDs to plan and implement practices to restore a critical fish habitat need for the stream.

• Encourage Minnesota PCA to complete a nitrate impairment criteria for streams. Identifying specific concentrations for impairment would be useful for SWCDs to plan and implement practices to reduce nitrate nitrogen levels to a specific goal.

• Urge the Minnesota DNR to complete its evaluation of reduced stream flow from high-capacity wells nearest to the Straight River.

• Develop and enhance state and federal programs to incentivize alternative practices that reduce groundwater and fertilizer needs in an irrigated agricultural setting.

Straight River (Hubbard County, MN) Nutrient Study

Author: Kevin Stroom, MPCA

Selected sections for the Clean Water Council 2025 Field Tour

Full version available upon request

Executive Summary

The Straight River is a coldwater stream with excellent water clarity, including a mid-section lake (Straight Lake), located just west of Park Rapids, in Hubbard County, Minnesota. It flows in a landscape of deep, sandy surficial soils which contribute to the formation of the Pineland Sands Aquifer, a large regional groundwater feature. The aquifer supplies significant flow to the Straight River via springs and seeps. Groundwater input makes up a substantial amount of the flow of the Straight River (Stark et al., 1994). This groundwater input creates cold water habitat conditions that are sufficient to make the Straight River a designated trout stream. Additionally, the Minnesota Department of Natural Resources (DNR) has purchased angler easements along a significant portion of the stream corridor downstream of Straight Lake, which form the Straight River Aquatic Management Area. It also lies in a part of the state that has few other trout streams. The DNR has done much work to enhance or restore fish habitat in the Straight River (DNR website, search “Straight River”). As such, it is a recreationally important stream for anglers interested in pursuing a trout fishing experience, while the flow-through lake has many shoreland cabins/homes.

The Straight River, despite its clear waters, has been listed on Minnesota’s 303(d) impaired waters list as not meeting the Class 2A (coldwater) standard for dissolved oxygen (DO). A total maximum daily load (TMDL) report was written in 2014 to achieve the DO standard via stream water temperature reduction (MPCA, 2014a, Section 2.3.1.2). Subsequently, more monitoring was done on nutrients and DO percent saturation. Nutrient enrichment is likely playing a strong role in this impairment through a process called eutrophication. Large mats of filamentous (surface-attached) algae are observed in the river. Midday DO levels are above natural saturation limits, evidence of large amounts of oxygen production by algae. At night, these same algae respire, drawing oxygen from the water column and decreasing DO levels. Eventual decay of algae also decreases oxygen levels as bacteria break it down.

The Straight River has a mixed land cover of forest and agricultural fields. The sandy soil here quickly dries out and makes growing crops difficult. Many of the historical fields were no longer planted and/or were cut for hay. Over the years, farmers have moved to utilize the easy-accessed surficial aquifer and irrigation was begun in order to grow row crops. The move to irrigation and row-cropping has grown in the last 30 years in the Straight River’s drainage area, close to doubling acre-wise since 1992. Nitrogen fertilization accompanies the conversion to the row crops.

The sandy soils of these cropped fields allow leaching of nitrate from fertilized acres. Nitrate is a soluble molecule and easily moves with water. Nitrate levels in the surficial groundwater aquifer surrounding the Straight River are elevated and in some places exceed the Minnesota drinking water nitrate standard of 10 mg/L. The City of Park Rapids recently had to drill a deeper well for its municipal water needs due to exceedances of the nitrate standard.

The springs that supply flow to the Straight River also transport their elevated nitrate concentrations to the river. Nitrate levels in much of the Straight River are anomalously high, based on comparisons of nitrate data from many streams in the surrounding area. Straight River nitrate concentrations are much, much higher than the regional norm. Nitrate

concentrations in the river at US Highway 71, where the data record is longest, have statistically-significantly increased since the 2004 through 2010 period, leveling off recently as the pace of new row crop acre additions in the Straight River drainage have slowed. Nitrate concentrations in the river are highest just upstream of Straight Lake and in the area of the Highway 71 crossing. Nitrate levels in the reaches downstream of Straight Lake start out fairly low and increase in the downstream direction as more groundwater is added to the flow via springs.

Nitrate concentrations in the Straight River vary substantially by season, with the summer period having the lowest concentration. The concentration peaks from late fall through early spring. At that time of year, concentrations are approaching a level that recent nitrate aquatic toxicity study show to be harmful to aquatic macroinvertebrates, which are an important component of the river's ecological health. Decreasing the levels of nitrate in the river would contribute to improving the DO levels that are the cause of the river's listing as impaired and improve the ecological health of the river.

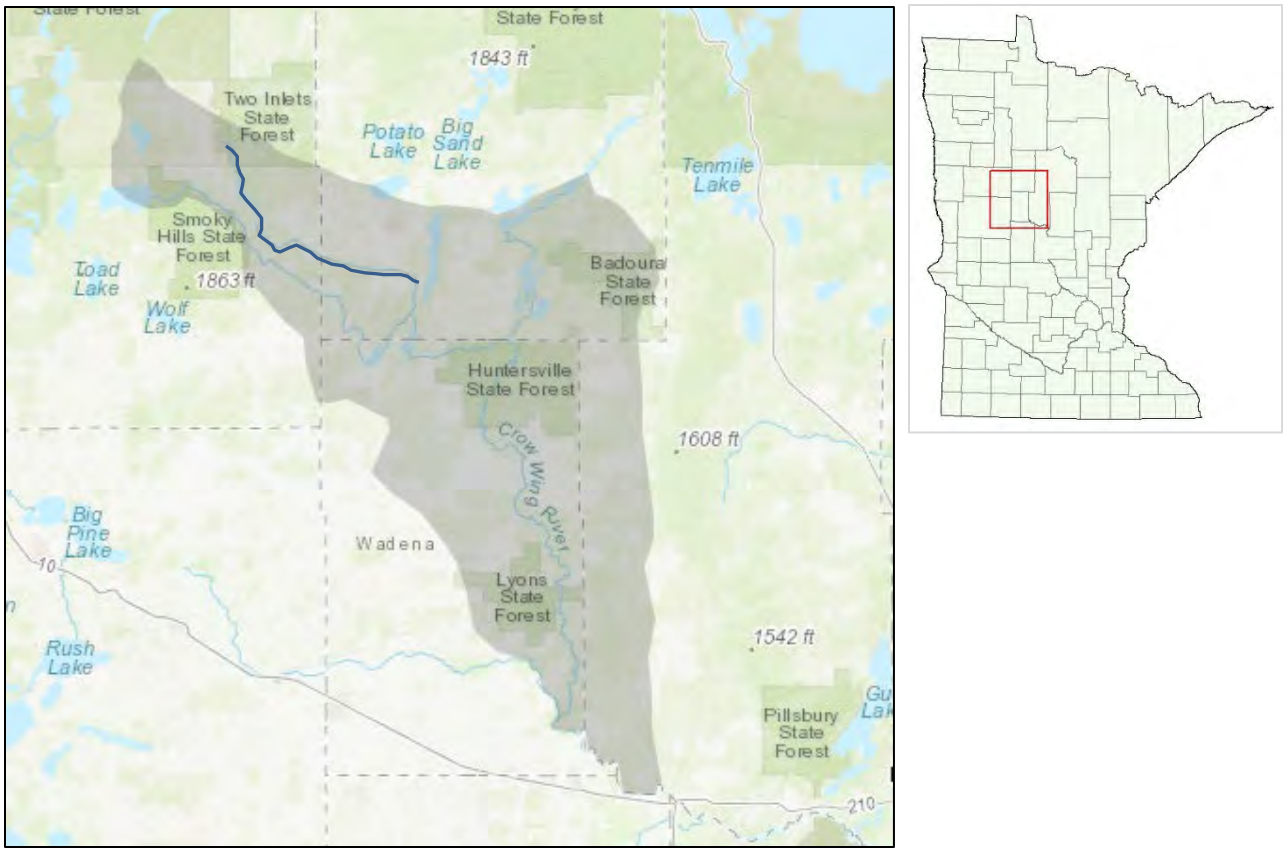
Background on the Straight River

The Straight River is one of the top stream trout fisheries in Minnesota and located in a part of the state that has few trout streams. The stream lies in an area with very high sand content soils, which continue to be sand and gravel commonly to depths of 20 to 40 feet, with some areas going to depths of greater than 100 feet below the ground surface (DNR 2024). Such soils allow for the formation of substantial surficial aquifers. The Straight River Watershed lies atop part of the Pineland Sands Aquifer (Figure 1). The Aquifer's sandy composition makes it strongly hydrologically connected to the Straight River, creating springs at many points along the channel. The Aquifer's characteristics have been described in detail in a USGS study, which highlighted the substantial role of groundwater inputs to the flow of the Straight River (Stark et al., 1994). The DNR has recently completed several years of additional study of the aquifer to collect additional information about its characteristics and has issued a report on their findings (DNR, 2024). The report states that monitoring will continue.

The upper part of the river is a spring-fed coldwater (trout) stream that flows into Straight Lake. The lower part of the river is fed by Straight Lake as well as additional groundwater via many springs along its course (Figure 2). This reach is also a designated trout stream. Land and water use developments over the last couple decades in the Straight River's Watershed, perceived as threats to the Straight River's quality, have received significant citizen and media attention. The Straight River was featured in a prominent article in the Minneapolis Star-Tribune (Marcotty, 2016) on December 31, 2016, titled *A great river, at risk*, about water quality of the upper Mississippi River Basin in north central Minnesota. Articles about the Straight's unique fishing opportunities and environmental challenges have been written in other prominent Minnesota media outlets (Gunderson, 2002; InForum, 2014; Kallok 2010; Johnson, 2020). Most recently, the Park Rapids Enterprise published a story on the Straight River and various monitoring going on within the Straight River Groundwater Management Area (GWMA; Geisen, 2021). Nitrate pollution is showing up in problematic levels in several agricultural landscapes with geological groundwater sensitivity in Minnesota, with a couple newspaper case studies highlighting Little Rock Creek in central Minnesota (Bjorhus and Stanley, 2021) and the southeastern Karst (limestone geology) region of Minnesota (Hargarten and Bjorhus, 2023).

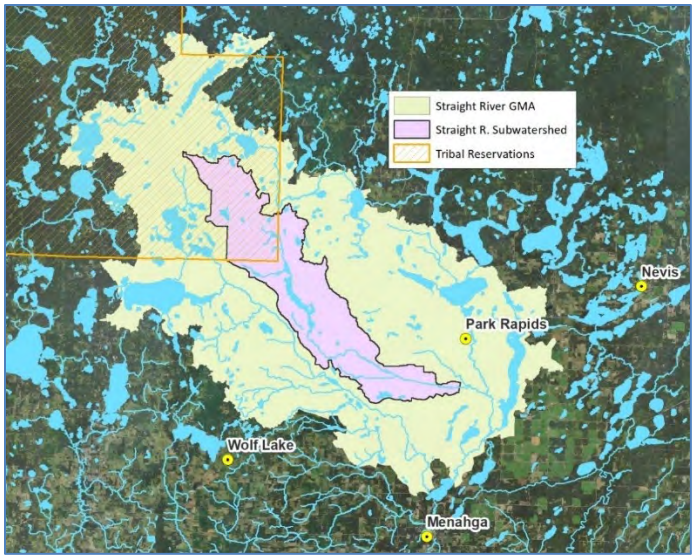
The water of the Straight River eventually enters the Mississippi River after first becoming part of the Fishhook and then Crow Wing Rivers.

Figure 1: The Pineland Sands aquifer (gray area), with the Straight River highlighted (USGS, 2023).



In 2012, the Minnesota Legislature created a law allowing for the designation by DNR of GWMAs in response to concerns about groundwater withdrawals in various parts of Minnesota having issues involving sustainability of aquifer resources. The DNR provides a discussion that defines their aquifer sustainability goals (DNR, 2013; also search "Groundwater Management Areas" on DNR's website). The DNR has created three pilot GWMAs in the state, one of which is the Straight River GWMA (Figure 3; internet search "Minnesota Groundwater Management Areas"). Much study has occurred recently in this GMA, led by DNR. An additional study is underway by a Tribal-University of Minnesota team focusing on the broader Pineland Sands aquifer area and land use influences on area resources (Marohn, 2023).

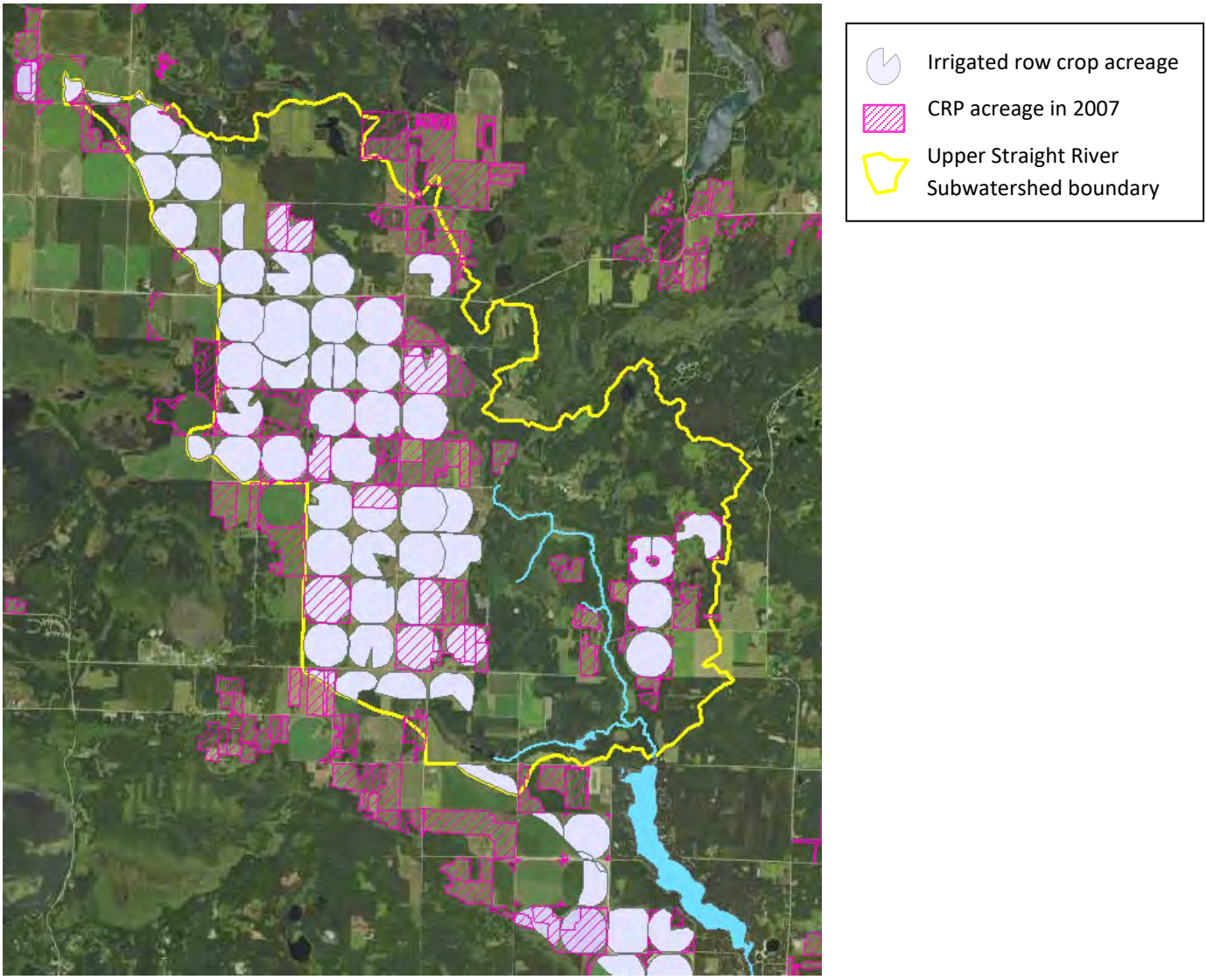
Figure 2. Map of the boundary of the Straight River Groundwater Management Area and the Straight River Subwatershed for the sample site at Highway 71.



The surrounding landscape and changes in recent years

The landscape surrounding the Straight River is a mix of forest and agricultural land. The growing of row crops is extremely difficult in these sandy soils, which quickly dry out following precipitation events unless augmented via irrigation. Many of the historical agricultural fields had been placed into the Conservation Reserve Program (CRP) in the last 20 to 30 years due to the difficulty in growing crops in these quick-drying soils and the susceptibility of these sandy soils to wind erosion. Irrigation of fields in the Straight River Watershed began more than thirty years ago. In recent years, there has been a steady conversion of these set-aside and/or nonrow-crop fields to center-pivot irrigated row cropping (Figure 3, Figure 4, and Figure 5; Table 1.). The more recent irrigation expansion first occurred mostly in the watershed upstream of Straight Lake, in the period between 1992 through 2009. Expansion has also happened in the lower part of the subwatershed, downstream of Straight Lake, especially between 2007 through 2016.

Figure 3. The upper portion of the Straight River Subwatershed (above Straight Lake). Irrigated fields in this subwatershed are current as of 2013 aerials. Areas where cross-hatching overlies the irrigated fields depicts land that was in the CRP program as perennial grasses in 2007 which now is an irrigated row crop.



The changes in acreage of irrigated row cropped fields shown visually in Figure 4 were quantified using GIS tools. Shapes of the circular or semi-circular areas were digitized by hand from aerial photography to create a shapefile in ArcMap, from which areas were calculated (Table 1 and Figure 4 and Figure 5).

Figure 4. Change in irrigated acreage over time from that present in 1992 to 2021 in the full Straight River Subwatershed. These changes are cumulative, so in 2021, all colors denoting irrigated cropland were operating as irrigated row crops. The municipal and industrial wastewater irrigation fields were present in 1992.

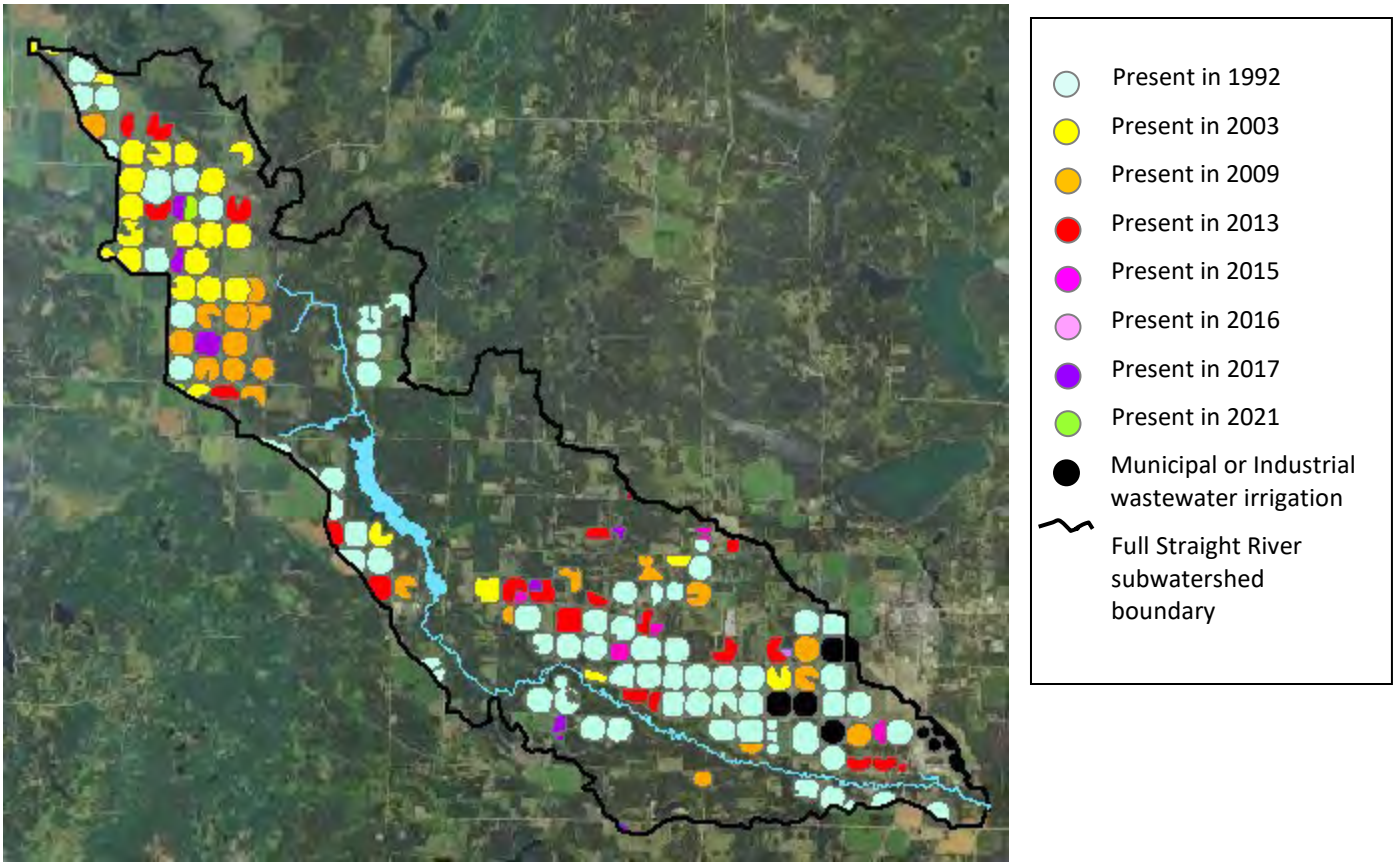


Figure 5. Graph of the changes in acreage of irrigated row cropped fields in the Straight River Subwatershed shown in Figure 4 and Table 1.

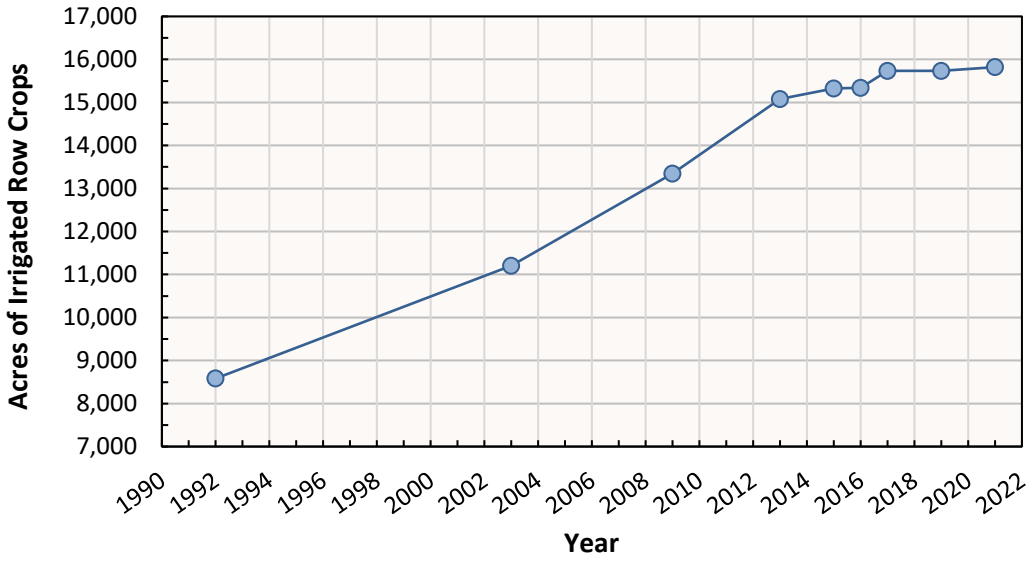


Table 1. Acreages of irrigated fields in the Straight River Subwatershed beginning in 1992 through 2021 (from available aerial photo sets). These acreage numbers are close approximations.

As of the Year	Added Acres	Total Acres
1992	--	8,582
2003	2,621	11,203
2009	2,142	13,345
2013	1,739	15,084
2015	244	15,328
2016	16	15,343
2017	391	15,734
2019	0	15,734
2021	87	15,821

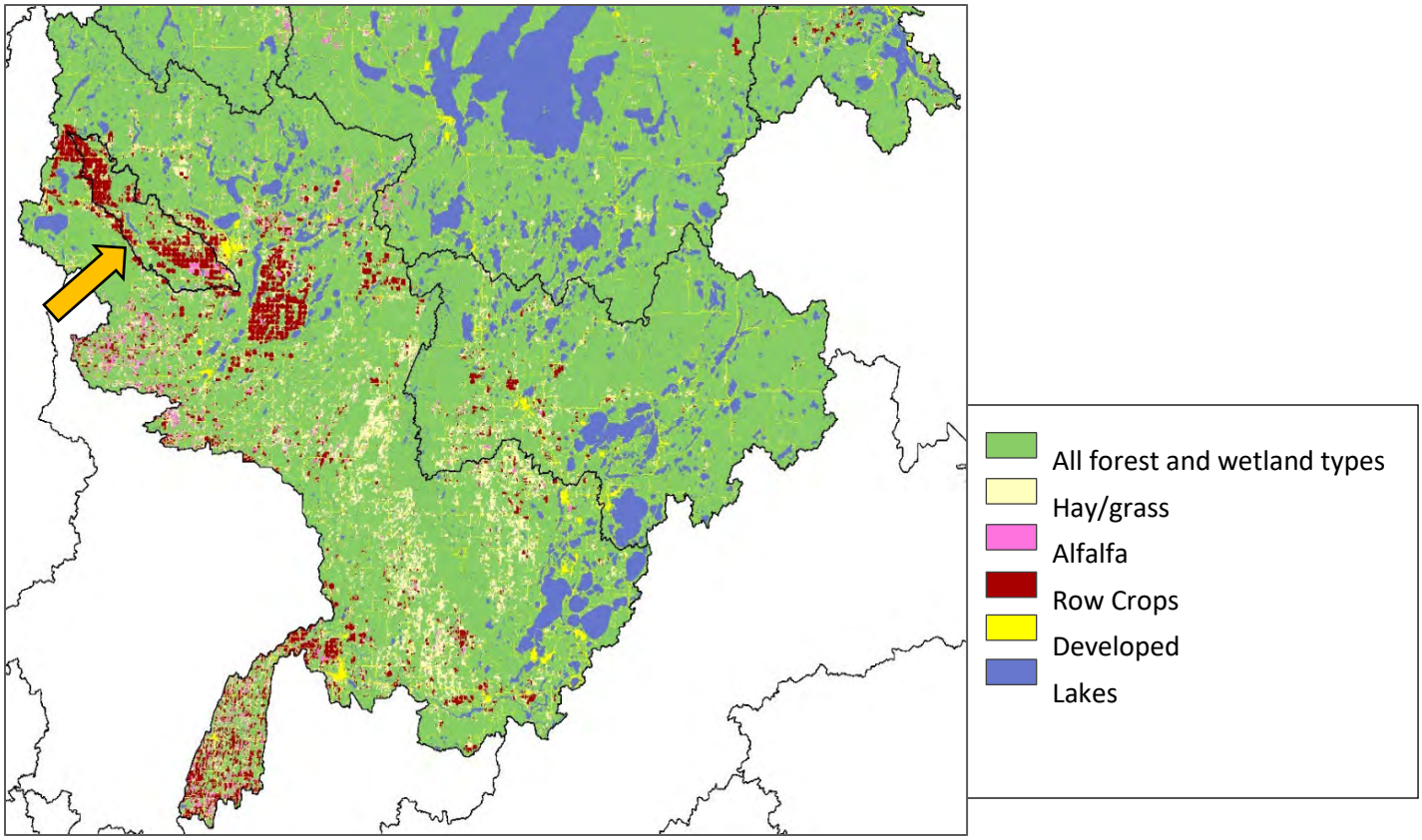
In some cases, these conversions also resulted in forest patches being converted to row crop agriculture (Figure 7), as removing these wooded plots results in achieving the most cropland under the footprint of the reach of the irrigation equipment. Many irrigated fields are quite closely adjacent to the river. In the lower Straight River landscape, six fields are within ~ 375 feet of the river, based on measurements from aerial photos (Figure 8). The distances of these six fields were 373, 340, 305, 202, 182, and 151 feet at their nearest field edge to the riverbank. Most of the fields in the Straight River Watershed; however, are relatively close to the river. The nearness of fields to the river mean that nitrate-containing groundwater has little distance to travel before it emerges in the river channel to become part of the Straight River's flow. Rates of flow within the aquifer may be available with data collected in the Straight River Groundwater Management Zone study project, headed by DNR.

Figure 6. Example of a land cover conversion to irrigated agriculture that straddles the Shell River - Straight River Subwatershed boundary. Note that forest area was also lost in this conversion to maximize irrigated field area, in addition to the perennial grassland.

Figure 7. Measured distances (in feet) from field edge to nearest riverbank.

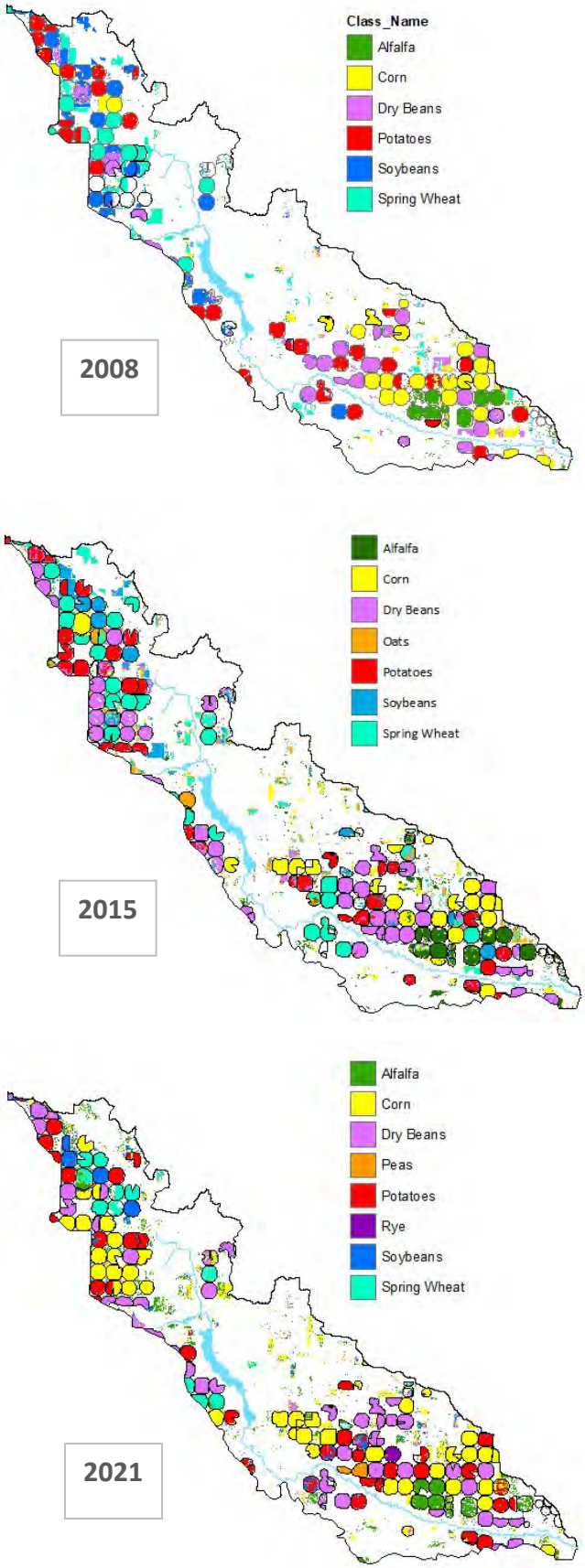
Row crop agriculture is substantially more-densely practiced in the area surrounding the Straight River than elsewhere in the Crow Wing River Watershed and other naturally forested watersheds nearby (Figure 9). Some of the common row crops grown in the fields surrounding the Straight River require significant inputs of nitrogen fertilizer, particularly potatoes and corn. Nitrate is water soluble, and easily moves through sandy soils. Once below the crop roots, nitrate will typically move through sandy subsoils and reach the shallow surficial aquifer. The nearby City of Park Rapids recently had to drill a new municipal well (MDH, 2013) due to groundwater nitrate-N concentrations above the Minnesota drinking water standard of 10 mg/L.

Figure 8. Land Use in the Crow Wing River Watershed (and the three other adjacent watersheds shown above). The arrow points to the Straight River Watershed. Source: Minnesota Department of Agriculture 2014 Cropland Database.



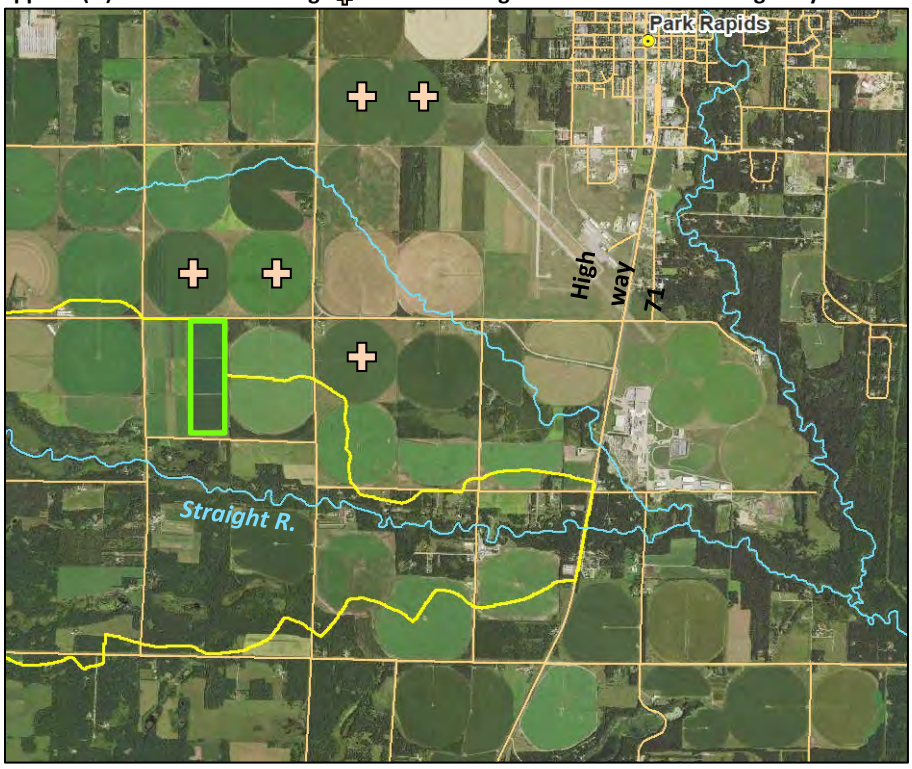
In order to see what the crop mix can be in a particular year; maps were made in GIS using yearly crop type data from MDA GIS layers. A random choice of one year was made for each of the three nitrate data sets. The acreages were not calculated, but the maps show there is a fairly even mix of corn, dry beans, potatoes, soybeans, and spring wheat, with lesser amounts of alfalfa and occasional small amounts of peas, rye, and oats (Figure 10).

Figure 9. Crops grown in the Straight River Subwatershed in 2008, 2015, and 2021, according to GIS data from MDA.



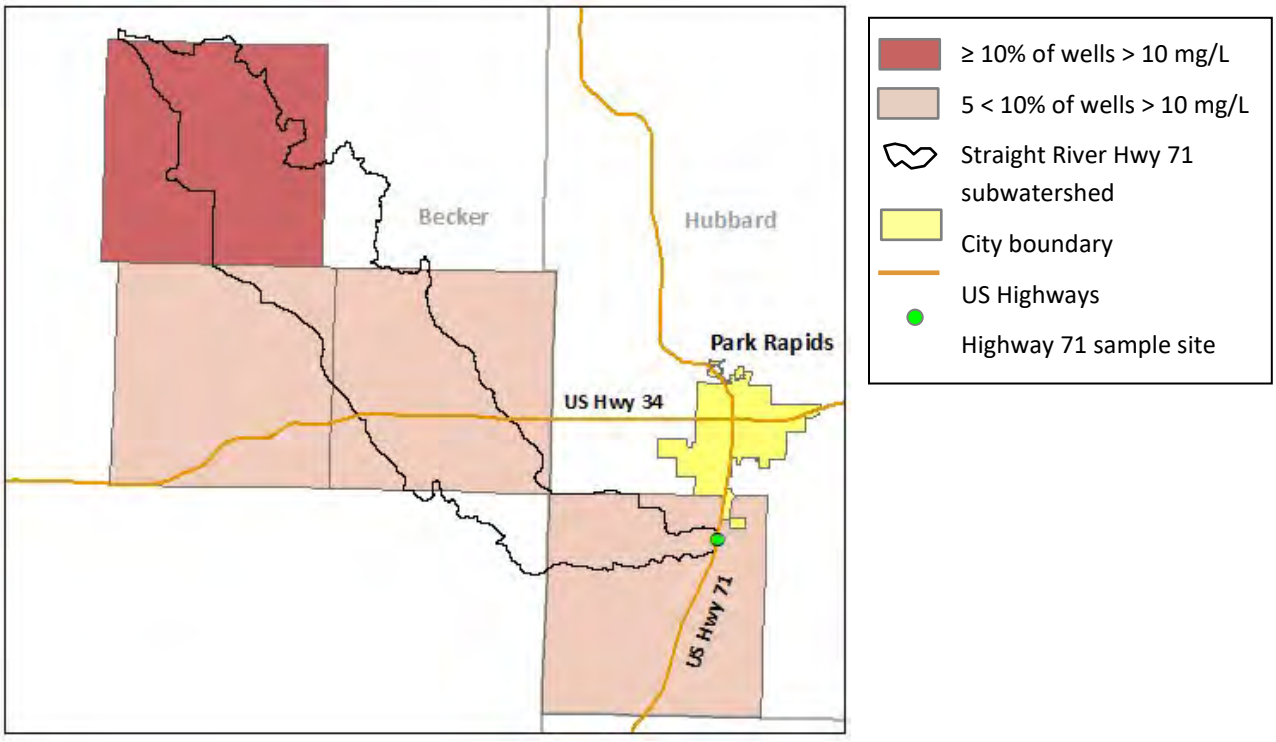
The City of Park Rapids municipal wastewater treatment ponds are located near the Straight River (Figure 11). After treatment in the ponds, the water is irrigated onto several nearby fields. These fields are outside of the surficial subwatershed boundary contributing to the river where it is sampled at US Highway 71. Generally, surficial aquifer groundwater follows the land's relief in its flow direction, and so any nitrate in the treated wastewater that enters groundwater should be contributing either to a location on the Straight River downstream of Highway 71, or to the Fishhook River (i.e., not part of the nitrate source measured at Highway 71).

Figure 10. Location of the Park Rapids municipal wastewater treatment ponds (green box) and fields where permitted treatment pond water is applied ( ). The surface drainage area of the Straight River for the site at Highway 71 is outlined in yellow.



As mentioned earlier, the nitrate-N concentration in the groundwater in the area surrounding the Straight River is elevated, in some cases beyond the drinking water standard (10 mg/L). In 2013, the Minnesota Department of Agriculture initiated a township-based private well nitrate testing project in areas with groundwater sensitivity based on soil/geology. Included in the project were several townships in the Straight River Subwatershed, sampled in 2016. One of the townships associated with the Straight River had greater than 10 percent of private wells testing at 10 mg/L or higher, and the other three had between 5-10 percent of wells testing at or above 10mg/L (MDA, 2022). Results of that sampling are shown in Figure 12. Groundwater input makes up a substantial amount of the flow of the Straight River (Stark et al., 1994). Thus, these groundwater inputs with elevated nitrate concentrations are a logical source of nitrate in the river.

Figure 11. Results of recent MDA township private well testing for nitrate, adapted from the Minnesota Department of Agriculture (2022). Only those townships that were both part of the testing project and likely contribute nitrate via groundwater to the Straight River down to the point of Highway 71 are shown in this graphic.



A few sample findings from studies

The nitrate concentration in the Straight River, especially at the US Highway 71 site, is much higher than nitrate concentrations in most other streams of the Crow Wing River/Pine River/Leech Lake River/Mississippi River - Headwaters Watersheds during the growing season, even though it is not at its annual high period (winter) (Figure 17). Stream nitrate levels in these natively-forested watersheds are very low with a few exceptions.

Figure 12. Crow Wing River Watershed nitrate concentrations from all IWM-1 biological monitoring site visits in the Crow Wing R., Mississippi R - Headwaters, Leech Lake R., and Pine R. Watersheds (most sites have just one sample).

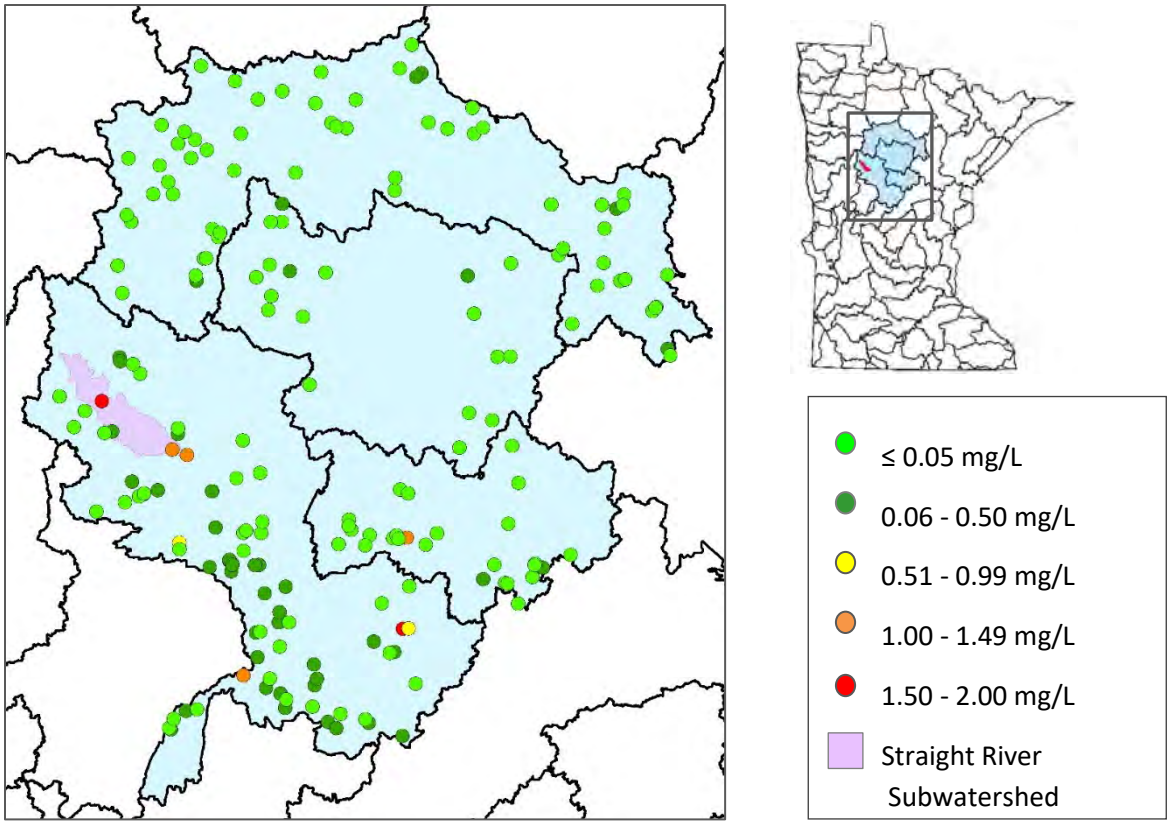


Table 2. Summary statistics of nitrate-N concentrations collected at IWM-1 biological monitoring visits from 2010 - 2015 from four contiguous HUC-8 scale watersheds (not including Straight River sites; see Figure 17). Most sites had one sample, while a number of sites had 2-4 samples. For sites with multiple samples, the values were averaged, with their average value used in creating the summary statistics. Straight River IWM samples from 2010 are also shown - each was a single sample.

Number of sites sampled	187
Total number of samples	259
Average concentration (mg/L)	< 0.123*
Standard deviation (mg/L)	0.211
Highest site average value (mg/L)	1.240
Highest single sample value (mg/L)	1.59
Lowest single sample value (mg/L)	0.007**
Number of samples < lab detection limit	171
Percent of samples < lab detection limit	66.0
Straight River (10UM060, at Bass Bay Ave) (mg/L)	1.99
Straight River (10UM061, at CR-125) (mg/L)	0.188
Straight River (10UM060, at Hwy 71) (mg/L)	1.29

*The average is less than this value because there were many samples that measured less than the laboratory detection limit.

** A few samples from an early sampling year in the dataset were done by another lab and reported at a lower level (below the typical detection limit for samples done by other labs; 0.02 or 0.05 mg/L).

Figure 13. Close-up of the Straight River Subwatershed area (the purple area) from Figure 9. Colored dots are the same 2010 IWM stream sample sites as in Figure 17.

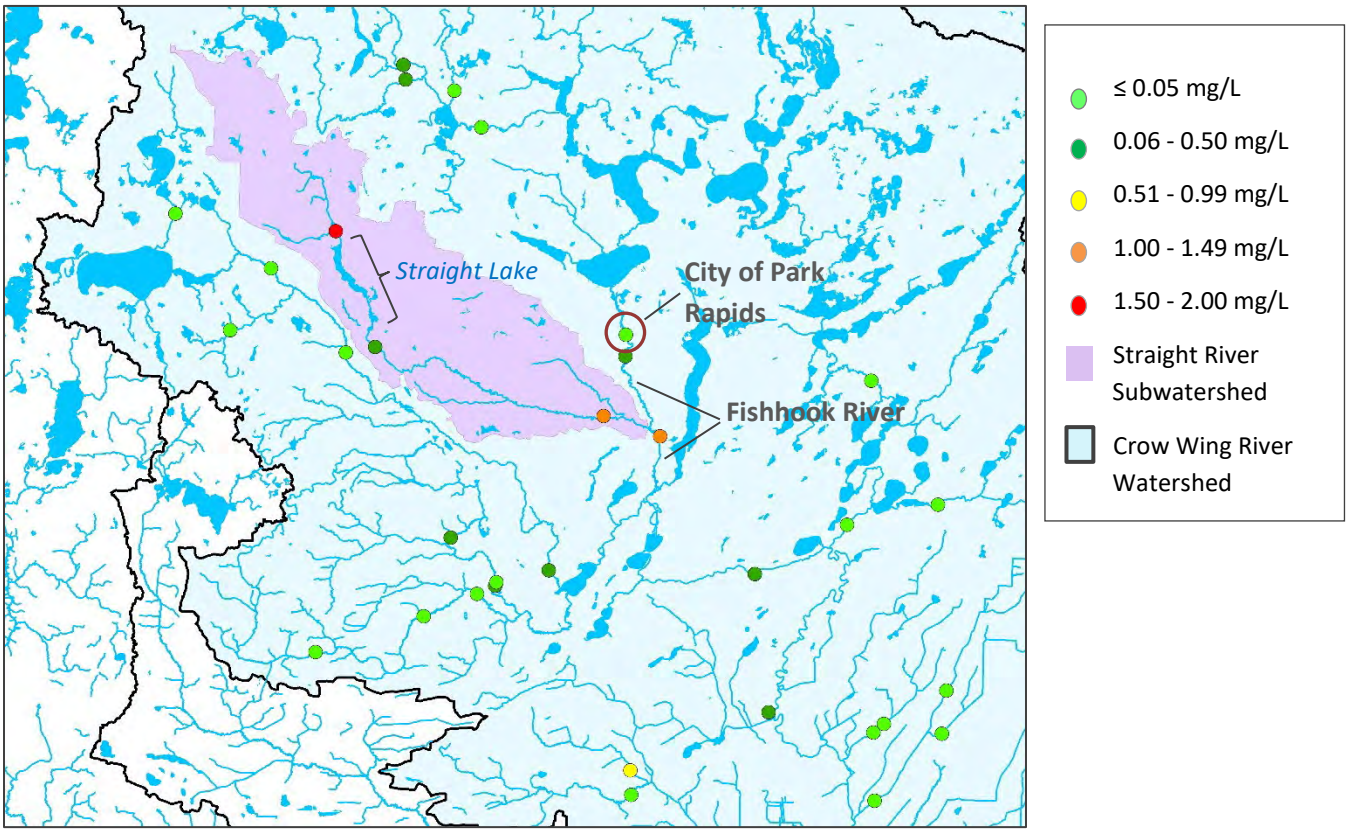


Table 3. Summary statistics from 17 IWM 10X sites surrounding the Straight River and including the Straight River. This dataset also contains a smaller number of samples collected by county water managers at some of the sites. The great majority of samples were collected from 2007 - 2020, and samples are from May through September. See Figure 19 for map of site locations.

Stream	HUC-8 watershed	EQuIS site number	# nitrate-N samples	Average nitrate-N (mg/L)	Highest nitrate-N concentration (mg/L)	# samples below lab detection limit and (%)
Cat River	Crow Wing R.	S002-408	22	0.142	0.29	0 (0%)
Blueberry River	Crow Wing R.	S003-501	31	< 0.110	0.36	14 (45.1%)
Fishhook River	Crow Wing R.	S006-251	11	< 0.043	0.08	6 (54.5%)
Kettle River	Crow Wing R.	S003-502	17	< 0.026	< 0.03	16 (94.1%)
Hay Creek	Crow Wing R.	S006-252	14	< 0.032	0.056	13 (92.9)
Shell River	Crow Wing R.	S003-442	123	0.388	0.83	0 (0%)
Necktie River	Leech Lake R.	S006-256	34	< 0.031	< 0.05	33 (97.1%)
Kabekona River	Leech Lake R.	S007-103	10	< 0.030	< 0.03	10 (100%)
Shingobee River	Leech Lake R.	S007-102	15	< 0.029	< 0.05	15 (100%)
Schoolcraft River	Mississippi Headwaters	S007-550	17	< 0.034	< 0.10	15 (88.2%)
Ottertail River	Ottertail R.	S003-937	13	< 0.035	< 0.05	13 (100%)
Toad River	Ottertail R.	S008-843	10	< 0.120	0.329	1 (10%)
Pine R., So. Fork	Pine R.	S007-101	10	< 0.039	0.091	7 (70%)
Redeye River	Redeye R.	S006-848	60	< 0.104*	2.98**	43 (71.7%)
Wild Rice River	Clearwater R.	S005-131	19	< 0.025	0.031	18 (94.7%)
Straight River	Crow Wing R.	S002-960	20	1.98	3.76 (July 7, 2020)	0 (0%)

*Without one extreme outlier, the value is < 0.056.

**Value is an extreme outlier. The second highest value is 0.12

Figure 14. Growing season (May - September) nitrate-N sample averages for IWM 10X chemistry monitoring stations.

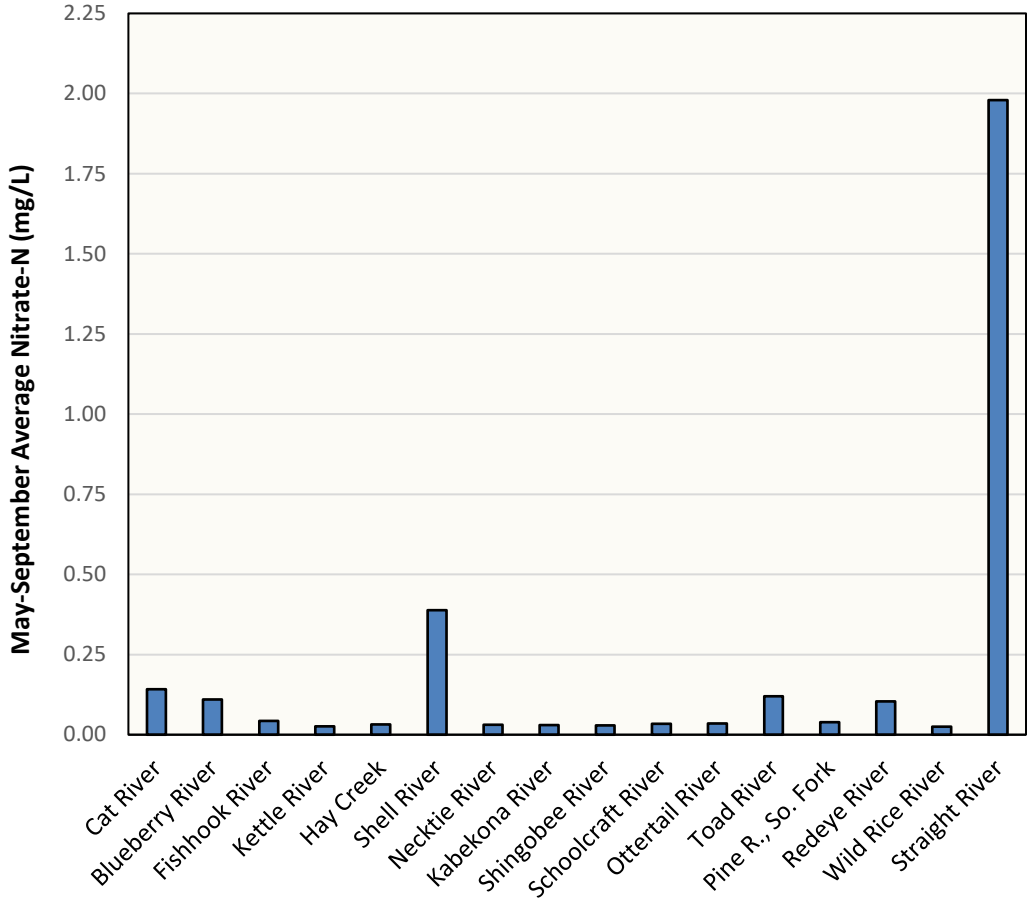
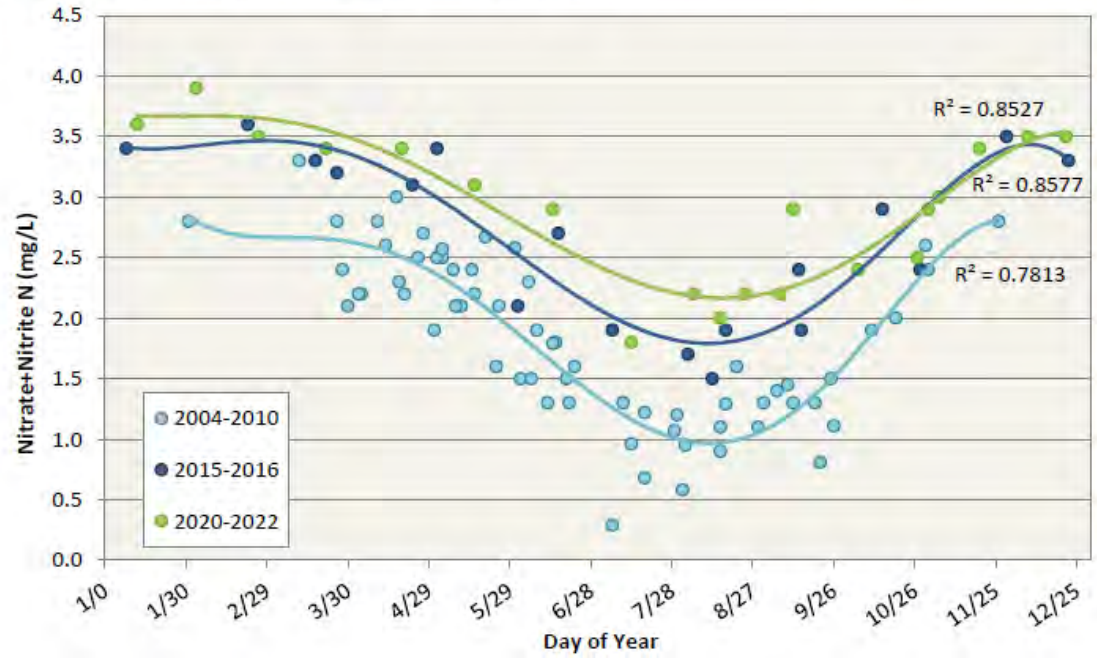


Figure 27. Straight River nitrate data at US Hwy 71 (S002-960), 2004-2010 vs. 2015-2016 vs. 2020-2022 periods. Curved lines are 4th order polynomial regression lines with accompanying R^2 values.



Conclusions

Nitrate concentrations in the Straight River are much higher than those monitored in streams and rivers elsewhere in the four-watershed, natively-forested north central Minnesota area discussed in this study. The exceptions were a

couple other intensively agricultural (though nonirrigated) locations. Most other streams in the Crow Wing River Watershed and the three adjacent watersheds to the north and or east (with similar landscapes, soils, etc.) have nitrate levels below lab detection limits (0.05 or 0.02 mg/L depending on lab used). Thus, levels in the Straight River are many, many times higher than is typical in this region's stream waters.

Several findings lead to a plausible conclusion that irrigated row crop agriculture, and its local intensification, have and are contributing significant amounts of nitrate to the Straight River:

- Groundwater nitrate concentrations are known to be high in the Straight River's Watershed,
- Streamwater nitrate concentration increases moving downstream in the Straight River just as the groundwater proportion of stream flow increases moving in the downstream direction,
- The monitored streamside spring at CR-125 had consistently high nitrate concentrations, much higher than the stream water at any site, though potential for some contribution from a nearby home cannot be ruled out.
- Higher stream nitrate concentrations in regional streams are co-located with areas of relatively high row crop agricultural land densities and/or farm animal production,
- The region has very low natural background of nitrate in areas where little agriculture is practiced,
- The landscape patterns of irrigated agricultural acreage parallel the Straight River and are in close proximity to the river,
- Irrigated agriculture has increased significantly here since the early 1990's, and
- The timelines of cropping intensification and increasing levels of nitrate concentrations in the Straight River correlate.

Nitrate concentrations were well above natural background levels in the years prior to 2011 and increased significantly by 2016. Sampling in 2020 through 2022 showed that nitrate levels may have increased a small amount from 2015 through 2016 levels based on graphical interpretation, though the data from 2020 is not statistically-significantly higher. Nitrate levels have possibly stabilized recently (but are not declining from the elevated levels) as new conversion to irrigated acreage has slowed.

The Straight River is formally listed on Minnesota's 303(d) impaired waters (in 2010) list for failing to meet the coldwater DO aquatic life standard, though the actual measured fish and macroinvertebrate communities are still meeting their respective standards. Elevated nitrate is most likely contributing to undesirable levels of plant life, attached algae in specific. The excess algae lowers DO via respiration and decay (i.e., eutrophication) and may in-turn be limiting the potential of the aquatic organism communities in the Straight River. Possible alterations in groundwater volume inputs to the river may be an exacerbating factor influencing aquatic species as well, by raising stream water temperature. Studies by DNR on the river's flow volume are ongoing. Nitrate levels are approaching a level that may be toxic to certain aquatic organisms, based on recent nitrate toxicity studies by the EPA and analysis by MPCA (MPCA, 2022).

Minnesota has developed a river nutrient reduction strategy which has a goal of substantially reducing nitrate and phosphorus in Minnesota's streams and rivers (MPCA, 2014b and 2020). In order to achieve our nitrate reduction goals in the state, significant reductions will be needed in nitrate-polluted waters throughout much of the state. Efforts to date in the Straight River Watershed to reduce nitrate loss from fertilized fields to the river via groundwater have not shown success yet (as of 2022) in the river, based on monitoring of nitrate in the Straight River, though these nitrate-leaching reduction efforts are relatively new. As MPCA primarily has surface water protection responsibilities, other state agencies have done monitoring of groundwater nitrate in the Straight River Watershed. Groundwater nitrate concentration trends will be informative to further interpreting the results presented in the present report. Findings from those studies will shed light on whether stream nitrate levels should be improving, and when that may happen. A report on the monitoring that has occurred recently as part of the Straight River Groundwater Management Zone is expected to be released soon.

Natural Shorelines

MINNESOTA NATURAL SHORELINE PARTNERSHIP

Jeff Hrubes, BWSR
Paul Radomski, DNR
Sami Selter, MN Lakes & Rivers Advocates

Sept 15, 2025, Clean Water Council

CLEAN WATER LAND & LEGACY AMENDMENT

What's a Lake?

1. A hole in the ground that fills up with water.
2. A hole in the ground that indicates the water table.
3. A complex aquatic ecosystem that is influenced by near-shore and watershed conditions.
4. A body of water created by blocking a river.
5. All of the above.

What area of a lake provides the greatest habitat complexity?

1. The deep basin of the lake.
2. Shallow water areas.
3. The narrow band around the lake that includes both water and land.
4. Under docks.

↑Lakeshore Uses Change

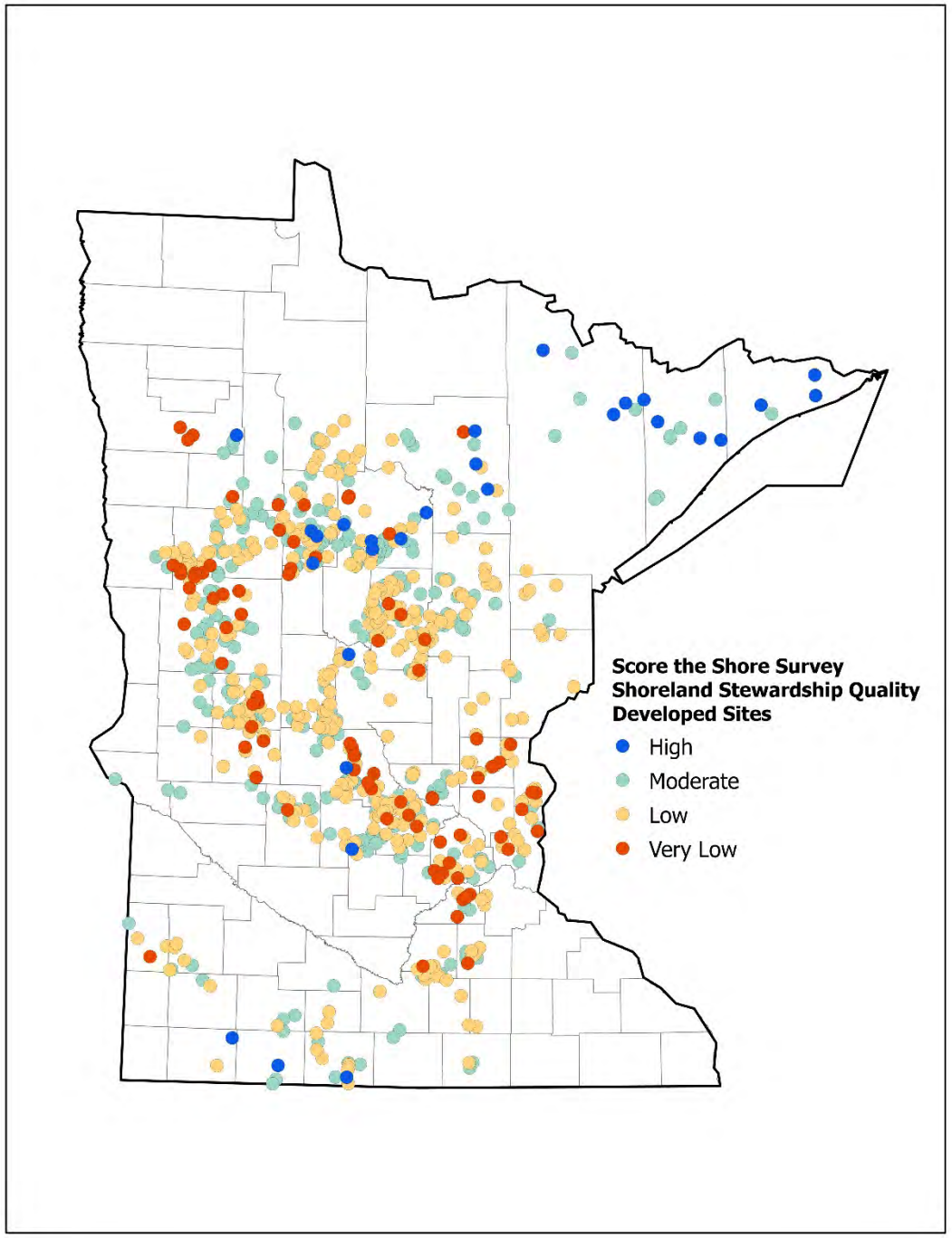
Lakeshore Norms Change→

Natural Shoreline –

We've lost 40-50% of our natural lakeshores

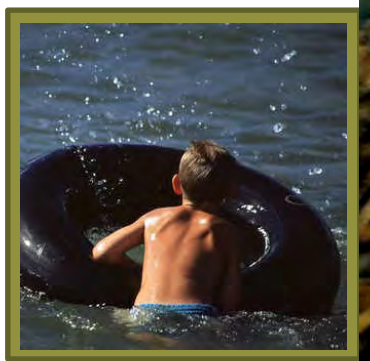
1-2% loss per decade

See the **Minnesota Natural Shoreline Partnership's** report:
Minnesota's Vanishing Natural Shorelines




Limiting Factor:
1 lb of Phosphorus produces 500 lbs of algae
Lawn-to-Lake Pollution:
0.2 lbs Phosphorus/lot per summer
Cumulative Effect:
0.2 lbs TP/lot X 100 lots = 20 lbs
20 lbs X 500 lbs = 10,000 lbs or 5 tons of algae

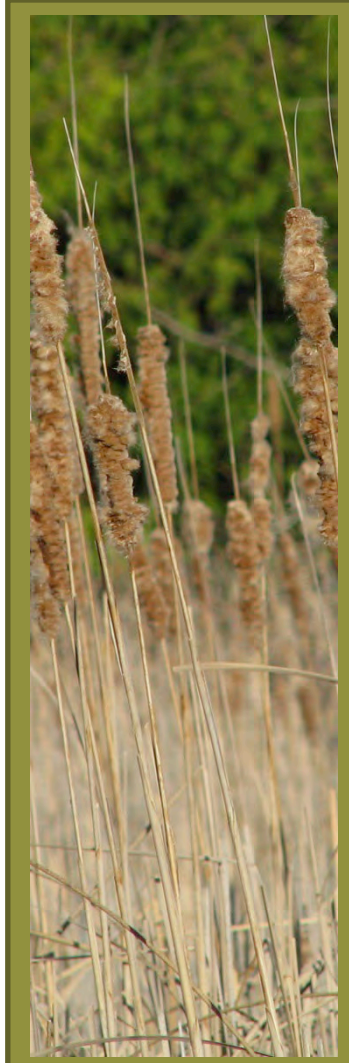

Water quality is reduced



Fish habitat is destroyed along shore

- Vegetation habitat is removed
- Sedimentation from lawn-down-to-lake
- Downed wood is removed
- Riprap is unfavorable for many small nongame fish

Eric Engbrettson



Loss of Loon Nesting Habitat

Loons are more likely to nest away from shoreline development, in areas with low fetch, low littoral slope, and high plant richness

Radomski et al. Common loon (*Gavia immer*) nesting habitat models for north-central Minnesota lakes. Waterbirds

Vanishing Natural Shorelines

This report was formulated out of discussions with non-profit organizational leaders and government (state and local) natural resource professionals concerned about the continuing loss of shoreline vegetation, which helps protect clean water, habitat, lakeshore character, and recreation.

MINNESOTA NATURAL SHORELINE PARTNERSHIP

Goal: 75% of a shoreline be natural vegetation that is at least 25 feet landward

MINNESOTA NATURAL SHORELINE PARTNERSHIP

Recent Actions of the Partnership

- Strengthening relationships with those interested in protecting and restoring shoreline
- Improving outreach with a sustained, consistent message
- Improving State and LGU governance related to shoreline alterations

Changing Public Perceptions about Natural Shorelines

It's Shore Important
A Game About Healthy Lakeshores 🌊🍃

Shoreline Stewardship:
3-month digital ad video series 🌻🖥️

Trouble by the Water:
Minnesota Public Radio articles 📰🚣

'Quit mowing': Turning Minnesota lake homeowners into shoreline stewards, one lawn at a time

A program born in the Brainerd Lakes Area to protect natural shorelines and curb pollution also wants to reset Minnesota's lake culture. It's led by property owners, including some who helped create the current...

by Kirsti Marohn

10 key data points and graphs about loss of shoreline on Minnesota's lakes

Inspired by MPR News' series, "Trouble by the water: Minnesota's vanishing natural lakeshores?" This supplement goes deeper into the trends and data, including some county- and even lake-level data about...

by Elisabeth Gawthrop and Alyson Clary

Unchecked development, lax regulation push Minnesota lakeshores to the edge

Development has destroyed nearly half the natural shorelines that help protect Minnesota lakes from erosion and pollution. Reversing that means convincing people that their vision of beauty is killing the thing they love.

by Kirsti Marohn

Local Success Stories: Programs

Minnesota Lakes & Rivers
Lake Steward

Freshwater Society
Water Stewards

Blue Thumb Partners
Lawns2Legumes

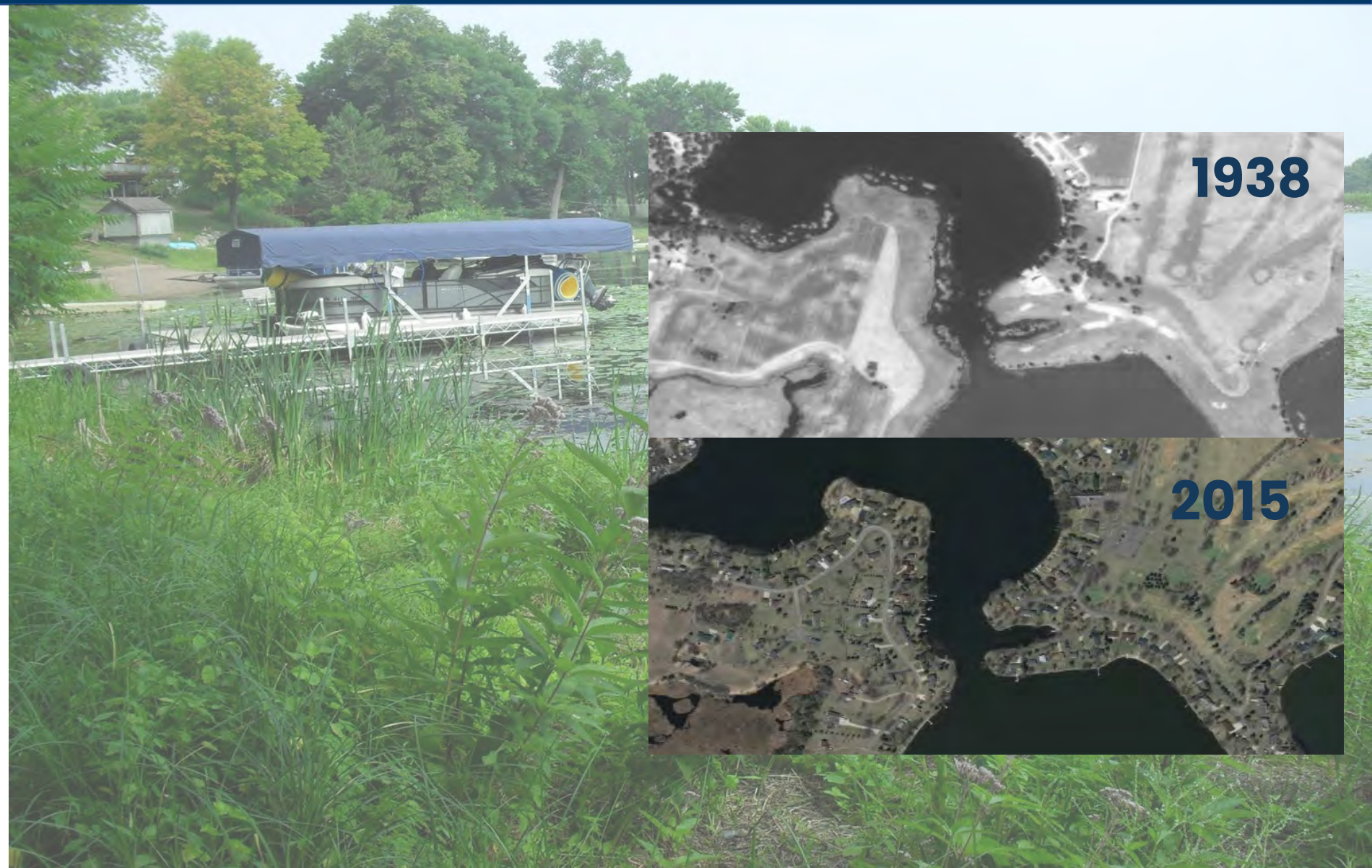
Local Success Stories: Governance

CLFLWD
WATERSHED DISTRICT

A *voluntary* approach:
Cost-share up to 100% for priority projects, technical assistance, outreach

STEARNS CONSERVATION DISTRICT

A *regulatory* approach:
Cost-share requires a deed restriction, mandated shoreline coverage, certified contractors



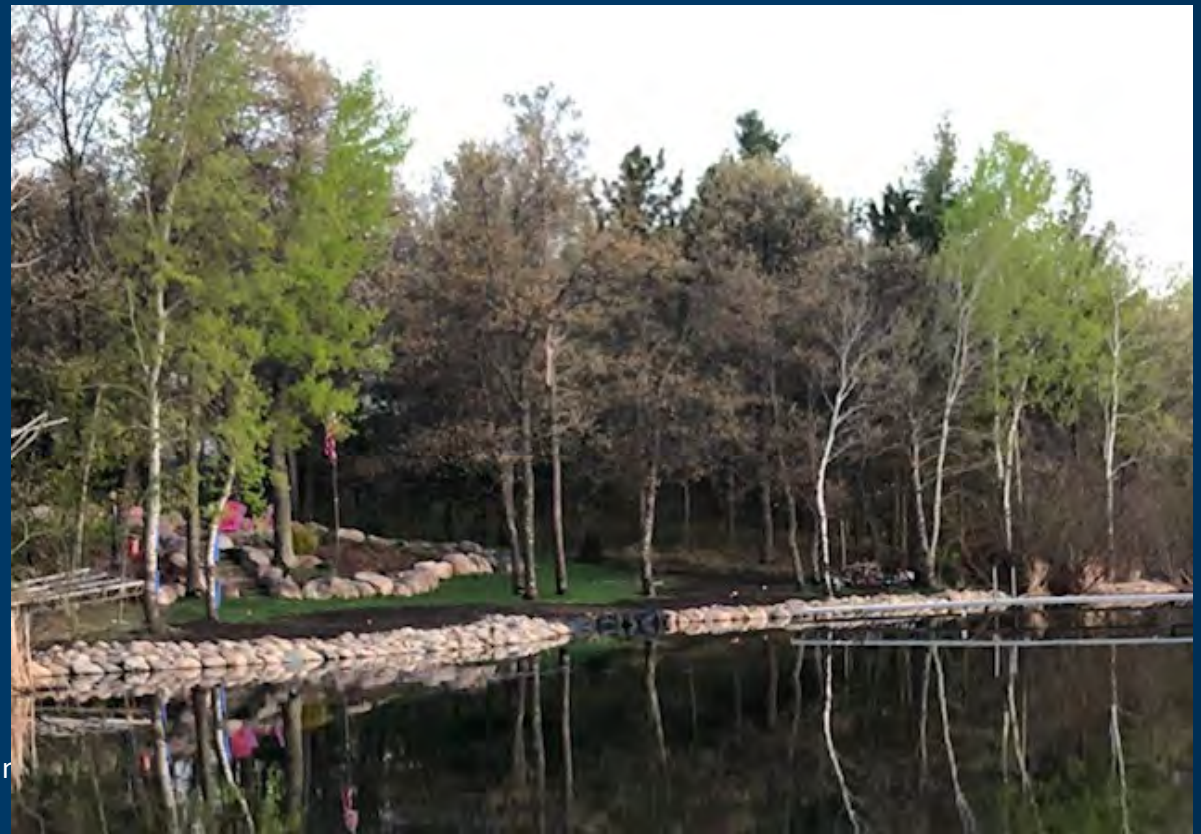
Stearns County Shoreland Contractor Training

- Every year has 125 – 200 attendees
- Product vendors attend to showcase products and services
- Creates a networking opportunity – main contractors attend every year
- Connection with contractors – understand their requests, assist without being overbearing, be available (site visits, phone, text),

Vanishing Natural Shorelines

Before

After



DNR Regulations on Shoreline Alterations

“Restoration means the repair, reconstruction, or re-creation of essentially natural or native conditions of shoreline and banks.”

DNR Regulations on Shoreline Alterations

"Demonstrated need to prevent erosion or to restore eroded shoreline"

SONAR:

"The change in emphasis is *to connect the use of riprap to address erosion problems … the DNR does not promote landscaping within public waters to the detriment of natural habitat…"*

MINNESOTA NATURAL SHORELINE PARTNERSHIP

LGU & DNR Initiative on Shoreline Alterations

Recommendations:

- Engage and assist shoreline property owners
- Our websites and fact sheets need to promote natural shorelines and the use of bioengineering where appropriate
- Greater coordination on projects and enforcement actions
- ID when there is a ‘demonstrated need’ for riprap
- Train staff

Progress Here and There

Morrison County—Incorporating Watershed Plans into Shoreland Ordinance

Douglas County—Limited clearing of vegetation; Lesser of 25 feet or 25% of shore

Aitkin County—No vegetation clearing allowed until a plan is submitted

Burnett County Wisconsin—Shoreline incentives Program (since 2000)

What's Next?

- Establish a goal?
- More tools—Incentives?
- How to spread the word?
- Technical Training?
- Do more with more

MINNESOTA NATURAL SHORELINE PARTNERSHIP

CLEAN WATER LAND & LEGACY AMENDMENT

YOUR Clean Water Fund AT WORK

Thank you

Shoreline Protection Subcommittee Recommendations on Shoreline Alteration Management

June 27, 2025

Background

The Subcommittee's purpose was to work collaboratively to identify approaches to improve how various entities regulate and provide technical services for shoreline property owners. To better protect and restore natural shorelines, the goal was to identify management opportunities and strategies to address shoreland and public water alterations that result in degraded shorelines.

Shoreline alterations are regulated by two different sets of Minnesota Rules. Minnesota Shoreland Management Rules (M.R. 6120) set the minimum shoreland development standards, which local governments can and do amend to higher standards and administer through their zoning ordinances. DNR Public Water Rules (M.R. 6115) include standards and criteria for granting permits to change the course, current, or cross-section of public waters. Thus, local governments regulate shoreline alterations above the ordinary high water level (OHWL) and the DNR regulates those below the OHWL. This complexity creates challenges for land owners and governments.

The Shoreline Protection Subcommittee met several times:

1. September 19, 2024; The purpose was to discuss the mission of the group and to have individuals express the challenges, shortcomings, and barriers of existing state and local regulations, implementations of those rules, and various programs that are designed to protect and restore natural shorelines.
2. December 2, 2024; Emily Javens, DNR, presented a summary of DNR Public Water Restoration Rules, with focus on riprap (M.R. 6115.0215 – 6115.0217). Tom Langer, Carnelian-Marine-St. Croix Watershed District, presented on shoreline assessments conducted by the district.
3. March 7, 2025; Jacob Frie and Tim Crocker, DNR, presented a summary of the DNR Public Water Rules, with focus on sand blankets, ice heaves, and General Permits.
4. April 30, 2025; Jacob Frie, DNR, presented a summary of the DNR Public Waters Rules enforcement process. Rob Haberman, DNR Water Resources Enforcement Officer, joined Jacob in addressing questions from the group.

DNR Public Waters Rules are designed to balance use and conservation of Minnesota's lakes and other public water resources. These rules have many positive components. There is a clear structure to these rules. For example, restoration of public waters (M.R. 6115.0215, Subpart 1), which regulates riprap, states that the goals for projects should improve and protect fish and wildlife habitat, preserve the natural character of shoreline zones, and prevent erosion. The scope (Subpart 2) defines 'restoration' as the repair, reconstruction, or re-creation of essentially natural or native conditions of shoreline and banks. These rules then specify the prohibited activities (Subpart 3) and the necessary criteria where 'no permit' is required (Subpart 4).

After review of DNR Public Water Rules, the Subcommittee concluded that these rules were likely not a significant barrier in protecting and restoring of natural shorelines. Rather, it was how shoreline alteration rules are expressed to the public, how those sets of rules are administered, and how governments coordinate with each other on projects that often impact areas above and below the OHWL.

For example, regarding DNR administration of riprap rules, there is a requirement for when a permit is not required that many found confusing in the restoration part of DNR Rules (M.R. 6115.0215, Subpart 4, item E). The rule states “to install natural rock riprap and associated filter materials where there is a ***demonstrated need*** to prevent erosion or to restore eroded shoreline.” [emphasis added]. The Statement of Need and Reasonableness for this subpart of the rule stated, *“This proposed change of emphasis to connect the use of riprap to address erosion problems is reasonable so that the department does not promote landscaping within public waters to the detriment of natural habitat values when there is not a demonstrated erosion problem*.” [January 7, 2002]. The interpretation of “where there is a demonstrated need to prevent erosion." implies that an appropriate assessment can be made. Pragmatically, how does one administer this requirement consistently and objectively?

The Shoreline Protection Subcommittee identified the primary issues and made recommendations on each:

Primary Issues and Bulleted Recommendations

1. DNR’s riprap, sand blanket, and ice heave rules are regularly misunderstood or ignored and result in inappropriate practices that contribute to habitat loss. They insufficiently promote the use of natural materials to restore shorelines and sustainably maintain natural processes. There needs to be more guidance about natural features and education regarding processes that accelerate erosion.
    - Update DNR websites and fact sheets to emphasize natural shorelines and, where appropriate, the use of bioengineering to stabilize eroding shorelines.
    - Encourage DNR, local governments, SWCDs, and Watershed Districts to seek new opportunities to engage and assist shoreline property owners and civic groups in natural shoreline protection and restoration activities.

2. There are times and places with inadequate coordination between DNR, local governments, SWCDs, and Watershed Districts on shoreland alteration permits, riprap, sand blankets, ice heaves, and other shoreline alterations.
    - Advance greater coordination between the DNR and local governments on projects or enforcement actions that include issues both above and below the ordinary high water, which also provides opportunities to converse with property owners.
    - Encourage local governments, SWCDs, and Watershed Districts, if applicable, to track and report required notifications.
    - For greater consistency of enforcement on non-compliance of ordinances and rules:
        - Continue to train DNR staff for a consistent understanding of enforcement procedures, how to pursue voluntary restoration, and prepare Restoration Orders.
        - Local governments will train their staff and officials on criteria for granting shoreland variances, how to identify violations, support DNR enforcement activities, and coordinate enforcement with local rule compliance.
    - Members of these governmental agencies should strive to work collaboratively to assist property owners’ efforts to protect and restore natural shorelines. Collaboration could range from regular informal coordination to more formal evaluations that help standardize assessments across agencies.

3. There are limited opportunities to ensure property owners and contractors correctly meet requirements for DNR 'no permit' guidelines, likewise, current administration of DNR 'no permit' requirements also limit discussions with property owners and contractors, which can inadvertently mislead people on the need for local permits.
    - Develop administrative procedures for the DNR 'no permit' requirement and enlist local governments for assistance with these procedures.

4. There are ambiguous or inconsistent criteria used to evaluate 'a demonstrated need to prevent erosion', and there are insufficient governmental processes for consistent decisions and outcomes (e.g., insufficient training, monitoring, and local-state partnerships).
    - Provide methods or a shoreline assessment tool to identify when there is a 'demonstrated need' for riprap.
    - Train DNR staff for a consistent understanding of 'demonstrated need' and alternatives to riprap.
    - Train local government staff on how 'demonstrated need' is determined.

5. There is inconsistent or variable interpretation of rule by local governments, contractors and landowners (as many rules/policies are open to interpretation).
    - Encourage local governments to certify and train contractors that work in shoreland.
    - Clarify existing shoreland and floodplain rules on grading and filling in the shore impact zone where a permit may be required by local governments for the installation of riprap and sand blankets.

6. Certain aspects of the DNR General Permit process sometimes act as a barrier to promoting and incentivizing natural shoreline alternatives.
    - Review and find solutions to DNR General Permit barriers.

7. Within public agencies, there has been a loss of shoreline restoration expertise.
    - Build technical capacity for lake habitat, natural shoreline restoration, and bioengineered shoreline designs that would result in coordinated assistance and field-based train-the-trainer workshops to state and local government staff.

Group Membership List

Jay Riggs (Washington Conservation District), Mike Isensee (Carnelian-Marine-St. Croix Watershed District), Tom Langer (Carnelian-Marine-St. Croix Watershed District), Aidan Read (Comfort Lake-Forest Lake Watershed District), Mat Nicklay (Riley Purgatory Bluff Creek Watershed District), Greg Berg (Stearns County SWCD), Tom Nelson (Itasca County SWCD Board Member), Chris Pence (Crow Wing County Environmental Services), Dave Rush (Douglas County Land & Resource Management), Marc Telecky (McLeod County Environmental Services), Jeff Forester (Minnesota Lakes and Rivers Advocates), Lily Carr (Minnesota Lakes and Rivers Advocates), Emily Javens (DNR), Tim Crocker (DNR), Jacob Frie (DNR), Paul Radomski (DNR), Stacy Zeigler (Leech Lake Band of Ojibwe).

Watershed Protection in the Mississippi Headwaters Basin

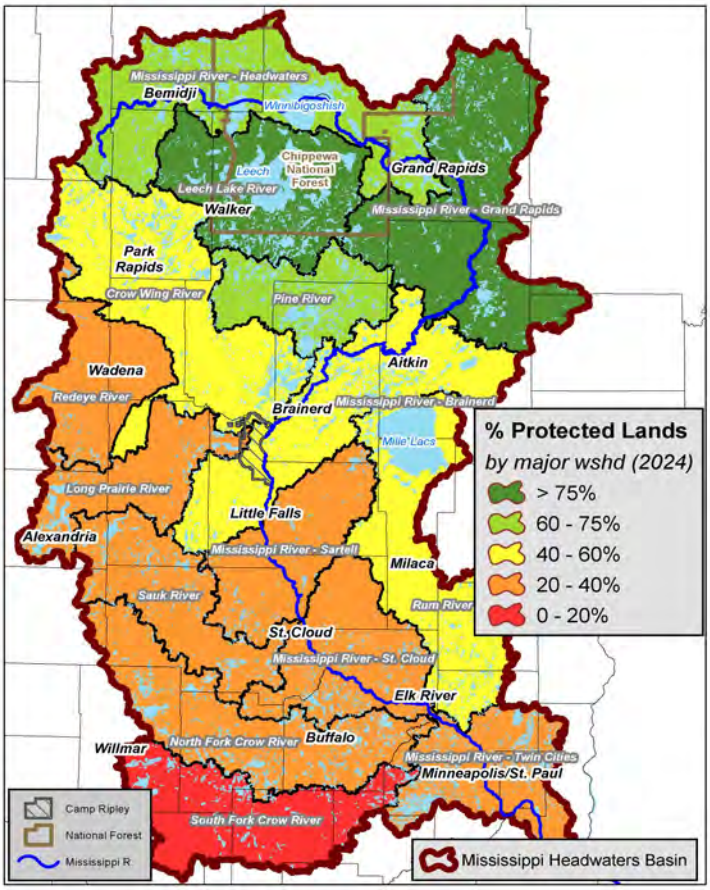
Successes and Future Directions

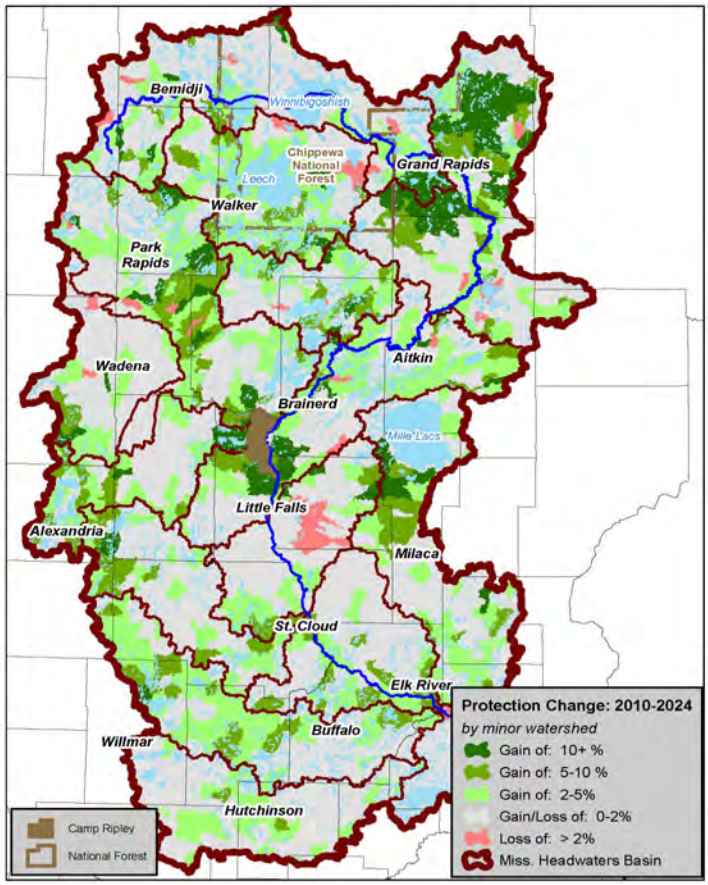
The Mississippi Headwaters contains some of the finest lakes and streams in the nation and has been the focus of significant land conservation. Over 300,000 acres have been protected in the Basin since 2008 by a "Who's Who" of conservation organizations. That protection has ranged from fee-title acquisitions, conservation easements, and incentive payments to landowners (see back page). All of these efforts have "Moved the Needle" and now, over 46% of the land in the Basin is under some form of conservation protection.

Most of these conservation efforts have been funded by the Outdoor Heritage Fund and consist of ongoing "phases" of funding. Significant opportunities exist for the Clean Water Fund to coordinate with these significant land and watershed projects and provide additional support to the efforts.

Organizations and Agencies

- *Mississippi Headwaters Board*
- *Soil and Water Conservation Districts*
- *Watershed Districts*
- *County Governments*
- *BWSR Rim Easements*
- *DNR Forest Legacy/Forests for the Future*
- *DNR Forestry / Department of Revenue SFIA*
- *DNR AMA and WMA Programs*
- *Leech Lake Band of Ojibwe*
- *Chippewa National Forest*
- *Northern Waters Land Trust*
- *Minnesota Land Trust*
- *Minnesota Trust for Public Lands*
- *The Conservation Fund*
- *The Nature Conservancy*





Mississippi Headwaters Basin: Protection Summary by Watershed 2024

Watershed Name *(based on 'One Watershed One Plan' boundaries)*	% Protected Lands* *(including SFIA)*	% Max Protection**	% Land Disturbance	General Mgmt Status***
Leech Lake River	**79.4**	90.0%	7.7	Vigilance
Mississippi River - Grand Rapids	**75.2**	88.3	9.1	Vigilance
Mississippi River - Headwaters	72.5	84.8	12.2	Protection
Pine River	65.6	81.4	11.7	Protection
Mississippi River - Brainerd	52.2	69.3	28.6	Protection
Crow Wing River	46.6	67.1	28.0	Protection
Rum River	46.0	58.4	38.6	Protect/Restore
Long Prairie River	33.9	46.6	53.7	Restoration
Redeye River	31.3	45.1	52.5	Restoration
North Fork Crow River	26.7	30.4	75.3	Restoration
Mississippi River - St. Cloud	26.6	35.2	66.8	Restoration
Mississippi River - Sartell	26.5	38.3	62.5	Restoration
Mississippi River - Twin Cities	25.6	25.6	71.6	Restoration
Sauk River	21.8	27.5	77.3	Restoration
South Fork Crow River	14.8	14.0	87.7	Restoration

*Protected Lands includes Public & Tribal Lands > 5 acres, Public Waters, Wetlands on Private Lands, Permanent Conservation Easements, & Land Enrollment in DNR's Sustainable Forest Incentive Program (SFIA)
**Max Protection = Current Protection + Potential to Protect (forested, 20+ acre privately owned parcels)
***General Management Status:

Vigilance = Watershed above 75% Protection Threshold, look for opportunities in areas less than 75%
Protection = Add Watershed Protection throughout watershed in pursuit of 75% goal (60% goal might be more achievable in some watersheds. Studies suggest that a 60% goal might be OK for stream-based watersheds
Protect/Restore = Upper half of Rum R. Watershed has a Protection Status, while the lower half is restoration
Restoration = Limited Protection Opportunities Existing due to high land disturbance (ag/development)

Protected Lands Type	Acres Gained	Timeframe*
Public Lands	62,160	2008-2024
Public Waters**	0	2008-2024
Wetlands on private lands**	0	2008-2024
Non-gov't Conservation Entities	19,918	2008-2024
*Easements (minus wetlands, includes DNR Forest Legacy/FFF)****	*201,020*	*2010-2024*
Easements *(minus wetlands)*	101,917	2010-2024
SFIA (minus wetlands)	35,635	2016-2024

*Timeframe is based on data availability dates
**Change is negligible, assumed to be 0 for calculation
***DNR runs the Forest Legacy/Forests for the Future Easements Program. In the early years following the 2008 referendum, over 100,000 acres of UPM Blandin Lands were put into easements using LSOHC funding.

Large-Scale Protection Gains since 2008 Referendum:	Acres Gained
Forest Legacy (Blandin) Easements (Itasca County)	>100,000
Potlatch/Deltic to The Conservation Fund, then to local, state entities	>50,000
ACUB (RIM Easements)	>50,000
Other fee-title Acquisitions (local, state, federal)	>50,000
Other RIM & Federal (Fish & Wildlife Services) Easements	>45,000
SFIA	>35,000

Maps and Table provided by Mitch Brinks

Forest fostering: Local farmer grows climate-adaptive seedlings as cooperative member

By Dennis Doeden, Bemidji Pioneer

September 06, 2025 at 9:00 AM

NARY — Brian Ingmire's mission to help reforest northern Minnesota with trees from south of here became a lot more important after the June 21 storm that leveled millions of trees in the Bemidji area.

Ingmire and his wife, Trina, own the 10-acre New North Farm southeast of Bemidji in Hubbard County. They sell Certified Naturally Grown produce at Bemidji's Natural Choice Farmers Market on Saturdays. They also raise sheep and chickens.

Brian is a member of the Farm & Forest Growers Cooperative, a network of small farms and nurseries that grow climate-adaptive tree seeds into seedlings, and then sell the seedlings to reforestation agencies and individuals.

The program is headed by Dr. Julie Etterson, Distinguished McKnight Professor at the University of Minnesota Duluth's Swenson College of Science and Engineering.

"Minnesota has a massive need for tree seedlings," Ingmire said. "Something like 10 million trees are needed every year at a minimum. And we have a lot of forest disturbance, whether it's fires or wind events."

Ingmire figures he has about 30,000 tree seedlings on his farm, and about two-thirds of them will be available for purchase this fall. Online orders can be placed at climatesmarttrees.com . He's also been selling seedlings at his Bemidji Natural Choice Farmers Market booth, and says having them there gives him an opportunity to talk about the project.

New North Farm is one of 24 members of the cooperative. Ingmire is growing several varieties, including red oak, burr oak, yellow birch and silver maple. All are collected from about 200 miles south and then started up north.

"I can tell you where their parent tree came from," Ingmire said. "They should be able to handle the changes in temperature extremes. We've got different insect pests and fungal pests that are putting

stressors on trees just because of the temperature extremes. These trees should have the genetic ability to deal with that kind of extreme.”

The need for reforestation was certainly exacerbated in the Bemidji area after the June storm. It is estimated that Beltrami County lost nine million trees, and many were also downed in parts of Hubbard and Cass counties.

“That number exceeds a lot of the nursery capacity that we have,” Ingmire said.

“Most of our sales will be done for spring planting,” Ingmire said, “but I would like to see as many available in the fall as possible. I think the trees do better when they're planted in the fall. But you've got a very narrow window here in northern Minnesota between when trees drop their leaves and when the ground freezes. Some years you've got a month to get all that done, and some years you've got two weeks.”

He said trees that are not sold this fall will be kept in cold storage at UMD and will be available in the spring.

A passion for science

Listening to Ingmire talk about the seedling program, his gardens and forest ecology, it’s clear to see his passion for science and the environment.

"In a lot of ways it’s a spiritual thing for me," he said. "You either set everything aside and you take a preservationist mindset where nature's best left without man touching it, or you recognize that we as humans have a unique role and responsibility to participate and be part of the natural world. There's really no separation between the two of them."

He noted that the impacts humans have are global, but that these impacts start on a local level.

"One tree at a time, or one farm that's growing vegetables that feed people. So you can choose to participate in a lot of different ways," Ingmire said. "The way that I choose to participate is to imagine and

envision what it could be, and then work to model that and make it happen. And help other people do the same."

Ingmire's full-time job is with the Minnesota Department of Agriculture as a water certification specialist. It's a position that allows for flexibility, especially during the growing season, and it also allows him to visit with farmers throughout the region.

He has a degree in natural resources and environmental maintenance from Ball State University in his native Indiana. He did graduate work at Western Kentucky University and Indiana University before becoming a science teacher at the junior college and high school level.

After that, he managed water quality programs for the Environmental Protection Agency and spent 13 years as a conservation planner and trainer with the United States Department of Agriculture.

The Ingmires moved to Minnesota nearly four years ago after he started his current position with the MDA. But finding the right place to live was a bit of a challenge for Brian and Trina.

"It was right in the middle of COVID," Brian said. "Interest rates were starting to go up. Everybody was racing to get a place."

The couple had planned to visit five properties in the Bemidji area, but by the time they arrived, three of them had been sold.

"The first one we looked at was just a nightmare," Brian said. Even the farm they bought didn't look right when they pulled into the snow-covered driveway.

"It looked horrible," Brian said. "We didn't have any photos of the inside of the house. The doors were open on the sheds when we pulled in. It hadn't been plowed. But then we got into the house and it had a bank of south-facing windows and all the sun was shining through. We thought, 'This is it. We can do this.'"

Fast forward four years, and Brian and Trina have created a pristine and productive farm, with a lot of sweat equity and a little help from their hungry sheep.

"I was looking at soil maps and thought it should be good," Brian said. "It's prime agricultural land. We had a lot of little surprises when everything thawed. There were piles of trash, it was all grown over and full of boxelder. Kind of daunting, but I was ready for it. I was just ready to have my own piece of land, and I had ideas I wanted to try out."

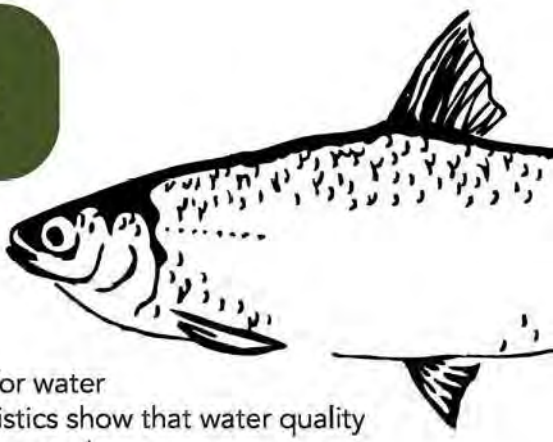
More information about Ingmire's operation can be found online at newnorthfarm.com .

Kabekona Lake

Features of the Watershed

Kabekona Lake is located three miles south of Laporte in Hubbard County. Kabekona has a surface area of 2,433 acres and a maximum depth of 133 feet. A county owned public access is located on the west shore of the lake off MN Highway 64. Kabekona is known for its Walleye fishery, but also holds Yellow Perch, Northern Pike, and supports an abundant Tullibee (Cisco) population and a low to moderate population of Whitefish.

Kabekona: Part of DNR Tullibee Lakes Project

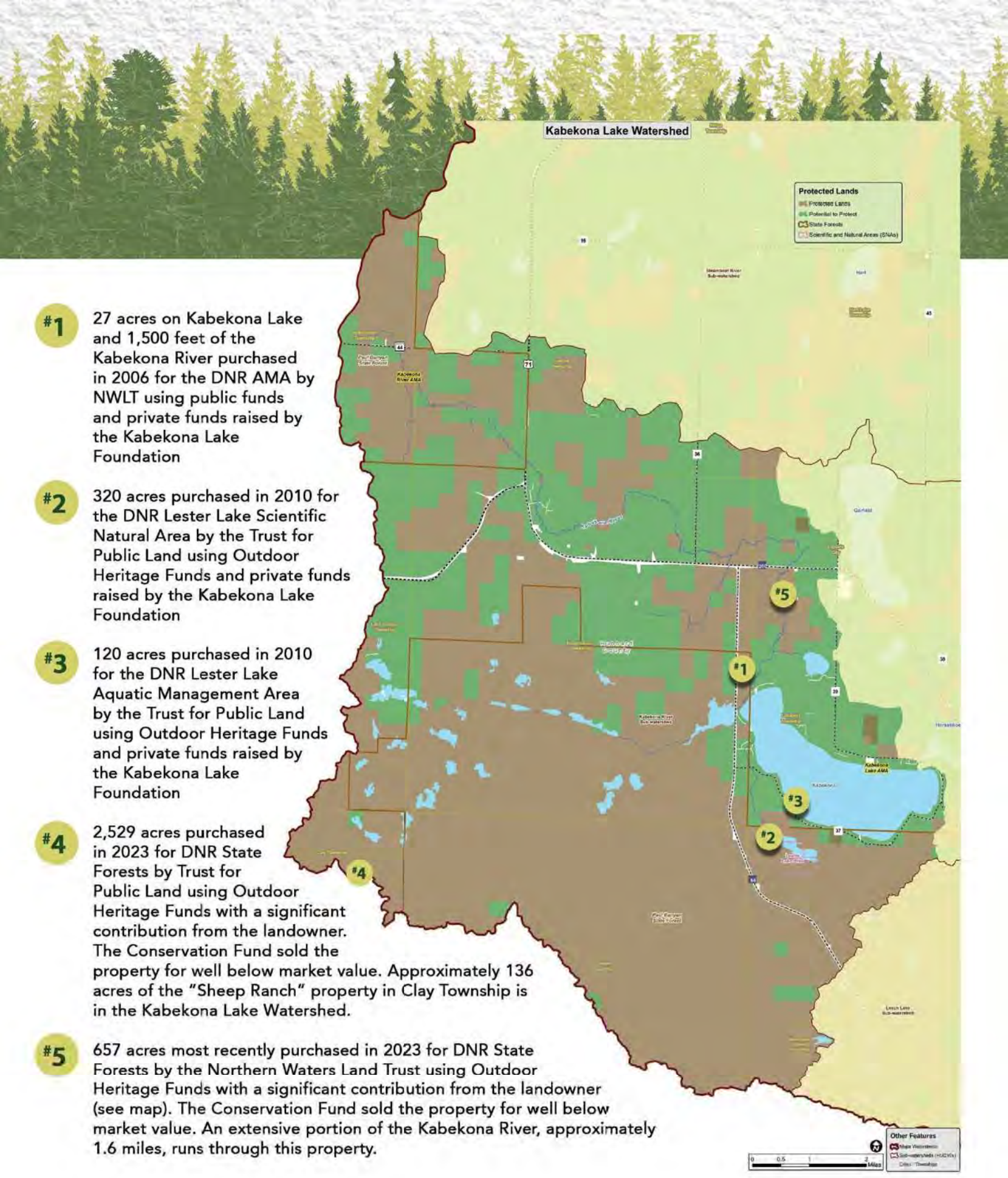


Tullibee, also known as cisco, are an important prey species for lake trout, pike, muskie & walleye. They are also an important forage fish for loons. Tullibee are only found in clean, cold, well oxygenated, deep waters.

Because of their habitat requirements they are fantastic "measuring sticks" for water quality. Protecting private forests could help save Minnesota's tullibees. Statistics show that water quality decreases as properties are over developed and when our woodlands are removed.

75% Goal Met

Today this Watershed has achieved 75% protection through collaborative efforts. This was accomplished in two ways - by conservation organizations purchasing lands for public ownership using public and private funds and through conservation easements which private landowners placed on their land permanently restricting development or land conversion.



#1 27 acres on Kabekona Lake and 1,500 feet of the Kabekona River purchased in 2006 for the DNR AMA by NWLT using public funds and private funds raised by the Kabekona Lake Foundation

#2 320 acres purchased in 2010 for the DNR Lester Lake Scientific Natural Area by the Trust for Public Land using Outdoor Heritage Funds and private funds raised by the Kabekona Lake Foundation

#3 120 acres purchased in 2010 for the DNR Lester Lake Aquatic Management Area by the Trust for Public Land using Outdoor Heritage Funds and private funds raised by the Kabekona Lake Foundation

#4 2,529 acres purchased in 2023 for DNR State Forests by Trust for Public Land using Outdoor Heritage Funds with a significant contribution from the landowner. The Conservation Fund sold the property for well below market value. Approximately 136 acres of the "Sheep Ranch" property in Clay Township is in the Kabekona Lake Watershed.

#5 657 acres most recently purchased in 2023 for DNR State Forests by the Northern Waters Land Trust using Outdoor Heritage Funds with a significant contribution from the landowner (see map). The Conservation Fund sold the property for well below market value. An extensive portion of the Kabekona River, approximately 1.6 miles, runs through this property.

Northern Waters LAND TRUST

KABEKONA WATERSHED

A Success Story

WATERSHED 75 PROTECTION

Photo by: Catherine Holmgren

ACKNOWLEDGMENTS

Authors:

- **Kathy DonCarlos**
  - Northern Waters Land Trust
- **Luther Nervig**
  - Kabekona Lake Foundation & Association

Researchers:

- **Pete Jacobson**
  - Retired - Minnesota Department of Natural Resources
- **Tim Cross**
  - Retired - Minnesota Department of Natural Resources

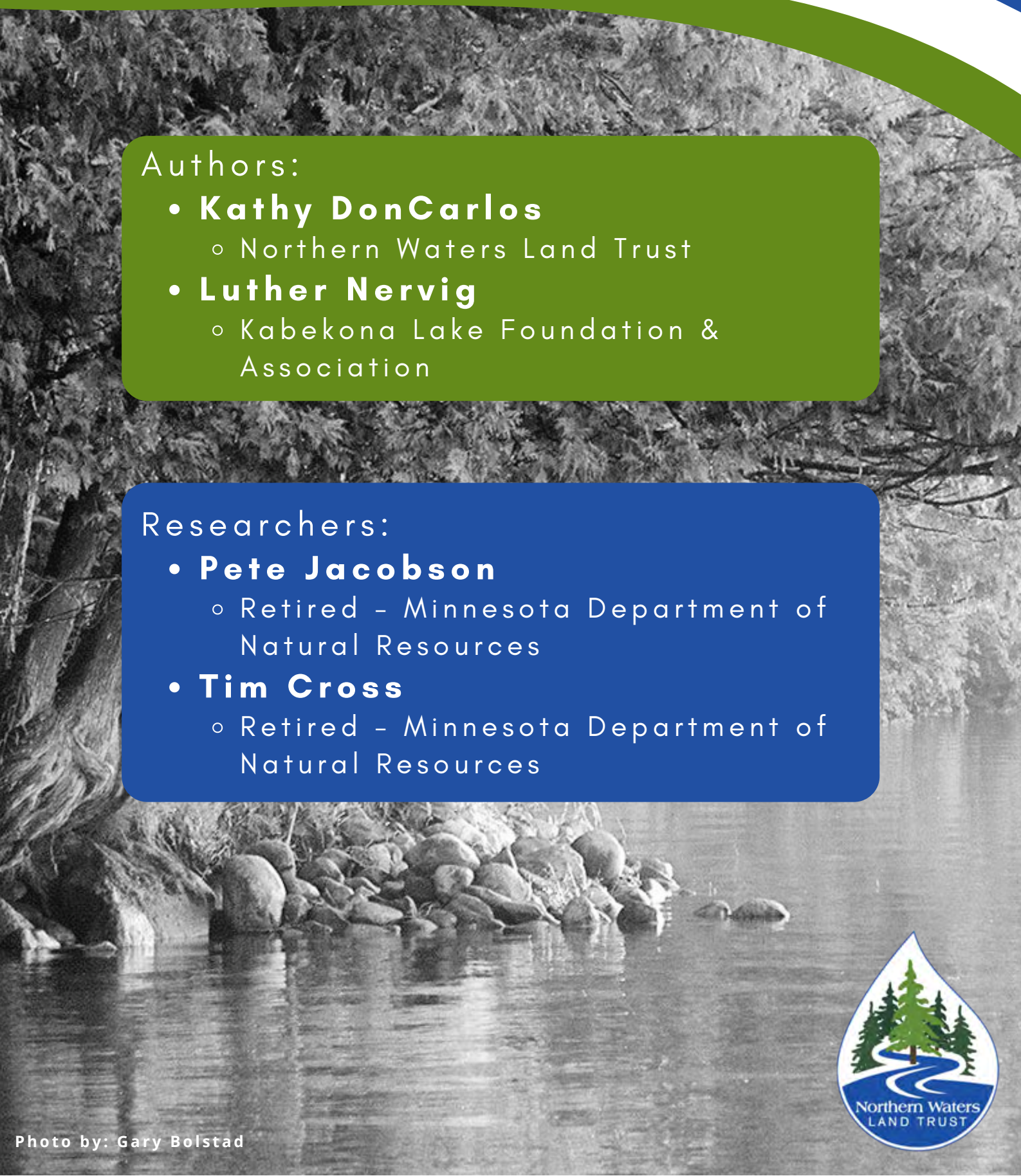


Photo by: Gary Bolstad

THE STORY OF KABEKONA LAKE AND ITS WATERSHED

This is the story of a northern cold-water lake in Minnesota, the conservation and protection of its watershed, the commitment and perseverance of a lake association, partners and landowners and financial support of State of Minnesota Clean Water, Land and Legacy Amendment Funds.

Kabekona Lake is a cold-water lake in Hubbard County with a surface area of 2,252 acres, a maximum depth of 133 feet and about ten miles of shoreline. The lake is spring fed and receives inflow from Kabekona River, Gulch Creek and Sucker Brook. Kabekona Lake flows out through three smaller lakes and into Kabekona Bay of Leech Lake.

Kabekona Lake is considered a “refuge lake” for tullibee (aka cisco), a preferred forage fish of walleye, northern pike, muskellunge and lake trout. Tullibee require cold, well oxygenated waters, a condition most common in lakes with deep water and healthy watersheds. Refuge lakes have the best chance to sustain conditions for cold-water habitat and species unique in northern Minnesota.

The land that drains rainfall and snowmelt into a lake is called a “watershed”. Kabekona Lake’s watershed is 97 square miles (62,000 acres) just a little smaller than an area the size of St. Paul and Minneapolis combined (133 square miles).

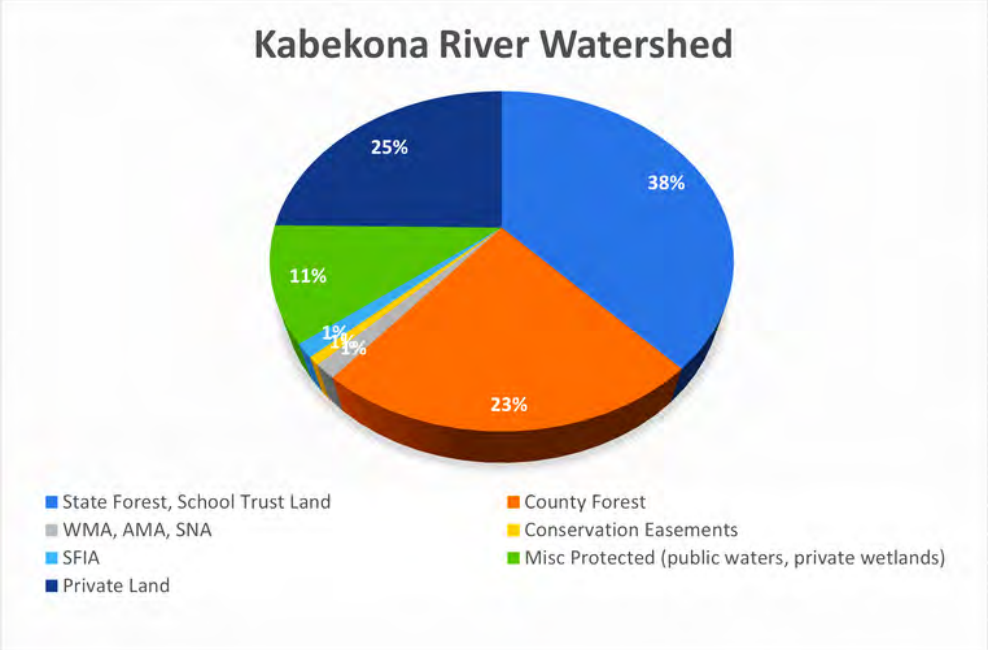
Map by: Mitch Brinks

The Story of Kabekona Lake and Its Watershed

A decade ago in 2013, Department of Natural Resources (DNR) described a new way of considering how to protect water quality and habitat in the Fish Habitat Plan; A Strategic Guidance Document. The concept is simple yet challenging – "watersheds with at least 75% of their area in protected status are reasonably protected from future disturbances at the watershed level." This goal became an important benchmark as agencies and nonprofit conservation organizations sought funding to protect these unique cold-water lakes and their watersheds in northern Minnesota.

In 2012 DNR Fisheries Research scientists, Pete Jacobson and Tim Cross, reported that 64% of Kabekona Lake's watershed was protected. In the ensuing eleven years, partners worked together using public and private funds to protect an additional 11% of the watershed. Today this Watershed has achieved 75% protection through these collaborative efforts. This was accomplished in two ways - by conservation organizations purchasing lands for public ownership using public and private funds and through conservation easements which private landowners placed on their land permanently restricting development or land conversion.

The extensive State and County Forests in the Kabekona Lake Watershed provide the majority of the protected lands. State Forests total 23,620 acres (38%) and County Forests total 13,996 acres (23%). Keeping forest lands forested and connecting these undeveloped lands provides a resilient landscape in a changing landscape.



DNR Wildlife Management Areas, Aquatic Management Areas (AMA) and Scientific Natural Areas total 862 acres (1.4%). Conservation easements and SFIA agreements account for 1,267 acres (2.0%).

Graphic by: Northern Waters Land Trust

The Story of Kabekona Lake and Its Watershed

There are now 461 acres protected with conservation easements held by the Minnesota Land Trust and DNR Forests for the Future within the Kabekona Lake Watershed. The Minnesota Land Trust and DNR used Outdoor Heritage Funds to purchase these easements. Some landowners have donated a portion or the entire value of the easement.

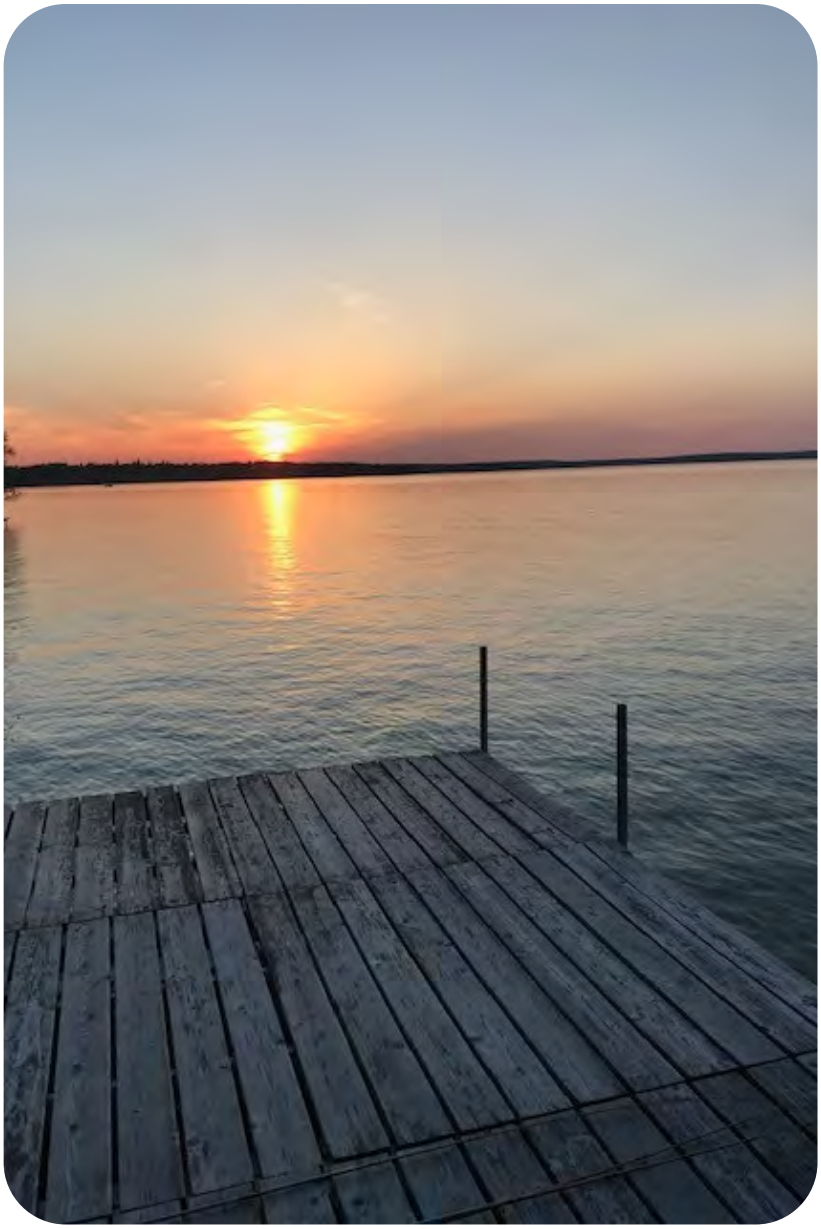
Lands have been purchased for public management with public and private funding including the following projects.

- 2 acres sold in 1995 to DNR for the Kabekona Lake AMA by the Kabekona Lake Foundation.
- 27 acres on Kabekona Lake and 1,500 feet of the Kabekona River purchased in 2006 for the DNR AMA by NWLT using public funds and private funds raised by the Kabekona Lake Foundation.
- 320 acres purchased in 2010 for the DNR Lester Lake Scientific Natural Area by the Trust for Public Land using Outdoor Heritage Funds and private funds raised by the Kabekona Lake Foundation.
- 120 acres purchased in 2010 for the DNR Lester Lake Aquatic Management Area by the Trust for Public Land using Outdoor Heritage Funds and private funds raised by the Kabekona Lake Foundation.

Photo by: Catherine Holmgren

The Story of Kabekona Lake and Its Watershed

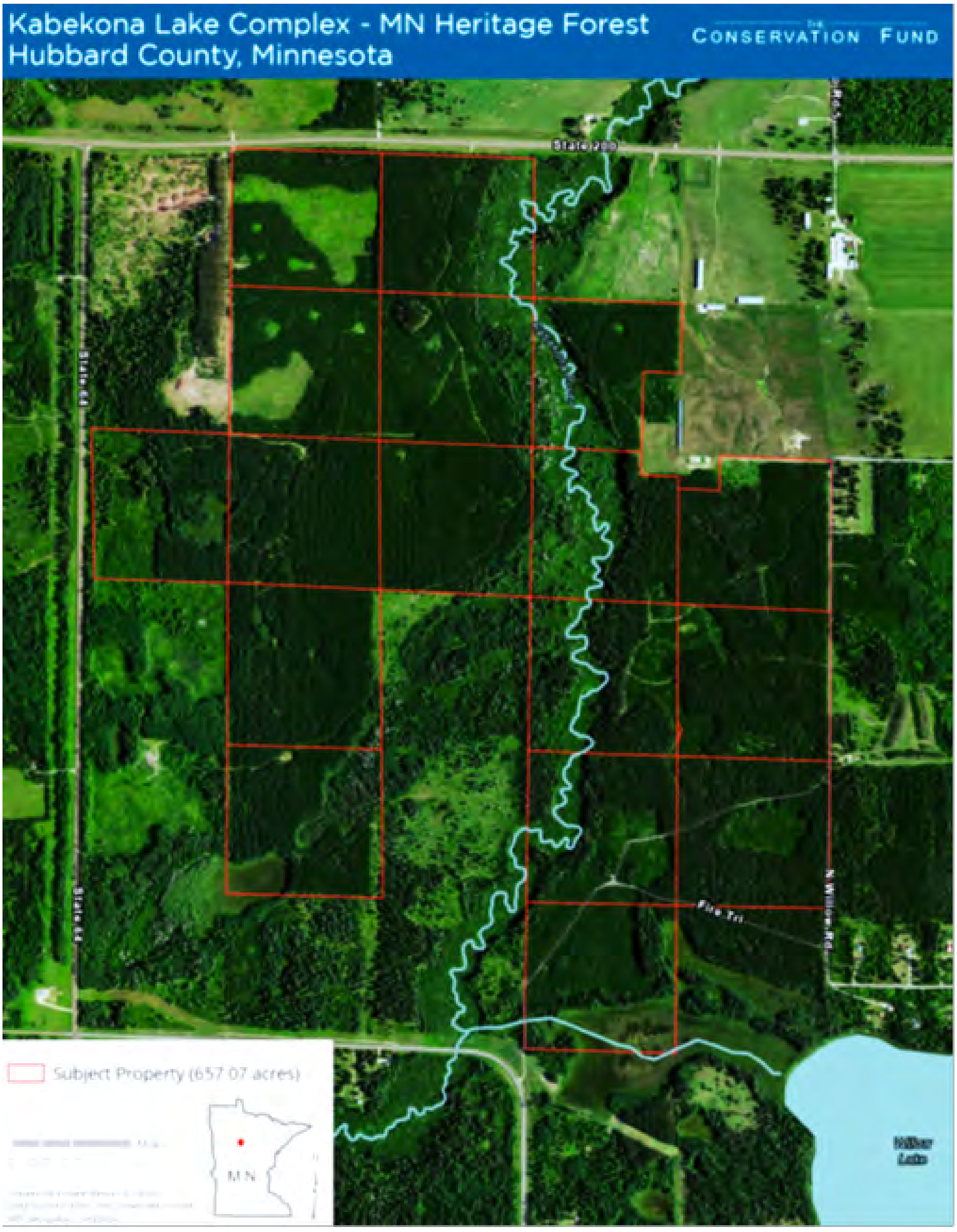
- 13 acres purchased in 2019 for the DNR Kabekona Lake AMA by the Northern Waters Land Trust using Outdoor Heritage Funds and private funds raised by the Kabekona Lake Foundation.
- 72 acres purchased in 2022 for Hubbard County Forests by Crow Wing Soil and Water Conservation District (Northern Waters Land Trust) using Outdoor Heritage Funds with a significant contribution from the landowner. The Conservation Fund sold the property for well below market value.
- 2,529 acres purchased in 2023 for DNR State Forests by Trust for Public Land using Outdoor Heritage Funds with a significant contribution from the landowner. The Conservation Fund sold the property for well below market value. Approximately 136 acres of the “Sheep Ranch” property in Clay Township is in the Kabekona Lake Watershed.



- 657 acres most recently purchased in 2023 for DNR State Forests by the Northern Waters Land Trust using Outdoor Heritage Funds with a significant contribution from the landowner (see map). The Conservation Fund sold the property for well below market value. An extensive portion of the Kabekona River, approximately 1.6 miles, runs through this property.

Photo by: Catherine Holmgren

KABEKONA RIVER COMPLEX



The Story of Kabekona Lake and Its Watershed

Does reaching the 75% protection level in the Watershed mean that our work is done? ***ABSOLUTELY NOT!*** DNR recommends that a primary goal for the watersheds with 75% of its land permanently protected is to remain vigilant and maintain this protection. This means that land uses within the watershed such as agriculture, mining, and development are conducted in a manner that do not increase phosphorous levels in lakes, rivers and streams. Phosphorous increases algae in the water which in turn decreases plant growth, water clarity and the recreational value of the lake.

We also need to protect lakes in the Watershed from stressors such as more severe and frequent rain events which flush phosphorous into streams and lakes. Streams and rivers are more likely to experience stream-bank erosion with these rain events. The Leech Lake River Comprehensive Water Management Plan provides a thorough overview of the threats and remedies for this larger Leech Lake River Watershed.

Where do we go from here? Partners need to continue to track potential important strategic land protection opportunities for the Kabekona Lake Watershed. Partners also need to continue to focus on reducing phosphorous entering the lake through traditional land uses and as a result of changing weather patterns.

North-central Minnesota is the focus of strategic conservation efforts by several nonprofit organizations and government agencies including Northern Waters Land Trust, Minnesota Land Trust, Trust for Public Lands, Mississippi Headwaters Board, The Nature Conservancy, The Conservation Fund, County Soil and Water Conservation Districts, Department of Natural Resources, Board of Soil and Water Resources and County Land Departments and Environmental Services. The collaboration between these entities will continue as we work together and with landowners to ensure the protection of the water and land in this area.

Graphic from: Leech Lake River Comprehensive Watershed Management Plan

The Story of Kabekona Lake and Its Watershed

Throughout the years and for every project, the Kabekona Lake Foundation (KLF) and the Kabekona Lake Association have been stalwart conservationists and partners. In 2010, KLF (Luther Nervig and others) led the effort to protect the Lester Lake property and contributed $60,000 for the required match towards that project. KLF contributed $40,000 for 2006 Kabekona Lake AMA addition and the full 10% match for the 2019 addition to the Kabekona AMA.

CLEAN WATER LAND & LEGACY AMENDMENT

Critical to the protection efforts in Kabekona Lake Watershed and other northern watersheds for the past thirteen years is the Outdoor Heritage Fund which was created in 2008 when Minnesota voters passed the Clean Water, Land and Legacy Amendment to the Minnesota Constitution. These funds "may be spent only to restore, protect, and enhance wetlands, prairies, forest and habitat for fish, game, and wildlife."

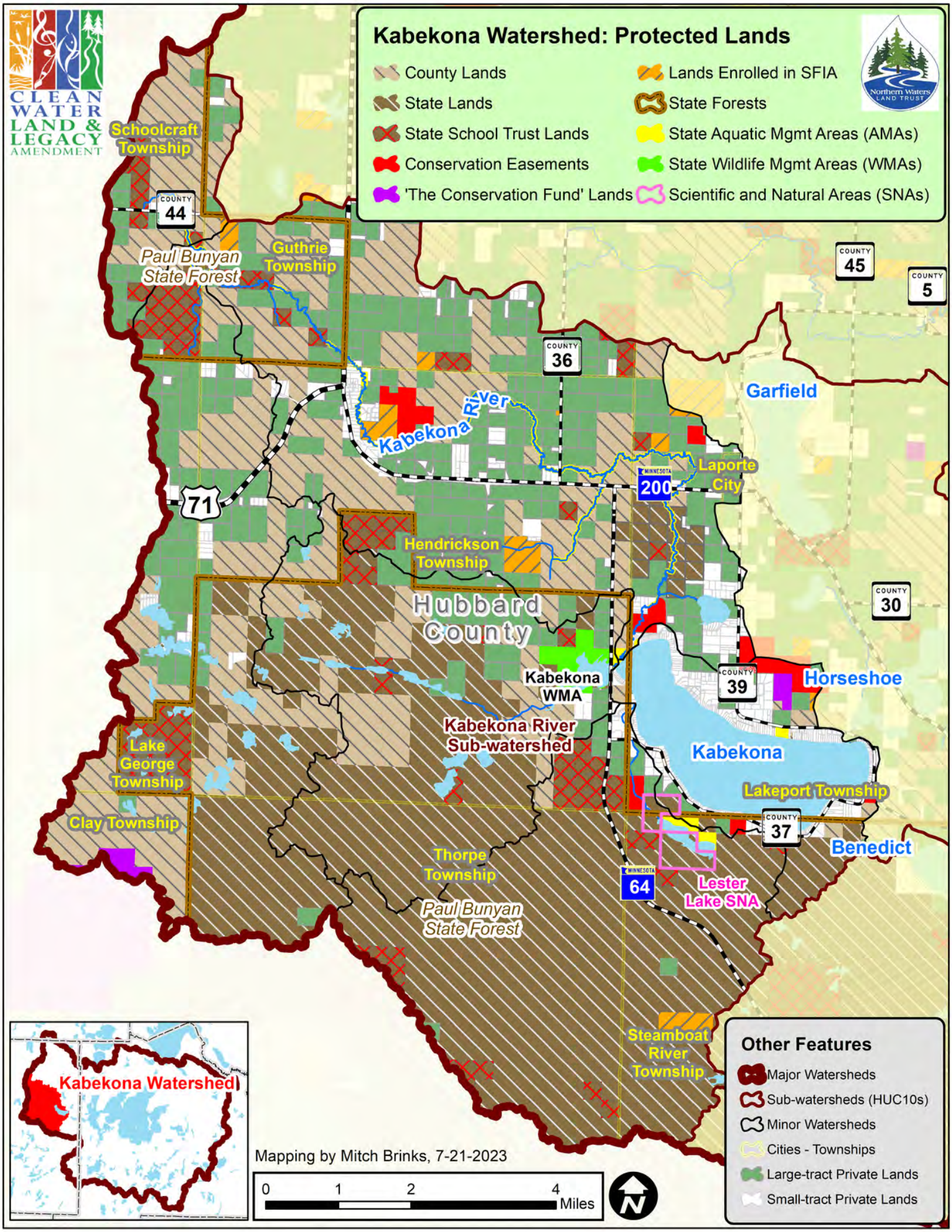
The 1,318 acres purchased and protected as public lands in the Watershed since 2010 have all been funded in large part by the Outdoor Heritage Fund. Most of this land (865 acres) was recently purchased from The Conservation Fund, a nonprofit conservation organization, which purchased more than 72,000 acres of former PotlatchDeltic Corporation land in 2020 with the intent of providing time to permanently protect these important forest lands. And 461 acres of private land have been protected with conservation easements funded in part or whole with Outdoor Heritage Funds since the Legacy Amendment was authorized by the Citizens of Minnesota.

This "watershed event" of the Kabekona Lake Watershed reaching 75% protection would not have happened without the commitment, perseverance and support of each of these key partners - the Kabekona Lake Association and Foundation, agency and nonprofit partners, landowners and State of Minnesota Legacy Funds.

Thank you to all for your past and ongoing efforts!

Photo from: Northern Waters Land Trust

KABEKONA LAKE WATERSHED MAP



Northern Waters LAND TRUST

TRUST FOR PUBLIC LAND™

KABEKONA LAKE ASSOCIATION

THE CONSERVATION FUND

MINNESOTA LAND TRUST

The Nature Conservancy

HUBBARD COUNTY Soil & Water Conservation District

Brinks WETLAND SERVICES

DEPARTMENT OF NATURAL RESOURCES

CLEAN WATER LAND & LEGACY AMENDMENT

WATERSHED 75 PROTECTION

HUBBARD COUNTY EST. 1883 MINNESOTA

MISSISSIPPI HEADWATERS BOARD

Kabekona

WATERSHED PROTECTION

Kabekona Lake Conservation

Photo by: Catherine Holmgren

Leech Lake River plan protects waters by cutting the (road) salt

CLEAN WATER LAND & LEGACY AMENDMENT

YOUR Clean Water Fund AT WORK

The Clean Water Fund is the sole source of Watershed-Based Implementation Funding. Thirty-three percent of sales tax revenue from the Legacy Amendment, passed by Minnesota voters in 2008, is allocated to the Clean Water Fund.

The Leech Lake River Comprehensive Watershed Management Plan (CWMP) focuses strongly on protecting lakes and rivers within the watershed from pollution. Other than the omnipresent mercury found throughout Minnesota, few impairments exist within the watershed. Improved management of forests, shorelines and stormwater are some of the identified activities in the watershed plan that will provide long-term water quality protection.

Another problem pollutant that hasn't yet shown up in water quality sampling but whose impacts can be seen in other ways is chloride. For a long time, chlorides have been used to clear paved winter roads and to protect gravel road surfaces, and to reduce dust. The effects of chloride use can be seen in salt-burned vegetation along highways, and in the impacts on insects and amphibians along gravel roads.

Less obvious is the salt that dissolves, permanently affecting the water quality of both surface and groundwater.

The main water-quality benefit is that it takes less salt to accomplish the same results. During an average winter, the Cass County Highway Department estimates using brine could cut salt use by up to 430 tons.

LEECH LAKE RIVER WATERSHED

In extreme circumstances, that chloride can interfere with the natural mixing cycle of lakes and affect the food web within those lakes.

Cass and Hubbard county highway departments are among the road authorities gradually moving away from using salt/sand mixtures for winter safety, instead turning to the application of salt brine, a solution of salt and water. Brine starts working immediately and can be applied proactively before it snows. Brine stays on the road and doesn't bounce off like rock salt. At lower temperatures, it can be more effective than rock salt.

Brine-making equipment, **left and right,** *is seen at the Cass County Highway Department. Cass and Hubbard county highway departments are among those gradually turning to brine instead of the salt/sand mix applied to icy roads. Watershed-Based Implementation Funding from BWSR supports retrofitting highway department snowplow trucks with tanks and brine application equipment.* **Photo Credits:** Cass County Highway Department **Center:** *Lower Trelipe Lake near Longville in Cass County is among the water bodies within the Leech Lake River watershed, where efforts are underway to protect lakes and rivers from chloride pollution.* **Photo Credit:** Cass SWCD

Chloride hasn't yet appeared in water quality sampling within the Leech Lake River watershed. Watershed-Based Implementation Funding supported work to reduce road salt helps to protect the water quality of lakes such as Lower Trelipe Lake near Longville in Cass County. **Photo Credit:** Cass SWCD

While the safety benefits are easily understood, the main water-quality benefit is that it takes less salt to accomplish the same results. During an average winter, the Cass County Highway Department estimates using brine could cut salt use by up to 430 tons.

Using less salt also results in cost savings — an environmental and economic win-win.

Through the Leech Lake River CWMP, the Cass Soil & Water Conservation District (SWCD) has been actively helping to accelerate local road authorities' salt-use reductions within the Leech Lake watershed and the surrounding area.

Plan partners made Watershed-Based Implementation Funds (WBIF) — a source of Clean Water Funds from the Minnesota Board of Water and Soil Resources (BWSR) — available to help the Cass County and Hubbard County highway departments retrofit plow trucks with tanks and brine application equipment.

The success of the initial equipment installation led to further cooperation between Cass County and Cass SWCD. In March 2024, the partnership acquired a supplemental $77,000 WBIF award to help the county upgrade its brine production equipment.

Faster and more efficient, the new equipment enabled Cass County to use more brine versus a salt/sand mix countywide. The county can sell the brine it makes to other local road authorities, such as townships and cities, which would increase the efficiency of winter road maintenance and reduce salt use across the watershed.

Producing and applying brine is one aspect of chloride reduction. The watershed partnership also protects water quality through training and salt application certification. The CWMP partners have

funded training for salt application certification to help road authorities reduce their salt impact.

The Mississippi Headwaters watershed allocated WBIF for a class at the Leech Lake Band of Ojibwe (LLBO) Tribal Roads and Maintenance Department in Cass Lake. The LLBO Division of Resource Management coordinated the November 2023 meeting and co-hosted with the Cass SWCD. The event drew 25 people, including nine from the LLBO roads crew.

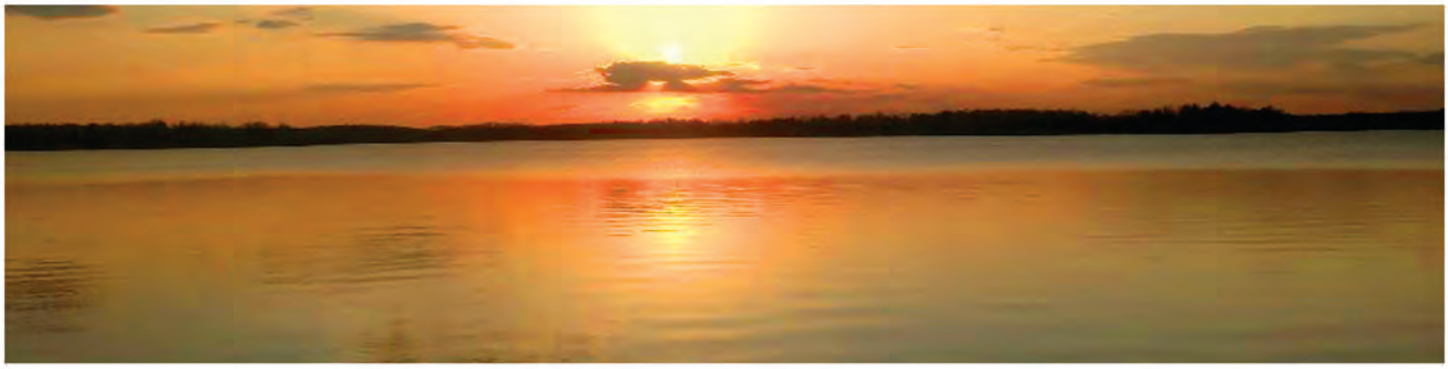
WBIF dollars from the Pine River watershed paid for an August 2024 Smart Salting training in Walker that drew 12 people.

The Cass SWCD has partnered with the LLBO Division of Resource Management and Roads Crew to explore possibilities and identify needs for future brine use by the Leech Lake Band of Ojibwe roads crew. The Cass SWCD continues to work with the city of Walker to develop a brining program.

Chloride use is not limited to winter safety applications. Road authorities use a variety of products to maintain the integrity of gravel roads and, not incidentally, reduce dust complaints from citizens. Not all roads are treated, and treatment methods vary across jurisdictions.

Cass County recently trimmed the treated road surface area 33% by reducing the application width from 18 feet to 12 feet. Early results show promise for the environment, road integrity and budget.

BWSR staff members write and produce Snapshots, a monthly newsletter highlighting the work of the agency and its partners.



Clean Water Council Tour

Cass SWCD

Chloride Reduction and Smart Salting

1 tsp of salt pollutes 5 gallons of water

Chloride reduction through smart salting is important for preventing permanent contamination of freshwater, protecting infrastructure and vegetation from salt damage, and saving money on salt and repair costs. Smart salting practices minimize chloride pollution by teaching effective strategies to apply the necessary amount of salt only when and where it's needed, reducing use by 30-70% and safeguarding the environment and community assets.

Execution of the Strategy

1. Retrofitting of plow vehicles
2. Hosted 3 Smart Salt trainings in Cass Lake (Fall of 2023), Walker (Fall of 2024), and Backus (Fall of 2025).

Smart Salting trainings help improve operator effectiveness and reduce chloride pollution by learning best practices, while keeping roads, parking lots, and sidewalks safe. Participating organizations have been able to cut their salt use by 30-70 percent, reducing costs for product and minimizing infrastructure damage. In addition, the training has been shown to prevent chloride contamination in lakes, rivers, and streams.

Projected Outcomes

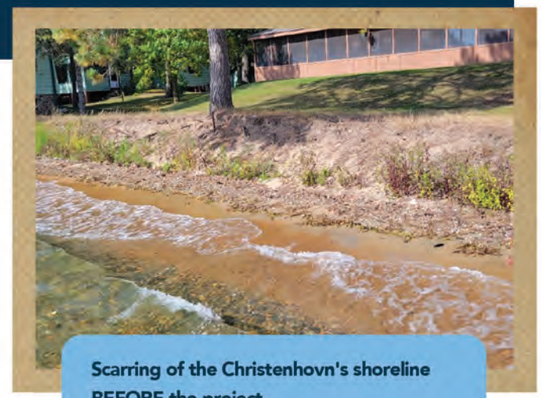
- Reduction of 537 tons salt per year
- Savings of $51,000 per year for Cass County

Ripple Effects of Conservation

Conservation Stories from Ten Mile Lake

Conservation spreads best through people and stories, and on Ten Mile Lake in Hackensack, one family has been at the heart of that process.

The Christenhovn family were the first to step forward in the summer of 2024, partnering with Cass SWCD and Great Roots, LLC to install a shoreline garden on their legacy property. They chose to make it a family event, inviting 20 relatives to spend the morning working side by side, installing willow wattle and planting native plugs to protect their shoreline. Their sweat equity not only saved money but also deepened their understanding of how healthy shorelines reduce runoff and protect one of Cass County's premier lakes.

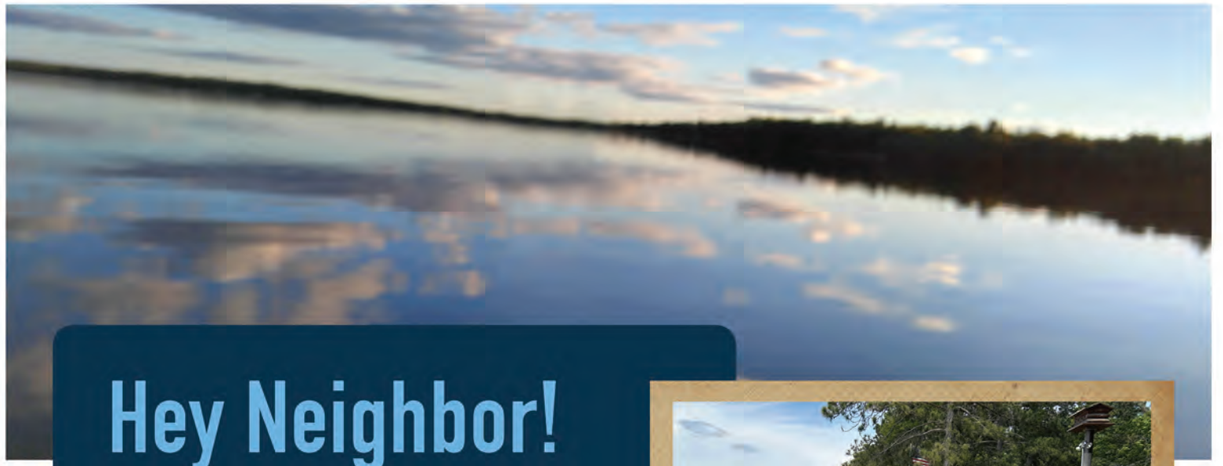


Scarring of the Christenhovn's shoreline BEFORE the project.

The FINISHED project on Ten Mile Lake!

What is Willow Wattle? Willow wattle is a bioengineering technique using bundles of willow branches, called wattles or live fascines, to stabilize shorelines and control erosion. The wattles are installed along the shore, secured with stakes, and act as a barrier to slow water velocity and trap sediment, allowing natural plant growth to take hold. This living system provides long-term erosion control by forming roots that stabilize the soil, slow water flow, and create valuable habitat

The project was more than an installation; it was a showcase demonstrating that there are alternatives to rip rap.



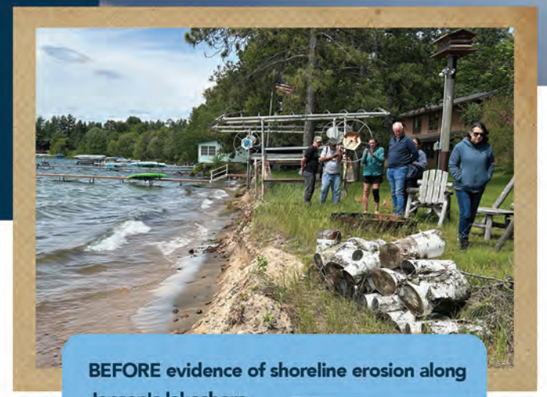
Hey Neighbor!

Neighborhood conservation party

The Christenhovn's efforts quickly inspired others. Word spread along the shoreline, and the Jensen family—also long-time stewards of a legacy property on Ten Mile—saw what was possible. By the summer of 2025, they had completed their own shoreline garden, learning firsthand how conservation can protect their lake while enhancing the beauty of their property.

Together, the two families are preventing an estimated 1,245 pounds of algae from forming in Ten Mile Lake each year. Their work demonstrates how neighbors can influence neighbors, showing that alternatives to riprap are not only effective but also attractive.

When families come together across generations, they can help ensure that Minnesota's lakes remain clean, healthy, and vibrant for both residents and visitors for years to come.



BEFORE evidence of shoreline erosion along Jensen's lakeshore.

The FINISHED project on Ten Mile Lake!

Phosphorus is a nutrient found in manure, leaves, soil, and fertilizer. Under natural conditions phosphorus is typically scarce in water. Human activities, however, have resulted in excessive phosphorus loading into our lakes. Phosphorus triggers harmful algae blooms.

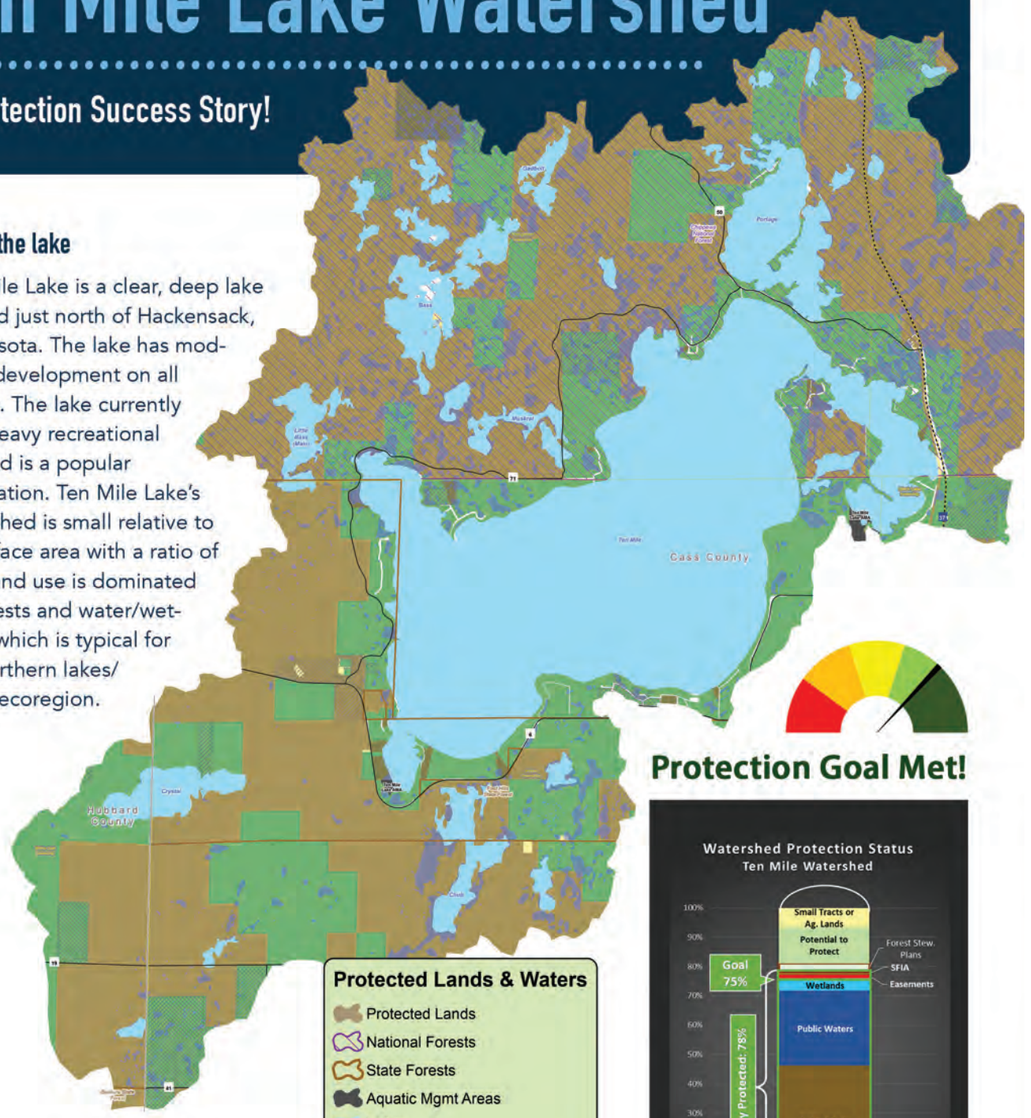
1 pound of phosphorus = 500 pound of algae

Ten Mile Lake Watershed

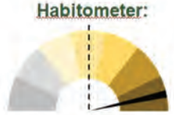
A Protection Success Story!

About the lake

Ten Mile Lake is a clear, deep lake located just north of Hackensack, Minnesota. The lake has moderate development on all shores. The lake currently sees heavy recreational use and is a popular destination. Ten Mile Lake's watershed is small relative to its surface area with a ratio of 5:1. Land use is dominated by forests and water/wetlands which is typical for the northern lakes/forest ecoregion.



Habitometer:



- Lakes of Outstanding Biodiversity (2)
- Cisco Refuge Lakes (2)
- High Terrestrial Bio-diversity
- Priority Shallow Lakes (3)
- Priority Wild Rice Lake
- High Wildlife Action Network Score

Protected Lands & Waters

- Protected Lands
- National Forests
- State Forests
- Aquatic Mgmt Areas
- Lakes
- Streams
- Wetlands (source: NWI)

Potential to Protect

- Current Woodland Stewardship Plan Areas
- Potential to Protect
- Small-tract Private Parcels (or other)

Protection Goal Met!

More about the Ten Mile Lake Watershed...

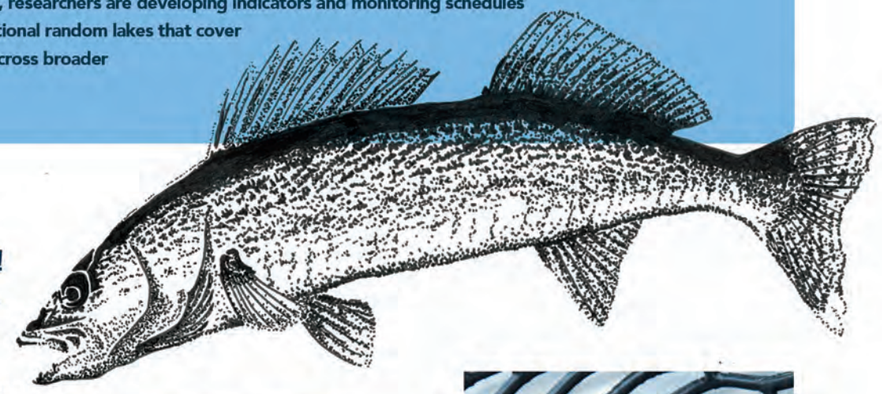
What is a Sentinel Lake?

A sentinel lake in Minnesota is part of the Sustaining Lakes in a Changing Environment (SLICE) Program, an intensive, long-term monitoring program that tracks the physical, chemical, and biological changes in Minnesota's lakes.

The Primary Goals of the Sentinel Lakes Program are to:

1. **Identify important biological, physical, and chemical trends in Minnesota lakes and monitor these trends over time.**
2. **Identify the mechanisms behind the trends that are being observed and monitored.**
3. **Identify management solutions to ensure the long-term sustainability of Minnesota's lakes given the presence of large and small-scale ecological disturbances facing these iconic ecosystems.**

Across 25 sentinel lakes, the program is measuring watershed, water quality, zooplankton, aquatic plant, and fish indicators. From this data, researchers are developing indicators and monitoring schedules in sentinel lakes and additional random lakes that cover larger numbers of lakes across broader geographic areas.



A premier walleye fishery!

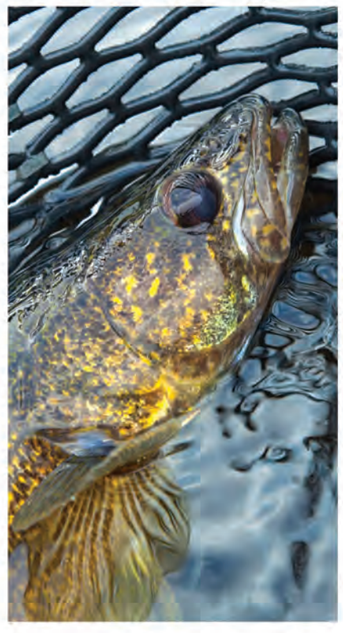
Compared with the other 23 Sentinel Lakes, Ten Mile Lake is among the best in terms of habitat conditions and fish populations. Lake teeming with fish are often a result of forests filled with trees. The Walleye population at Ten Mile is thriving!

Part of DNR Tullibee Lakes Project

Tullibee, also known as cisco, are an important prey species for lake trout, pike, muskie & walleye. They are also an important forage fish for loons.

Tullibee are only found in clean, cold, well oxygenated, deep waters. Because of their habitat requirements they are fantastic "measuring sticks" for water quality.

Protecting private forests could help save Minnesota's tullibees. Statistics show that water quality decreases as properties are over developed and when woodlands are removed.



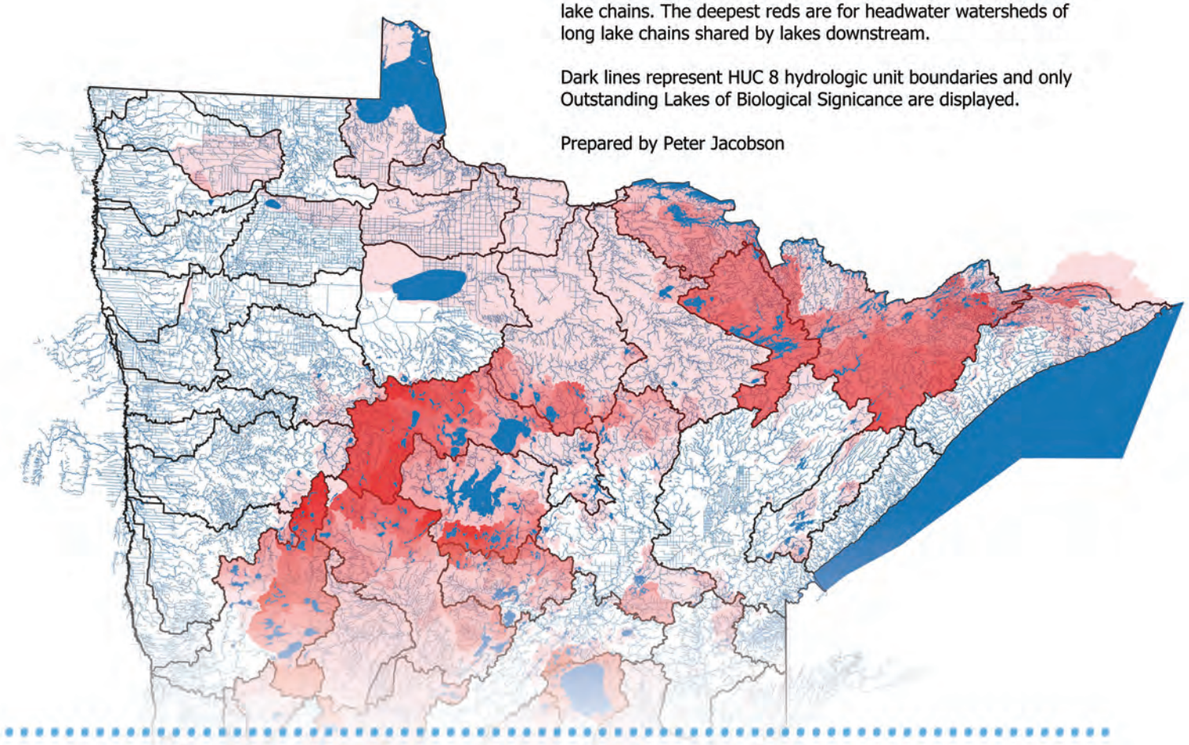
Stacked Conservation Benefits

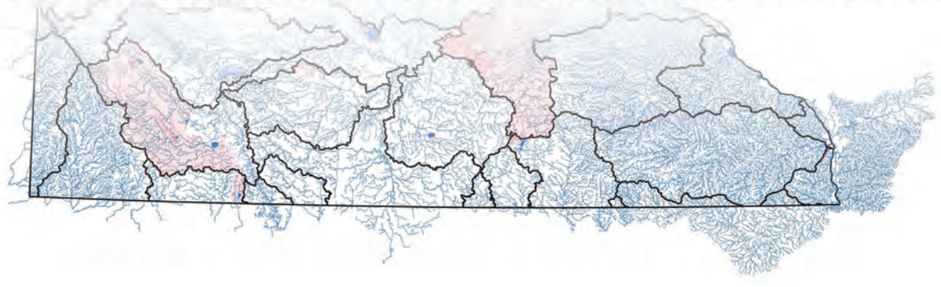
Shared benefits across 5 watersheds

Long chains of lakes are a notable feature in Minnesota's lake country. Headwater lakes are connected by successive segments of streams to lakes downstream. For example, the Woman Lake Chain starts at Ten Mile Lake and connects to many other lakes downstream by way of the Boy River.

These lake chains present substantial conservation efficiencies for watershed protection. Since the watershed of each lake in the chain includes the watersheds of all lakes upstream, land protection in the headwater lakes will benefit the water quality in lakes downstream. So, protecting the watershed of Ten Mile Lake benefits other lakes as the clean water flows downstream into Birch, Pleasant, Woman, and other lakes

The degree to which each of these watersheds overlap can be mapped by the increasing shade of red in the map as lakes share the lake watersheds upstream in the chain. The deepest reds are located in the headwater lake watersheds of long chains and present especially important targets for conservation efforts. These benefits effectively "stack up" for multiple downstream lakes when working in these headwater watersheds.

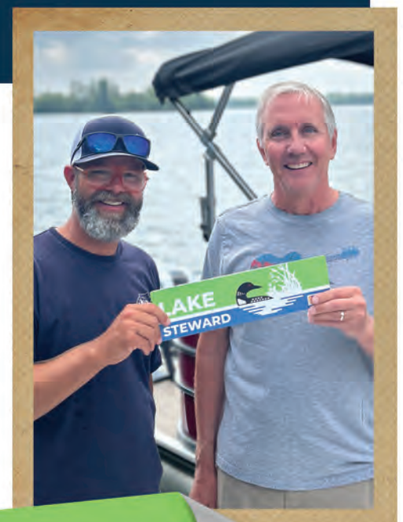




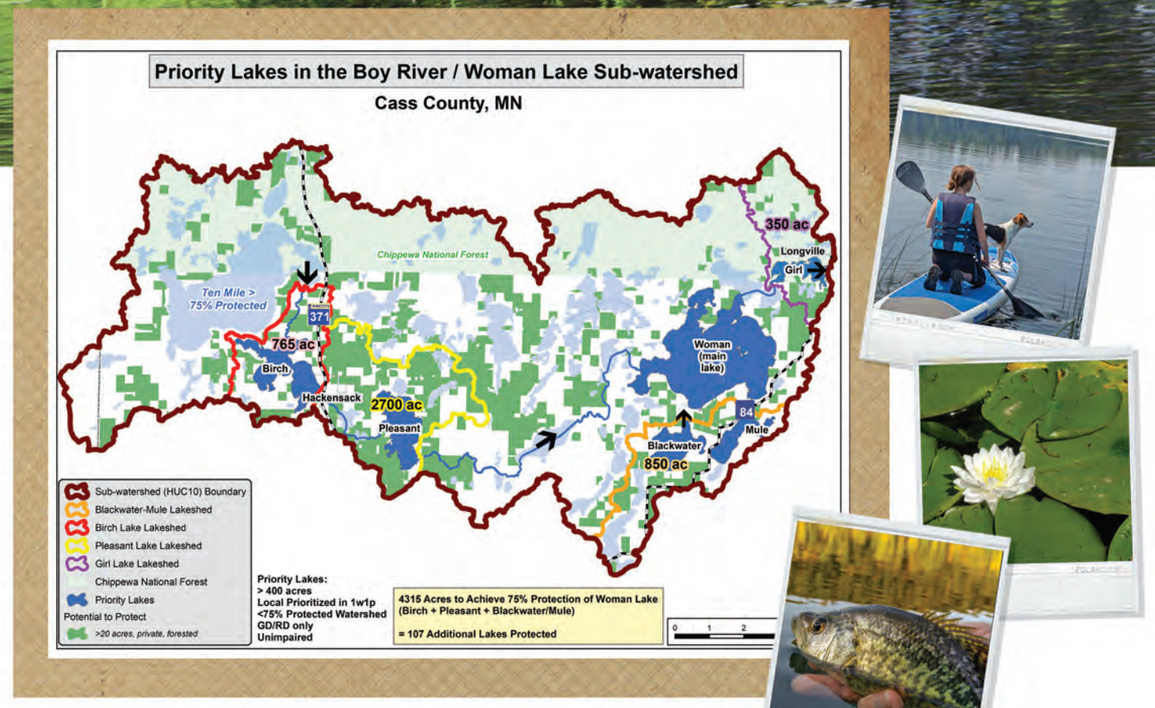
Switching the Narrative

Changing the Social Norm Around Native Shorelines

The Birch Lake Shoreline Protection Project focuses on preserving existing shoreline buffers while simultaneously raising awareness of the benefits they provide to Birch Lake and the entire downstream lake system. By demonstrating the connection between healthy shorelines and clean water, the project is working to shift community norms toward long-term stewardship. Building on the successes and projects in the Ten Mile Watershed, this initiative provides stacked benefits for the entire Upper Mississippi Basin while also benefiting millions of Minnesotans downstream. The collective benefit of these water quality gains is the protection of exceptional lake conditions that make this region a destination. The effort highlights how shifting community norms can lead to healthier lakes and a stronger community.



Clean water in this area sustains the fishing, boating, and tourism industries that drive the local economy, while ensuring future generations can enjoy Minnesota's lakes just as generations before them have.



Participation and Results

- **311** Total properties reviewed.
- **174** Properties qualified as Lake Stewards per initial review.
- **48** Responses received, resulting in:
- **13** Properties not qualifying.
- **7** Site visit requests, leading to 4 new shoreline projects.
- **35** New Lake Stewards recognized (see included images).

Next Steps

- The Lake Association is contacting 57 qualified members who have not yet responded.
- There is potential to connect with an additional 82 qualified property owners who are not currently association members.
- Continue to educate landowners and provide cost share for projects that benefit the Woman Lake chain.

Cass SWCD at work

Grass Roots Conservation Around the District

- Cass SWCD contributed grant funds and technical expertise to its partners to accomplish the work listed here. The District paid $396,000 from a variety of grants. Property owners, local government units, and other entities contributed $418,000. According to a report by the USDA, $1.81 is generated in the economy for every $1 spent on conservation. This means the conservation projects completed in Cass County in 2024 generated $1,473,000.

- Implemented 11 agricultural best management practices on 340-acres for drinking water and surface water protection. Designed an additional project for future implementation.

- Sealed three abandoned wells to protect ground water.

- Created 18 Forest Stewardship Plans on 2,000 acres for enrollment in protection programs such as Sustainable Forest Incentive Act (SFIA) or conservation easements. Initiated eight conservation easements on priority properties.

- Completed 11 shoreline restoration and stabilization projects on 1,600 linear feet of shoreline. Conducted site visits and plan designs for an additional 89 shoreline properties. Inspected 27,198 boats to prevent the spread of aquatic invasive species.

- Completed stormwater projects in the cities of Walker, Federal Dam, Longville, and Backus to protect surface waters.

- Retrofitted a truck with the City of Cass Lake for brine application. Cass SWCD also assisted in the purchase of a brine maker for Cass County, which will allow them to produce and apply more brine rather than road salt throughout the county.

CLEAN WATER LAND & LEGACY AMENDMENT

YOUR Clean Water Fund AT WORK

Cass SWCD

Phone: 218-547-7241
Website: www.cassSWCD.org
Email: SWCD@casscountymn.gov

Minnesota Heritage Forest Protected Forever

Connecting Forests and Habitat Across Northern Minnesota

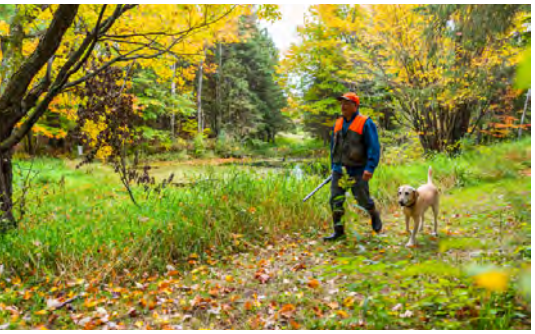
MN Heritage Forest
Photos by: Jay Brittain

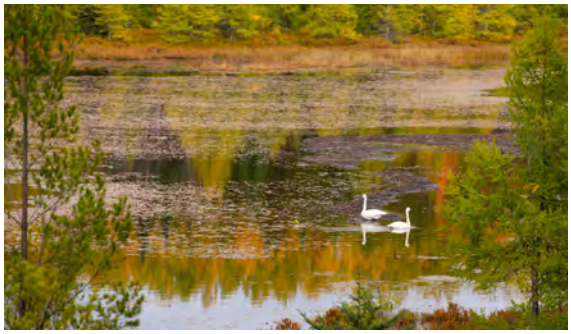
8,197
acres of forest land
protected forever

Northern Waters Land Trust **safeguarded 8,197 acres** across **nine counties** in the region between Brainerd and Duluth. The land will **remain forested**, yielding **new opportunities** for hunters and anglers, **ongoing benefits** for wildlife, and **permanent protection of waters** that feed into the Mississippi River.

In 2020, The Conservation Fund bought over 72,000 acres of forest in northern Minnesota to keep the land together and protect it from being broken up. This provided a critical window to plan for permanent conservation.

From 2022-2025, Northern Waters Land Trust led the effort to **protect 8,197** of those acres forever. **Early support from local individuals and partners made it possible to secure a $10.2 million grant from the Outdoor Heritage Fund,** as a part of the Clean Water Land and Legacy Amendment. These lands are now owned by counties and will be managed for the benefit of wildlife habitat and local communities for years to come.

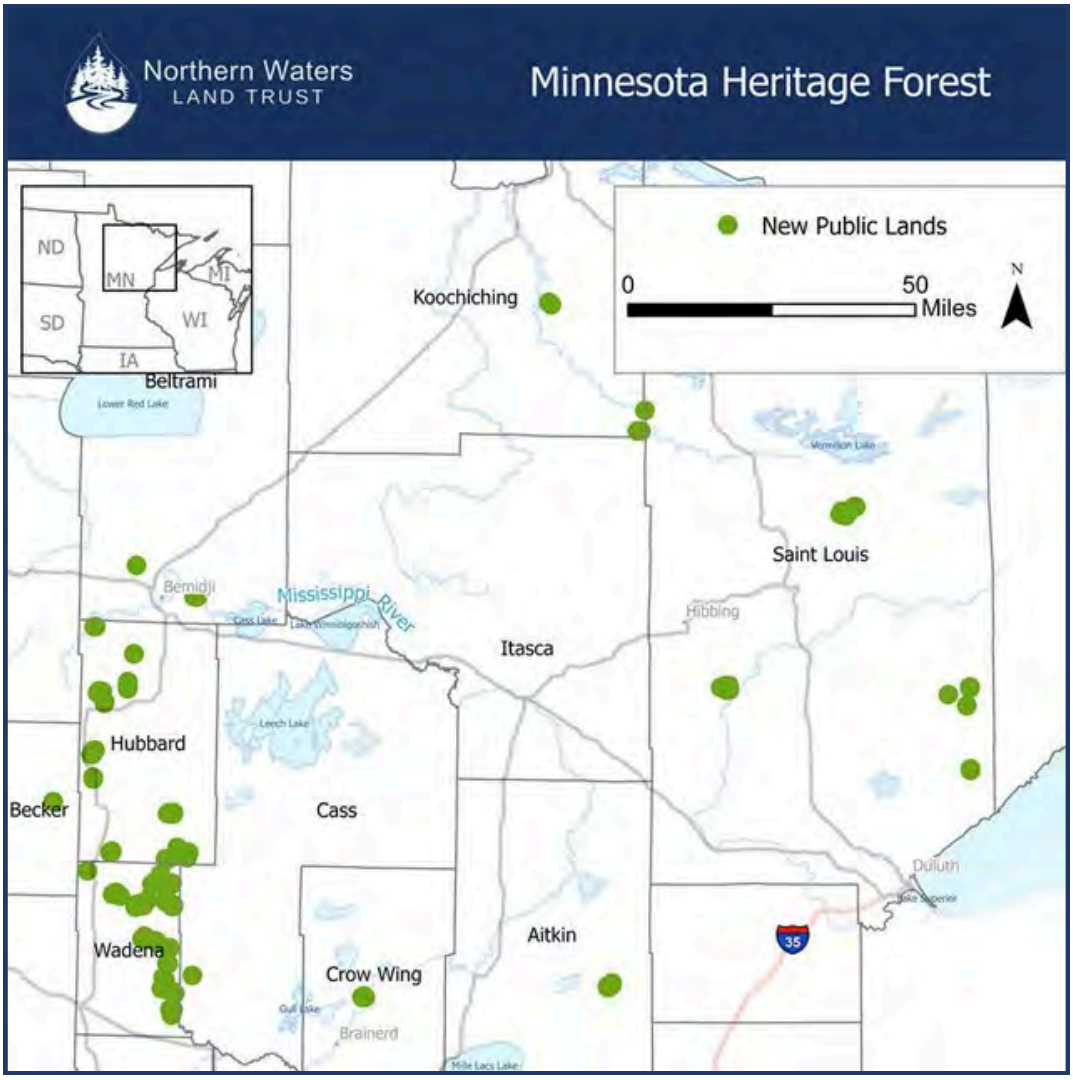




About the Minnesota Heritage Forest

- **Counties:** Expanding across **9 counties** in Northern Minnesota: Aitkin, Becker, Beltrami, Cass, Crow Wing, Hubbard, Koochiching, Saint Louis, and Wadena
- Supports more than **350 species**, including **endangered** and **rare species**
- Sustains **local economies** by preserving jobs in the land management and outdoor recreation sectors

> “This project shows what’s possible when local people, conservation groups, and state funding come together to protect the places we love—for wildlife, for clean water, and for future generations.”
>
> ***– Annie Knight, Northern Waters Land Trust Executive Director***



County	NWLT acres
Aitkin	320
Becker	80
Beltrami	286
Cass	120
Crow Wing	110
Hubbard	1,849
Koochiching	560
Saint Louis	1,517
Wadena	3,355
Total Acres	**8,197**

Funding for this project was provided by the Outdoor Heritage fund as part of the Clean Water, Land and Legacy Amendment. Special thanks to our sponsors, whose support made the critical preparation work for this project possible.

Field Tour Reflections

Mississippi River Headwaters

September 15-16, 2025

Council Members,

Turn to your neighbor to discuss the following questions and turn your sheets in when you get off the bus. You are not expected to work on this for the entire drive back to Park Rapids, but take your time and enjoy the discussion nonetheless. Thank you for your participation in the tour, and for sharing your insights below! Please feel free to use additional space on the back of this page.

1. What stood out to you from the tour, between yesterday and today? What did you notice?

2. As you think about the work of the Clean Water Council, what lessons are you taking away from the tour? What do you think the role is for the Council and Clean Water Fund in protection and restoration efforts—here and across the state?

3. What next steps make sense—by when, and for whom? What questions do you still have that could be explored further?