Nemadji 1W1P

Nemadji Comprehensive Watershed Management Plan

2021-2031

CLEAN WATER LAND & LEGACY AMENDMENT

Nemadji 1W1P

ONE WATERSHED ONE PLAN

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CLEAN WATER LAND & LEGACY AMENDMENT

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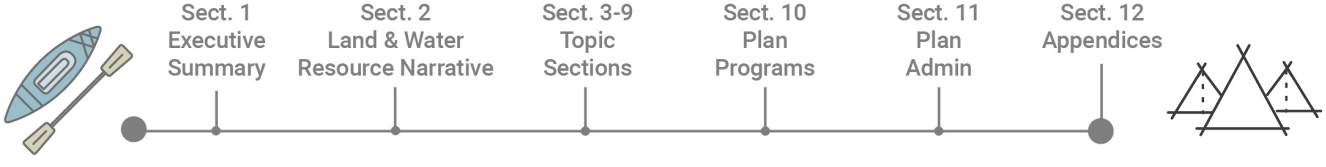


Section 1: Executive Summary

SECTION 1. EXECUTIVE SUMMARY

Introduction

Anyone who has spent time in the Nemadji Watershed is likely most familiar with the red waters that flow north to Lake Superior. The watershed has a unique geological history, providing clay-rich soils that are prone to slumping and erosion. However, the Nemadji is a largely wild place with abundant forests that are an important resource for wildlife, recreational landowners and industry. In addition, most of the Nemadji's streams are home to sensitive trout species, making the watershed a destination for anglers. Along with its wild places, the Nemadji Watershed feeds the region with a diversity of farms, growing everything from vegetables and fruits to pork and beef. The watershed's streams also contribute to important drinking water supplies for the Cities of Duluth, MN and Superior, WI.

The goal of the Nemadji One Watershed One Plan is to prioritize actions that will protect these valuable resources along with targeting projects to help solve water quality problems. The result will be a measurable improvement in water quality and protection of this important resource for future generations. To accomplish this goal, we first need to understand the resource and the issues it faces.

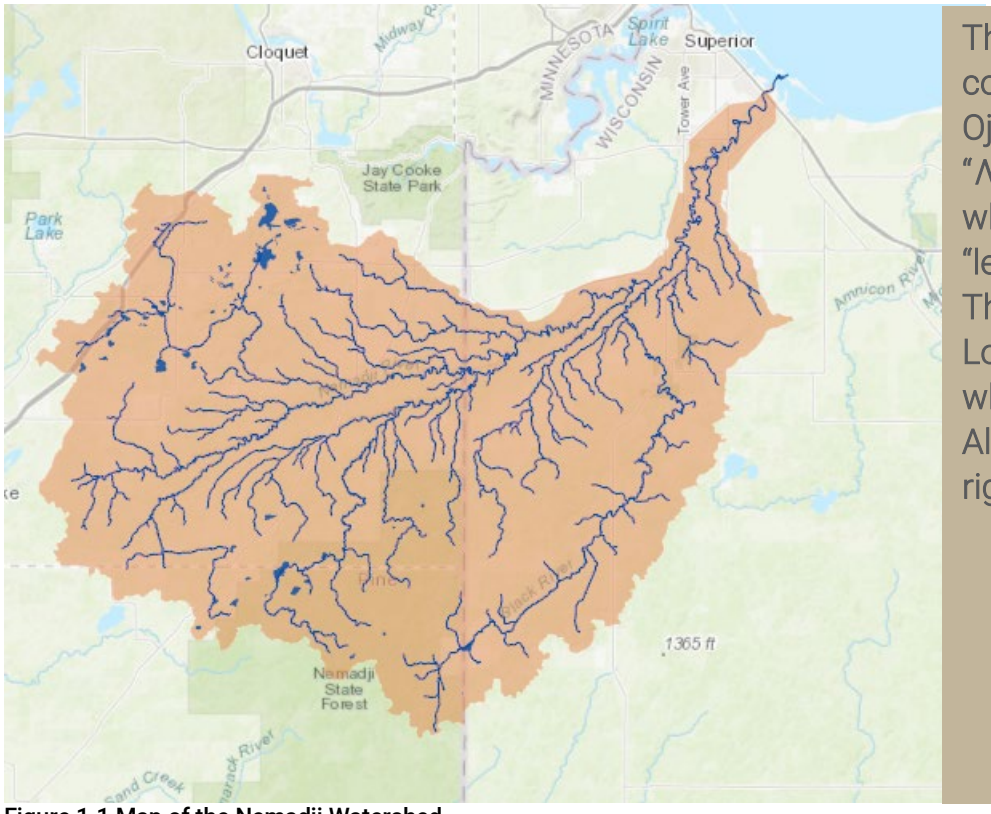


Figure 1.1 Map of the Nemadji Watershed.

The word Nemadji comes from an Ojibwe word "*Nemanjitigweyaag*" which means "left-handed river." This references the St. Louis River, which when viewed from Allouez Bay is the right-handed river.

Vision Statement

The vision statement was developed to describe the sense of place in the watershed and frame the work that this plan outlines. It was formed through input from the public during the bus tour and the Advisory Committee in response to the questions: “what do you value in the watershed and what do you want it to look like in 50 years?”

We honor our deep roots and the connections between people, water, and land in the Nemadji River Watershed, where the fragile red clay slopes cause the river to run red to Lake Superior. We strive to strengthen these connections as we work towards clean water, diverse forests, healthy farms and sustainable communities.

Figure 1.2. North Fork Nemadji River.

Purpose, Roles and Responsibilities

The Nemadji Watershed One Watershed, One Plan was developed following the guidelines set by the Minnesota Board of Water and Soil Resources (BWSR). The purpose of the process is to align local water planning along major watershed boundaries, not just local governmental jurisdictions. All 1W1Ps must contain targeted, prioritized and measurable implementation plans, with the purpose of achieving meaningful and lasting results for Minnesota's water resources.

A Memorandum of Agreement (MOA) between the Carlton Soil and Water Conservation District, Carlton County, Pine Soil and Water Conservation District and Pine County (Appendix E) was established as the first step in the planning process. A representative from each governmental unit was appointed to service on the Policy Committee, which is the decision-making body for this plan. Carlton SWCD was the fiscal agent for this project.

An Advisory Committee was formed to provide valuable input to the planning process. For the Nemadji 1W1P, a wide range of stakeholders formed the Advisory Committee and drafted all the major plan content. At each milestone in the process, the Policy Committee provided input and approved the plan's progress (Figure 1.3).

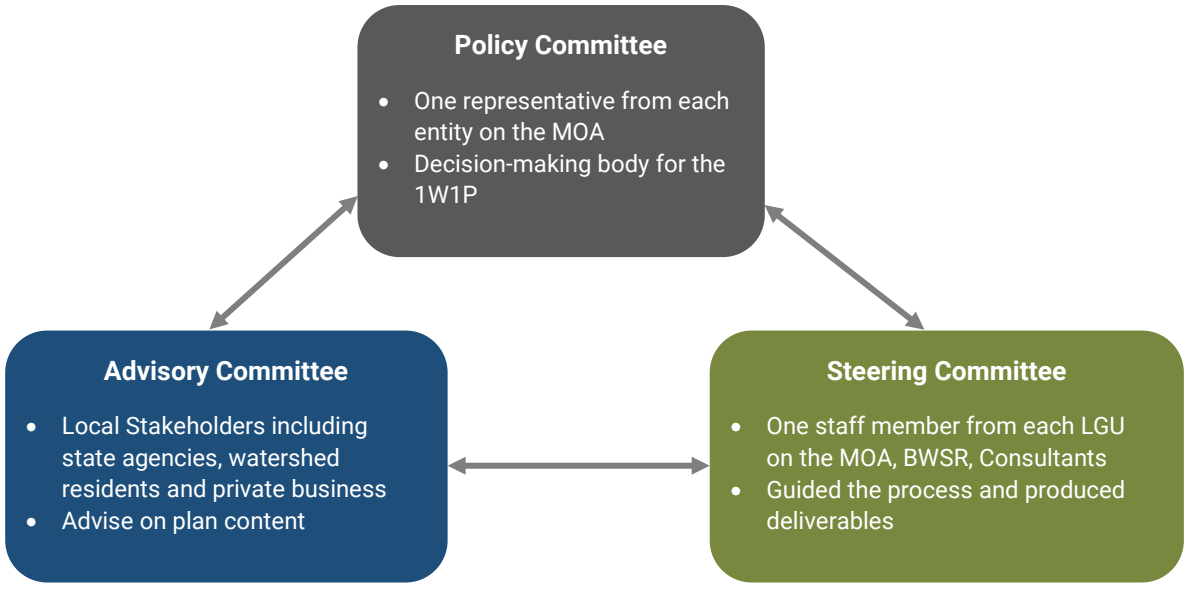
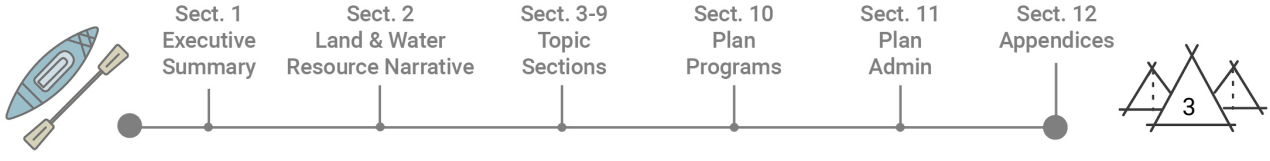


Figure 1.3. The three committees involved in the development of the Nemadji 1W1P and their roles.



Prioritization and analyses were completed using the latest existing data and science including the Nemadji River Watershed Habitat Assessment Using LiDAR (WI DNR, 2018), Lakes of Phosphorus Sensitivity Significance (Radmonski 2018) Current and Historic Sediment Loading in the Nemadji River Basin (Wisconsin DNR & Tetratech**)** and the Nemadji Watershed Restoration and Protection Strategy, (MPCA, 2017).

Plan development followed the steps outlined in Figure 1.4.

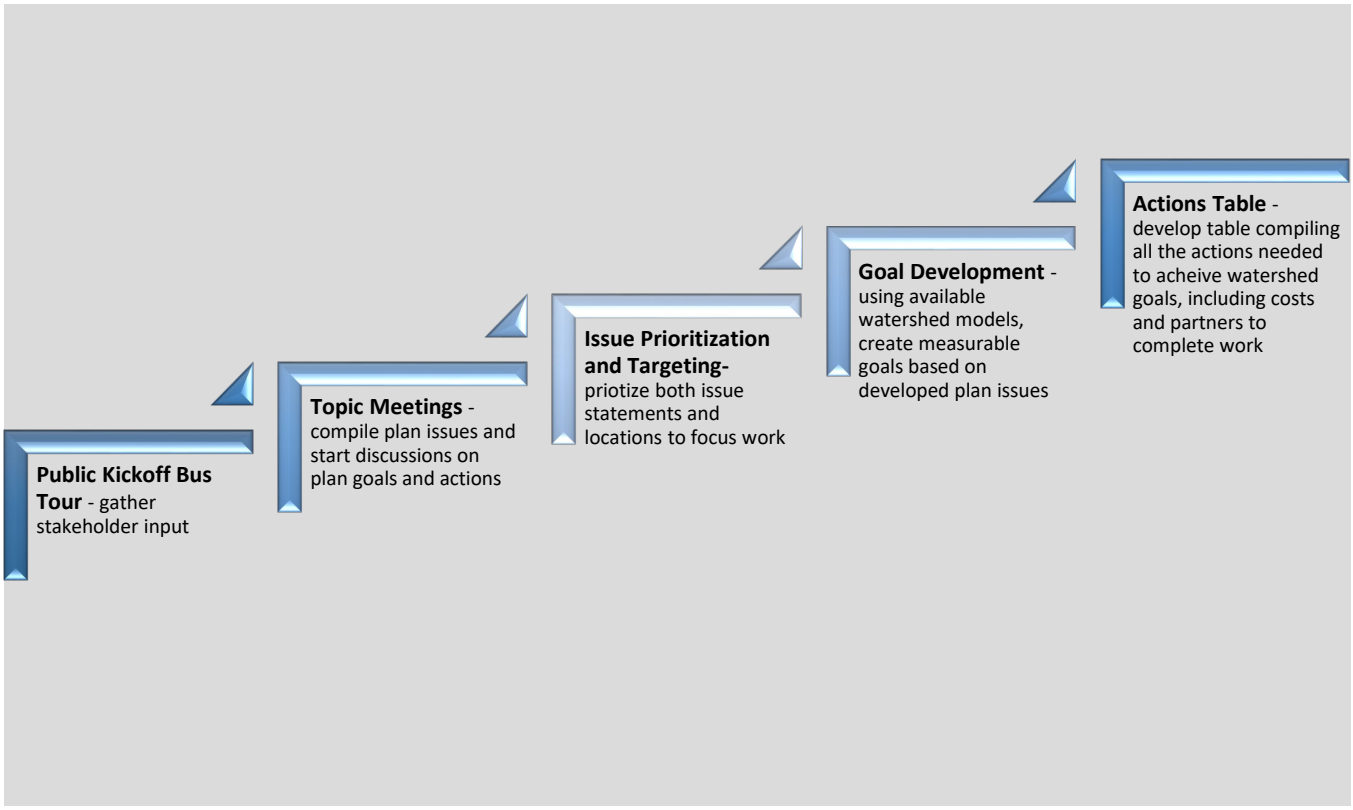
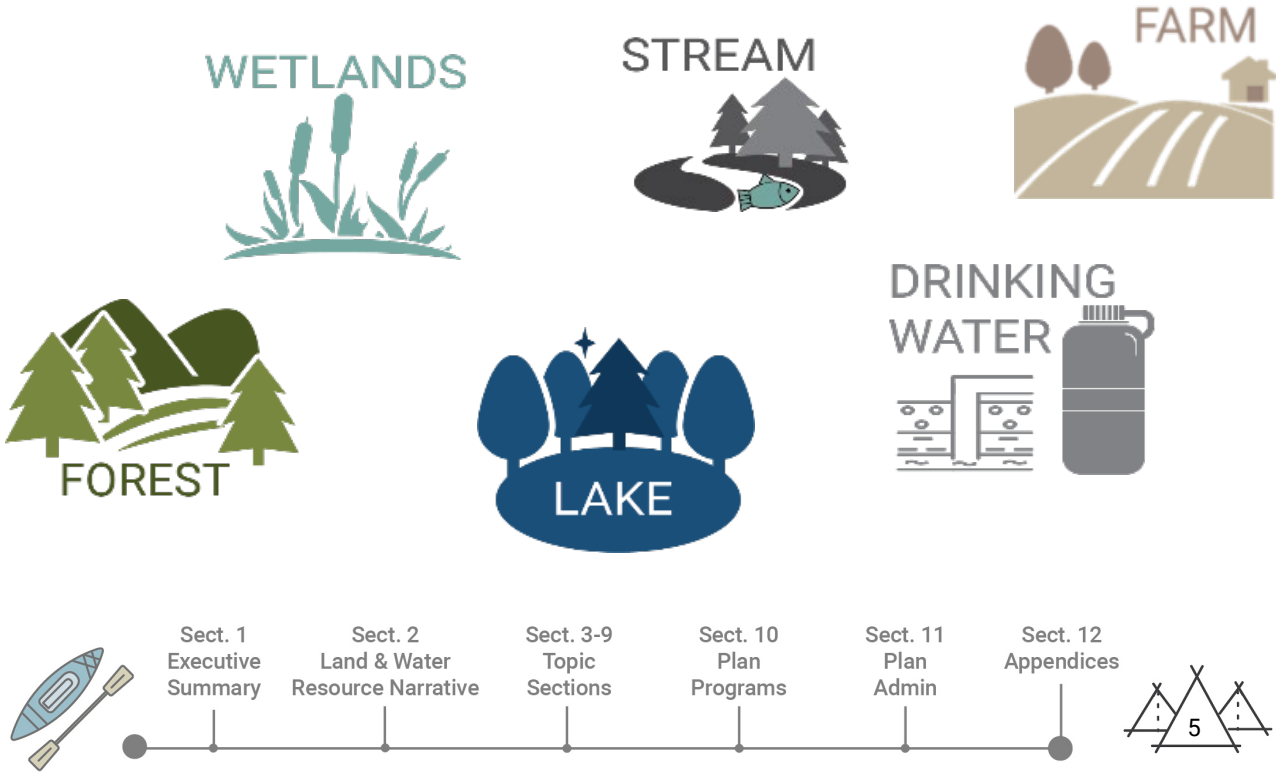


Figure 1.4. Steps in the development of the Nemadji 1W1P.

Topic Areas

Early in the planning process, several topic areas became clear priorities for the watershed: Forests, Wetlands, Lakes, Streams, Agriculture and Groundwater. The Planning Team wanted to include a wide variety of stakeholders for each topic but realized that many stakeholders would not be able to commit to a year-long planning process. The solution was to hold several focused topic meetings that invited the Advisory Committee along with topic experts to provide their unique watershed prospective (Figure 1.5). At these meetings, the group developed issue statements, and provided their thoughts on potential goals and actions for the plan. The topic experts reviewed meeting reports and provided further feedback for the plan development, creating in-depth plan content for the Advisory Committee to further develop in later meetings.

Figure 1.5. Topic-focused meetings in the fall of 2019.



Issue Identification

Issues and opportunities for the plan were generated and organized by the six topics areas: Streams, Wetlands, Forests, Agriculture, Drinking Water and Lakes. A kickoff bus tour held in July 2019 gathered watershed residents and stakeholders to showcase these resources and compile stakeholder concerns and priorities to the planning process (Appendix C). In addition, a review of past plans and studies was used to compile previously identified issues. Issues called out in the State Agencies Responses to the planning effort were also added. During fall 2019, four topic meetings invited the Advisory Committee and topic experts to review the extensive issues list and help craft issue statements for the plan (Figure 1.6).

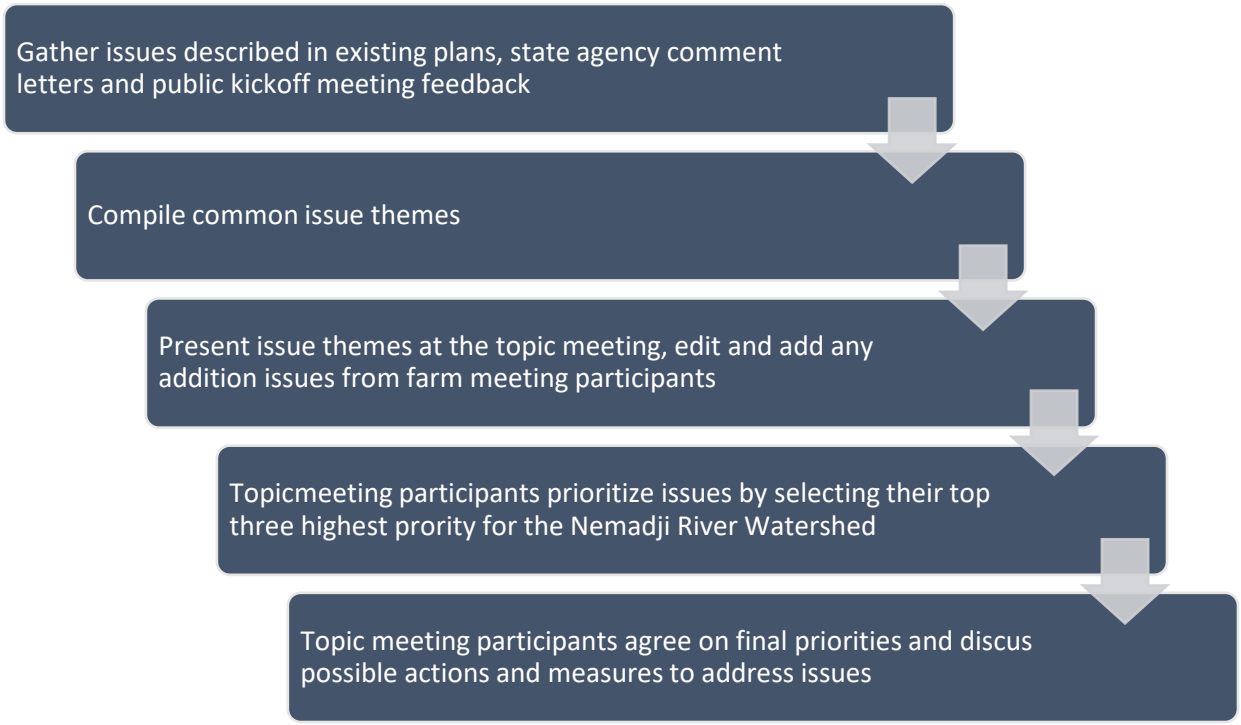


Figure 1.6. Process for developing issue statements.

Emerging Issues

During each topic meeting, emerging issues were discussed by the Advisory Committee and topic experts. An emerging issue is a potential problem or opportunity that is in the early stages of development or has not been addressed in the past but may be influential in the future. Each topic's emerging issues were recorded as part of the process.

Priority Issues

A comprehensive list of issues and opportunities were generated during the topical meetings held in the fall of 2019. Topics included: forestry, lakes & wetlands, streams, farms and drinking water. During these meetings, the most important issues were ranked. From this list, the following list of priority issues (in no particular order).

- Increased **coordination** between entities in forest management at the Nemadji watershed level is needed to maximize environmental and economic benefits.
- **Forest health** is vulnerable to climate change and invasive species, which can affect species composition and forest productivity.
- **Wetlands** are in continued need of **protection and restoration**, which provides benefits including but not limited to water quality, peak flow reduction, habitat, recreational and cultural uses, and wildlife.
- A better understanding of function, historical changes and value is needed to prioritize restoration and protection of **wetland function**.
- Alteration of **lakeshore/vegetation and conversion of cabins to year-round homes** has the potential to negatively affect lake water quality and shoreline habitat.
- The **road and stream interface** (culverts, bridges, ditches, road maintenance) can contribute to stream instability, sediment transport, habitat fragmentation, and disruptions in public safety and commerce.
- **High peak flows** contribute to stream channel instability, sediment and biological impairments in the watershed.
- **Nutrient runoff** from agricultural areas has the potential to impact stream and lake water quality.
- **Livestock access** to streams and overgrazed pastures can cause erosion and affect stream habitat.
- **Drinking water** is vulnerable to contaminants in karst and sandy soils of the watershed.
- **Noncompliant septic systems** are a risk to drinking and surface water in the watershed.
- **Lack of understanding of impacts of land use decisions and technical and financial assistance are barriers** for implementing lake, forest and farm best management practices.

The next step was to further prioritize these issues to help determine what work should be started first. The Advisory Committee was divided into small groups that ranked each statement based on its degree of difficulty and urgency. The degree of difficulty might be impacted by infrastructure, resources, technology, legislation, intergovernmental commitments, or other impacts. The degree of urgency helps to understand where there may be higher potential for worsening conditions or future consequences if work is not started in the next 10 years (Table 1.1).

Table 1.1. Explanation of the process used to prioritize the issue statements.

Issues	Difficulty	Urgency	Where
Issue Statement	*Can we make progress in 10 years?*	*What do we want to tackle first?*	*Are there any specific areas that this is a known issue?*

The results of this method helped to organize the issue statements into tiered categories (Table .

Table 1.2. Tiered priorities determined by the Advisory Committee. 1st and 2nd priority issues are those that we will address first in the plan timeframe and put the most time and funding into.

1ST PRIORITY	2ND PRIORITY	3RD PRIORITY
The **road and stream interface** (culverts, bridges, ditches, road maintenance) can contribute to stream instability, sediment transport, habitat fragmentation, and disruptions in public safety and commerce.	**Livestock access** to streams and overgrazed pastures can cause erosion and affect stream habitat. **Nutrient runoff** from agricultural areas has the potential to impact stream and lake water quality.	Alteration of **lakeshore/vegetation and conversion of cabins to year-round homes** has the potential to negatively affect lake water quality and shoreline habitat.
A lack of public understanding linking impacts of land use decisions to water quality along with a lack of technical and financial assistance are barriers for implementing lake, forest and farm best management practices.	**Drinking water** is vulnerable to contaminants in karst and sandy soils of the watershed.	**Forest health** is vulnerable to climate change and invasive species, which can affect species composition and forest productivity.
Better understanding of function, historical changes and value is needed to prioritize restoration and protection of wetland function. This is needed to **protect and restore wetlands**, which provides benefits including but not limited to water quality, peak flow reduction, habitat, recreational and cultural uses, and wildlife.	**Noncompliant septic systems** are a risk to drinking and surface water in the watershed.	**High peak flows** contribute to stream channel instability, sediment and biological impairments in the watershed.**
	Increased **coordination** between entities in forest management at the Nemadji watershed level is needed to maximize environmental and economic benefits.	

A repeating discussion point at each topic meetings was the importance of peak flow reduction. Peak flows result in large amounts of sediment erosion, and impact infrastructure and downstream communities. Even though this issue had a high urgency, the Advisory Committee recognized that it is difficult to directly affect peak flows. As a result, it was decided that the plan will focus on actions that will "slow the flow" through forest protection and wetland restoration. Slow the flow actions help flatten the peak flow curve by holding rainfall and snowmelt runoff on the land longer (Figure 1.7).

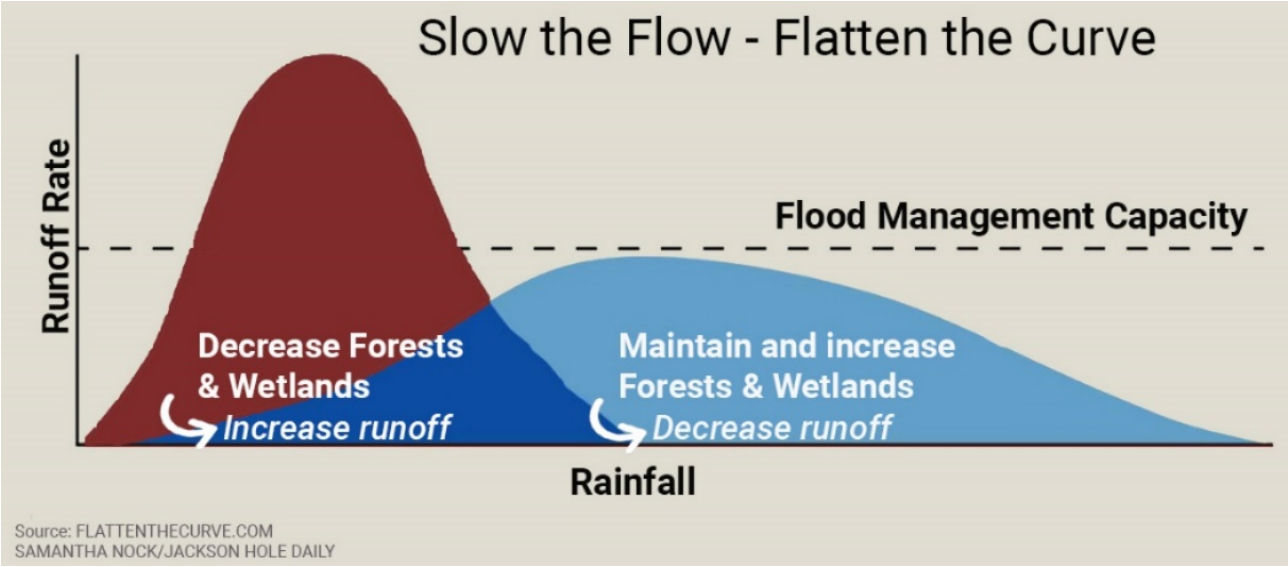


Figure 1.7. Slow the flow – flatten the curve illustration that shows the value of maintaining forests and wetlands in the watershed.

Goals

The priority issues were then used to develop the plan's goals. Goals are a guide for what quantifiable changes the plan can accomplish in its 10-year lifespan. The goals for the plan were initiated at each topic meeting and further developed by the Advisory Committee at two additional goal meetings held winter 2019-2020.

Each topic area resulted in a single goal. An additional protection goal was developed, as it was recognized that protection activities were an important tool for forest, drinking water, stream, and wetland topics.

Nemadji Watershed Goals

Reconnect 46 miles of stream to benefit aquatic life, improve the road/stream interface, and reduce sediment.

Increase water storage by 1,174 acre-feet through wetland restoration.

Increase agricultural best management practices by 4,401 acres.

Increase forest management by 5,666 acres and 88 forest stewardship plans in areas that have the most benefit to reducing peak flows and protecting drinking water.

Protect drinking water in areas of high pollution sensitivity by sealing 10 unused wells.

Enhance priority lakes by reducing the phosphorus load by 5% and restoring the shoreline in 5% of the parcels.

Increase permanent protection by 1,717 acres in the most sensitive areas for habitat, lakes, springs, forests and drinking water.

Actions

Plan actions and their associated cost estimates can be found in each topic section. Actions were compiled from the public kickoff bus tour, WRAPS, Carlton and Pine County Water Plans, the draft Groundwater Restoration and Protection Strategy (GRAPS), the Northeast Landscape Stewardship Plan, other past planning efforts and input from topic experts at the topic meetings. The Advisory Committee further developed the actions tables at two additional meetings.

The plan actions focus on outreach, knowledge exchange, and the adoption of conservation practices on the land. These steps are laid out in the communications strategy developed for the plan (Figure 1.8).

Figure 1.8. Communications strategy for the Nemadji 1W1P.

The Nemadji Watershed partners are consistently implementing actions to achieve watershed goals through many different efforts, but to fully implement this plan, additional funding and capacity over current levels will be needed. The implementation table displays funding in three different categories (Table 1.4).

Table 1.3. Funding categories for plan actions.

Baseline:	**Local baseline funding**
WBIF:	**Watershed-based Implementation Funding**
Other:	**Other funding sources including competitive grants and partner funding**

The plan provides a framework for the Nemadji Watershed to work towards goals that maximize benefits. Partners that will help with plan implementation include state agencies such as BWSR, MPCA, DNR, MDH, MNDOT and MDA, along with other organizations such as the Carlton County Transportation Department, Townships, Trout Unlimited, Net Lake Association, Minnesota Land Trust, American Bird Conservancy and many others.

Plan Administration

The Nemadji 1W1P planning effort was conducted through a Memorandum of Agreement (MOA) between Carlton and Pine Counties and SWCDs (Appendix E). The parities plan to form a new Memorandum of Agreement for administering the plan.

Section 2: Land & Water Resource Narrative

SECTION 2. LAND AND WATER RESOURCE NARRATIVE

Introduction

The Nemadji Watershed has almost 847 miles of stream with over 353 miles in Minnesota. The waters flow from the headwaters located in Northern Pine County and Central Carlton County, Minnesota to Lake Superior in Superior Wisconsin. The watershed covers 473 square miles with 276 square miles in Minnesota. In Minnesota, the land is largely forested or is a wetland. All sub-watersheds have at least 63% natural land cover (University of Minnesota 2013 land cover dataset). In our region, wetlands and forests play a vital role in helping protect water quality by reducing run-off rates and the quality and speed at which water reaches and moves through streams. In addition to the scenic natural setting, the Nemadji is also home to many small farms that provide a variety of food to the region. The result is a watershed that provides a variety of benefits to our region: forests, wetlands, lakes, streams, farms, drinking water and people.

1. Forests

The forests of the Nemadji are not only important for water quality but provide habitat for a variety of threatened species and are an important resource for the local economy. They also provide valuable recreation land. Surveys conducted in the late 1800's provide us with clues on what the Nemadji Watershed looked like prior to European settlement. The watershed was largely forested with conifers (pine and spruce) and aspen as dominant species. Although much of the watershed is still forested, the Nemadji's forests have a larger aspen component. In addition, some land has been converted to grass, hay and crops since European settlement. The northern most subwatersheds have the most disturbance associated with them. Disturbance includes land conversion from forest/wetlands to farm (row crops or grazing), development or mining. Even in the Nemadji's most disturbed subwatersheds, less than 32% has been converted.

On the Minnesota side of the watershed, there are nearly 40,000 acres (39,908 acres) of privately-owned forest in the Nemadji watershed. These lands would be at a higher risk of conversion to other land use types (development or agriculture). Of the 133,195 acres of privately-owned land in the Nemadji Watershed, 46,208 acres are absentee landowner owned. Especially in the southern part of the watershed, cabins and hunting properties are common. Of the 25 sub-watersheds, 12 are 40% or more absentee owned. These are all located in the southern half of the watershed.

Figure 2.2. Aspen forests near Blackhoof River.

The Nemadji has an abundance of publicly managed land. In general, land that is publicly owned is considered protected because it is unlikely to be converted to a different land use through development or agriculture. Protected forests are managed for multiple benefits which includes timber harvest as an important management tool. Out of the 25 subwatersheds in the Nemadji Watershed, 12 are 30% or more protected in public lands. Four watersheds are over 90% in public lands. Much of the headwater's region for the Net and Little Rivers is protected in the Nemadji State Forest. In addition, the Blackhoof WMA provides protection to the Blackhoof and Deer Creek rivers. County managed forests also contribute to a large amount of public land throughout the watershed.

2. Wetlands

There are extensive wetlands in the Nemadji watershed, that provide a variety of benefits, including water storage during high rain events that helps mitigate flood damage. In addition, wetlands provide an abundance of biodiversity. Approximately 30% of the watershed is currently classified as wetland, but historic land use changes have resulted in an 18% loss of historic wetlands. Wetland loss is caused by ditching, land conversion or changes to streams that result in drained riparian areas. About 85% of the lost wetlands are restorable, but more data is needed to help us understand how well our wetlands are functioning.

Figure 2.3. Wetland near Lac La Belle.

3. Lakes

Although the Nemadji is best known for its streams and rivers, there are also many lakes in the watershed with 35 lakes on the Minnesota side. While most of the lakes are healthy, high phosphorous levels can lead to algae blooms in some places. Lakes that have high phosphorous and chlorophyll-a levels are listed as impaired by the Minnesota Pollution Control Agency. Net Lake was listed as impaired for high nutrient levels. Aquatic Invasive Species are also an issue for one lake in the Nemadji Watershed. Chub Lake, a popular recreational lake, is infested with Eurasian Watermilfoil. Although most lakes are healthy, some lakes are more sensitive to inputs of additional phosphorous. These lakes may warrant additional protection to keep them from becoming impaired. One of these sensitive lakes includes Hay Lake which is also a DNR designated wild rice lake.

Figure 2.3. Net Lake on the Carlton/Pine County border.

4. Streams

The Nemadji Watershed has almost 847 miles of stream with over 353 miles in Minnesota. Most of the Nemadji's streams are designated trout streams. This means the stream habitat provides the right conditions for the sensitive species to live, including cold water during warm summer months. The well know Blackhoof River is a destination for anglers, with excellent trout populations.

Figure 2.4. The Nemadji River near Highway 23

Even with several high-quality streams, six streams did not meet Minnesota Pollution Control Agency's (MPCA) standards for fish and/or macroinvertebrate diversity and are listed as impaired. In addition, nine streams in the watershed have very high levels of total suspended solids (sediment) and are also listed as impaired by MPCA for exceeding the state standard. Most of this sediment comes from near the channel, not from overland erosion. Large parts of the Nemadji Watershed are made up of red clay soils. In addition, many of the rivers cut through deep ravines. The combination of soils and steepness make the banks prone to slumping into streams. A 1998 MN Natural Resource Conservation Service (NRCS) study estimated the Nemadji River transports an average of 120,000 tons of sediment to Lake Superior each year, making the Nemadji the largest single source of sediment to Lake Superior. Each year, about 33,000 tons of sediment are dredged by the US Army Corps of Engineers to maintain shipping traffic in Superior Bay.

The combination of steep slopes and soils also have impacts on infrastructure. Many of the Nemadji Streams are flashy, presenting challenges to designing road crossings. Compounding the problem, about 75% of culverts are undersized, leading to erosion, infrastructure vulnerability and aquatic organism passage. In addition to undersized and/or perched culverts, there are 16 dams that were constructed in the 1970s as part of the Red Clay Project. These dams were built to reduce peak flows within the watershed with a goal of reducing erosion, but unfortunately were not properly maintained. As a result, they no longer function as they were designed and pose a risk for failure and have negative impacts to fish and other aquatic organisms.

4. Farms

The region has a long history of farming, and today agriculture is a valuable part of our community and economy. The Nemadji Watershed grows it all from beef, pork, dairy and chickens to many community supported agriculture (CSA) farms that grow fruit and vegetables. Most farms are found in the northern portion of the watershed where the terrain is flatter. Compared to other areas of the state, the watershed's farms are relatively small, with most of the feedlot operations below the state requirements for registration.

There are two streams listed as impaired by MPCA for high levels of bacteria (*Escherichia coli*). E. coli bacteria is a by-product of animal and human waste, and it can come from a number of sources. When we see high numbers after rain fall events like we do in the Nemadji Watershed, it indicates the bacteria is running off the land. Feedlots or livestock with access to streams can be a source.

Nemadji Watershed farms play an important role in our local economy and watershed health. Farmers in the region employ practices such as cover crops, rotational grazing, nutrient management, conservation tillage, crop rotation and livestock exclusion from sensitive areas help boost farm productivity and protect the Nemadji's valuable natural resources.

Figure 2.5. Cows enjoying Nemadji managed grasslands.

5. Ground Water

Clean drinking water is an essential resource for watershed residents. Throughout the watershed, there are up to 20 private wells per section of land. Arsenic and nitrate are both concerns for some private wells. In general, wells in the Nemadji tested low for both, but some wells had higher levels, especially in the north where soils are sandier. These sandy soils are also vulnerable to near surface pollutants. In addition to drinking water, ground water provides valuable cold water to streams, creating necessary conditions for trout and other aquatic organisms. Ground water is also vital for providing baseflow for some stream systems, providing flow during the dryer summer months.

Figure 2.6. Section 36, a stream near Holyoke, has low base flows that affects habitat for aquatic organisms during dry summer months.

6. Precipitation

Rainfall amounts help maintain groundwater reserves and can have large impacts on the watershed. Several recent flood events in recent years have washed out roads and caused property damage. Drought can have equally troubling results. Mean annual precipitation shows that the watershed receives 30-32 inches of rain a year, but 500-1000-year flood events have occurred in 2012, 2016, 2018 and 2019. In this region, heavy rain events have doubled since the 1900s and are predicted to double yet again by 2100.

Figure 2.7. A washout on Clear Creek and County Road 103 in June 2018. The stream overtopped the road, washing out many tons of road material into the stream and affecting public safety during the storm.

7. People

Although the Nemadji is a rural watershed, the people who live, work and play here play an important role in protecting and restoring water quality. The 2010 Census indicates that the northern most townships have the highest population. Twin Lakes Township has the highest population with 2108 residents and 31% of the housing units. The median age of the Nemadji Watershed's townships is between 40 and 50, with Blackhoof Township having the youngest median age and Holyoke Township with the oldest. There is a wide range of median incomes throughout the watershed, between $37,813 (Nickerson Township) and $67,500 (Blackhoof Township). The watershed's population has remained relatively stable, with the most growth occurring in the north where we also see the highest number of structure permits.

Figure 2.8. Watershed enthusiasts enjoying a paddle on the Nemadji River.

7. Conclusion

Through previous studies and planning efforts, we have a greater understanding of the Nemadji Watershed and the issues it faces. The goal of the One Watershed One Plan is to use limited restoration and protection funds wisely to keep this valuable resource healthy for years to come.

Section 3: Streams

SECTION 3. STREAMS

Introduction

The Nemadji Watershed is made up of a complex network of streams that flow north to Lake Superior. Of these streams, approximately 350 miles are designated trout streams that provide valuable cold-water habitat. However, six streams are listed as impaired because they did not meet MPCA's standards for fish and/or macroinvertebrate diversity. In addition, nine streams are listed as impaired for Total Suspended Solids (TSS). In fact, the Nemadji watershed contributes more sediment to Lake Superior than all the other North Shore streams combined (Magner 2007). Most of this sediment comes from near channel sources and not overland erosion which is exacerbated by the steep slopes and clay soils that make up a large part of the watershed (Erosion and Sedimentation in the Nemadji River Basin). This leads to a flashy system, presenting challenges for the stream/road interface. Stream crossings in the watershed have led to issues with erosion, connectivity/aquatic organism passage and infrastructure vulnerability.

Figure 3.1. The upper reaches of the Net River in the Nemadji State Forest.

In 2019, a Kickoff Bus tour was held for watershed residents and stakeholders to provide input into the Nemadji 1W1P process. Through this event, we learned that 89% of attendees agreed that streams are in important resource.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. One of the stops was at a recently replaced culvert that improved stream health by reconnecting stream habitat.

Figure 3.2. July 2019 Nemadji 1W1P bus tour.

Issues

In order to help us understand what issues/opportunities surround streams in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority stream issues for the Nemadji 1W1P (Figure 3.3).

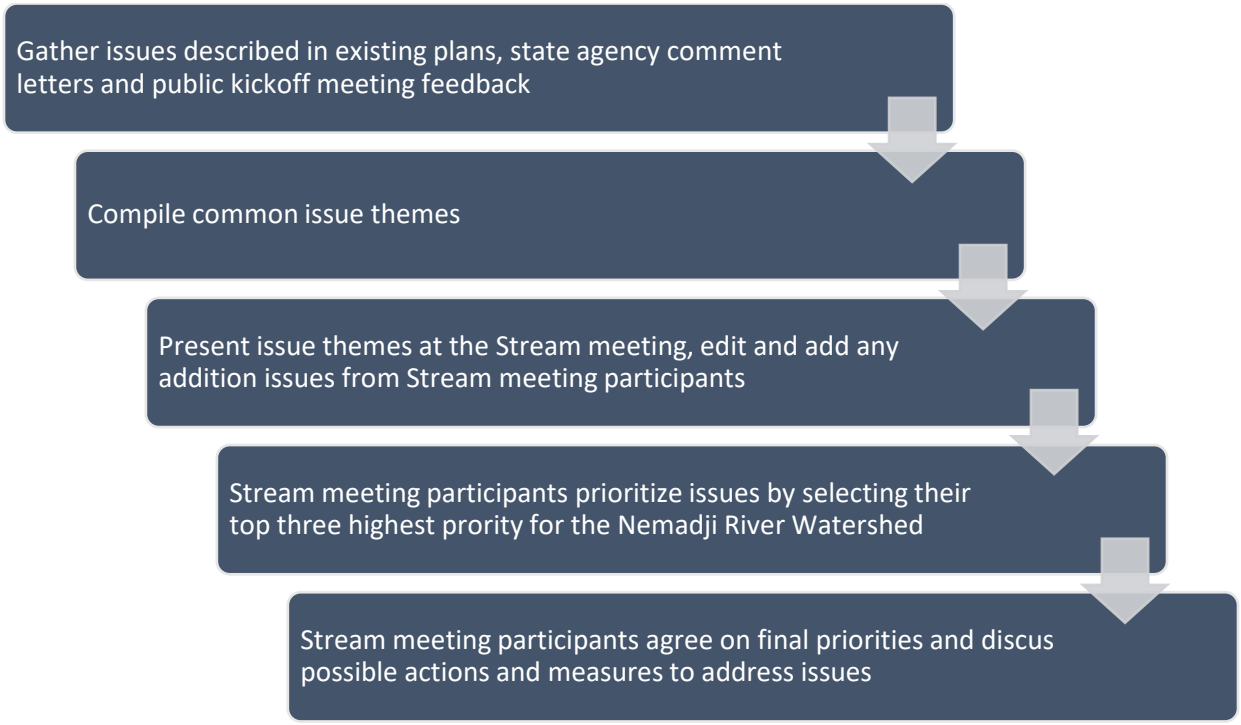


Figure 3.3. Issue statement development process.

A diverse group of topic experts were invited to help gather and priotitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from Fond Du Lac Band of Lake Superior Chippewa, DNR Fisheries, DNR Wildlife, DNR Forestry, Carlton and Pine SWCD lakeshore and stream techical specialists and private land owners participated in the **Stream** meeting.

To illustrate the diversity of viewpoints for stream values, at the beginning of the **Stream** topic meeting, experts and Advisory Committee members were asked to provide their definition of what comes to mind when they think of the watershed's streams. From this discussion, a word cloud was assembled (Figure 3.4).

Figure 3.4. Word cloud depicting the diversity of responses to the question, "When you think of the Nemadji's streams, what comes to mind?"

At the **Stream** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of six issue statements (Figure 3.5, Table 3.1).

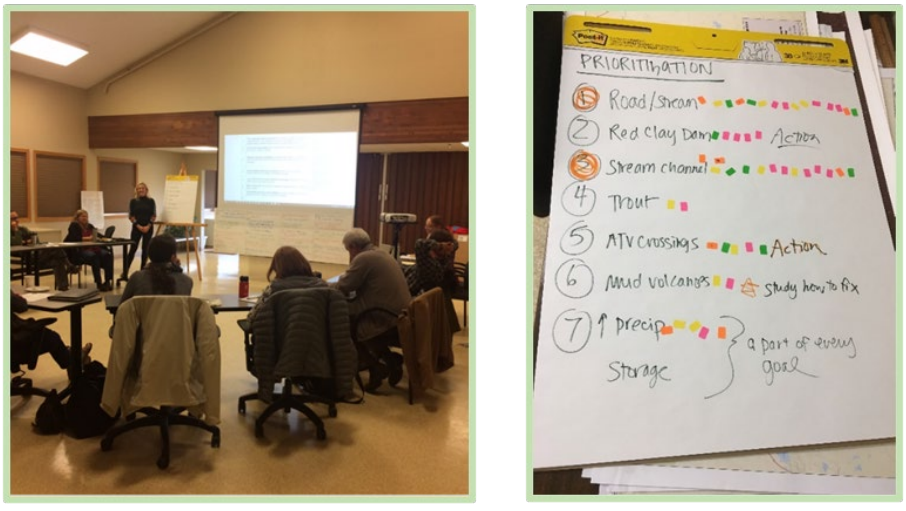


Figure 3.5. Photos from the Stream Meeting held October 23rd, 2019.

Table 3.1. Stream issue statements as revised at the Stream topic meeting.

Issues Statement	References
The road and stream interface (Culverts, bridges, ditches, road maintenance) can contribute to stream instability, sediment impairments, habitat fragmentation, public safety and commerce.	Carlton County Water Plan, Pine County Water Plan, WRAPS, TMDL, Public kickoff, MPCA, BWSR, DNR
Failing red clay dams can contribute to stream erosion and are barriers to aquatic habitat.	Carlton County Water Plan, WRAPS, TMDL, MPCA, DNR
Stream channel instability and high peak flows contribute to sediment and biological impairments in the watershed.	Carlton County Water Plan, Pine County Water Plan, WRAPS, TMDL, Public Kickoff, Erosion and Sedimentation in the Nemadji River Basin, USDA - NRCS Rapid Watershed Assessment Beartrap-Nemadji
Groundwater-fed trout streams are at risk of increased temperature and turbidity.	Pine County Water Plan, WRAPS, Erosion and Sedimentation in the Nemadji River Basin
Uncontrolled/unmanaged stream crossings (such as ATV and other uses) can cause erosion.	WRAPS, Public Kick-off, Erosion and Sedimentation in the Nemadji River Basin
Mud volcanoes contribute to sediment impairments on Deer and Mud creeks.	WRAPS, Carlton County Water Plan
Increasing trends in precipitation impact infrastructure, water quality and fish habitat.	Stream Topic Meeting, Public kickoff

After a lot of discussion, each participant ranked their top issues for streams. These priorities will have measurable goals assigned to them and will be the focus of implementation. The two top priorities overall were:

- The **road and stream interface** (Culverts, bridges, ditches, road maintenance) can contribute to stream instability, sediment impairments, habitat fragmentation, public safety and commerce.
- Stream channel instability and **high peak flows** contribute to sediment and biological impairments in the watershed.

Emerging Issues

High rainfall events observed in 2012, 2016, 2018 and 2019 have had major impacts to the Nemadji Watershed's streams. Road washouts resulted in many tons of road material washing into streams and years later have lingering impacts. Observations by local road authorities and MPCA have observed large slump formations develop after flood events, sometimes as long as 6-18 months after a flood event. The MPCA has observed similar slumps throughout the watershed. Extreme rain events are predicted to increase due to climate change in future years (NOAA NCDC / CICS-NC). Equally concerning are impacts due to draught. Small streams that currently support aquatic life may not have enough flow during certain times of the year.

Figure 3.6. Road washout on County State Aid 8 and Stony Brook during the June 2018 flood. The crossing had washed out in previous floods in 2012 and 2016. This undersized crossing was replaced by a climate resilient culvert in 2019.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The stream subwatershed prioritization map (Figure 3.6) ranked each subwatershed based on:

- Trout abundance (MN DNR Fisheries)
- Total Suspended Solids Impairment (MPCA)
- Perched and Undersized Culverts (Carlton SWCD/County Culvert Inventories)
- Red Clay Dams (Carlton SWCD Inventory)

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore stream resources, and are the focus of where to work first during plan implementation.

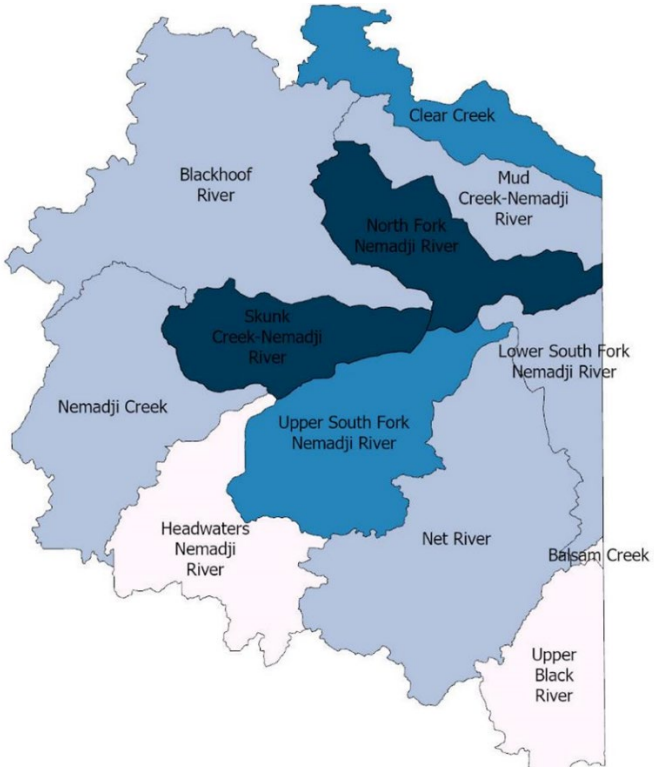


Figure 3.7. Stream map ranking each HUC 12 subwatershed based on number of undersized and perched culverts, trout abundance, Total Suspended Solids impairment status and presence of Red Clay Dams. A darker color indicates a higher rank.

Goals and Targeting

The stream subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted to the road-stream interface where there is vulnerable infrastructure.

To specifically target where to work, the FishWerks tool (Great Lakes Commission) was used in conjunction with culvert inventories and local knowledge to measure:

- The distance between perched and undersized culverts and red clay dams
- Approximate sediment savings per replaced undersized culvert and road washout

The short-term goal targets planned work by road agencies in the next 10-years that addresses vulnerable infrastructure. The long-term goal is to replace all undersized and perched culverts. Through establishing proper sizing and placement of culverts and improving the road/stream interface, sediment loading to streams will be reduced.

There are nine streams in the watershed that are impaired for total suspended sediment (TSS). A study by NRCS (1998) concluded that the majority of sediment exported from the Nemadji is generated from mass wasting processes, due to slumps of valley walls as the streams down cut into erodible sediment (Magner and Brooks 2008). For the first 10-years, the plan will target erosion and slumps associated with infrastructure. Future inventories planned by MN DNR and MPCA will help target and prioritize potential stream stabilization projects in other parts of the watershed.

Spotlight: Skunk Creek

Skunk Creek is impaired for sediment. In order to meet water quality standards (TMDL), reductions are required.

Very High Flows: requires a 99% reduction (100 tons/day)

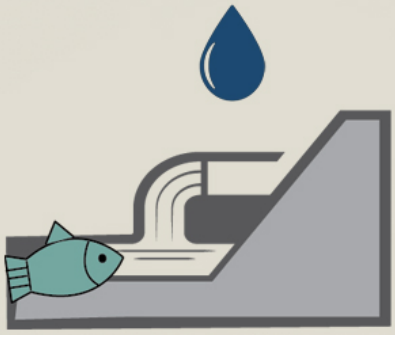
10 tons roughly equal 1 dumptruck

How does fixing culverts relate to sediment in the stream?

600 TONS SEDIMENT PER CULVERT

per **200** YEAR RAIN EVENT*

*There was a 200-year rain event in 2012, 2016, 2018, and 2019.



The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics, and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

Stream Goal: Reconnect 46 miles of stream to benefit aquatic life, improve the road/stream interface, and reduce sediment.

Introduction

The stream goal focuses on reconnecting streams and reducing erosion by targeting perched and undersized culverts and stabilizing the road-stream interface. In conjunction with culvert replacements, projects will attempt to re-connect floodplain or near stream functional wetland habitat to help slow the flow. By focusing on vulnerable infrastructure, climate change impacts will be mitigated resulting in safer roads. In addition, habitat for aquatic life will be improved. Many fish species use a variety of stream habitats during different parts of their life cycle and different seasons. Small spring-fed streams may offer protection during hot summer months, but larger rivers offer refuge during winter.

In addition to the road-stream interface, the second focus for the stream goal is to address the Red Clay Dams (Appendix I) found in the Skunk and Deer Creek subwatersheds. These structures also impact stream connectivity and are at risk of failure due to their age.

Outcomes

- Improved public safety
- Reduced sediment erosion to streams and Lake Superior
- Improved habitat for fish and aquatic life
- Protection of commerce
- Mitigation of climate change impacts

Target (Figure 3.7)

- Short-term (10-year): Streams with priority culvert project sites.
- Long-term (Future): All stream barriers.

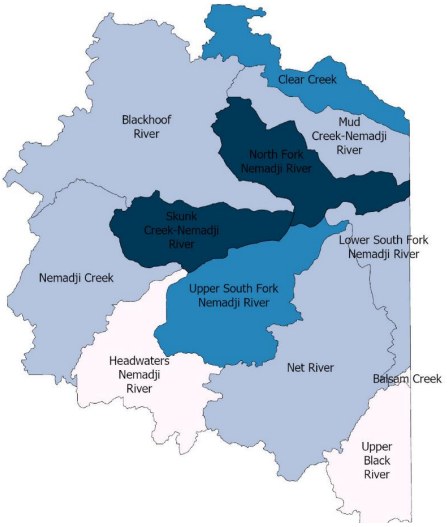
Issues Addressed

- Road/Stream interface
- High Peak Flows
- Stream sediment

Metrics

- Miles of connected stream
- Tons of sediment reduced

Subwatershed Prioritization



Subwatershed	Long-term (miles)	Short-term (miles)
North Fork Nemadji River	10.7	3.6
Skunk Creek	5.8	1.0
Clear Creek	10.4	0.2
Upper S. Fork Nemadji River	43.9	21.6
Blackhoof River	29.5	0.7
Nemadji Creek	22.8	6
Mud Creek	8.5	0.0
Lower S. Fork Nemadji	8.3	8.3
Net River	45.3	7.2
Headwaters Nemadji River	23.0	0.0
Balsam Creek	0.0	0.0
Upper Black River	0.0	0.0
Total	208.1	46.6

Targeting Map

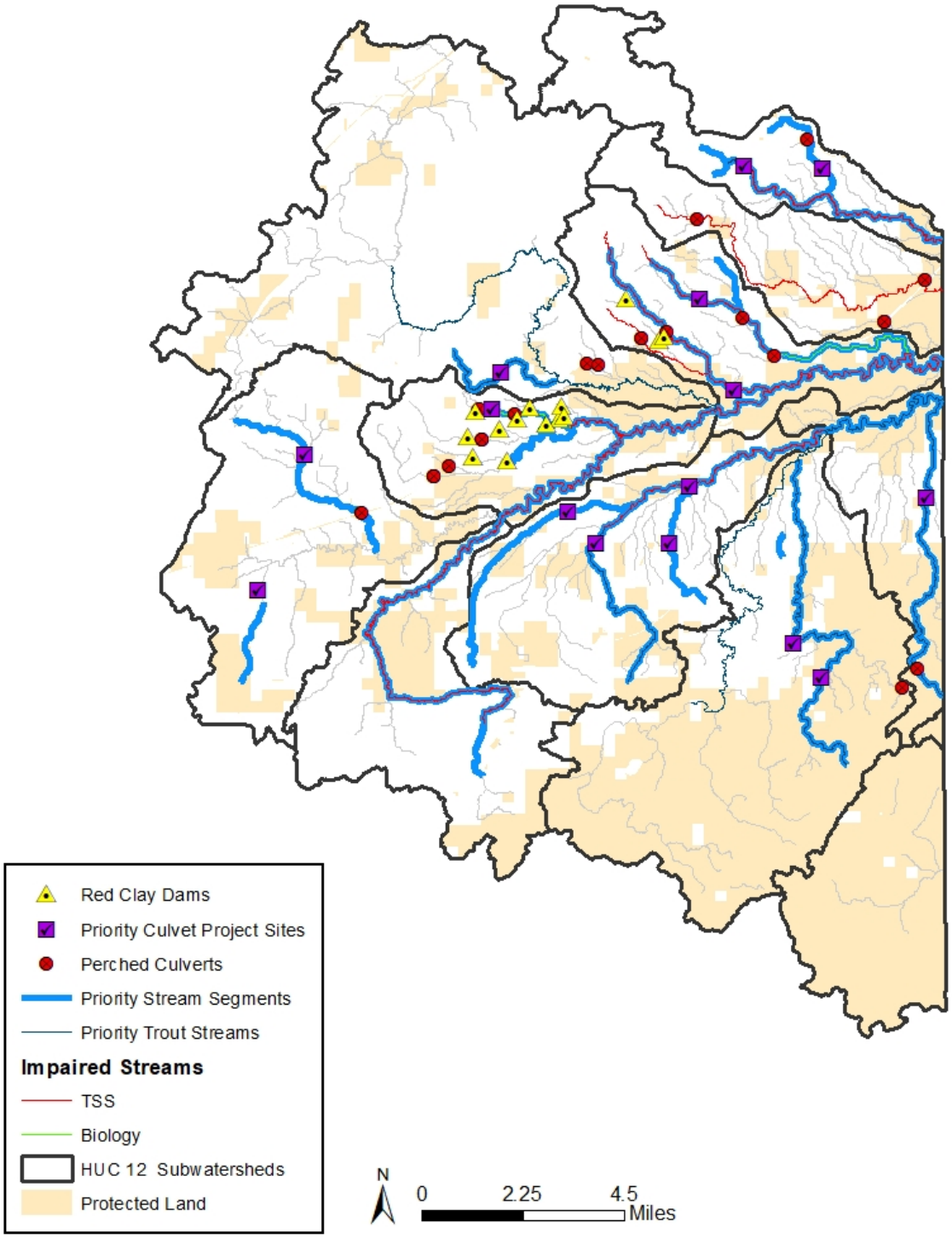


Figure 3.8. Priority culverts for replacement to reconnect stream habitat and protect infrastructure. Datasets used for targeting include Carlton County Culvert Inventory, MPCA Impaired Waters List and Carlton SWCD Red Clay Dam Inventory.

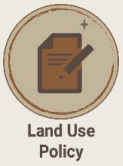
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Stream Connectivity Targeted Implementation Schedule

Stream actions will focus on mitigating impacts of the road/stream interface.

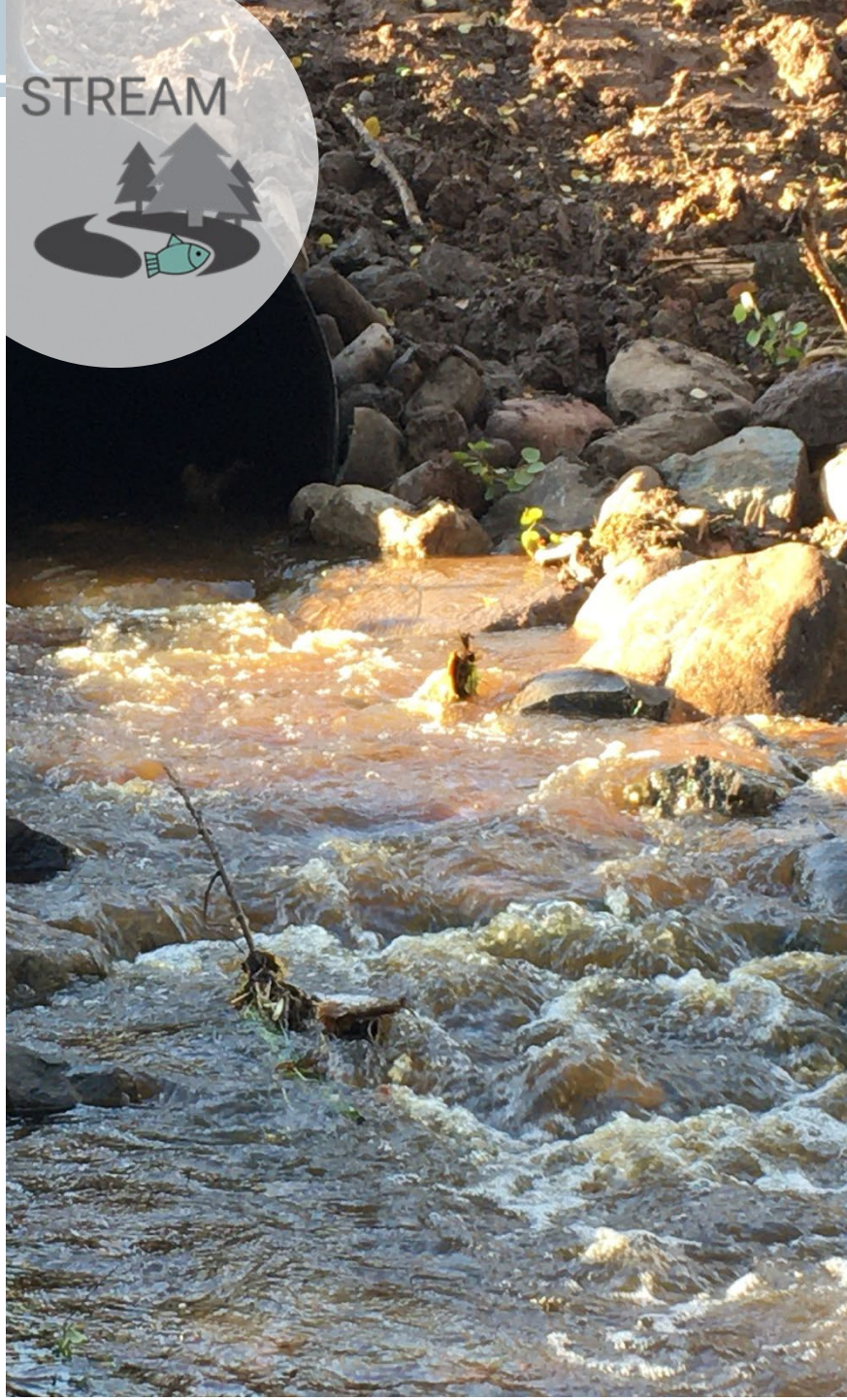
Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. For the stream goal, this will rely on County State Aid, County Road Tax and Township Bridge Funds. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the stream goal will include federal and state grants, Federal 319 Small Watershed Funds (Skunk Creek), Federal Highway Administration, Minnesota Department of Transportation and DNR funds.

Estimated total 10-year cost for the Stream Connectivity Goal:

Baseline:	**Local baseline funding (County State Aid, County Road Tax and Township Bridge Funds)**	**$10,235,000**
WBIF:	**Watershed-based Implementation Funding**	**$399,000**
Other:	**Other funding sources including competitive grants and partner funding (i.e. Grants, Federal and State Project Funding, DNR).**	**$14,012,726**
	Total	**$24,646,726**

Related Activities:

- When planning projects, increase collaboration between entities.
- Learn where streams are unstable and collaborate with local educational institutions to better understand clay on bedrock.
- Increase the number of river gages on the Nemadji system for better culvert/stream project design



Stream Connectivity Targeted Implementation Schedule

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Reconnect streams by removing barriers created by culverts (undersized, perched, misaligned).	Conservation	46 miles of streams reconnected, 600 Tons of sediment/ ~200-year rain event/per culvert*	North Fork Nemadji River, Skunk Creek, Clear Creek, Upper South Fork Nemadji River	**CCTD, MN DOT & Townships** SWCD, TU, Land Department (Soo Line Trail)	✦	✦	✦	✦	✦	**Baseline** **Other:**	**$10,185,000** **$11,016,726**
Reconnect streams by removing Red Clay Dams.	Conservation	1 mile of stream reconnected	Skunk Creek & Deer Creek	**SWCD** EPA			✦	✦	✦	**Other:**	**$2,000,000**
Feasibility Study for large Red Clay Dams (Elim & Hanson Dams).	Conservation	2 Feasibility Studies Completed	Skunk Creek	**SWCD**	✦	✦				**WBIF:** **Other:**	**$32,000** **$96,000**
Stabilize gravel roads in priority areas (steep slopes near streams) to reduce road material erosion into streams.	Conservation	17,000 tons of sediment per spring melt and 2-year rainfall event per site	Skunk Creek Nemadji Creek, Upper South Fork Nemadji River, Net River	**CCTD** SWCD	✦	✦	✦	✦		**Baseline** **WBIF:** **Other:**	**$50,000** **$345,000** **$100,000**
Restore unstable stream reaches, focusing on protecting infrastructure and where benefits can be stacked.	Conservation	2 Projects; 200,000 tons of sediment, 200,000 lb of TP	Net River, Blackhoof River, Skunk Creek	**SWCD, CCTD** TU, DNR	✦	✦	✦			**Other:**	**$800,000**

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Field inventory of slumps and log jams to prioritize future projects considering risk to infrastructure, size, sediment loss, habitat impact, and accessibility.	Research, Data, Monitoring	4 Inventories Completed	Skunk Creek, Net River, Little Net River	**SWCD, MPCA**	✦	✦				**Other:**	**$20,000**
Complete a geomorphology study to guide future restoration work	Research, Data, Monitoring	2 Completed Studies	Skunk Creek, Blackhoof River	**DNR**	✦					**Other:**	**Not Calculated**
Conduct biological, temperature and chemistry monitoring to assess BMP effectiveness and target future projects	Research, Data, Monitoring	1 Monitoring Report	Stateline Creek, Little Net River, Skunk Creek, Elim Creek Stony Brook, anderson Creek, Silver Creek	**MPCA**	✦					**Other**	**Not Calculated**
Protect infrastructure by increasing watershed storage and floodplain connectivity.	Conservation	1,193 acre/feet storage	Upper South Fork Nemadji River, North Fork Nemadji River, Nemadji Creek, Mud Creek	**SWCD, CCTD Count Land Department**	✦	✦	✦	✦	✦	**WBIF:**	**See Storage Goal**
Track benefits of all watershed projects using ESRI Arcmap tools which includes cost of both projects and consequences of not completing projects, such as road closures. Include tools for partners to add data.	Research, Data, Monitoring	Online map application created	Watershed Wide	**SWCD** Partners	✦	✦	✦	✦	✦	**WBIF:**	**$7,000**

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Review historical road erosion BMP designs/locations, field verify condition and prioritize future replacement projects	Conservation	Review Completed	Watershed Wide	**SWCD, CCTD**	✦	✦				**WBIF:**	**$10,000**
Update culvert inventory on private and township roads.	Research, Data, Monitoring	Inventory Complete	Watershed Wide	**SWCD County** (County maintained township roads)		✦	✦			**WBIF:**	**$5,000**
Help townships, private landowners and other road authorities with culvert/road projects by providing technical assistance and funding	Education & Outreach	3 culvert replacements	Skunk Creek, Net River, Upper South Fork Nemadji River	**SWCD, CCTD, Townships**	✦	✦	✦	✦	✦	**Baseline** **WBIF:** **Other:**	**Incorporated in reconnect stream action**

- A 200-year+ rainfall event has occurred in the watershed in 2012, 2016, 2018 and 2019.

Section 4: Wetlands

SECTION 4. WETLANDS

Introduction

Wetlands make up a large portion of the Nemadji Watershed and play a vital role in protecting water quality, providing valuable habitat and helping to slow the flow of water during high rain events. In turn, this helps protect infrastructure and property. Approximately 30% of the watershed is classified as wetland, but through historic land use changes, we have lost 18% of wetlands (WI DNR, 2018; Appendix B). Approximately 85% of the lost wetlands are restorable. In addition, even existing wetlands may be impacted in ways that effect their function.

Figure 4.1. Wetland near Lac La Belle

In 2019, a Kickoff Bus tour was held for watershed residents and stakeholders to provide input into the Nemadji 1W1P process. Through this event, we learned that 92% of attendees agreed that wetlands are an important resource.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. Maps were displayed during the event for participants to learn more about resources, including where wetlands have been lost due to land use changes.

Figure 4.2. 2019 Nemadji 1W1P bus tour.

Issues

In order to help understand what issues/opportunities surround wetlands in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority wetland issues for the Nemadji 1W1P (Figure 4.3).

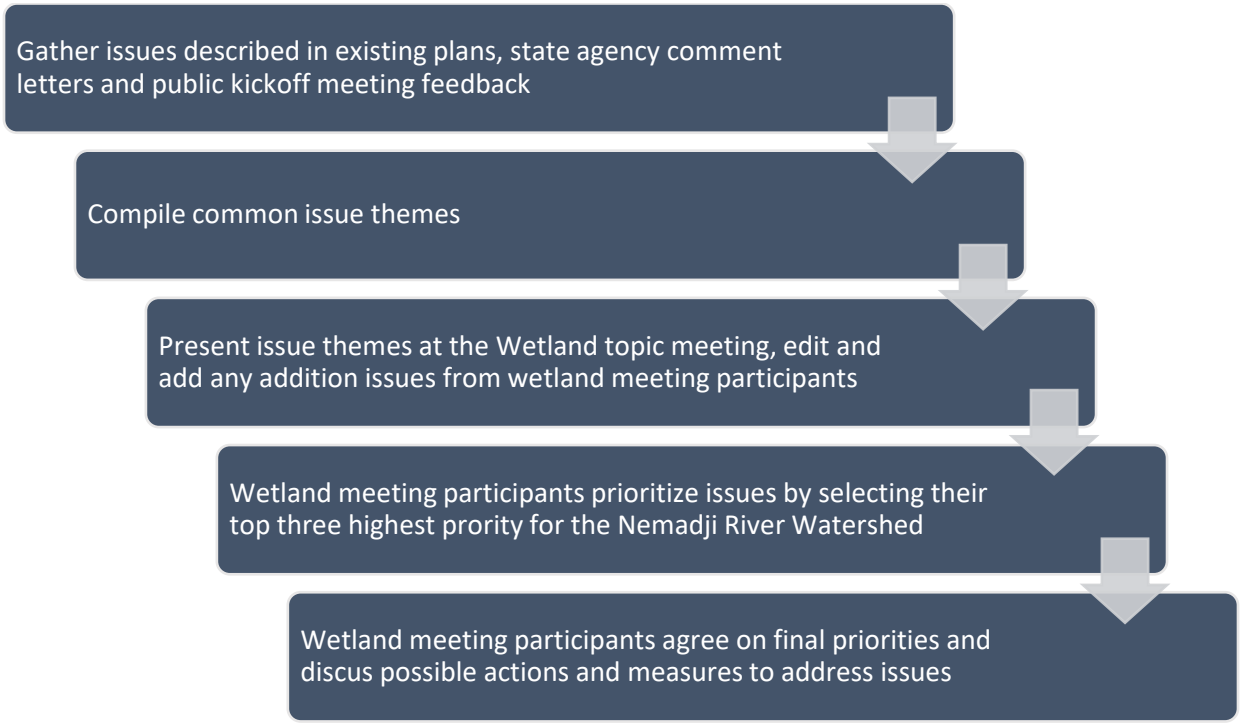


Figure 4.3. Issue statement development process.

A diverse group of topic experts were invited to help gather and priotitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from Fond Du Lac Band of Lake Superior Chippewa, DNR Fisheries, DNR Wildlife, DNR Forestry, Carlton and Pine SWCD wetland techical specialists and private land owners participated in the **Wetland** meeting.

To illustrate the diversity of viewpoints for wetlands, and their function and value, at the beginning of the topic meeting, we asked experts and Advisory Committee members to provide us with their definition of what comes to mind when they think of the watershed's wetlands. From this discussion, we assembled a word cloud (Figure 4.4).

Figure 4.4. Word cloud depicting the diversity of responses to the question, "when you think of the Nemadji's lakes and wetlands, what comes to mind?"

At the **Wetland** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of four issue statements (Figure 4.5, Table 4.1)

Figure 4.5. Photos from the Wetland & Lake Meeting held October 2nd, 2019.

Table 4.1. Wetland issue statements as revised at the Wetland topic meeting.

Issues Statement	References
Wetlands are in continued need of protection and restoration, which provides benefits for water quality, peak flow reduction, habitat, ecoservices & designated uses, and wildlife.	Carlton County Water Plan, Pine County Water Plan, Public kickoff, Erosion Report, North East Landscape Report, Exploring the Relationship Between Wetlands and Flood Hazards in the Lake Superior Basin. Carlton & Pine County wetland regulations, State and Federal wetland regulations
Outreach and technical assistance are needed to convey the value of wetlands, wetland laws, and impacts of wetland loss.	Carlton County Water Plan, Public Kickoff, Exploring the Relationship Between Wetlands and Flood Hazards in the Lake Superior Basin.
Better understanding of function, historical changes, and value to prioritize restoration and protection (*need more data*).	Wetland Topic Meeting
Invasive species are a threat to wetlands (buckthorn, EAB, purple loosestrife, phragmites).	Wetland Topic Meeting

After much discussion, each participant ranked their top issues. These priorities will have measurable goals assigned to them and will be the focus of implementation. The two top priorities overall were:

1. **Wetlands** are in continued need of **protection and restoration**, which provides benefits for water quality, peak flow reduction, habitat, ecoservices & designated uses, and wildlife.
2. **Better understanding** of function, historical changes and value is needed to prioritize restoration and protection of wetlands.

The Nemadji Watershed is commonly believed to have few drained wetland acres. However, farming and grazing was attempted in almost all parts of the watershed at one point and attempts at drainage were employed in many areas. While much of the watershed has reverted to forests, these ditches remain. The loss of watershed storage results in increased peak flows and contributes to flood damages. One action of this plan is to better understand the location and impact of these hidden ditches.

Emerging Issues

Invasive species such as phragmites and purple loosestrife are an emerging concern for Nemadji Watershed's wetlands. These species can negatively impact biodiversity and wetland function, reducing the wetlands ability to provide crucial watershed ecological functions including slowing the flow of water.

Wetlands will also be impacted by climate change. Predictions of both extended draughts and increased floods will limit species composition to those that can tolerate these changes, resulting in impacts to wetland function (Wisconsin Wetlands Association). But wetlands will play a crucial role in providing resilience to climate change by slowing the flow of water during high rainfall events and protecting downstream infrastructure and properties including the city of Superior in Wisconsin.

Figure 4.6. A wetland in the Net River subwatershed helps slow the flow of water during winter snow melt.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The wetland subwatershed prioritization map (Figure 4.7) ranked each subwatershed based on:

- Potentially restorable wetlands in areas that reduce peak flows (St Mary's Tool)
- Potentially restorable wetlands in areas that have historically lost storage (St Mary's Tool)

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore forest resources, and are the focus of where to work first during plan implementation.

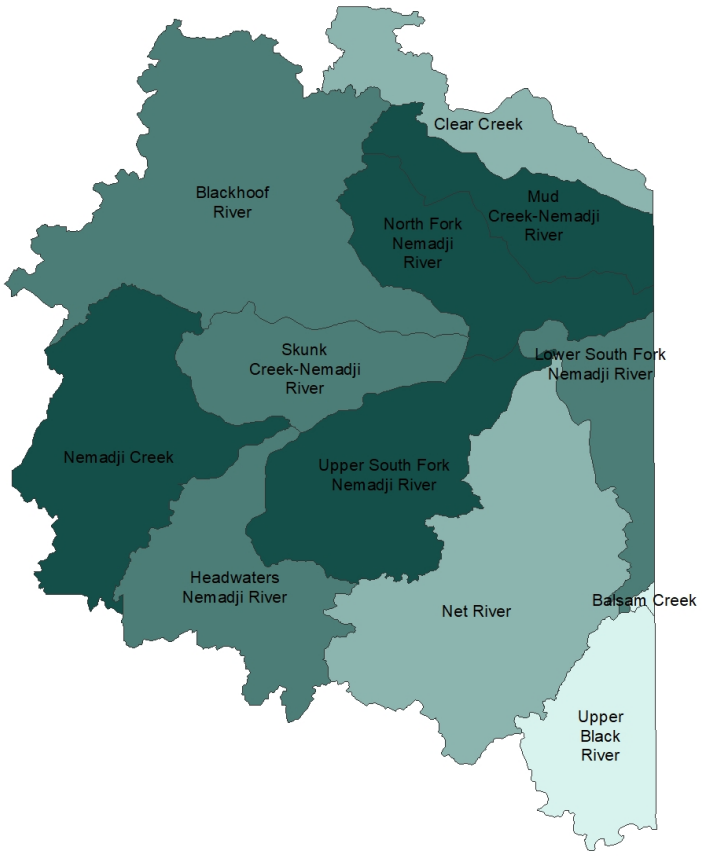


Figure 4.7. Wetland map ranking each HUC 12 subwatershed based on wetland restoration potential to reduce peak flows and increase watershed storage. A darker color indicates a higher rank.

Goals and Targeting

The wetland subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted in privately-owned potentially restorable wetlands. Current wetlands are already protected through the Wetland Conservation Act.

To specifically target where to work, the St. Mary's tool (Appendix X) was used to determine the locations of:

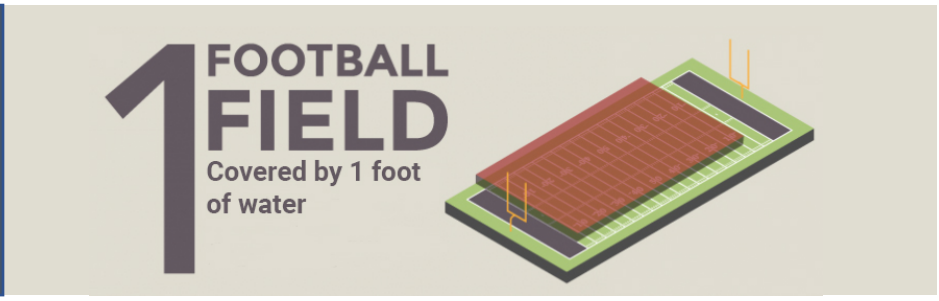
- Potentially restorable wetlands that restore lost watershed storage and reduce peak flows
- Infrastructure that is vulnerable to peak flow related damages (local knowledge)

The short-term goal acreage targets potentially restorable wetlands upstream of infrastructure that has a history of high flow related damage. The long-term goal is to restore all wetlands that increase storage and reduce peak flows.

To put the water storage need in perspective, both lost storage from the past and future storage needed to mitigate climate change effects were evaluated. The *Current and Historic Sediment Loading in the Nemadji River Basin* (Wisconsin DNR and Tetra Tech) report was used to determine the lost storage since pre-European settlement. This report specified a 0.2 inch runoff depth change, which translates to 2,936 acre-feet of lost storage in the Minnesota-side of the Nemadji watershed. Looking forward, the median increasing precipitation trend for the watershed is 0.08 inches/year (DNR Climate Trend Data). To build resiliency in water storage to keep up with this trend an additional 366 acre-feet of storage is needed annually. Adding these numbers up means that in the next ten years, to catch up from past lost storage and mitigate increasing precipitation trends, a total of at least 6,603 acre-feet of additional storage is needed. Increasing storage is expensive, and not feasible everywhere due to land ownership. This plan strives to guide increasing storage where feasible within the funding available.

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics, and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

What is an acre-foot?



Wetland Goal: Increase water storage by 1,174 acre-feet through wetland restoration.

Introduction

Wetland and floodplain restoration will be used to increase watershed storage. This increased storage will help reduce the impacts of high rainfall and snowmelt events by slowing the flow of water. An estimated 98% of soil erosion in the Nemadji Watershed comes from near channel erosion (Erosion and Sedimentation in The Nemadji River Basin, 1998), and bank erosion is exacerbated by runoff which can be reduced by increased storage. The first focus will be restoring wetlands upstream of vulnerable infrastructure. The East-West roads in the Nemadji have a history of erosion and washouts because they limit the flow of water as it travels North to Lake Superior. A main target is CSAH 8 in Southern Carlton County (Advisory Committee). Another focus will be the mud volcano on Deer Creek, which is a contributor to the stream's muddy colored water, even during low flows. A beaver dam removed using dynamite is believed to have caused the mud volcano (Mossberger 2010). Restoring the beaver formed wetland would increase watershed storage and help reduce sediment loads.

Outcomes

- Protection of vulnerable infrastructure
- Mitigate climate change impacts
- Reduce sediment erosion by reducing peak flows
- Protect valuable fish habitat by mitigating drought effects

Target (Figure 4.8)

- Short-term (10-year): High ecological value potentially restorable wetlands that have the most benefit to protect vulnerable infrastructure and wetland restoration to address the mud volcano site.
- Long-term (future): Increase watershed storage to restore historical loses and help mitigate climate change impacts.

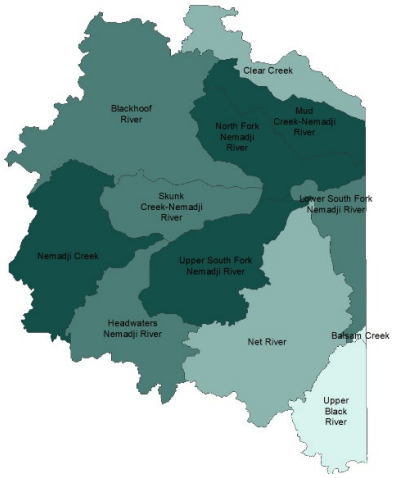
Issues Addressed

- High Peak Flows
- Wetland Function
- Wetland Protection and Restoration
- Road/Stream Interface
- Tons of sediment reduced

Metric

- Acre-Feet

Subwatershed Prioritization



Subwatershed	Long-term (acre-feet)	Short-term (acre-feet, acres restored, number of projects)
Upper S. Fork Nemadji River	1,618	298, 149, 16
North Fork Nemadji River	1,990	19, 9, 1
Nemadji Creek	2,599	272, 136, 7
Mud Creek	1038	158, 79, 5
Skunk Creek	1312	18, 9, 2
Headwaters Nemadji River	1,089	232, 116, 8
Lower S. Fork Nemadji River	660	18, 9, 1
Blackhoof River	1860	0
Net River	1180	196, 98, 3
Clear Creek	1,348	0
Balsam Creek	0	0
Upper Black River	0	0
Total	6,603	1,174, 596, 43

Targeting Map

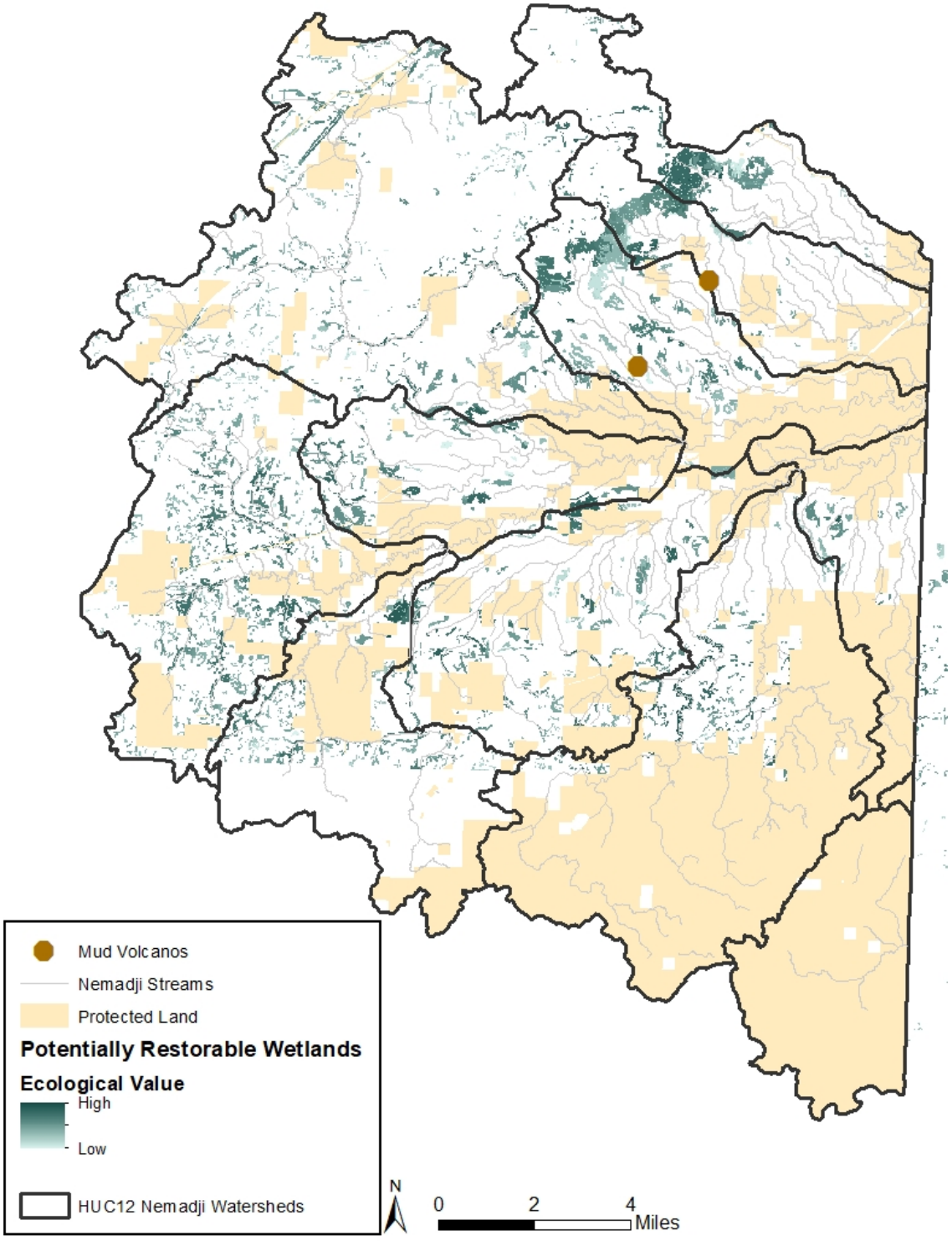
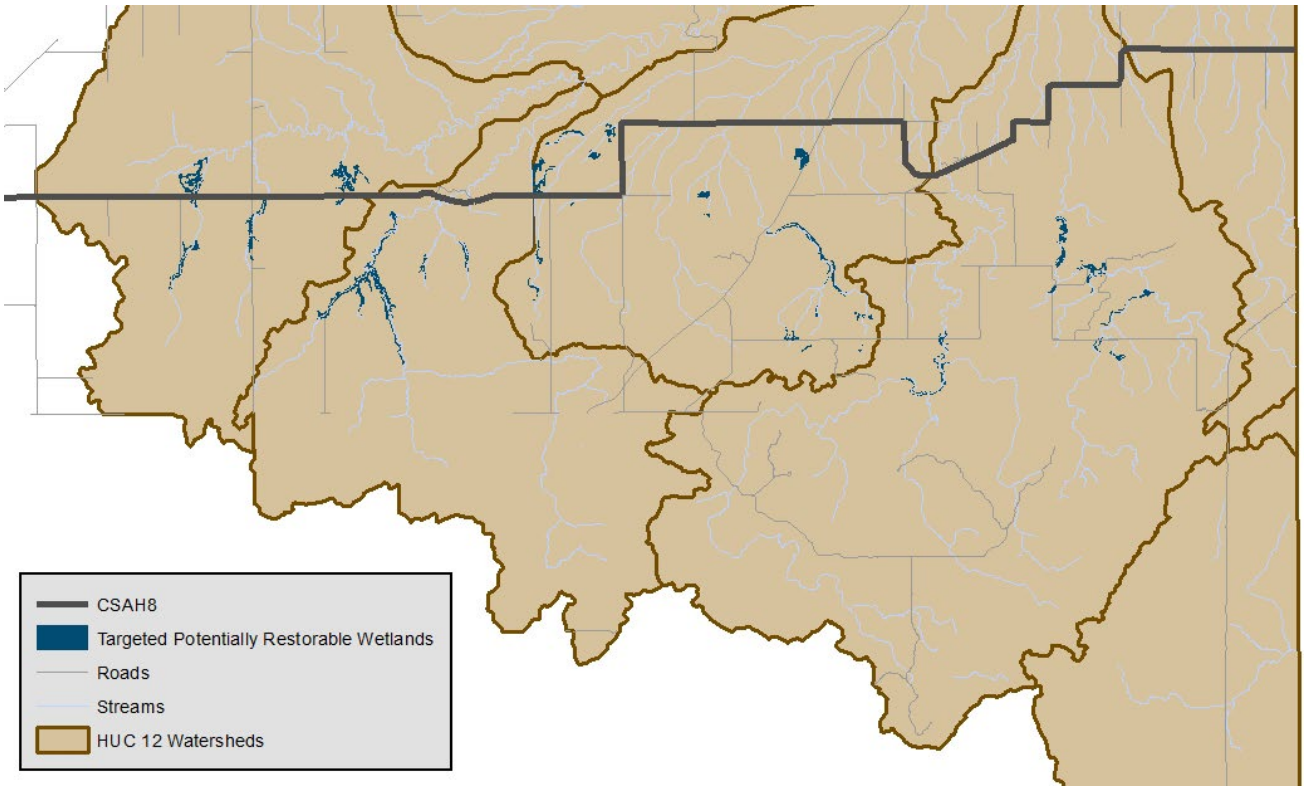


Figure 4.8. Targeted areas for increasing storage. Datasets used for targeting include the St. Mary's Nemadji River Watershed Habitat Assessment Using LiDAR wetland restoration dataset and local infrastructure knowledge.



Where to Restore Wetlands First?

There are many opportunities throughout the watershed to restore wetlands, so where do we start? A large focus of our wetland goal will be to restore wetlands that protect vulnerable infrastructure. An example of this is County State Aid Highway 8 that runs East-West across the watershed (see above map). During large rain events, this road has had many washouts because it acts as a barrier to the rivers flowing north to Lake Superior. Many of the potentially restorable wetlands upstream of CSAH 8 are along streams (left photo). These riparian or floodplain wetlands have been drained over time due to many factors, including improper culvert placement, erosion of the stream channel (stream incision) and the loss of beaver dams. Restoring these wetlands will protect roads from future flood damage.

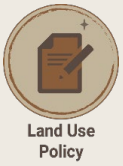
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Water Storage Targeted Implementation Table

These actions will work towards increasing watershed storage to protect vulnerable downstream infrastructure.

Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the water storage goal will include grants to restore wetlands and riparian areas.

Estimated total 10-year cost for the Water Storage Goal:

Baseline:	**Local baseline funding (County and SWCD)**	**$30,000**
WBIF:	**Watershed-based Implementation Funding**	**$398,500**
Other:	**Other funding sources including competitive grants and partner funding (i.e. DNR, MPCA, TNC, Lessard Sams, etc).**	**$300,000**
	Total	**$728,500**

There were several actions discussed at the wetland topic meeting that are important but had outcomes that are difficult to measure. These include the following items below and are recorded as ideas for future activities.

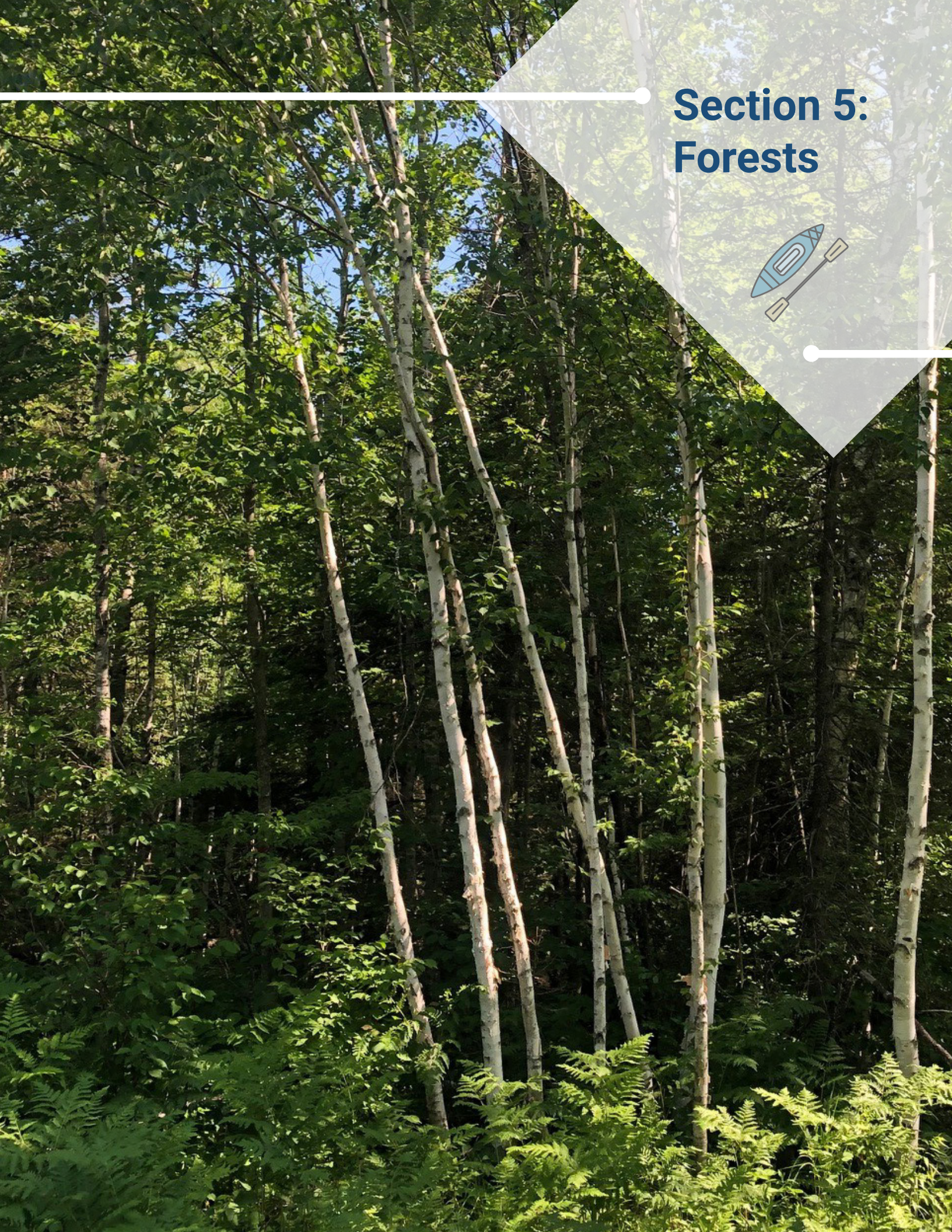
- Engage partnerships and collaborations to help build our understanding of wetland function and ecosystem services valuation, and to share emerging wetland data and tools
- Evaluate the current status of invasive species and species diversity in wetlands.

Water Storage Targeted Implementation Table

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Continue to enforce the Wetland Conservation Act (WCA).	 Land Use Policy	Continue local program	Watershed Wide	**TEP:** County SWCD, BWSR DNR US ACOE	✦	✦	✦	✦	✦	**Baseline:**	**$30,000**
Hold meetings to discuss wetland banking opportunities in the Nemadji Watershed.	 Conservation	2 meetings with wetland banking staff	Watershed Wide	**County BWSR & SWCD** Consultants	✦	✦				**WBIF:**	**$500**
Identify and prioritize wetland connectivity impacted by roads/trails/ditches, drainage ditch and tiling in the watershed. Review past studies.	 Research, Data, Monitoring	Completed analysis and prioritized list	Watershed Wide	**SWCD** Interns, Consultants, County		✦	✦			**WBIF:**	**$6,500**
Restore/rehabilitate wetlands/floodplains in key subwatersheds to increase watershed storage, reduce bank erosion and protect vulnerable infrastructure.	 Conservation	1,174 acre-feet	Upper S. Fork Nemadji River, N. Fork Nemadji River, Nemadji Creek, Mud Creek	**SWCD** BWSR, DNR, NRCS, MPCA, Fish & Wildlife Service, Tribal Governments			✦	✦	✦	**WBIF:** **Other:**	**$370,000** **$300,000**
Mud volcano monitoring study to understand the depth that would be required to reduce sediment impacts.	 Research, Data, Monitoring	1 study for Deer Creek mud volcano	Deer Creek, Mud Creek	**MPCA** SWCD	✦	✦				**Other:**	**Not Calculated**
Develop an education and outreach strategy for wetlands that includes wetland value and opportunities for restoration and protection.	 Education & Outreach	1 strategy developed	Watershed Wide	**SWCD** MPCA, BWSR, Schools, TU, County, Tribal Governments, Universities/ Colleges	✦	✦	✦	✦	✦	**WBIF:**	**$6,500**

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Complete wetland and riparian assessments to prioritize future restoration projects. Explore using the Minnesota Stream Quantification Tool to riparian assessments.	Research, Data, Monitoring	4 Priority areas assessed	Skunk Creek, Mud Creek, North Fork Nemadji, Upper South Fork Nemadji	**SWCD** BWSR, ACOE, MPCA	✦	✦	✦	✦	✦	**WBIF:**	**$15,000**
										Other:	**Not Calculated**

Section 5: Forests



SECTION 5. FORESTS

Introduction

Forests make up a large part of the Nemadji Watershed and play a vital role in protecting water quality. Forests help reduce run-off rates, limiting the amount and speed at which water reaches and moves through streams. There are just under 80,000 acres of forested land in the watershed (45% of the watershed per University of Minnesota Land Cover Dataset), with a variety of private, state and county ownership. Nearly half the acres of forests are privately owned. Absentee landowners make up a large percentage of privately-owned forests, especially in the southern half of the watershed. The Nemadji Watershed also has an abundance of publicly managed land, including both state and county lands. Much of the headwaters for the Net and Little Net Rivers are protected in the Nemadji State Forest. In addition, the Blackhoof WMA provides protection to the Blackhoof and Deer Creek rivers.

Figure 5.1. Forests near Skunk Creek.

In 2019, a Kickoff Bus tour was held for watershed residents and stakeholders to provide input into the Nemadji 1W1P process. Through this event, it was learned that 100% of attendees agreed that forests are an important resource.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. One stop was a managed forest adjacent to the Nemadji River where participants learned about the role private landowners play in keeping forests healthy.

Figure 5.2. 2019 Nemadji 1W1P bus tour.

Issues

In order to help us understand what issues/opportunities surround forests in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority forestry issues for the Nemadji 1W1P (Figure 5.3).

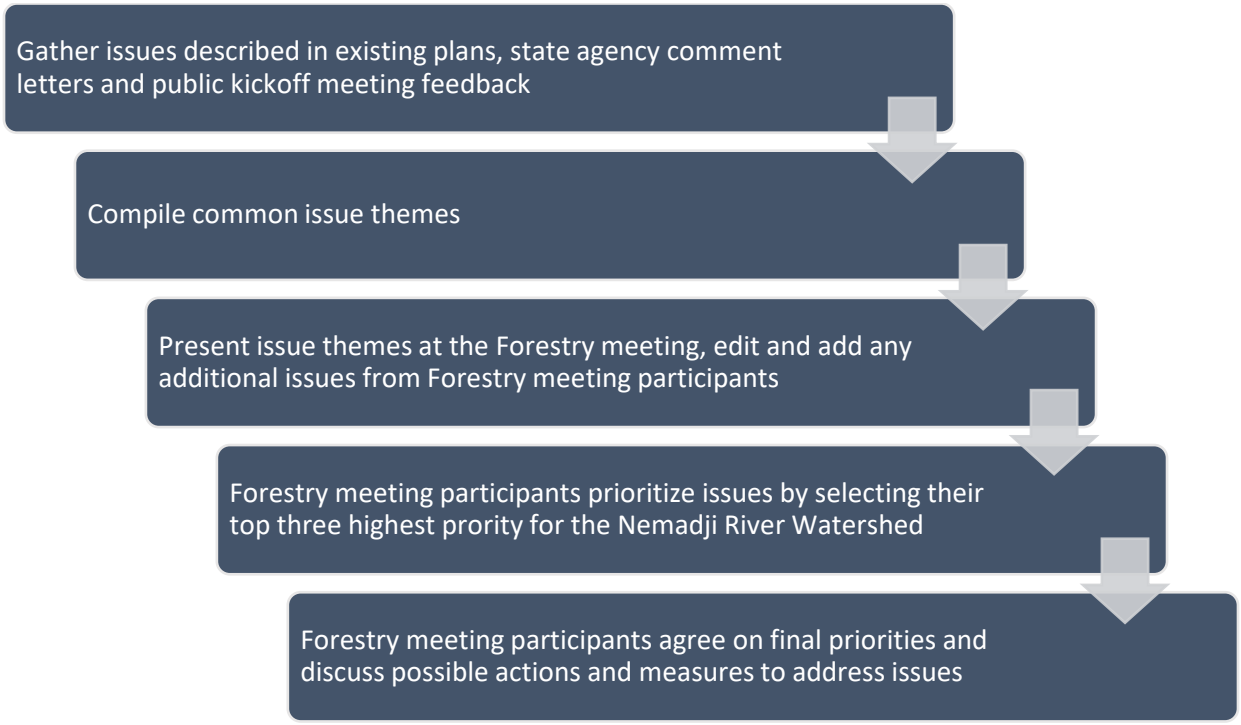


Figure 5.3. Issue statement development process.

A diverse group of topic experts were invited to help gather and priotitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from DNR Forestry, Sappi Fine Paper, University of Minnesota Extension, American Bird Conservency, University of Minnesota Cloquet Forestry Center, Nemadji private forest land owners, Minnesota Forest Resource Council, Carlton and Pine County Land Departments, Carlton and Pine SWCD foresters, logging companies and the Lake Superior Lakewide Action and Mangement Plan participated in the **Forest** meeting.

The definition of forestry management can mean different things to different people depending on their objectives and goals. To illustrate the diversity of viewpoints, at the beginning of the **Forest** meeting we asked forestry experts and Advisory Committee members to provide us with their definition of what forest management means to them, which was assembled to create a word cloud (Figure 5.4).

Figure 5.4. Word cloud depicting the diversity of responses to the question, "what does forestry management mean to you?"

At the **Forest** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of 6 issue statements (Table 5.1).

Figure 5.5. Photos from the Forest meeting, September 11, 2019.

Table 5.1. Forestry issue statements as revised at the Forestry meeting.

Issue Statement	References
Forestry or lack of forestry management can affect stream flows, erosion, and water quality.	WRAPS, MPCA, BWSR, USDA, Erosion Report, Riedel et al.
Forest health is vulnerable to climate change and invasive species, which can affect species composition and forest productivity.	DNR, North East Forest Landscape Plan, Riedel et al.
There are barriers that limit private landowners from participating in private forestland management. (*Increase education and outreach*)	Carlton Co. Water Plan, Pine Co. Water Plan, WRAPS, Public survey, BWSR, Erosion Report
Increased coordination in forest management at the Nemadji River Watershed level is needed to maximize ecosystem services.	Carlton Co. Water Plan, Pine, Co. Water Plan, WRAPS, Public survey,
Forests are at risk of conversion to non-forested land uses and parcelization.	MPCA, DNR, North East Forest Landscape Plan
Best Management Practice implementation may require additional technical and financial assistance to maintain private forests.	Erosion Report

After a lot of discussion, each participant ranked their top three issues. These priorities will have measurable goals assigned to them and will be the focus of implementation. The three top priorities overall were:

1. There are barriers that limit private landowners from participating in **private forestland management**. (*Increase education and outreach*)
2. Increased **coordination** in **forest management** at the Nemadji River Watershed level is needed to maximize ecosystem services.
3. **Forest health** is vulnerable to climate change and invasive species, which can affect species composition and forest productivity.

In a subsequent Steering Committee meeting, the decision was made to combine all the outreach issues into one issue statement. Therefore, priority (1) above was changed to:

A **lack of public understanding** linking impacts of land use decisions to water quality along with a lack of technical and financial assistance are barriers for implementing lake, forest and farm best management practices.

Emerging Issues

The forests of the Nemadji Watershed are predicted to be impacted by effects from climate change (Handler et al. 2014; https://www.fs.usda.gov/treesearch/pubs/45939). Some of these impacts include affects from pest species, both native and non-native. For example, the eastern larch beetle is a native pest that attacks tamarack trees. Historically, the beetle's outbreaks only last a few years, but climate change has lengthened its growing season, resulting in unprecedented infestations. Emerald Ash Borer is an example of an invasive pest. Its spread is believed to be slowed in Minnesota due to cold temperatures, but as the climate warms, infestations are expected to grow. Both tamarack and ash trees are vital to the watershed's forested wetlands and help to slow the flow of water during large rain events. Managing these forests by diversifying tree species could help mitigate these impacts.

In addition to pests, some tree species do not thrive in warmer temperatures. Balsam fir, black spruce and quaking aspen may decline as temperatures warm. Managing these forests for diversity will also be an important strategy to mitigating climate change impacts.

Figure 5.6. An ash dominated forests growing near the banks of Skunk Creek.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The forest subwatershed prioritization map (Figure 5.7) ranked each subwatershed based on:

- Private acres without Forest Stewardship Plans (MN DNR),
- acres of privately owned forest (University of Minnesota landcover dataset and Carlton and Pine County's parcel data), and
- risk of conversion to agriculture based on soils (USDA-soils data and University of Minnesota landcover dataset).

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore forest resources, and are the focus of where to work first during plan implementation.

Figure 5.7. Forest subwatershed prioritization map ranking each HUC 12 subwatershed based on private forest management potential, private forest acres and risk of forests being converted to agriculture based on soil type. A darker color indicates a higher rank.

Goals and Targeting

The forest subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted in privately-owned forests. Commercially and government-owned forests are already being managed by those entities.

To specifically target where to work, the Wisconsin DNR Nemadji River Habitat Assessment Using LiDAR Tool (WI DNR, 2018; Appendix B) was used to determine the locations of:

- Forests that have the most benefits for reducing peak flows, meaning, that if these existing forests were removed, peak flows would increase.
- Forests that protect groundwater. These are areas of groundwater recharge and if these existing forests were removed, there is a risk of groundwater contamination.

The short-term goal acreage is the location of privately-owned forests on the landscape that had both benefits. The long-term goal is the location of privately-owned forests on the landscape that had one of these benefits. Forests and wetlands maintain water on the landscape and help it infiltrate into the ground instead of running off the surface. The more forests and wetlands that are removed, the higher the runoff experienced during storms. Higher runoff causes increased sedimentation, road washouts, and has a negative effect on aquatic and terrestrial habitat.

In order to maintain healthy forest cover in the watershed, the first action is to increase forest management planning through the DNR's Woodland Stewardship Planning Program. This program pairs professional foresters with private landowners to help them meet the objectives of their forest land while also protecting sensitive resources on their property. Woodland Stewardship Planning leads landowners to implement on the ground projects that result in healthy forests that provide watershed benefits (Figure 5.8).

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics (how goal progress will be measured), and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

Figure 5.8. Woodland Stewardship planning helps private forest owners meet the objectives of their properties while protecting sensitive areas. This results in healthy forests that continue to provide many watershed benefits.

Forest Goal: Increase forest management by 5,666 acres and 88 forest stewardship plans in areas that have the most benefit to reducing peak flows and protecting drinking water.

Introduction

Forest management is a key tool to ensure forests maintain their benefits of protecting drinking water, reducing peak flows, protecting lakes and streams, and providing valuable habitat. Proper forest management can also mitigate impacts to climate change. Publicly owned land is managed by resource professionals, but a large portion of forests are privately owned. Forest Stewardship Plans provide private landowners a guide on how to manage their forests, preserving the important ecological benefits of their property while meeting their goals and supporting the local wood products industry.

Forest management does not end in Forest Stewardship Plans, but should result in actions. These actions could include diversifying both the species and ages of trees, improving forest health along stream, river and lake banks and installing best management practices during forest harvests.

Outcomes

- Drinking water protection
- Maintained peak flow reduction
- Support the local wood products industry while protecting water resources
- Protect and improve forest habitat

Target (Figure 5.7)

- Short-term (10 year): Forests that have the most benefit to reducing peak flow + protecting drinking water.
- Long-term (future): Forests that have the most benefit to reducing peak flow or protecting drinking water.

Issues Addressed

- Forest Management Coordination
- Forest Health
- Lack of Public Understanding
- High Peak Flows
- Vulnerable Drinking Water

Metrics

- Acres of forest managed
- Number of Forest Stewardship Plans

Subwatershed Prioritization

Subwatershed	Long-term (acres)	Short-term (acres, plans)
Blackhoof River	7,406	746, 16
Nemadji Creek	3,167	711, 7
Headwaters Nemadji River	2,709	389, 4
Upper S. Fork Nemadji R.	4,384	621, 13
Clear Creek	3,711	534, 11
Mud Creek	1,429	149, 4,
Net River	2,637	840, 13
North Fork Nemadji R.	1,433	280, 7
Skunk Creek	1,939	624, 6
Lower S. Fork Nemadji R.	534	772, 7
Balsam Creek	0	0
Upper Black River	0	0
Total	29,349	5,666, 88

Targeting Map

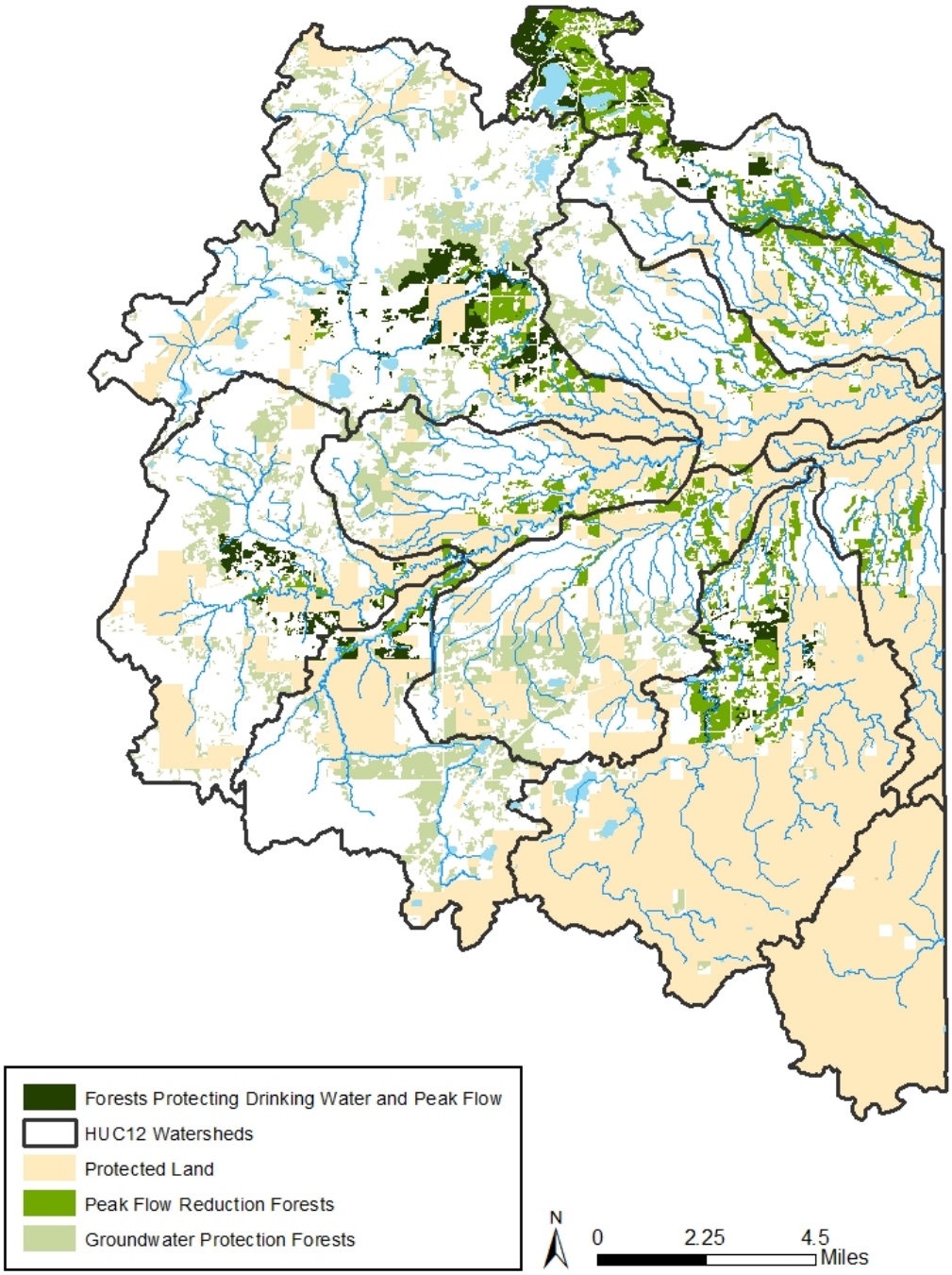


Figure 5.9. Map targeting forest management. Datasets used for targeting include St. Mary's Nemadji River Watershed Habitat Assessment Using LiDAR forest management protection, MDH sensitivity to near surface pollution, and DNR Forest Management Plan datasets.

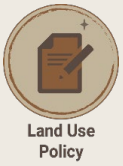
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Forest Targeted Implementation Schedule

These actions will work towards increasing forest management planning and implementation where forests protect ground water quality, promote groundwater recharge and reduce peak flows.

Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the forest goal will include DNR and NRCS Cost Share programs and landowner match.

Estimated total 10-year cost for the Forest Management Goal:

Baseline:	**Local baseline funding (SWCD Funding)**	**$30,000**
WBIF:	**Watershed-based Implementation Funding**	**$135,783**
Other:	**Other funding sources including competitive grants and partner funding (i.e. DNR, NRCS, Landowners).**	**$261,168**
	Total	**$426,951**

There were several actions discussed at the forest topic meeting that are important but had outcomes that are difficult to measure. These include the following items below and are recorded as ideas for future activities.

- Conduct forest BMP effectiveness monitoring on private lands.
- Conduct harvest BMP monitoring on private lands
- Inventory invasive species to assess risks; target high value land.
- Mitigate the effects of recreational ATV trail erosion.
- Use emerging data (LAMP dataset) to understand where shading will have the most impact protecting cold water fisheries.
- Work with elected officials to include the Nemadji Watershed in the coastal program.

Forest Targeted Implementation Schedule

What			Where	Who	When					Cost	
Action	Program	10-year Outcome	Priority Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Encourage the use of logging contracts on all timber sales to encourage BMP implementation.	 Conservation	22 contracts prepared	Watershed Wide	**SWCD** NRCS, DNR, Consultants	✦	✦	✦	✦	✦	**Baseline:**	**Included in local capacity costs**
Develop new forest stewardship plans, or amend existing plans on private forests.	 Conservation	5,666 acres, 88 plans	Blackhoof, Nemadji Creek, Headwaters Nemadji River, and Upper South Fork Nemadji River	**SWCD** MN DNR, NRCS, Consultants	✦	✦	✦	✦	✦	**Baseline:** **WBIF:** **Other:**	**$30,000** **$23,146** **$42,915**
Develop a community based social marketing strategy by defining specific actions for landowners, finding influential community members and through surveys and peer to peer outreach.	 Education & Outreach	1 completed strategy	Watershed Wide	**SWCD & Woodland Council** University of Minnesota, DNR	✦	✦	✦	✦	✦	**WBIF:**	**$10,000**
Hold a biennial forest management coordination meeting with DNR, BWSR, SWCDs, Industry and Counties to identify opportunities for coordination in forest management initiatives	 Conservation	5 meetings	Watershed Wide	DNR, BWSR, SWCD, County, Private industry, MN Logger Education	✦	✦	✦	✦	✦	**WBIF:**	**$6500**
Develop a strategy to provide new forest landowners and realtors information about forest management at point of sale. Work with auditor's/assessor's office and realtor continuing education programs.	 Education & Outreach	1 strategy developed	Blackhoof, Nemadji Creek, Headwaters Nemadji River, and Upper South Fork Nemadji River	**SWCD** DNR, Continuing Education Organizations			✦	✦	✦	**WBIF:**	**$6500**

What			Where	Who	When					Cost	
Action	Program	10-year Outcome	Priority Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Increase local capacity to support an enhanced private forestry management program	Conservation	88 plans written	Blackhoof, Nemadji Creek, Headwaters Nemadji River, and Upper South Fork Nemadji River	**SWCD** DNR, NRCS	✦	✦	✦	✦	✦	**WBIF:**	**$48,221**
Manage forests to increase tree species diversity, enhance forest health, and mitigate future impacts from climate change and invasive species.	Conservation	22 Forest Management Plans with implemented management strategies	Blackhoof, Nemadji Creek, Headwaters Nemadji River, and Upper South Fork Nemadji River	**DNR, SWCD** NRCS, County, Universities, Tribal Governments	✦	✦	✦	✦	✦	**WBIF:** **Other:**	**$31,858** **$96,324**
Enhance/restore riparian forest buffers in agriculture areas to increase shading on priority trout streams.	Conservation	4 projects, 7,000 linear feet restored, 14 acres protected	Blackhoof, Skunk Creek, Upper South Fork Nemadji, Clear Creek, Net River, Lower South Fork Nemadji River	**SWCD** NRCS, DNR, TU			✦	✦	✦	**WBIF:** **Other:**	**$9,558** **$93,376**
Increase the amount of SFIA enrolled forests. Also see protection goal.	Conservation	1,717 acres	Blackhoof and Upper South Fork Nemadji River	**SWCD and Landowners** County Assessor, MN Department of Revenue	✦	✦	✦	✦	✦	**Other:**	**$28,553**
Include water quality discussions/watershed focus in Nemadji Forest Stewardship Plans.	Conservation	Completed plan insert	Watershed Wide	**DNR, BWSR**	✦	✦	✦	✦	✦	**Other:**	**Not Calculated**

Section 6: Agriculture

SECTION 6. AGRICULTURE

Introduction

The region has a long history of farming, and today agriculture is a valuable part of our community and economy. The Nemadji grows it all from beef, pork, dairy and chickens to many community supported agriculture (CSA) farms that grow fruit and vegetables. Based on estimates from USDA statistics, in the Nemadji Watershed there are approximately:

- 230 farms
- 4,000 cows
- 23 registered feedlots
- 69 livestock producers
- 27,000 acres of agricultural land, which includes a variety of crops and pastureland.

Figure 6.1. A Community Supported Agriculture farm near Wrenshall, MN.

In 2019, a Kickoff Bus tour was held for watershed residents and stakeholders to provide input into the Nemadji 1W1P process. Through this event, we learned that 89% of attendees agreed that farms are in important resource.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. One stop was at a Nemadji Community Supported Agriculture Farm where the public learned how farmers help protect and improve water quality and sampled some of the watershed's crops.

Figure 6.2. July 2019 Nemadji 1W1P bus tour.

Issues

In order to help us understand what issues/opportunities surround farms in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority farm issues for the Nemadji 1W1P (Figure 6.3).

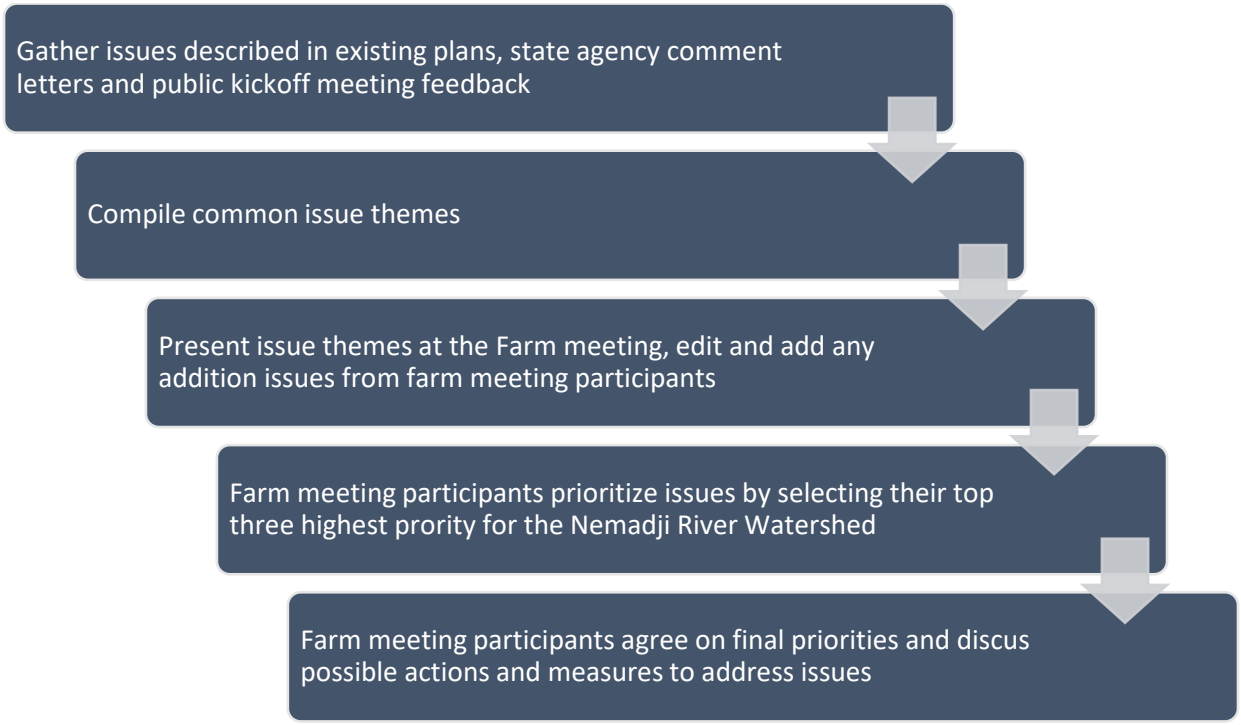


Figure 6.3. Issue statement development process.

A diverse group of topic experts were invited to help gather and priotitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from Townships, Minnesota Department of Health, Minnesota Agriculture Water Quality Certification Program (MAWQCP), United States Department of Agriculture - Natural Resources Conservation Services (USDA-NRCS) and local livestock and community supported agriculture producers participated in the **Farm** meeting.

To illustrate the diversity of viewpoints on farming, at the beginning of the **Farm** meeting, we asked the experts and Advisory Committee members to tell us what comes to mind when they think of Nemadji farms. The responses were assembled to create a word cloud (Figure 6.4).

Figure 6.4. Word cloud depicting the diversity of responses to the question, "When you think of the Nemadji's farms and drinking water, what comes to mind?"

At the **Farm** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of six issue statements (Figure 6.5, Table 6.1).

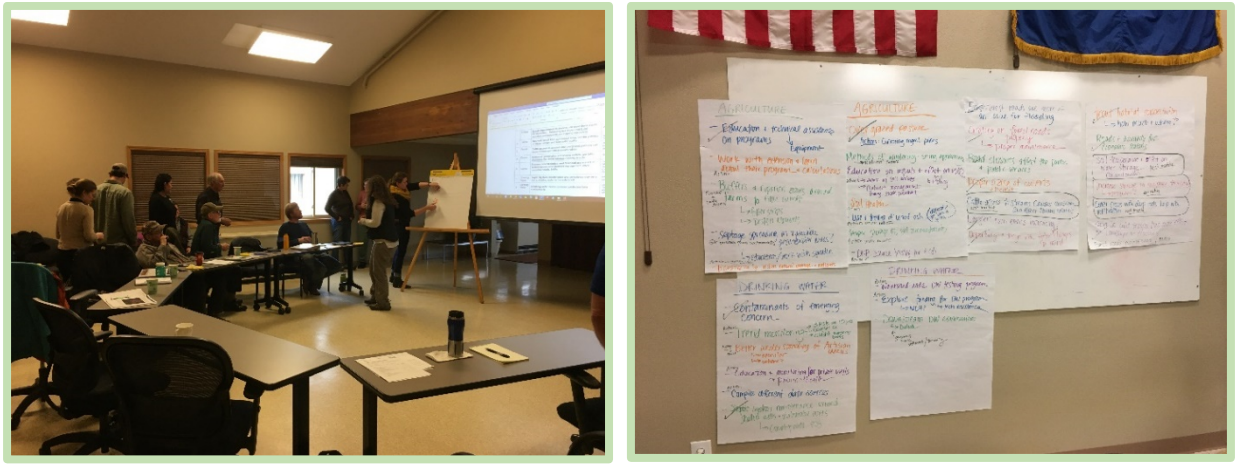


Figure 6.5. Photos from the Farm & Drinking Water Meeting held November 20th, 2019.

Table 6.1. Issue statements from the Agriculture topic meeting.

Issue Statement	References
E.coli impairments in streams can make them unsafe for recreation. Monitoring has shown that E.coli standard exceedances occur during rain events.	WRAPS/TMDL, BWSR
Nutrient runoff from agricultural areas has the potential to impact stream and lake water quality.	WRAPS/TMDL, Kickoff, Sediment Report
Cattle access to streams and overgrazed pastures can cause erosion and affect stream habitat.	Stream meeting, Kickoff, State Letters, Sediment Report
Increased precipitation and shorter winters (wet falls) decreases the water storage capacity in soils.	Stream meeting
Farmers need technical and financial assistance to protect the resource (Nutrient management, cover crops/soil health, BMPs	Kickoff, State Letters, WRAPS/TMDL, Sediment Report, Carlton & Pine County Water Plan

Each participant ranked their top issues for farms. These priorities will have measurable goals assigned to them and will be the focus of implementation. The three top priorities overall were:

1. Farmers need **technical and financial assistance** to protect the resource (Nutrient management, cover crops/soil health, BMPs.
2. **Nutrient runoff** from agricultural areas has the potential to impact stream and lake water quality. (Tied for second)
3. **Cattle access** to streams and overgrazed pastures can cause erosion and affect stream habitat. (Tied for second)

In a subsequent Steering Committee meeting, the decision was made to combine all the outreach issues into one issue statement. Therefore, priority (1) above was changed to:

- A **lack of public understanding** linking impacts of land use decisions to water quality along with a lack of technical and financial assistance are barriers for implementing lake, forest and farm best management practices.

Figure 6.6. Cows enjoying an early spring day in the Blackhoof subwatershed.

Emerging Issues

Winter rain events are occurring more frequently due to climate change, causing runoff events to occur when vegetative buffers are not effective. This challenges traditional manure management strategies. In addition, wetter falls result in reduced water soil storage capacity. This increases runoff rates and effects timing of crop cultivation.

Extreme weather events can affect livestock health resulting in slower weight gain, longer time to market and lower production of milk and eggs. Extreme events have equally negative impacts to fruit and vegetable crops by reducing crop yields.

As farmland in some areas of the state becomes more expensive, some forested areas of the watershed are at risk of conversion to agriculture land. While agriculture is a very important resource for the watershed, forests that protect drinking water, reduce peak flows and protect stream banks and lakes should be considered when converting land to new uses.

Figure 6.7. A mosaic of farms and forests in the Clear Creek Subwatershed help feed the region while providing multiple watershed benefits. Climate change will impact the timing of soil amendments.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The farm subwatershed prioritization map (Figure 6.8) ranked each subwatershed based on:

- Number of Agriculture Acres (University of Minnesota Land Cover Dataset),
- Number of animal units in registered feedlots (MPCA)
- Approximate number of animal operations (SWCD Analysis)

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore forest resources, and are the focus of where to work first during plan implementation.

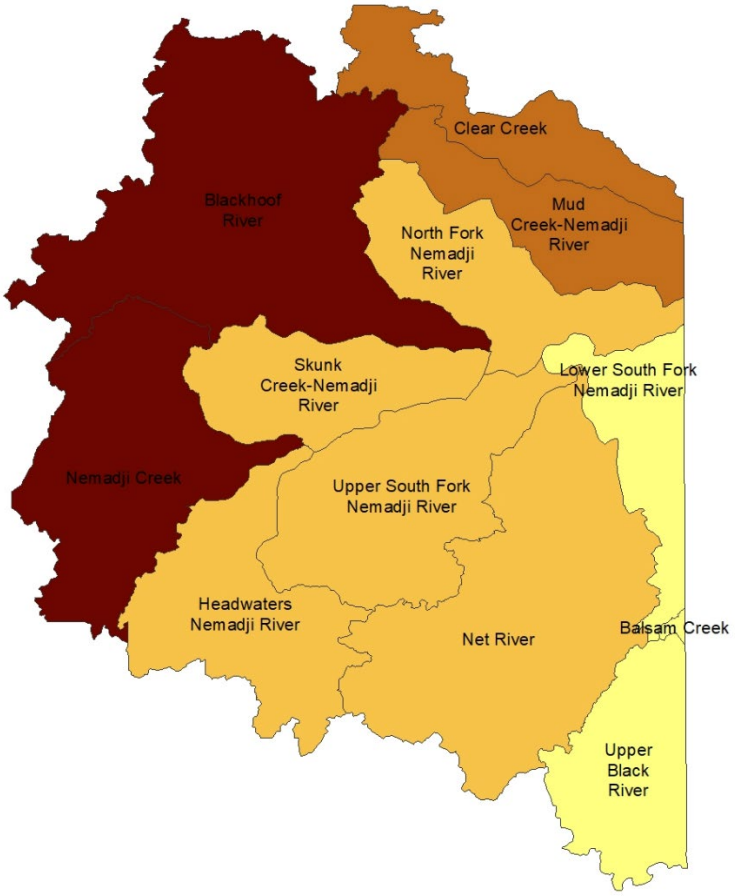


Figure 6.8. Farm map ranking each HUC 12 subwatershed based on number of agricultural acres, number of animal units in registered feedlots and approximate number of animal operations. A darker color indicates a higher rank.

Goals and Targeting

The farm subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would target farms that could supply multiple watershed benefits.

To specifically target where to work, the St. Mary's tool (Appendix X) in conjunction with known datasets was used to determine the locations of:

- Agricultural land near streams (University of Minnesota Land Cover Dataset)
- Lost watershed storage (St. Mary's Tool)
- Lands at risk to groundwater pollution (MN Hydrogeology Atlas)

The short-term goal acreage targets farms that could supply multiple watershed benefits. The long-term goal targets all farms. Many agricultural producers are already applying best management practices to their farms because they can improve yield, water management on the property, and water quality.

What are Agricultural Best Management Practices?

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics (how goal progress will be measured), and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

Agriculture Goal: Increase land enhanced by agricultural best management practices by 4,401 acres.

Introduction

Farms in the Nemadji Watershed provide many watershed benefits by employing Best Management Practices (BMPs). Manure is a valuable nutrient that feeds plants, and its careful management ensures farm productivity and protects water quality. Livestock exclusion from streams protects senstiive resources, while also protecting animals from diseases such as bovine leptospirosis and mastitis. Soil health practices such as cover crops help increase watershed storage and reduce the impacts of flood events.

The Minnesota Agriculture Water Quality Cerfification Program and the Natural Resources Conservation Service have established cost share programs to help farmers plan and install BMPs. This plan will focus on current known gaps in services, including technical and engineering resources.

Outcomes

- Reduced phosphorous and sediment into impaired streams and Lake Superior
- Protection of drinking water
- Increased watershed storage by improving soil health
- Preserve farming by increasing farm productivity while protecting water quality

Target (Figure 9)

- Short-term (10-year): Farmland near streams + farmland lost watershed storage + groundwater pollution sensitivity
- Long-term (future): All farmland in the watershed

Issues Addressed

- Nutrient runoff
- Livestock access to streams
- Lack of public understanding

Metric

- Acres of BMPs
- Landowners contacted

Subwatershed Prioritization

Subwatershed	Long-term (acres)	Short-term (acres, landowners)
Blackhoof	4,145	1,050, 23
Nemadji Creek	2,343	631, 8
Clear Creak	1,400	314, 7
Mud Creek	1,554	457, 9
North Fork Nemadji River	1,247	273, 4
Skunk Creek	1,001	361, 7
Upper S. Fork Nemadji River	1,377	440, 2
Headwaters Nemadji River	520	360, 2
Net River	385	75, 1
Lower S. Fork Nemadji River	1,331	440, 1
Balsam Creek	0	0
Upper Black River	0	0
Total	15,303	4,401, 64

Targeting Map

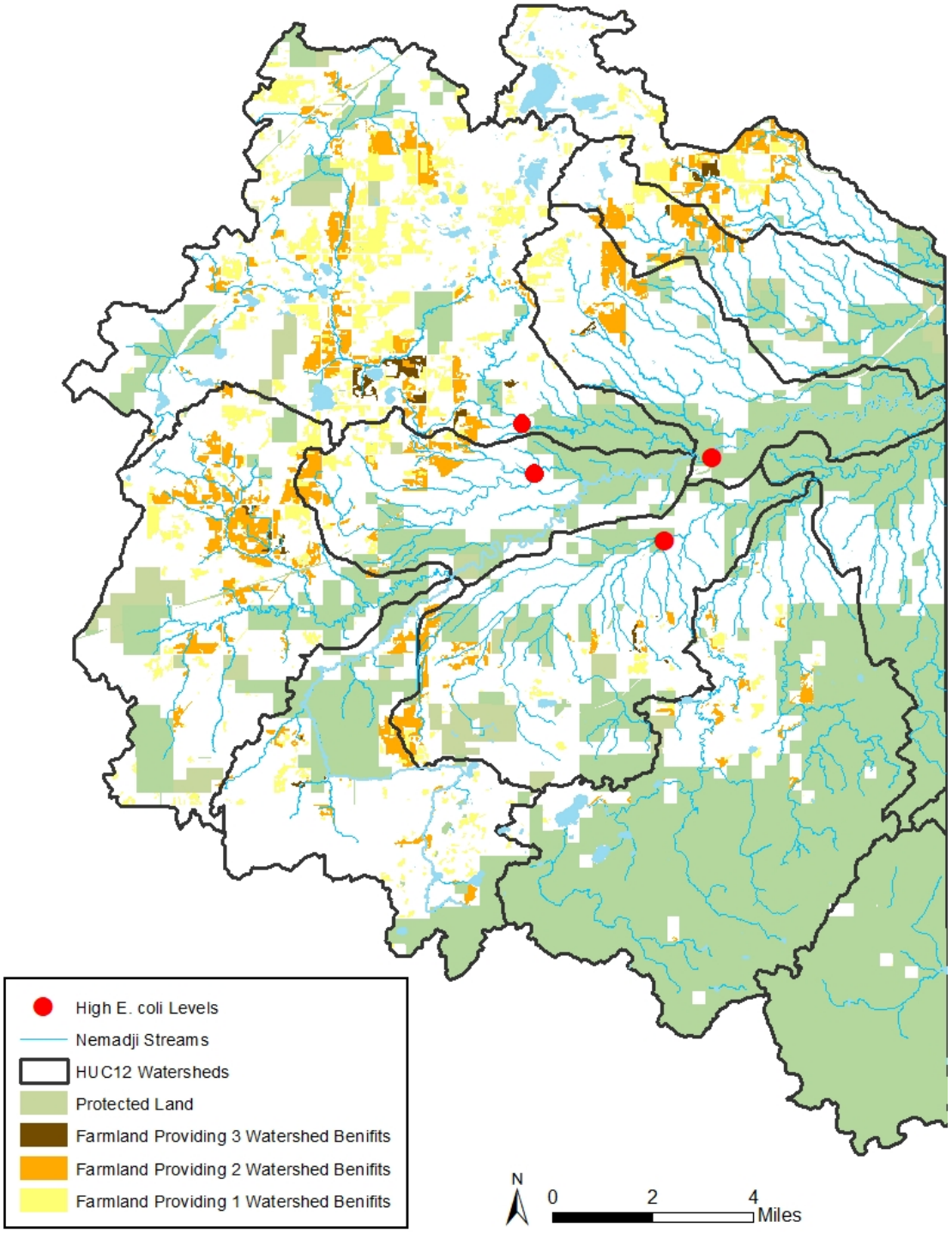


Figure 6.9. Targeted farmland for agricultural best management practices. Datasets used for targeting include St. Mary's Nemadji River Watershed Habitat Assessment Using LiDAR lost storage capacity, MDH sensitivity of near surface pollution, MPCA Impaired Waters List and Carlton SWCD desktop analysis.

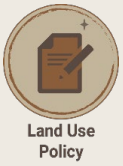
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Agricultural Targeted Implementation Table

These actions will work towards increasing Farm Best Management Practice acres in land that is near streams or rivers, sensitive to groundwater pollution, and provides watershed storage.

Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the farm goal will include NRCS and Minnesota Agriculture Water Quality Certification Program cost share programs.

Estimated total 10-year cost for the Agricultural Goal:

Baseline:	**Local baseline funding (Minnesota Department of Agriculture)**	**$66,592**
WBIF:	**Watershed-based Implementation Funding**	**$744,675**
Other:	**Other funding sources including competitive grants and partner funding (i.e. NRCS and MAWQCP)**	**$838,590**
	Total	**$1,649,857**

There were several actions discussed at the farm topic meeting that are important but had outcomes that are difficult to measure. These include the following items below and are recorded as ideas for future activities.

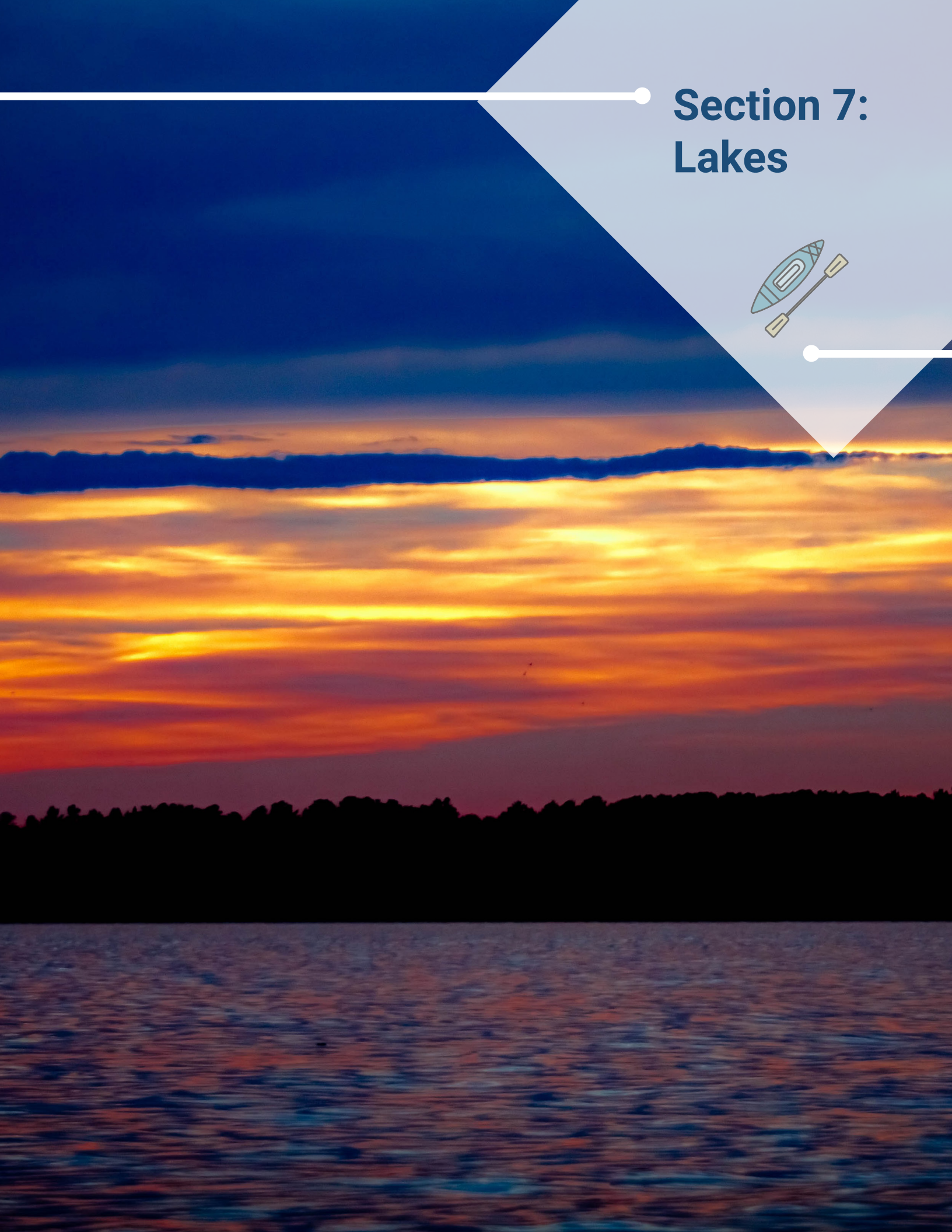
- Encourage more detailed soil tests that include: Cation exchange capacity, Base saturation, Ca/Mg/K, and provide landowners assistance with understanding soil test results.
- Work with classrooms and 4-H to educate youth on farming.

Agricultural Targeted Implementation Table

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Priority Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Increase one-on-one interactions with engineering and technical staff to increase BMPs	Conservation	27 Engineering Designs Completed	Watershed Wide	**SWCD** Extension, NRCS, MDA, TSA	✦	✦	✦	✦	✦	**Baseline** **WBIF:**	**$66,592** **$675,000**
Improve buffers and riparian areas around farms.	Conservation	20 acres; 4 projects	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS	✦	✦	✦	✦	✦	**WBIF:**	**See Forest Goal**
Identify and assist owners of historic farm sites with concerns such as: drainage ditches, closing old manure storage facilities, old dump sites, old well, etc.	Education & Outreach	Identify sites and develop prioritized list for outreach/ Implement-ation	Watershed Wide	**SWCD** Universities, interns, NRCS, MDA			✦	✦	✦	**WBIF:**	**$7,500**
Increase water storage on non-productive/inactive farmland.	Conservation	100 acre/feet	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS, County			✦	✦	✦	**WBIF:**	**See storage goal**
Increase soil health/cover crop practices.	Conservation	380 acres	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS, MDA	✦	✦	✦	✦	✦	**Other:**	**$30,400**

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Priority Sub-watersheds	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Limit livestock access to streams and provide alternative watering sources.	Conservation	405 acres access control; 100 tons sediment/yr; 100 lbs TP/yr	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS, MDA	✦	✦	✦	✦	✦	**WBIF:** **Other:**	**$54,675** **$8,640**
Develop an outreach/education strategy for farm landowners that includes increasing peer-to-peer networks.	Education & Outreach	1 strategy developed	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**Carlton SWCD** Extension, Sustainable Farmers Association, Soil Health Coalition, NRCS, MDA	✦	✦	✦	✦	✦	**WBIF:** **Other:**	**$7,500** **$5,000**
Increase the number of grazing management plans.	Conservation	1,050 acres	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS		✦	✦	✦	✦	**Other:**	**$32,550**
Improve methods of wintering livestock and manure storage using nutrient management planning.	Conservation	27 plans; 200 lbs TP/yr	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** Extension, NRCS, MDA	✦	✦	✦	✦	✦	**Other:**	**$762,000**
Work with farmers to integrate forestry and farming.	Education & Outreach	Include Silviculture as needed in 27 grazing plans	Blackhoof, Nemadji Creek, Clear Creek, Mud Creek	**SWCD** NRCS		✦	✦	✦	✦	**Other:**	**See grazing action**

Section 7: Lakes



SECTION 7. LAKES

Introduction

There are 35 lakes in the Minnesota side of the Nemadji Watershed, providing habitat to a diversity of species including three wild rice lakes (Hay, Venoah and Net Lakes). While most of the lakes are healthy, high phosphorous levels can lead to algae blooms in some places. Lakes that have high phosphorous and chlorophyll-a (a measure of algae) levels are listed as impaired. The watershed has one impaired lake (Net Lake). Transparency trends can indicate if a lake's water quality is improving or declining over time. With our current data, we know that three lakes have declining water quality (Graham, Chub and Net Lakes). In addition, there is one lake infested with Aquatic Invasive Species (Chub Lake-Eurasian Water Milfoil).

Figure 7.1. Net Lake on the Carlton/Pine County border.

In 2019, a Kickoff Bus tour was held for watershed residents and stakeholders to provide input into the Nemadji 1W1P process. Through this event, we learned that 81% of attendees agreed that lakes are in important resource.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. The first stop was on the shores of Lac La Belle where the public learned about the watershed's many lakes.

Figure 7.2. July 2019 Nemadji 1W1P bus tour

Issues

In order to help us understand what issues/opportunities surround lakes in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority lake issues for the Nemadji 1W1P (Figure 7.3).

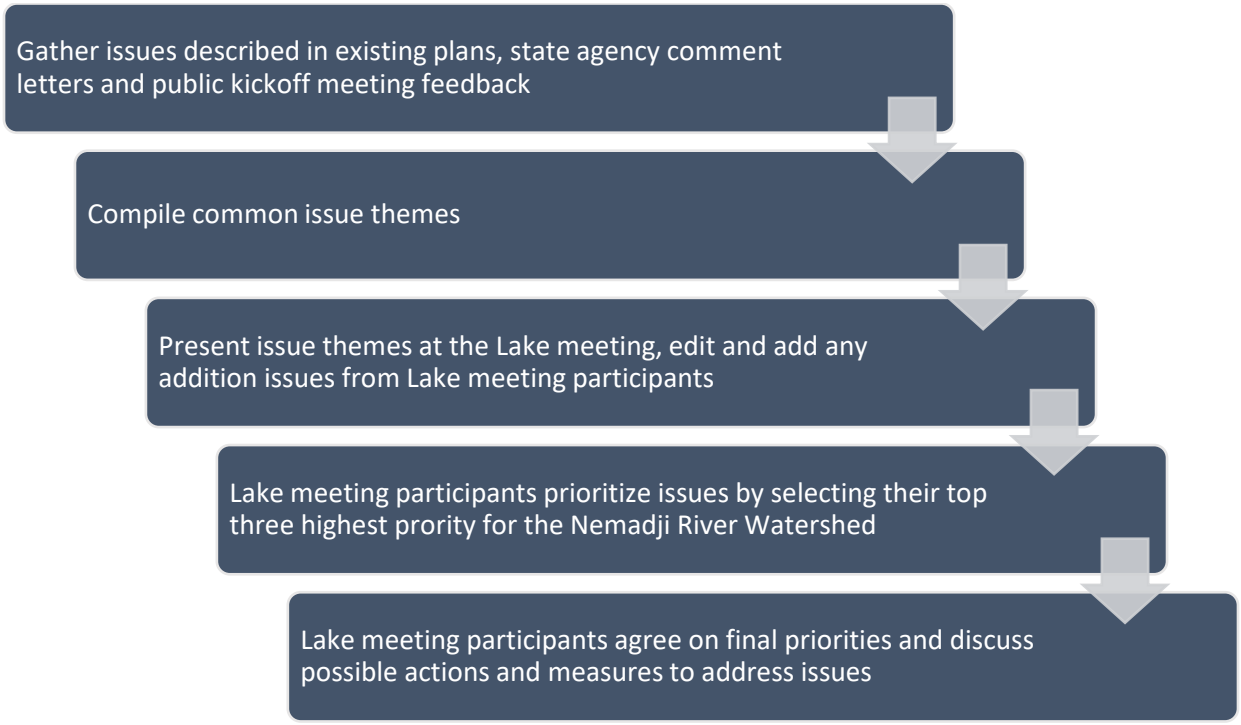


Figure 7.3. Issue statement development process.

A diverse group of topic experts were invited to help gather and priortitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from Fond Du Lac Band of Lake Superior Chippewa, DNR Fisheries, DNR Wildlife, DNR Forestry, Carlton and Pine SWCD lakeshore techical specialists, private land owners and lake associations participated in the **Lake** meeting.

At the **Lake** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of 10 issue statements (Table 7.1).

Table 7.1. Lake issue statements as revised at the Lake topic meeting.

Issue Statement	References
Poorly functioning septic systems can contribute bacteria and nutrients to water resources.	WRAPS, Public Kickoff, MPCA
Alteration of lakeshore/vegetation and conversion of cabins to year-round homes (nonconforming) has the potential to negatively affect lake water quality and shoreline habitat.	WRAPS, Public Kickoff, MPCA, BWSR, A paleolimnological study of Net Lake and Lac La Belle, Carlton and Pine Counties, Minnesota.
Lake owners need to be more aware and engaged in land use decisions/actions, buffers, lakeshore stewardship, ecosystem function through education.	Public Kickoff, WRAPS
Excess nutrients (phosphorus) have caused impairments and decreasing water quality trends in some lakes.	WRAPS, TMDL
Aquatic Invasive Species and lake access are a risk/concern.	Lake Topic Meeting
Changing land use within the watershed may affect water quality	Lake Topic Meeting
Chloride from road salt and water softeners is an emerging issue	Lake Topic Meeting
Climate change can affect hydrology, water temperature and species composition.	Lake Topic Meeting
Better understanding of how to prioritize value including natural environment, wild rice lakes, habitat and tannins and water quality	Lake Topic Meeting
Different regulation/enforcement between counties and states within the watershed	Lake Topic Meeting

Each participant ranked their top issues and the resulting two top priorities were:

1. Alteration of **lakeshore/vegetation and conversion of cabins to year-round homes (nonconforming)** has the potential to negatively affect lake water quality and shoreline habitat.
2. Lake owners need to be more **aware and engaged** in land use decisions/actions, buffers, lakeshore stewardship, ecosystem function through education.

In a subsequent Steering Committee meeting, the decision was made to combine all the outreach issues into one issue statement. Therefore, priority (2) above was changed to:

- A **lack of public understanding** linking impacts of land use decisions to water quality along with a lack of technical and financial assistance are barriers for implementing lake, forest and farm best management practices.

Figure 7.4. Lac La Belle near Carlton, MN

Emerging Issues

Salt contamination to lakes can have long-lasting negative impacts. Once salt is added to a lake, it cannot be removed, effecting the lake's ability to support aquatic life. Salt contamination in lakes can come from ice-removal products on roads and private walkways. It can also come from inefficient water softening devices that use salt to remove calcium and magnesium in well water.

Invasive species are also an emerging concern. Only one lake in the watershed currently has an infestation of Eurasian Water Milfoil, but all lakes are susceptible to new invasive species introductions. Contamination can come from moving unclean watercraft or docks from infested to non-infested lakes.

Lakeshore development on some lakes may have future impacts. Many lakeshore properties are currently used as cabins, but recent trends have converted these properties to year-round residents, putting strain on undersized septic systems.

Figure 7.5. Eurasian Water Milfoil in Chub Lake. This is an invasive species that outcompetes native vegetation impacting fish and other aquatic life.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The lake subwatershed prioritization map (Figure 7.6) ranked each subwatershed based on:

- Lakes of phosphorous sensitivity (MN DNR)
- Lake Impairment Status (MPCA)
- Lake Transparency Trends (MPCA)
- DNR Shoreland Classification
- Wild Rice Designation (1854 Treaty)
- Amount of permanent protection

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore lakes, and are the focus of where to work first during plan implementation.

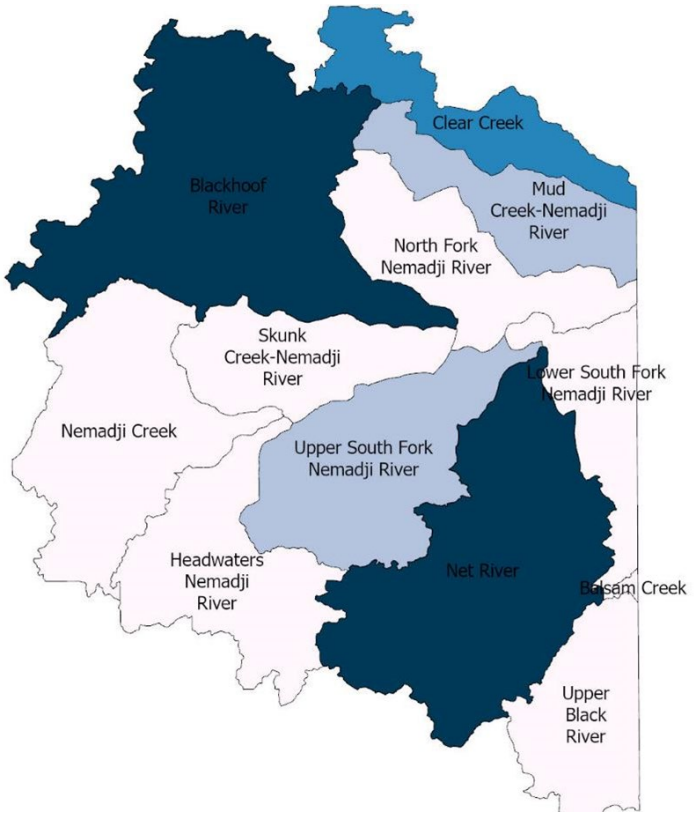


Figure 7.6. Lake map ranking each HUC 12 subwatershed based on phosphorous sensitivity, impairment status, declining clarity trends, DNR shoreland classification and wild rice lake designation. A darker color indicates a higher rank. High priority lakes include Net, Chub, and Hay.

Goals and Targeting

The lake subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted to three lakes: Net, Hay and Chub.

To specifically target where to work, parcel and landcover data was used to:

- Determine highest density of shoreline development (Carlton and Pine County Parcel Data)
- Percent of Lakeshed protected by government owned land or wetlands.

The short-term goal acreage is to reduce phosphorous on Net, Hay and Chub lakes. The long-term goal is to reduce phosphorous on all vulnerable lakes. Phosphorus can increase in lakes due to runoff from yards, and impervious surface (roofs, driveways, sidewalks), leaking septic systems, and pet waste. A buffer of natural vegetation along the lakeshore slows the runoff and also provides habitat for birds, aquatic insects, reptiles, amphibians, and nearshore fish.

One pound of phosphorus can feed 500 pounds of algae in the lake. Algae blooms can limit recreational opportunities, aesthetics, and aquatic habitat.

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics (how goal progress will be measured), and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

Lake Goal: Enhance priority lakes by reducing the phosphorus load by 5% and restoring the shoreline in 5% of the parcels.

Introduction

The lake goal is to reduce phosphorous in lakes and restore shorelines to their natural state. Increased development around lakes and conversion of cabins to year-round homes can significantly change the runoff into the lake from rain events. DNR fisheries modeling shows that once a lake's watershed is over 25% disturbed (developed, agriculture, mining), the lake phosphorous levels increase. By reducing phosphorus and restoring shoreline habitat this goal aims to protect and improve the water quality of priority lakes.

The Forest Management and Protection goals will also protect lake water quality. Watersheds that are over 75% forested have been shown to have better water quality and protect against future impacts (DNR Fisheries).

Outcomes

- Lakes continue to be fishable and swimmable
- Protection of wild rice resources
- Improved lake visual aesthetics
- Increased lake property values

Target (Figure 7.7)

- Short-term (10-year): lakes with impairments, highest phosphorus sensitivity, highest development density, and lowest protection (Hay, Chub, and Net Lakes)
- Long-term (future): All lakes in the watershed

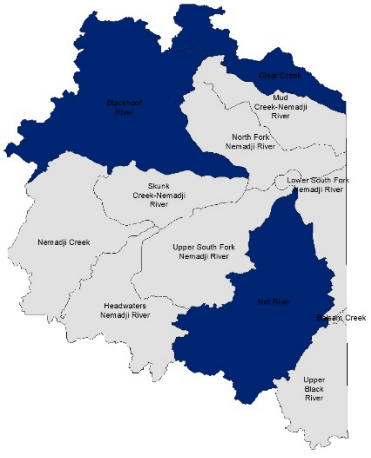
Issues Addressed

- Alteration of Lakeshore/Vegetation and Cabin Conversion
- Lack of Public Understanding
- Noncompliant septic systems

Metric

- Pounds of phosphorous reduced.
- Number of parcels with shoreline restoration.
- Acres of permanent protection (Goal 7).
- Septic system study on Net Lake

Subwatershed Prioritization



Subwatershed	Long-term (lbs P, parcels)	Short-term (lbs P, parcels)
Blackhoof (Hay Lake)	**29 lbs, 2 parcels**	**18 lbs, 1 parcel**
Clear Creak (Chub Lake)	**54 lbs, 14 parcels**	**23 lbs, 7 parcels**
Net River (Net Lake)	**365 lbs, 5 parcels**	**69 lbs, 2 parcels**
Nemadji Creek	0	0
Mud Creek	0	0
North Fork Nemadji River	0	0
Skunk Creek	0	0
Upper S. Fork Nemadji River	0	0
Headwaters Nemadji River	0	0
Lower S. Fork Nemadji River	0	0
Balsam Creek	0	0
Upper Black River	0	0
Total	**110 lbs, 21 parcels**	**44 lbs, 10 parcels**

Targeting Map

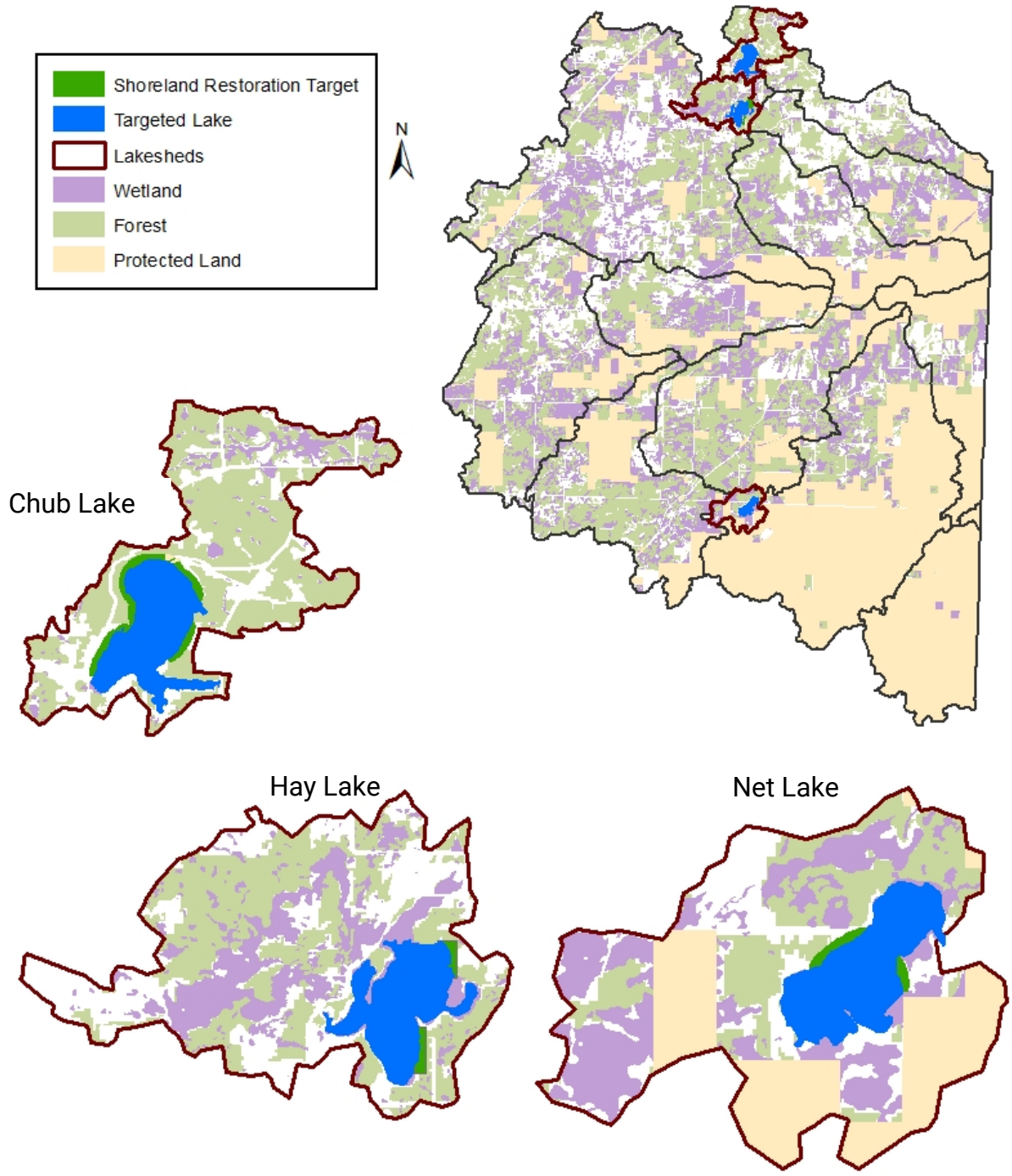


Figure 7.7. Map targeting lake enhancement practices. Datasets used for targeting include DNR Lakes of Phosphorous Sensitivity, DNR and 1854 Treaty Wild Rice Lakes and Carlton and Pine County Parcel datasets.

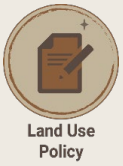
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Lake Management Targeted Implementation Table

Lake actions will focus on projects that reduce phosphorus in vulnerable lakes.

Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the lake goal will include MPCA grants.

Estimated total 10-year cost for the Lake Management Goal:

Baseline:	**Local baseline funding (County)**	**$5,500**
WBIF:	**Watershed-based Implementation Funding**	**$59,250**
Other:	**Other funding sources including competitive grants and partner funding (i.e. MPCA, CWF, etc).**	**$55,000**
	Total	**$119,750**

There were several actions discussed at the lake topic meeting that are important but had outcomes that are difficult to measure. These include the following items below and are recorded as ideas for future activities.

- Encourage/empower lake associations and create a coalition of lake associations.
- Encourage cost effective lake data collection using citizen monitors, interns, students, and conservation corps.
- Collaborate with the Fond du Lac Band/1854 Treaty Authority on wild rice assessments.

Lake Management Targeted Implementation Table

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Provide technical service for lakeshore landowners by continuing the work of local shoreland regulators and SWCDs	Conservation	Continued local program	Watershed Wide	**County, SWCD** Lake Associations, DNR, MPCA	✦	✦	✦	✦	✦	**Baseline:**	**$2,000**
Continue to enforce the shoreline ordinances.	Land Use Policy	Continued local program	Watershed Wide	**County**	✦	✦	✦	✦	✦	**Baseline:**	**$3,500**
Develop individual lake management plans & target practices.	Conservation	3 plans completed	Net Lake Hay Lake Chub Lake	**SWCD** County, MPCA, Lake Associations, DNR	✦	✦				**WBIF:**	**$10,000**
Implement stormwater management practices on lakeshore properties (such as rain gardens).	Conservation	Net: 69 lbs Chub: 23 lbs Hay: 18 lbs	Net Lake Hay Lake Chub Lake	**SWCD & County** MPCA, Lake Associations, DNR, TSA			✦	✦	✦	**WBIF:** **Other:**	**$6,750** **$25,000**
Restore shorelines to reduce phosphorus and improve habitat.	Conservation	Hay: 1 parcel Chub: 7 parcels Net: 2 parcels	Net Lake Hay Lake Chub Lake	**SWCD** County			✦	✦	✦	**WBIF** **Other**	**$25,000** **$25,000**
Develop a community based social marketing strategy to encourage BMPs and educate landowners on lake issues including County Ordinances	Education & Outreach	1 completed strategy	Watershed Wide	**SWCD** Extension	✦	✦				**WBIF:**	**$7,500**
Provide workshop/continuing education for realtors and contractors on lakeshore BMPs.	Education & Outreach	5 workshops	Watershed Wide	**SWCD, County**	✦	✦	✦	✦	✦	**WBIF:**	**$10,000**

What			Where	Who	When					Cost	
Action	Program	10-year Measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Provide education to road salt applicators and owners of water softeners on the concerns of chloride in lakes and cost benefits of reduced salt use. Partner with the RSPT on outreach opportunities.		Salt use included in outreach strategy	Net Lake, Chub Lake, Hay Lake, Lac La Belle, Sand Lake	**MPCA** RSPT, SWCD, County, Townships, DOT, DNR, Lake Associations	✦	✦	✦	✦	✦	**WBIF:**	**Included in Outreach Action**
Gather data on impaired lakes and lakes with declining transparency trends including: DNR Score Your Shore, septic system inventories, ground truth upstream erosion issues		3 completed Inventories	Net Lake Hay Lake Chub Lake	**SWCD & County** MPCA, Lake Associations, DNR			✦	✦	✦	**Other:**	**$5,000**
Work towards 75% lands protection (public ownership, easements, SFIA) for targeted lakes.		780 acres	Chub, Net and Hay Lakes	**SWCD** BWSR, DNR, NRCS	✦	✦	✦	✦	✦	**Other:**	**See Protection Goal**

Section 8: Groundwater

SECTION 8. GROUND WATER

Introduction

Ground water is a valuable resource in the watershed, providing clean drinking water to residents. Because the watershed is largely rural, most residents have private wells. The watershed has 743 wells according to the Minnesota Well Index, but wells drilled prior to 1974 are not included in this count. In addition to private wells, there are 10 non-community public water suppliers in the watershed, and of that, 7 are considered vulnerable to contamination (MDH). Three have tested positive for E. coli levels in recent years. Although much of the watershed's ground water is protected by clay soils, the northwestern and southern parts of the watershed have high sensitivity to pollution due to sandy soils. Groundwater is also an important resource to the watershed's lakes and streams. It supplies vital cold-water inputs to streams which in turn creates valuable habitat for sensitive species like trout. In addition, some lakes rely on groundwater to maintain lake levels.

Figure 8.1. Groundwater springs in Deer Creek can be viewed as they disturb clay sediments on the stream bottom. For more information on Deer Creek's mud volcanoes, see Appendix I.

Issues

In order to help us understand what issues/opportunities surround groundwater in the Nemadji Watershed, issues listed in previous plans, reports, agency comment letters and public input were gathered and compiled into common themes, becoming the basis of creating the priority groundwater issues for the Nemadji 1W1P (Figure 8.2).

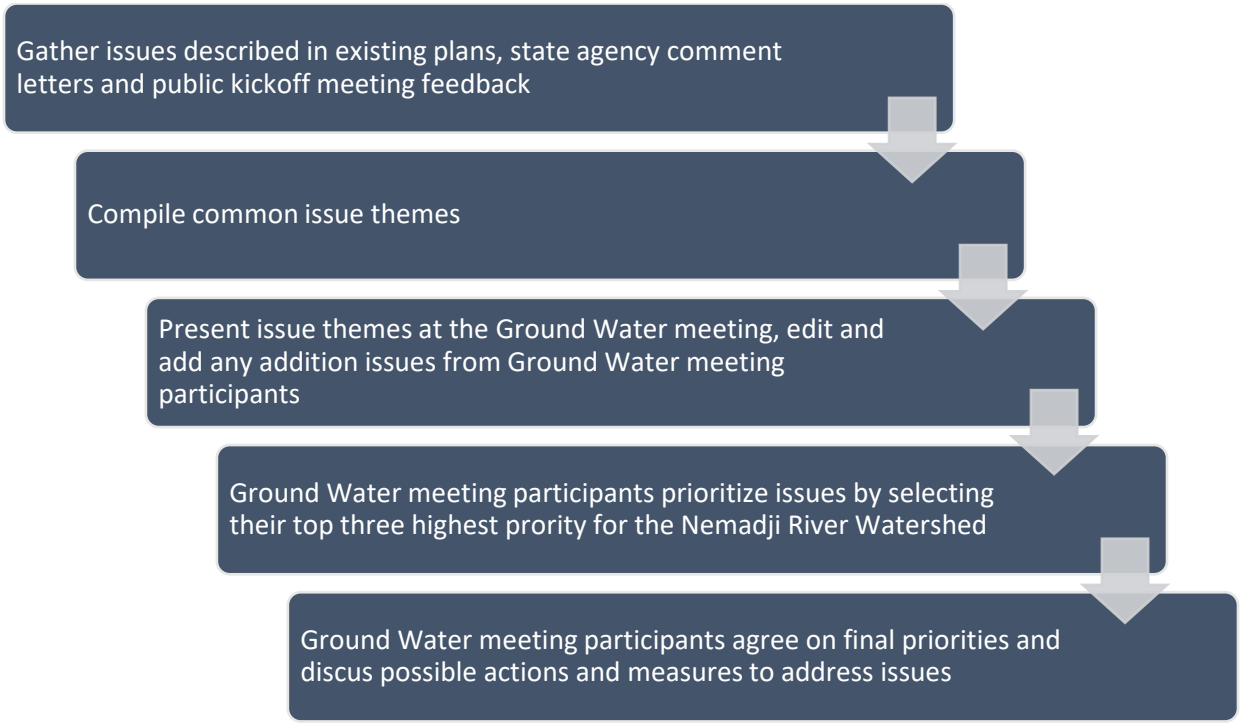


Figure 8.2. Issue statement development process.

A diverse group of topic experts were invited to help gather and priotitize issues. In addition to the Nemadji 1W1P Advisory Committee, topic experts from Townships, Minnesota Department of Health, Minnesota Agriculture Water Quality Certification Program (MAWQCP), United States Department of Agriculture - Natural Resources Conservation Services (USDA-NRCS) along with local livestock and community supported agriculture producers participated in the **Groundwater** meeting.

At the **Groundwater Water** meeting, participants provided input on the compiled issues list and were also provided the opportunity to add additional issues. The group agreed on a final list of two priority issue statements (Table 1). These priorities will have measurable goals assigned to them and will be the focus of implementation.

1. **Septic System** maintenance and compliance may be a risk to ground water in the watershed.
2. **Ground water** needs continued protection from contaminants.

Figure 8.3. An artesian well in Wrenshall Township flows year-round. Artesian wells are located where water is under pressure so that it flows to the surface naturally and does not need to be pumped. They are common in some parts of the watershed where clay layers created this pressure.

Emerging Issues

Extended drought punctuated by extreme rain events and flooding are potential consequences of predicted climate changes. Flood events can put wells at risk, increasing the possibility of bacterial contamination along with other pathogens or chemicals (Nemadji GRAPS). Extended drought could impact aquifer water levels. Droughts may also impact some lakes that depend on groundwater inputs to maintain lake levels. The Nemadji Watershed has 10 groundwater dependent lakes (GRAPS).

In addition to climate change, pharmaceutical and salt contamination are emerging concerns for drinking water supplies. Potential contaminants enter ground waters when excess medicines are flushed down the toilet and cannot be removed by septic system treatment. Excess salt can come from inefficient water softeners which use salt to remove calcium and magnesium from well water. Once in our lakes, streams and drinking water, pharmaceuticals and salt are difficult to remove (GRAPS).

Figure 8.4. Chub Lake is one of ten groundwater dependent lakes. Extended periods of drought could impact lake levels.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The groundwater subwatershed prioritization map (Figure 8.5) ranked each subwatershed based on:

- Groundwater pollution sensitivity based on soil type (Minnesota Hydrogeology Atlas)
- Known well vulnerabilities in the watershed (MDH)

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore groundwater resources, and are the focus of where to work first during plan implementation.

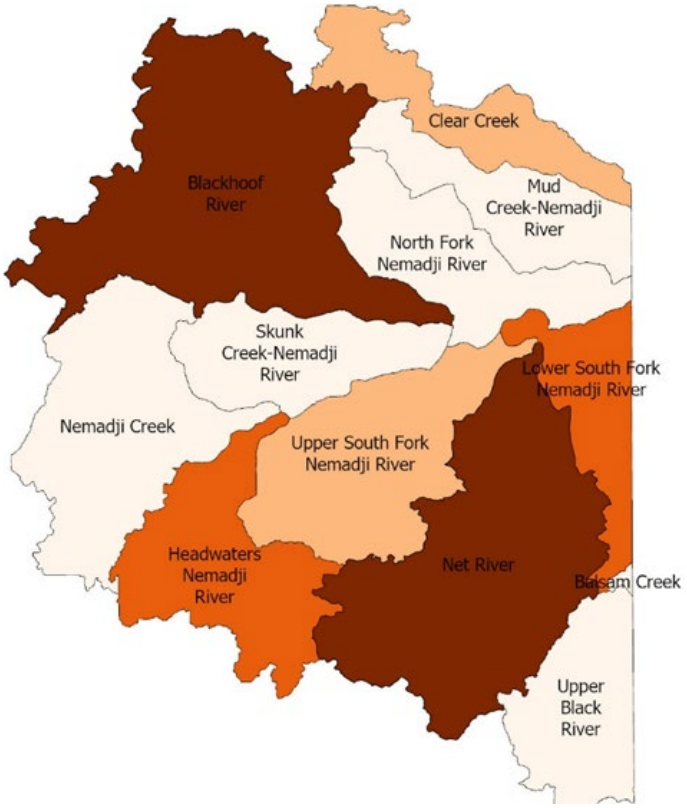


Figure 8.5. Drinking water map ranking each HUC 12 subwatershed based pollution sensitivity (based on soil type) and known vulnerabilities. A darker color indicates a higher rank.

Goals and Targeting

The groundwater subwatershed prioritization map provides guidance on what areas to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted to private land where ground water is at risk of contamination due to soil type. Government-owned land is largely forested which has limited risk to impact water quality.

To specifically target where to work, datasets were combined to determine the locations of:

- Potential groundwater contamination based on soil type (Minnesota Hydrogeology Atlas)
- Estimated number of private wells (Homesteaded Parcel data, Carlton and Pine Counties)

The short-term goal is to close 10 unused wells in priority locations. The long-term goal is to close all unused wells. For more information visit:
https://www.health.state.mn.us/communities/environment/water/wells/sealing/abandwel.html

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics (how goal progress will be measured), and the positive outcomes that will result from the goal being implemented. After the goal fact sheet is a map showing the targeting areas geographically.

Groundwater Goal: Protect drinking water in areas of high pollution sensitivity by sealing 10 unused wells.

Introduction

Any well can become a point of contamination to groundwater, especially during flood events that are predicted to increase with climate change. Our goal is to locate and seal unused wells, protecting our valuable drinking water resource. In addition, we want to expand our understanding of the current drinking water quality by implementing a drinking water quality monitoring program. This will allow us to establish a baseline of current conditions and allow tracking of trends so that we can better understand if our actions are achieving groundwater protection.

The MN Well Index provides an estimate of newer wells, but based on homestead parcels, there are more wells in the watershed than what are included in the database. The table below provides an estimate of the number of private wells. The short-term goal is to seal 10 unused wells, and the long-term goal is to close all unused wells once they are identified. Outreach will be used to find where unused wells exist.

Farm, forestry and wetlands goals including nutrient management, forest protection and wetland restoration will also play an important role in protecting ground water quality and quantity.

Outcomes

- Protection of public health by protecting groundwater quality.

Target (Figure 8.6)

- Short-term (10-year): Seal wells in high sensitivity areas and two known issues (contaminated church and campground)
- Long-term (future): All wells and water suppliers in the watershed

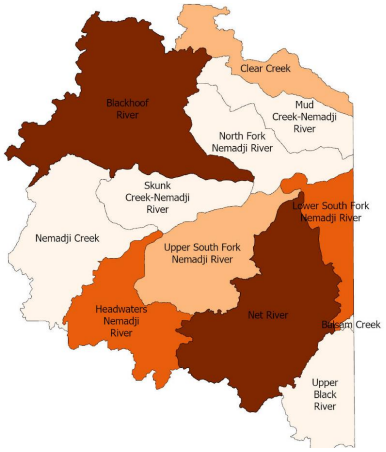
Issues Addressed

- Drinking Water Vulnerability
- Noncompliant Septic Systems
- Livestock Access to Streams
- Lack of Public Understanding

Metric

- Number of wells sealed
- Acres of permanent forest protection (Protection Goal).

Subwatershed Prioritization



Subwatershed	Long-term (approx. wells)	Short-term (approx. wells, sealed wells goal)
Blackhoof River	911	911, 4
Net River	94	94, 2
Headwaters Nemadji River	117	11, 0
Lower S. Fork Nemadji River	17	17, 0
Clear Creek	517	517, 2
Upper S. Fork Nemadji River	131	131, 1
Nemadji Creek	305	0
Mud Creek	282	0
North Fork Nemadji River	170	0
Skunk Creek	121	0
Balsam Creek	0	0
Upper Black River	0	0
Total	2,665	1,787, 10

Targeting Map

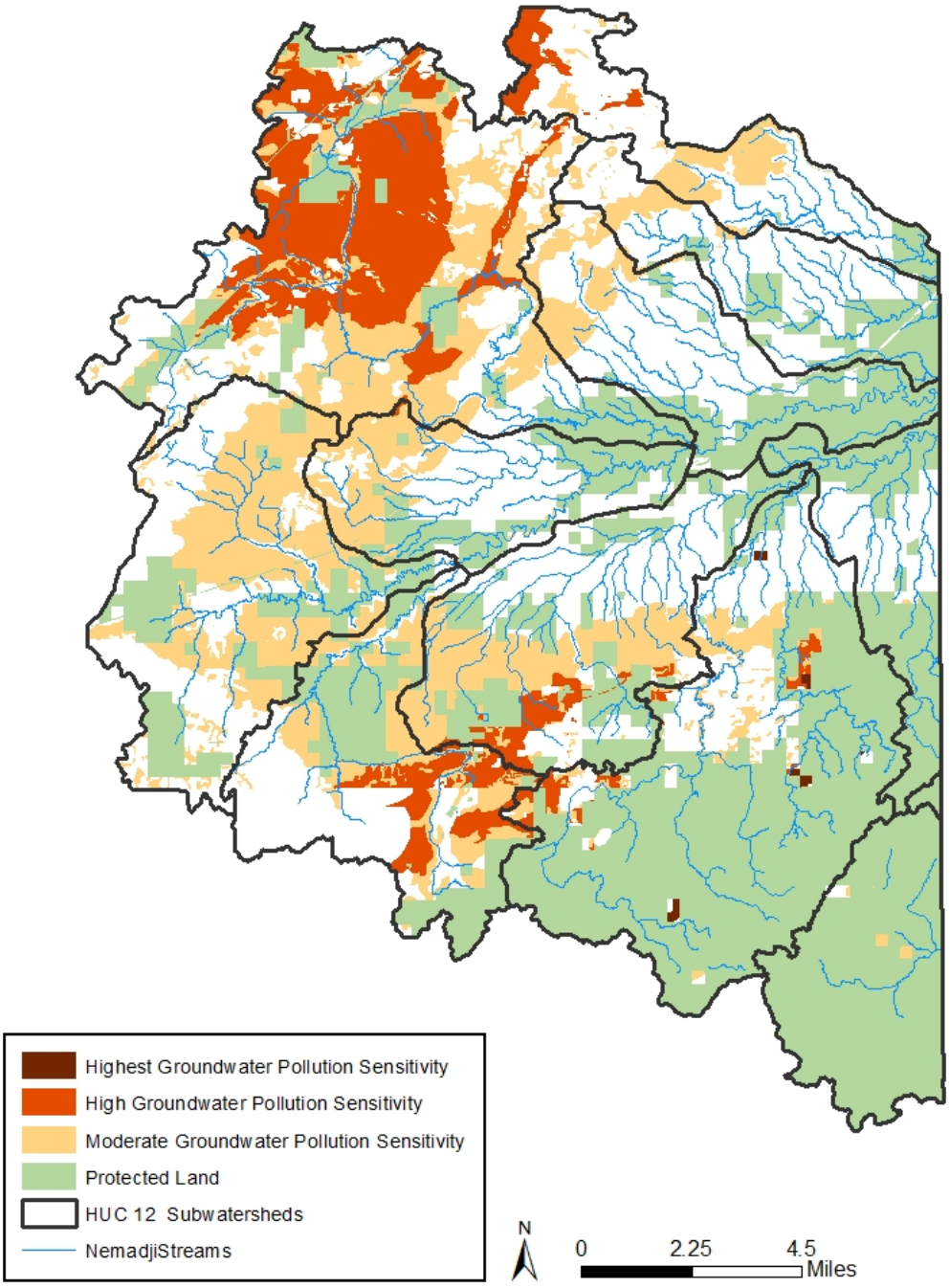


Figure 8.6. Targeting map for drinking water protection. Datasets used for targeting include MDH sensitivity of near surface pollution and MDH data of known groundwater vulnerabilities.

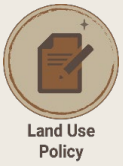
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Drinking Water Targeted Implementation Schedule

These actions will work towards protecting drinking water by conducting private well testing and finding locations and sealing unused private wells. Healthy working forests will also play a role in protecting ground water quality and increasing groundwater recharge (see Forest Management and Protection actions).

Funding to achieve this goal will come from a variety of sources. Baseline funding is the current reliable baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the drinking water goal will include NRCS Cost Share and MPCA monitoring projects and grants to increase citizen monitoring.

Estimated total 10-year cost for the Drinking Water Protection Goal:

Baseline:	**Reliable local baseline funding (County)**	**$4,200**
WBIF:	**Watershed-based Implementation Funding**	**$21,100**
Other:	**Other funding sources including competitive grants and partner funding (NRCS, MPCA, MDH, MDA)**	**$166,600**
	Total	**$191,900**

Drinking Water Targeted Implementation Schedule

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Seal unused wells.	 Conservation	10 Wells	Watershed Wide	**SWCD** County, MDH	✦	✦	✦	✦	✦	**WBIF:** **Other:**	**$2,200** **$6,600**
Start a drinking water screening program that tests a subset of private wells 3 times in 10 years to help understand water quality trends. Work with MDH and MDA.	 Research, Data, Monitoring	50 Wells Monitored	Watershed Wide with attention given to pollution sensitive, recharge, and drinking water management areas	**MDH, County**	✦	✦	✦	✦	✦	**Baseline:** **Other:**	**$4,200** **$150,000**
Meetings to discuss point of sale well inspections	 Land Use Policy	2 meetings with zoning and County Board	Watershed Wide	**County** MDH	✦	✦	✦	✦	✦	**WBIF:**	**$1,200**
Meetings to discuss point of sale septic inspections for all sales in Carlton County (Pine County already has this ordinance) or in areas of drinking water vulnerability.	 Land Use Policy	2 meetings with zoning and County Board	Watershed Wide -or- Blackhoof and Net River Subwatersheds	**County** MDH	✦	✦	✦	✦	✦	**WBIF:**	**$1,200**
Organize current and new private well data into a database	 Research, Data, Monitoring	Well data database created	Watershed Wide	**SWCD County** MDH	✦	✦	✦	✦	✦	**WBIF:**	**$5,000**

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Funding Level	Total 10-year cost
Develop an education and outreach program for private well owners on well sealing, ground water vulnerability, and testing options. Use outreach to learn locations of unused wells.	Education & Outreach	1 outreach strategy developed	Watershed Wide	**SWCD** County, Extension, MDH, MPCA	✦	✦	✦	✦	✦	**WBIF:**	**$11,500**
Gain a better understanding of artesian wells and springs/cold water inputs. Use volunteers to collect data in priority areas.	Research, Data, Monitoring	Preliminary DNR spring data is field verified, priority streams are inventoried	Protection Map	**MPCA, SWCD** Citizens, TU	✦	✦	✦			**Other:**	**$5,000**
Conduct DNA source testing of E. coli in streams.	Research, Data, Monitoring	Source testing completed on 3 streams	Impaired Waters, Waters of emerging concerns (Blackhoof, Skunk Creek, Net River)	**MPCA** UMD, SWCD					✦	**Other:**	**$5,000**

Section 9: Protection

SECTION 9. PROTECTION

Introduction

The Nemadji Watershed has abundant unique and valuable resources. Because the watershed is largely a wild place, it is home to a variety of wildlife, including some rare and threatened species. The forests and wetlands of the watershed not only provide habitat, but also help slow the flow of water, protecting downstream infrastructure and communities. These same forests and wetlands help protect our drinking water and lakes. Ultimately, they also help protect the receiving waterbody of Lake Superior. In addition, cold ground water springs feed many of the watershed's streams, providing vital habitat for trout which require these cold waters to survive and thrive.

Figure 9.1. A Nemadji watershed trout.

The Advisory Committee recognized the importance of protecting these valuable resources. Most of the topics (forests, streams, wetlands lakes and drinking water) discussed protection actions. As a result, they decided protection actions required its own goal.

Protection tools can range from land covenants where landowners agree not to develop their land for a period of time, to consevation easments, which perminetly protect a resource but allows landowners to retain property rights. Some examples include the Sustainable Forest Incentives Act, Reinvest in Minnestoa, Minnesota Land Trust, and DNR Trout Stream Easement programs. Land acquisition by conservation organizations or government units can also help permentantly protect sensitive lands, providing the added benefit of allowing public access.

In 2019, the Nemadji 1W1P planning group hosted a bus tour. The public learned about many of the watershed's unique and valuable resources.

Emerging Issues

While development in the watershed is low, the headwaters of the Blackhoof have seen the highest amount of the watershed's population growth in recent years (DNR Watershed Health Assessment Framework). The watershed's residents are important contributors to both county's tax bases, and thoughtful development ensures resources are protected.

Cold water stream habitats in the Nemadji are at risk to a warming temperature due to climate change. The watershed is fortunate to have many identified springs that provide cold water, even during warm months. These cold-water inputs will be an increasingly valuable resource for cold water habitats as air temperatures warm.

Figure 9.2. Protection actions can help keep forested land forested, which in turn protects drinking water quality.

Subwatershed Prioritization

To better understand where to work first to address priority issues, maps were created combining known datasets that represent the different topic areas. In order to divide the watershed into more manageable parts, subwatersheds (HUC12) were used as a guide.

The protection subwatershed prioritization map (Figure 3) ranked each subwatershed based on:

- Sensitivity to near surface pollution (Minnesota Department of Health),
- Priority trout streams (MN DNR Fisheries)
- Wild rice lakes (MN DNR and 1854 Treaty Authority data)
- Spring locations (MN DNR Fisheries, Advisory Committee input)

A future dataset includes the MPCA Stream Protection assessment planned for the Nemadji WRAPS Cycle 2.

A darker color indicates a higher rank, meaning darker colors have more opportunities to protect and restore resources, and are the focus of where to work first during plan implementation.

Figure 9.3. Protection subwatershed prioritization map ranking each HUC 12 subwatershed based on groundwater pollution sensitivity, priority trout streams, wild rice waters and spring locations. A darker color indicates a higher rank.

Goals and Targeting

The protection subwatershed prioritization map provides guidance on what regions to begin implementation work. The Advisory Committee determined that for this local plan, work would be targeted to forests protecting drinking water and springs providing cold water inputs.

To specifically target where to work, ground water vulnerable areas in combination with the Wisconsin DNR Nemadji River Habitat Assessment Using LiDAR Tool (WI DNR, 2018; Appendix B) was used to determine the locations of:

- Forests that protect erosive areas
- Areas with high percentages of open land
- Forests that reduce peak flows
- Forests that are near natural habitats
- Forested slopes
- Forested wetlands
- Presence of white cedar
- Proximity to public ownership
- Forests that protect groundwater

The short-term goal acreage is the location of privately-owned forests on the landscape that provide most of the listed benefits. The long-term goal is the location of privately-owned forests on the landscape that had one of these benefits.

What does Protection mean?

Forest protection does not mean preservation. Active forest management is an important tool to protect water quality and habitat by increasing species and age diversity. These actions help build climate change resiliency in the Nemadji's Forests, ensuring their ability to continue to provide their vital slow the flow and stream/lake protection functions. Disturbance is a natural part of the forest cycle that has been altered due to human intervention such as fire suppression. Many bird and animal species rely on forest diversity for their survival, including declining species like the golden-winged warblers and American woodcock.

The goal fact sheet on the next page describes the goal per subwatershed, plan issues addressed, metrics (how goal progress will be measured), and the positive outcomes that will result from the goal being implemented.

Protection Goal: Increase permanent protection by 1,717 acres in the most sensitive areas for habitat, lakes, springs, forests and drinking water.

Introduction

The sustainable forest incentives act is a key tool for watershed protection. This program encourages the active management of forests and protects land conversion from forest land to other land use types such as agriculture or development. In return, landowners receive a payment for every acre they enroll in the program. Payment rates depend on the number of acres and years they enroll in the program (8,20 or 50 years).

Conservation Easements are another tool that can be used to protect sensitive areas. Easements are especially useful to permanently protect ecologically valuable resources, such as restored wetlands, cold water inputs or other sensitive habitats.

Land acquisition is a possible tool but will be saved for very large restoration projects that require public land ownership for project funding.

Outcomes

- Protection of trout and other cold-water species
- Protection of wild rice
- Reduction of peak flows and water quality protection
- Protection of safe drinking water
- Maintenance of valuable habitat for sensitive species

Target (Figure 9.4)

- Short-term (10-year): Areas where springs emerge from the ground into trout streams, priority lakes (Lake Goal), highest ecological value forests, and highest risk drinking water (Drinking Water Goal).
- Long-term (future): Forests in the greater watershed as identified in future assessment.

Issues Addressed

- Forest Health
- Alteration of Lakeshore/Vegetation
- High Peak Flows
- Wetland protection and restoration
- Wetland function
- Drinking Water Vulnerability

Metric

- Acres of Watershed Permanently Protected (SFIA, Easements, Acquisitions)

Subwatershed Prioritization

Subwatershed	Long-term (acres)	Short-term (acres)
Blackhoof River	2858	715
Upper S. Fork Nemadji River	209	52
Skunk Creek	517	129
Lower S. Fork Nemadji River	241	60
North Fork Nemadji River	646	162
Net River	441	110
Headwaters Nemadji River	354	89
Nemadji Creek	320	80
Clear Creek	1227	307
Mud Creek	55	14
Balsam Creek	0	0
Upper Black River	0	0
Totals	6,868	1,717

Targeting Map

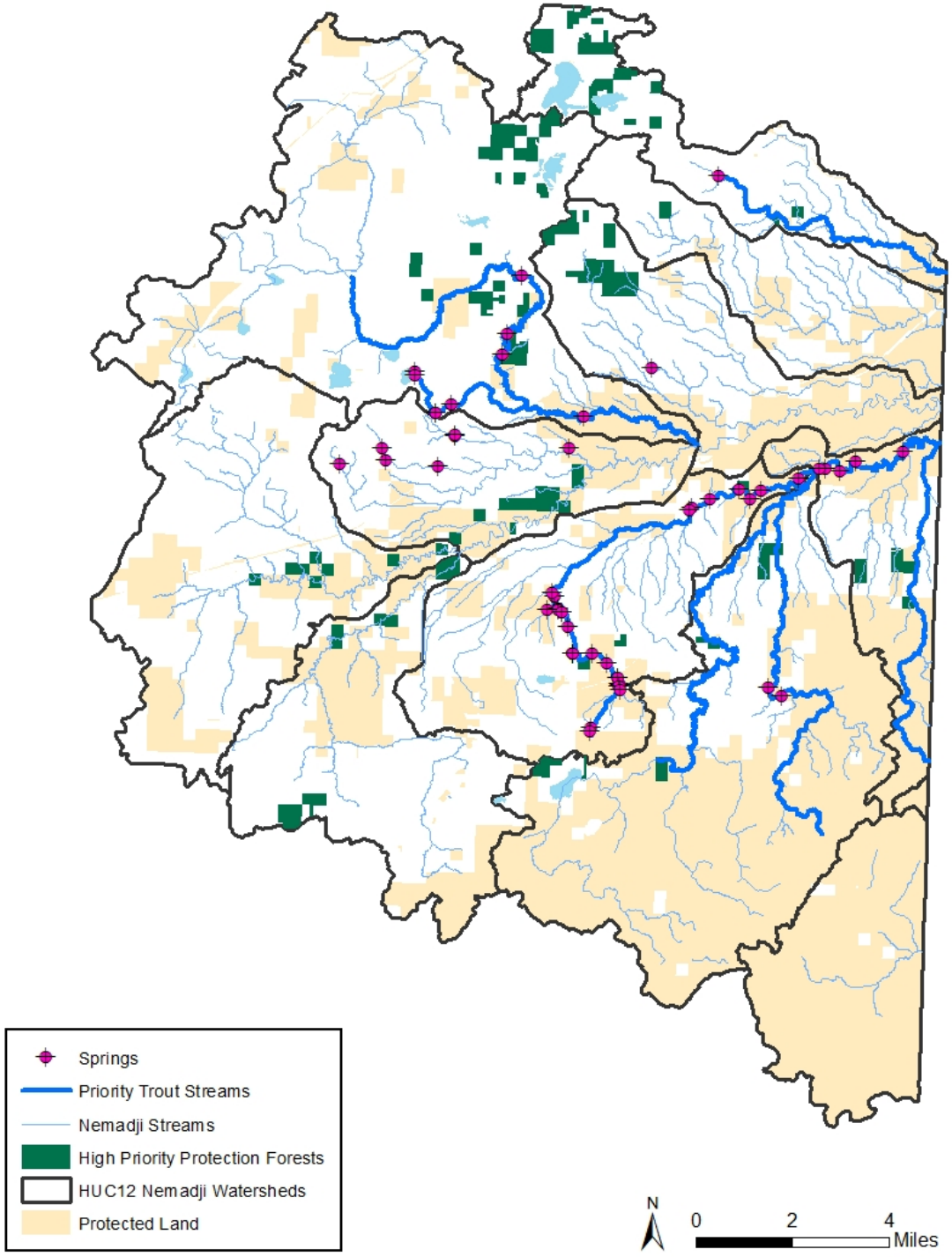


Figure 9.4. Targeted areas for permanent protection. Datasets used for targeting include St. Mary's Nemadji River Watershed Habitat Assessment Using LiDAR forest management protection, MDH sensitivity to near surface pollution, DNR potential springs, local knowledge of cold-water inputs and DNR priority trout stream datasets.

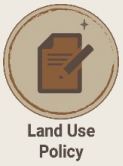
Actions

Each goal has a corresponding list of actions that will help make progress towards that goal. At the topic meetings, the groups brainstormed a list of actions, allowing topic experts an opportunity to add their ideas to the list. In addition, actions were gathered from previous reports along with the State Agency letters, and a draft list of actions were compiled under each goal. At the Actions Meeting, the Advisory Committee added any actions they thought were missing from the list along with including the following details:

- **Targeted Resources** describes where each action will be targeted (subwatersheds or specific lakes/streams).
- **Lead / Supporting Entities** explains who will oversee completing this task
- **When** estimates when in the next 10 years the work towards the action will start.
- **Cost** estimates the cost of implementing this action.
- **Program** explains the implementation program that action falls under (see below).

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis. Each action is indicated the program it is in by the icons below.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.



Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Protection Targeted Implementation Schedule

These actions will work towards protecting valuable cold-water streams through easements. In addition, forests that protect targeted lakes, drinking water and provide peak flow reduction will be protected through the Sustainable Forest Incentives Act (SFIA).

Funding will come from a variety of sources. Baseline funding is the current baseline funding available to complete an action. Watershed Based Implementation Funding (WBIF) are new funds available for completed One Watershed, One Plan watersheds. Other funds can come from a variety of sources, and for the protection goal will include grants to fund an easement program and SFIA payments.

Estimated total 10-year cost for Protection:

Baseline:	**Reliable local baseline funding (SFIA Program)**	**$67,955**
WBIF:	**Watershed-based Implementation Funding**	**$37,566**
Other:	**Other funding sources including competitive grants and partner funding (i.e. SFIA, TNC, Lessard Sams, etc).**	**$127,000**
	Total	**$232,521**

Protection Targeted Implementation Schedule

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Maintain current SFIA acres.	Conservation	Continue 5,222 SFIA acres	Watershed Wide	**SWCD**	✦	✦	✦	✦	✦	**Baseline:**	**$67,955**
Work towards 75% lands protection (public ownership, easements, SFIA) for targeted lakes.	Conservation	780 acres	Chub, Net and Hay Lakes	**SWCD** BWSR, DNR, NRCS	✦	✦	✦	✦	✦	**WBIF:** **Other:**	**$3,366** **$27,000**
Protect springs and cold-water inputs on priority trout streams using easements.	Conservation	76 acres	Blackhoof, Skunk, Lower South Fork Nemadji River, Upper South Fork Nemadji River	**SWCD** BWSR		✦	✦	✦	✦	**WBIF:** **Other:**	**$30,200** **$100,000**
Work with County Land Department and other stakeholders to prioritize potential areas of targeted conservation acquisition to improve access for forest management and fire suppression, increase public access and protect large restoration project investments.	Conservation	2 Meetings, 1 prioritized list	Watershed Wide	**SWCD,** Carlton and Pine County Land Departments	✦	✦				**WBIF**	**$4000**

What			Where	Who	When					Cost	
Action	Program	10-year measurable Outcome	Targeted Resources	Lead/ Supporting entities	2021-2022	2023-2024	2025-2026	2027-2028	2029-2030	Level of Effort	Total 10-year cost
Prioritize protection actions (easements, SFIA ext.) based on groundwater recharge/drinking water vulnerability areas and drinking water protection for the City of Duluth.	Conservation	1,717 acres	Blackhoof River, Upper South Fork Nemadji River	**SWCD** MDH, MPCA	✦	✦	✦	✦	✦	Other:	See forestry goal
Protect forested wetlands and upland forests that help slow the flow, reduce erosion and have habitat benefits using SFIA, 2C and targeted easements to help slow the flow.	Conservation	Same as above	Blackhoof River, Upper South Fork Nemadji River	**SWCD** BWSR, DNR, NRCS	✦	✦	✦	✦	✦	Other:	See forestry goal

Section 10: Plan Programs

SECTION 10. PLAN IMPLEMENTATION PROGRAMS

This section of the plan describes the programs that will be used for implementing this plan. The Steering Committee developed the program categories that best fit the Nemadji Watershed and the Policy Committee approved them. There are four main program categories: Conservation, Land Use Policy, Education & Outreach, and Research, Data, and Monitoring.

Introduction

Implementation of this plan will involve programs that will be actively targeted to prioritized areas for management. Non-priority areas will be considered on an opportunity basis.

Conservation Programs are voluntary programs implemented mainly by the Soil and Water Conservation Districts. These programs include incentive programs, easements, and capital improvements.

Land Use Policy are required programs including regulation and ordinances. These programs include the Wetland Conservation Act, Buffer Law, Shoreline Ordinances, Septic System maintenance and more.

Education and outreach programs are used to promote conservation in the watershed and encourage landowners to adopt practices on their land.

Research, Data Collection and Monitoring practices identify places (or "gaps") where projects are needed, where existing research is insufficient, and where additional monitoring would help to track the progress toward plan goals.

Conservation Programs

Conservation programs are those that protect and manage land, water, and forest resources through voluntary measures. These programs include private and public forest management, permanent protection such as conservation easements, and government-sponsored large capital improvement projects such as culvert replacement projects.

- ***Applicable Goals***: Stream Connectivity, Wetland Restoration, Forest Management, Agricultural BMPs, Drinking Water Protection, Phosphorus Reduction and Shoreline Restoration, Land Protection

Private Forest Management

There are many different options for managing forests on privately-owned lands. These can range from permanent protection to management plans described in this section.

- ***Forest Stewardship Plans***: Forest owners can manage their woods through Woodland Stewardship Plans in coordination with the Minnesota Department of Natural Resources' (DNR) Forest Stewardship Program. Forest goals can be developed in coordination with trained foresters to create wildlife habitat, increase natural beauty, enhance environmental benefits, or harvest timber. Plans must be prepared by a DNR-approved plan writer, which may include SWCD staff and private foresters.

- ***Forest 2C Designation***: Landowners with DNR-registered Woodland Stewardship Plans are eligible for 2C Classification, which is a state program that provides a reduced tax rate to forested property of 20 acres or more. This is an annual program.

- ***The Sustainable Forest Incentive Act (SFIA)*** provides annual incentive payments for the landowner recording a covenant taking away some of the rights of the land (development and farming, for example). Private landowners can receive a payment for each acre of qualifying forest land they enroll in SFIA. In return, they follow the covenant for a set period of time: either 8, 20, or 50 years. Data on current enrollees shows that landowners who start with an 8-year covenant commonly move up to a 50-year covenant (DNR).

Minnesota Agriculture Water Quality Certification Program (MAWQCP)

The MAWQCP is a voluntary program for farmers who are working to protect water resources by implementing conservations practices on their property. Producers are considered to be in compliance with any new water quality rules and can use the certification to promote their business. In addition, they are eligible for technical and financial assistance to implement conservation practices.

Conservation Reserve Program (CRP)

CRP is administered by the Farm Service Agency of the USDA. It is a voluntary program that contracts with agricultural producers so that environmentally sensitive agricultural land is not farmed or ranched, but instead devoted to conservation benefits. CRP participants establish

long-term, resource-conserving plant species to control soil erosion, improve water quality and develop wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance. Contract duration is 10-15 years.

Incentive Programs

Like CRP, incentive programs can be used to take land out of production to protect vulnerable habitats. For example, access control payments can encourage producers to limit access to stream corridors or wetlands but may have shorter duration contracts or less requirements for participation than CRP.

Cost-Share Programs

Cost-share programs or projects are those where the cost of installing a project is shared with the landowner(s). Implementing soil health practices such as cover crops and reduced tillage or forest enhancement are applicable examples that meet plan goals.

Cost-share programs can also be used for structural practices. Implementing fencing and water sources for grazing cattle away from streams, shoreline restorations on lakeshore, and well sealing are applicable examples that meet the goals of this plan.

Conservation Easements

Conservation easements are voluntary, legal agreements between a landowner and governmental or nonprofit organization, whereby land use and development are limited on a property while conserving natural values that reside upon that landscape. The easements are individually tailored agreements with an organization such as the BWSR, DNR, Minnesota Land Trust, or the Nature Conservancy.

Land Acquisition

For areas with unique and important resources that meet state goals, the DNR, United States Fish and Wildlife Service (USFWS), counties, cities, townships, and other entities may purchase and manage the land. Examples of this include Aquatic Management Areas that are used for fish spawning habitat and Wildlife Management Areas that are used for small game hunting and waterfowl mitigation.

Low-Interest Loans

Low-interest loans may be made available for septic system replacement, small community wastewater treatment systems, agricultural best management practices, and other projects that meet eligibility criteria for funding.

Capital Improvements

Capital improvements are large projects that require significant investment and have longer lifespan than that for cost-share programs. These types of projects and activities often require feasibility studies before design and construction can proceed. Capital improvement projects often involve collaboration amongst multiple public and private organizations or governmental departments and are often good candidates for state or federal grant funding. Culvert replacements are examples of capital improvement projects within the plan boundary.

Operations and Maintenance

After projects are installed, regular on-site inspections and maintenance to ensure the project's continued function and success is required by the BWSR Grants Administration Manual. These details, along with records including notes and photos should be included with each project's Operations and Maintenance Plan. BWSR's recommended inspection plans, according to the Grants Administration Manual, include the following:

- Conservation practice with a minimum effective life of 10 years:
  - The ends of Years 1, 3, and 9 after the certified completion are recommended.
- Capital-improvement projects with a minimum effective life of 25 years:
  - The ends of Years 1, 8, 17, and 24 after certified completion is a recommended minimum.

Figure 10.1. Section 36 culvert replacement in the Nemadji Watershed, and example of a Capital Improvement Project.

Land Use Policy

Land Use Policy programs are determined by the County, State and Federal Governments. Counties and cities will meet once a year to discuss ordinances and counties will notify each other of any proposed ordinance amendments. Activities will be tracked by the individual counties. An effort will be made to compile the information watershed-wide. A full comparison of Carlton and Pine County Ordinances is provided in **Appendix D**.

- Applicable Goals: Wetland Restoration, Forest Management, Drinking Water Protection, Phosphorus Reduction and Shoreline Restoration

County-Wide Zoning Ordinance

A county-wide zoning ordinance establishes land use regulations for unincorporated areas. Both counties have these and subdivision ordinances in place, though Pine County also allows for townships to create their own ordinances.

- ***Pine***: Optional for townships with their own ordinances
- ***Carlton***: All Nemadji Townships follow County Zoning
- ***Regulations***: ***Minnesota Statutes, 394.21-394.37***

Aggregate Management

The MPCA oversees air permits, hazardous waste licenses, stormwater and wastewater management, and storage tanks (https://www.pca.state.mn.us/regulations/aggregate-sand-and-gravel). Local ordinances are in place in Pine and Carlton counties that include additional guidelines for aggregate management in those jurisdictions.

- ***Regulations: Minnesota statutes 298.75, 394.25***

Bluffland Protection

Blufflands are managed under several State programs including programs for shoreland management and Wild and Scenic Rivers. Minimum structure setbacks from bluffs and related development standards apply to land in shoreland for this watershed. The State-wide shoreland program includes land within 1,000 feet of any public water body or 300 feet of any public water river or stream, or the landward extent of their floodplains. The land around public waters with a shoreland classification are regulated. In Carlton County, there is also a Red Clay Overlay that requires additional protection in areas that that correspond with the Ontonagon Silty Clay, Campia-Ontonagon Complex, Bergland Clay, Campia Silt Loam, and Udorthents soil types found within the County as shown on the Carlton County Soil Survey. The Red Clay Overlay District is intended to establish additional requirements that reflect the unstable and highly erodible soil characteristics of several clayey soil associations within the Nemadji and St. Louis River basins.

Buffers

In 2015, Minnesota enacted legislation requiring buffers of perennial vegetation of an average of 50 feet with a minimum of 30 feet on public waters and 16.5 feet for public drainage systems. This program is regulated by BWSR and implemented at the county level. Each county has an ordinance for buffer management.

- ***Regulations: Minnesota Statutes 103B and 103F.48 Subd. 4***

Construction Soil Erosion

Temporary construction erosion control is the practice of preventing and/or reducing the movement of sediment from a site during construction. All construction projects should follow construction BMPs, but projects disturbing one acre or more of land will require a National Pollutant Discharge Elimination System (NPDES) Permit from the MPCA.

- ***Regulations: Minnesota Rules, chapter 7090***

Feedlots

MPCA rules govern the collection, transportation, storage, processing, and land application of animal manure and other livestock operation wastes. Carlton County follows Minnesota regulation on feedlots while Pine County has established their own ordinance.

- ***Pine County***: 500-ft setback from non-farm dwelling; animal structures shall meet setbacks established in the Agriculture District.
- ***Carlton County***: State Compliance
- ***Regulations***: ***Minnesota Rules Chapter 7020***

Groundwater Use

The DNR administers groundwater appropriation permits for all users who withdraw more than 10,000 gallons of water per day or 1 million gallons per year. SWCD, Counties, and municipalities cooperate with the state and are offered the opportunity to comment on landowners' permit applications.

- ***Regulations: Minnesota Statute 103G for appropriation; 103H, 1989 Groundwater Act***

Groundwater Protection Rule

The MDA administers the Groundwater Protection Rule, which went into effect on June 24, 2019. The rule has two parts: Part 1 restricts the application of nitrogen fertilizer in the fall and on frozen soils; Part 2 responds to public water supply wells and elevated nitrate. Part 1 does apply to parts of the Nemadji Watershed.

- ***Regulations: Minnesota Statute 14.16***

Hazard Management

Hazard mitigation may be defined as any action taken to eliminate or reduce the future risk to human life and property from natural- and human-caused hazards. Climate change adaptation also plays a part in hazard management. These requirements direct the state to administer cost-sharing. Hazard Mitigation Local Emergency Management Programs are deployed in each of the contributing counties within the 1W1P boundary.

- ***Regulations: Minnesota Statute, chapter 12***

Invasive Species

Invasive species, both aquatic and terrestrial can cause ecological and economic damage to water resources and forests. The DNR has regulatory authority over aquatic plants and animals, and terrestrial animals. For aquatic species, permits are required by the general public for transporting lake water, invasive species, and for treating invasive species. Pine and Carlton Counties oversee the aquatic invasive species prevention and management programs.

- ***Carlton County AIS Program***: https://www.co.carlton.mn.us/226/Aquatic-Invasive-Species
- ***Pine County AIS Program***: https://www.co.pine.mn.us/departments/planning_and_zoning/aquatic_invasive_species.php
- ***Regulations: Minnesota Statute 84D***

Noxious Weed Law

Noxious weeds affect the natural, native balance of ecological functions. The Noxious Weed Law in Minnesota is administered by the MDA through SWCDs. The State maintains noxious weed lists of those species to eradicate, control, restrict, and specially regulated plants.

- ***Regulations: Minnesota Statutes 18.75-18.91***

Public Drainage Systems: Establishment, Improvement, Re-routing, Repairs, and Impoundments

Minnesota Drainage Law enables multiple landowners to collectively construct, improve, and repair drainage systems across property boundaries and governmental boundaries. These drainage systems can be open ditches and/or subsurface tile. There are no public drainage systems in the Nemadji Watershed.

- ***Regulations: Minnesota Statute 103E***

Shoreland Management

Minnesota has shoreland management rules that are administered by the DNR. Local governmental units are required to have land use controls that protect shorelands along lakes and rivers, and they can adopt more strict ordinances than the state's if desired. Carlton and Pine counties have DNR Approved Ordinances, but they are slightly different. The DNR published an Innovative Shoreland Standards Showcase website that may be helpful to local governments as they implement this plan: https://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/innovative-standards.html.

- ***Carlton***: DNR Approved Shoreline Ordinance with red clay overlay. The Red Clay Overlay District is intended to establish additional requirements that reflect the unstable and highly erodible soil characteristics of several clayey soil associations within the Nemadji and St. Louis River basins.
- ***Pine***: DNR Approved Shoreline Ordinance
- ***Regulations: Minnesota Statute 103F and Minnesota Rules 6120.2500-3900***

Subsurface Sewage Treatment Systems

The Subsurface Sewage Treatment System (SSTS) Programs are required by Minnesota State Statute to protect the public health and environment. Counties are required to have an ordinance that regulates SSTS enforced at the county level. Cities and townships may administer their own programs but must be as strict as their county's ordinance. Low interest loans and low-income grants are available through the SWCD or County. Pine County requires SSTS inspections on point-of-sale, while Carlton is slightly more limited. Carlton County allows SSTS holding tanks where Type I SSTSs cannot be feasibly installed and Pine County allows holding tanks for seasonal dwellings.

- ***Carlton***: Point of sale inspections only required in shoreland district (1000 feet from a lake, 300 feet from a river or stream).
- ***Pine***: County-wide point of sale inspections.
- ***Regulations***: ***Minnesota Statutes 115.55 and 115.56, Minnesota Rules Chapters 7080, 7081, 7082, 7083***

Waste Management

Waste management permitting and regulatory programs (including hazardous waste, storage tanks, and solid waste) are implemented by the MPCA. The counties have a hazardous waste facility available at no charge to county residents.

- ***Regulations: Minnesota Statutes 115.55, Minnesota Rules Chapters 7001, 7035, 7045, 7150, 7151, 9215, 9220***

Wellhead Protection

The purpose of the Wellhead Protection Program is to prevent contamination of public drinking water supplies by identifying water supply recharge areas and implementing management practices for potential pollution sources found within those areas. The program has since expanded to Source Water Protection to include supplies which rely on surface water. Wellhead Protection is mostly administered at the city level.

- ***Regulations**: Minnesota Statutes, chapter 103I; Minnesota Rules, chapter 4720; Federal Safe Drinking Water Act, US Code, Title 42, Chapter 6A, Subchapter XII, Part E, Section 300j-13; Minnesota Rules, chapter 4725.*

Wetlands

Wetlands are protected by the Minnesota Wetland Conservation Act (WCA). The overall goal of the act is no net loss of wetlands. Draining, filling and in some cases, excavating in wetlands is prohibited unless (a) the drain, fill, or excavation activity is exempt from requiring replacement or (b) wetlands are replaced by restoring or creating wetland areas of at least equal public value. Replacement can be buying credits or creating/restoring a wetland (usually credits are encouraged over an on-site replacement). Carlton and Pine Counties serve as the local LGU for implementing WCA.

- ***Regulations: Minnesota Rules, part 8420.0105***

Existing Comprehensive or Land Use Plans in the Watershed:

- Carlton County Water Plan, 2010-2020, Amended in 2014
- Pine County Water Plan, 2015-2020
- Carlton County Community-Based Comprehensive Plan - 2001
- Pine County Comprehensive Plan, 2017-2030

Figure 10.2. Pollinator project in the Nemadji Watershed.

Education and Outreach

Public Participation and Engagement

Public participation and engagement are essential for successful implementation of this plan. The implementation of actions in this plan is voluntary and require willing landowner participation. There are many different steps to adopting conservation practices (Figure 10.3).

Landowners have varying levels of understanding of conservation practices, programs and funding opportunities available. Many times, the first step towards adopting conservation practices is outreach. Outreach can be conducted in a variety of ways including mailings, workshops and social media. It can be targeted to landowners in priority areas to help target conservation practices in those areas to reach plan goals. The second step is knowledge exchange, including site visits, technical assistance, peer-to-peer networks, and demonstration plots. Sometimes the outreach and knowledge exchange can take years before landowners adopt the practices. Once the landowner is interested in adopting practices, incentives and cost-share programs can help them get started. For example, incentives for farmers to adopt cover crops from the SWCD or the EQIP program can help them implement the practice for a couple years to ensure profitability (Figure 10.3).

Figure 10.3. The steps toward conservation.

Outreach

During the public kickoff bus tour, a need for increased education and outreach was identified as a barrier to protecting and restoring resources, as illustrated in the survey responses below:

- Lakeshore owners are not aware of lake best management practices
- Landowners are unaware of forestry protection programs such as forest management plans, SFIA and 2C
- There is a need for local increased knowledge of location and importance of trout streams
- People do not understand the importance of wetlands in water quality
- There is a need for increased local knowledge of farm best management practices

Specific outreach actions for implementation of this plan related to each goal are listed below. The lead organization and specific goal are listed in brackets.

- Provide education and outreach on the value of wetlands along with opportunities for restoration and protection [SWCD, Wetland Restoration].
- Conduct 1 workshop/outreach event per year to help livestock producers and farmers learn about the resources available [SWCD; Agricultural BMPs Goal].
- Provide new forest landowners and realtors information about forest management at point of sale [County Realtor Associations; Forest Management Goal].
- Provide landowner workshops (1 per year). Produce flyers and factsheets to encourage lakeshore BMPs and educate them on lake issues including County Ordinances [SWCD; Phosphorous Reduction Goal].
- Educate outreach staff on University of Minnesota Extension Civic Engagement techniques to reach lakeshore landowners [SWCD; Phosphorous Reduction Goal].
- Provide workshop/continuing education for realtors and contractors on lakeshore BMPs [SWCD; Phosphorous Reduction Goal].
- Work with classrooms and 4-H to educate youth [Extension; Agricultural BMPs Goal].
- Encourage more detailed soil tests that include the parameters listed below and provide landowners assistance with understanding soil test results. [Extension, Agricultural BMPs Goal]:
    - Cation exchange capacity
    - Base saturation
    - Ca/Mg/K
- Develop a community based social marketing strategy by defining specific actions for landowners, finding influential community members and through surveys and peer to peer outreach [SWCD, Woodland Council; Forest Management Goal].
- Provide education to road salt applicators and owners of water softeners on the concerns of chloride in lakes [MPCA; Phosphorous Reduction Goal].
- Increase education and outreach to private well owners on well sealing, ground water vulnerability, and testing options [SWCD; Drinking Water Protection Goal].

Knowledge Exchange

Specific knowledge exchange actions for implementation of this plan related to each goal are listed below. The lead organization and specific goal are listed in brackets.

- Collaborate with agencies/tribal governments/universities to share emerging wetland data and tools [DNR, BWSR; Wetland Restoration Goal].
- Engage partnerships to help build our understanding of wetland function and ecosystem services valuation [DNR, BWSR; Wetland Restoration Goal].
- When planning stream projects, increase collaboration between entities [Everyone; Stream Connectivity Goal].
- Help townships, private landowners and other road authorities with culvert/road projects by providing technical assistance and funding [SWCD, County, Townships; Stream Connectivity Goal].
- Provide education for road maintenance crews on ditch/grading for steep slopes [County; Stream Connectivity Goal].
- Increase one-on-one interactions with technical staff to increase BMPs [SWCDs; Agricultural BMPs Goal].
- Increase peer-to-peer networks [SWCDs; Agricultural BMPs Goal].
- Assist owners of historic farm sites with concerns such as: drainage ditches, closing old manure storage facilities, old dump sites, old well, etc. [SWCDs; Agricultural BMPs Goal].
- Work with farmers to integrate forestry and farming [SWCD; Agricultural BMPs Goal].
- Encourage/empower lake associations and create a coalition of lake associations [SWCDs; Phosphorous Reduction Goal].

Research, Data and Monitoring


Research, Data, Monitoring

Data collection, inventories, and monitoring are crucial for determining where projects are needed, investigating problems, and tracking progress towards the measurable goals of this plan. Current data collection and monitoring efforts are described, along with data gaps that have actions for implementation in this plan. Targeted screening, inventory, monitoring and outreach actions are listed under each goal.

Current Data Collection and Monitoring Efforts

Currently, a wide variety of monitoring is carried out on multiple government and local organization levels (Table 10.1). These existing data helped determine the current conditions of surface water, groundwater, habitat, and land resources in this plan and developed a starting point for measuring goals moving forward. Because these are already established projects, they don't cost additional funds for this plan.

Table 10.1. Summary of ongoing water quality & quantity monitoring programs. RS = rivers & streams, L = lakes, W = wetlands, and GW = groundwater.

Parameters	MPCA	DNR	MDH	MDA	County & SWCD	Lake Associations & Citizens
Nutrients	***RS, L, W***	***RS, L***		***RS, GW***	***GW***	***RS, L***
Suspended Solids	***RS, L, W***	***RS***		***RS***		***RS***
Productivity	***RS, L***	***RS***				***RS, L***
Pesticides				***RS, L, W, GW***		
Bacteria	***RS, L***		***GW***			
Biology	***RS, L, W***	***RS, L***				
Water level/Flow	***RS, L***	***RS, L***				
Algal Toxins	***L***					
Invasive Species		***RS, L***			***L***	***RS, L***
Fish Contaminants	***RS***	***L***				
Chlorides	***RS, L, W***	***RS***	***RS, L, GW***			
Sulfates	***RS, L, W***	***RS, L***	***RS, L, GW***			

- As part of the Intensive Watershed Approach, the MPCA conducts lake and stream monitoring in each watershed on a 10-year cycle. This assessment includes water chemistry and biological parameters, any Total Maximum Daily Loads (TMDL) needed, and results in numerous comprehensive reports. The Nemadji Watershed was first assessed in 2011 and is scheduled for Cycle 2 to begin in 2021.
- Chub Lake has a lake association that conducts general condition monitoring annually including total phosphorus, chlorophyll a, and transparency parameters.
- The roles in groundwater monitoring in Minnesota are spread between four agencies:

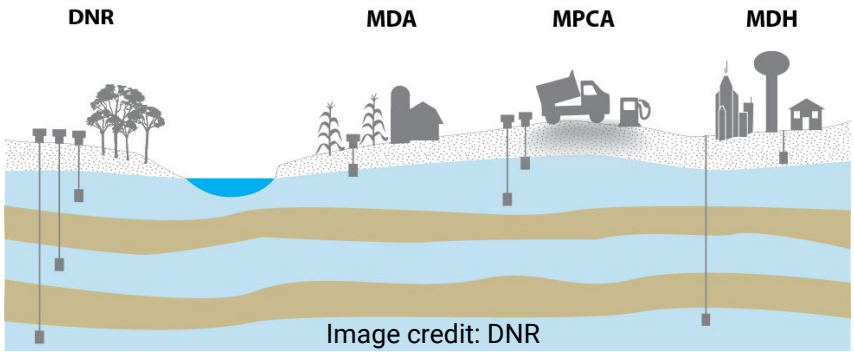


Image credit: DNR

- The MDH monitors wells and drinking water supplies for public health, including bacteria, nitrates, and arsenic.
- The DNR monitors groundwater availability and ecological impacts through the Cooperative Groundwater Monitoring network. There are X monitoring observation wells in the Nemadji Watershed.
- The MDA monitors groundwater for agricultural chemicals and fertilizer contamination.

- The MPCA monitors groundwater for industrial contamination.
- During the MPCA's intensive monitoring cycle, the rivers in the watershed are tested for biological parameters including fish and macroinvertebrate habitat. Any biological impairments are assigned a stressor that is likely causing the reduction in diversity. Stressors include loss of habitat, loss of connectivity, sediment, dissolved oxygen, and altered hydrology.
- Forest habitat is described in the Northeast Landscape Forest Resources Plan. Areas for restoration and enhancement and recommended species assemblages are outlined in the plan.
- Land Stewardship practices are tracked in eLINK and NRCS databases.

Filling Data Gaps

This planning process has identified data gaps to be filled through implementation of this plan. The following inventory and study activities are listed in the targeted implementation schedule. The lead organization is listed in brackets.

STREAM

- Track benefits to watershed projects using a database which includes cost of both projects and consequences of not completing projects, such as road closures. Hold an annual meeting and maintain a web map [SWCDs].
- Update culvert inventory on private and township roads [SWCDs].
- Learn where streams are unstable and collaborate with local educational institutions to better understand clay on bedrock [DNR].
- Increase the number of river gages on the Nemadji system for better culvert/stream project design [MPCA].

WETLANDS

- Assess/inventory drainage ditch and tiling for the watershed, including historic practices [SWCDs].
- Complete field verification of wetland function (the desktop analysis procedure by Ralph Tiner at the U.S. Fish & Wildlife Service was completed as part of the St. Mary's tool) [SWCDs].
- Identify and prioritize wetland connectivity impacted by roads/trails/ditches [SWCDs].
- Evaluate the current status of invasive species and species diversity in wetlands [County and State Agencies].

- Conduct forest BMP effectiveness monitoring on private lands [SWCDs].
- Conduct harvest BMP monitoring on private lands [MN Forest Resource Council].
- Inventory invasive species to assess risks; target high value land [DNR].
- Use emerging data (LAMP dataset) to understand where shading will have the most impact protecting cold water fisheries with shading [DNR (LAMP)].
- Complete a Watershed Landscape Stewardship Plan for the Nemadji Watershed

- Conduct DNA source testing of E. coli in streams [MPCA].
- Compile existing well data to increase our understanding of drinking water quality (private and public) [MDH].
- Gain a better understanding of artesian wells and springs [MDH, MPCA, DNR].
- Start a drinking water monitoring program that tests a subset of watershed wells 3 times in 10 years to help understand trends. The Douglas County program could be used as a model, and MDH could help with program development [MDH, County].

- Gather data on impaired lakes and lakes with declining transparency trends including: DNR Score Your Shore, septic system inventories, ground truth upstream erosion issues [SWCDs].
- Collaborate with the tribe/1854 Treaty on wild rice assessments [SWCDs, 1854 Treaty].
- Encourage cost effective lake data collection using citizen monitors, interns, students, and conservation corps [MPCA, Lake Associations, CCM].
- Identify and prioritize trout streams for protection [MPCA, DNR].

Achieving Plan Goals

Overall plan monitoring and progress will be tracked by Carlton County. Table 10.2 summarizes the different levels of measuring progress and how it will be implemented in this plan. Projects will be tracked during plan implementation using a system set up for the watershed.

Table 10.2. Description of how different activities will be measured during plan implementation.

Level	Description	Nemadji 1W1P Application
Tracking	Practices, Acres, Miles of River, Number of Landowners Contacted	Outputs in Targeted Implementation Schedule. Projects will be tracked with a system and reported in eLINK during implementation.
Estimating	Using lower resolution calculators and tools to give a sense of the collective impacts of projects.	Estimating the tons of sediment reduced for each culvert replacement. Estimating tons of sediment and pounds of phosphorus reduced from the implementation of Agricultural BMPs.
Modeling	Incorporating landscape factors and project information to predict future conditions.	HSPF modeling in WRAPS Cycle 2 in 2021
Measuring	Using field-collected information to assess the condition of the water.	Lake Monitoring, Pollutant Load Monitoring Network stream monitoring (Nemadji River nr Pleasant Valley, MN23, S000-110), WRAPS Cycle 2 in 2021
Proving	Having enough measurements to compare with standards and decide if it is improved.	Analysis of lake water quality trends, Analysis of loading at WPLMN (S000-110), WRAPS Cycle 2 in 2021, future WRAPS Cycles.

Water and Equity

Water is a universal, free-flowing entity and a requirement for all life. It is sacred in many traditions. Water is therefore not only its material, chemical composition; water also shapes and is also shaped by humans and embedded in social, cultural, and political practices.

Equity throughout communities and in larger geographies is important because of global climate change and the development of sustainable and resilient communities. Addressing equity at a watershed scale is a way of exploring, delineating, and prescribing actions for addressing the equitable management of natural resources for the welfare of all people in those communities within the plan boundaries. Though particular goals or actions directly addressing equity are not specifically prescribed in this plan, it is encouraged to be considered during plan implementation.

Section 11: Plan Admin

SECTION 11. PLAN ADMINISTRATION

The Nemadji Watershed spans two counties and two states (Figure 11.1). The Plan Administration describes how the plan will be implemented, how the watershed partners will work together, how the funding will move between them, and who will handle the administrative duties. The Nemadji 1W1P will be implemented through a Memorandum of Agreement (MOA) between Carlton SWCD, Carlton County, Pine SWCD and Pine County. This MOA largely contains the same framework that was included in the MOA for developing this plan (Appendix E). Refinements to the implementation agreement that changed from the planning agreement include clarifying voting procedures and fiscal agent responsibilities

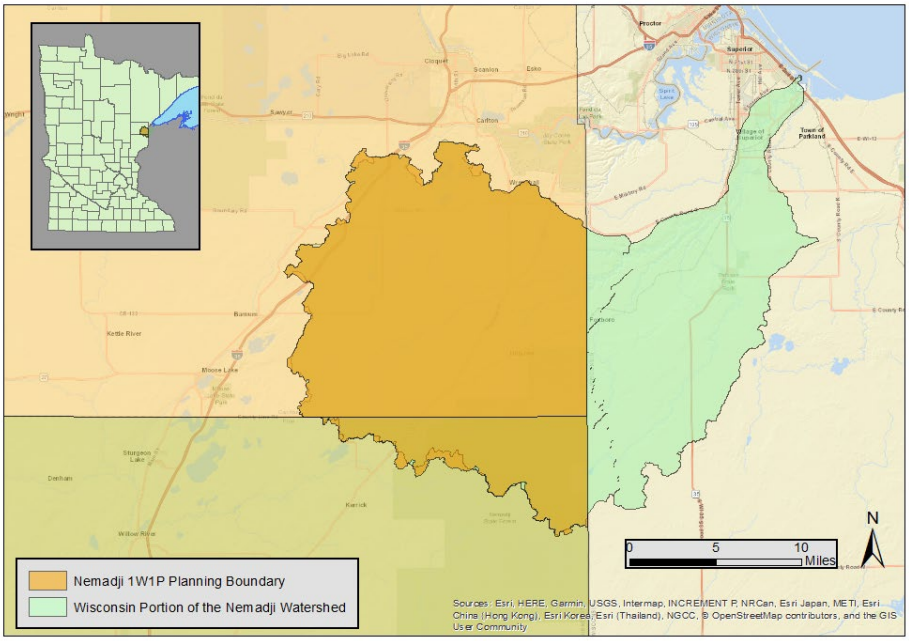


Figure 11.1. Map of county and state jurisdictions in the Nemadji Watershed.

Decision-making and Staffing

Implementation of the Nemadji 1W1P will require increased capacity of plan partners, including increased staffing, funding, and coordination from current levels. Successful plan implementation will depend on generating active interest and partnerships within the watershed.

The decision-making and staffing for implementing the Nemadji 1W1P will be conducted based on the concepts outlined in this section of the plan. Presented below are the probable roles and functions related to plan implementation (Table 11.1). Expectations are that the roles of each committee will shift and change during implementation to best meet the needs of the planning partners. Fiscal and administrative duties for plan implementation will be assigned to an LGU through a Policy Committee decision as outlined in the formal agreement. Responsibilities for work planning and serving as the central fiscal agent will be revisited by the Policy Committee on a biennial basis.

Table 11.1: Roles for Nemadji 1W1P Implementation.

Committee Name	Description	Primary Implementation Role and Functions
Policy Committee	One board member from each MOA entity.	• Meet twice a year or as needed • Recommend approval of the annual work plan by the individual boards of the MOA members • Annual review and confirmation of Advisory Committee recommendations • Direction to Advisory Committee on addressing emerging issues • Recommend approval of the annual work plan by the individual boards of the MOA members • Review the implementation funds from plan participants
Local Fiscal and Administrative Agent	One of the participating LGUs as decided by the Policy Committee.	• Convene committee meetings • Prepare the annual work plan • Prepare and submit grant applications/funding requests • Research opportunities for collaborative grants • Report on how funds were used • Compile annual results for annual assessment
Steering Committee	A representative from the staff of each MOA entity and local BWSR Board Conservationist.	• Review the status of available implementation funds from plan participants • Review opportunities for collaborative grants • Review annual fiscal reports • Review annual reports submitted to BWSR • Biennial review and confirmation of priority issues • Evaluate and recommend response to emerging issues • Prepare plan amendments • Implement the targeted implementation schedule
Advisory Committee	A committee of local stakeholders and state agency representatives appointed by Policy Committee	• Meet twice a year • Review and provide input for the annual work plan • Review and identify collaborative funding opportunities • Recommendations to Planning Work Group on program adjustments • Assist with execution of the targeted implementation schedule

Collaboration

Collaboration between Nemadji 1W1P Planning Partners

The Nemadji 1W1P Steering Committee and Policy Committee acknowledge the value of collaboration between planning partners to achieve successful plan implementation. Benefits of successful collaboration include consistent implementation of actions watershed-wide, increase likelihood of funding, and resource efficiencies gained. There is already some collaboration in the watershed:

- Carlton SWCD and County have worked collaboratively on multiple projects.
- Carlton and Pine SWCD both have access to service through Technical Service Area 3 Engineering staff.

This collaboration is an advantage for implementation in the watershed. Where possible and feasible, the Nemadji 1W1P Steering Committee will pursue opportunities for collaboration with fellow planning members to gain program efficiencies, pursue collaborative grants, and provide technical assistance. The Nemadji 1W1P Steering Committee and Policy Committee will also review similarities and differences in local regulatory administration to identify local successes and identify changes needed in the future to make progress towards goals outlined in this plan.

Collaboration with Other Units of Government

The Nemadji 1W1P Steering Committee will continue to coordinate and cooperate with other governmental units at all levels. Coordination with state agencies including BWSR, DNR, MDH, MDA, and the MPCA will continue as they are experts in many of the topic areas included in this plan, have been participating members of the planning Advisory Committee, and will be members of the implementation Advisory Committee. Cooperation with units of government such as NRCS, municipalities, city councils, township boards, county boards, joint powers boards, and other water management authorities are a practical necessity to facilitate watershed-wide activities. Examples of collaborative programs in the watershed include EQIP (NRCS), CRP (FSA), Minnesota Agriculture Water Quality Certification (MDA), Wellhead Protection for city DWSMAS (MRWA and MDH), Minnesota Forest Resource Council and WRAPS (MPCA).

Nemadji 1W1P implementation actions and goals were developed through a collaborative process. Some agency goals, objectives, directions, and strategies for resource management within the plan area have not been selected as priority issues. The responsibility for achieving the goals associated with lower priority tier issues remains with the respective agency or organization.

Collaboration with Others

Local support and partnerships will drive the success of final outcomes of the actions prescribed for implementing this plan. Because this plan's focus is voluntary land stewardship practices, collaborations with landowners in the watershed is of paramount importance. There are many actions in the plan that describe working with individual landowners on personalized forest management plans and providing cost share and technical assistance for implementing agricultural best management practices. Many of the existing collaborations in the watershed have been involved in the development of this plan and are committed to protecting and enhancing the Nemadji Watershed resources. Partners for these collaborations include, but are not limited to, lake associations, Trout Unlimited, Pheasants Forever, American Bird Conservancy, University of Minnesota Extension, civic groups, 1854 Treaty Authority, Fond du Lac Band of Lake Superior Chippewa, private businesses, individuals, and foundations. The Nemadji 1W1P Steering Committee collaborates with these groups for education, outreach, monitoring, and project implementation.

Funding

The Nemadji 1W1P Steering Committee will pursue funding opportunities collaboratively to implement the activities prescribed in the targeted implementation schedule for each topic area (Sections 2-9). Table 11.2 lists the most used programs and grants for executing the implementation programs described by this plan and used within the targeted implementation schedule. The funding grants and programs are cross-referenced to plan implementation programs, thereby showing potential sources of revenue for implementation. Programs will be coordinated uniformly throughout the watershed where possible.

Current programs and funding (Baseline) will not be enough to meet the full targeted implementation schedule. The success of plan implementation will hinge on reliable non-competitive watershed-based funding being available for plan implementation in addition to competitive state, federal, and private grant dollars. The Nemadji 1W1P Steering Committee and Policy Committee acknowledge that additional staffing may be necessary to meet plan goals. Because implementation is occurring under a MOA, staff will be hired by existing local government units in the watershed.

The current funding level (Baseline) is based on the annual revenue and expenditures for the following counties and SWCDs: Carlton and Pine. The current level of investment by each local government unit is expected to remain the same during the Nemadji 1W1P ten-year time period. The current expenditure includes all the state program and conservation delivery grants, including the Natural Resources Block Grant and SWCD Local Capacity Building Grants. WBIF funding describes watershed-based implementation funding that could be obtained to implement the plan. The total funding can also be broken out by management focus (Table 11.3).

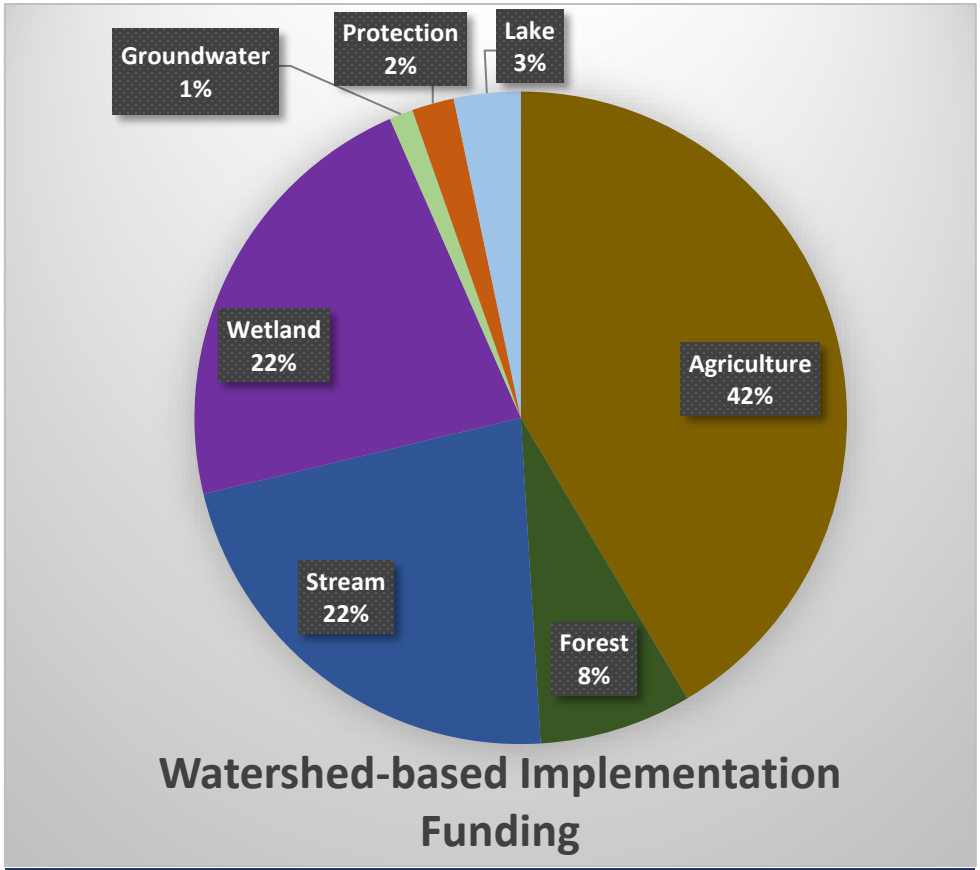
Table 11.2. Nemadji 1W1P Total Estimated Cost per funding level.

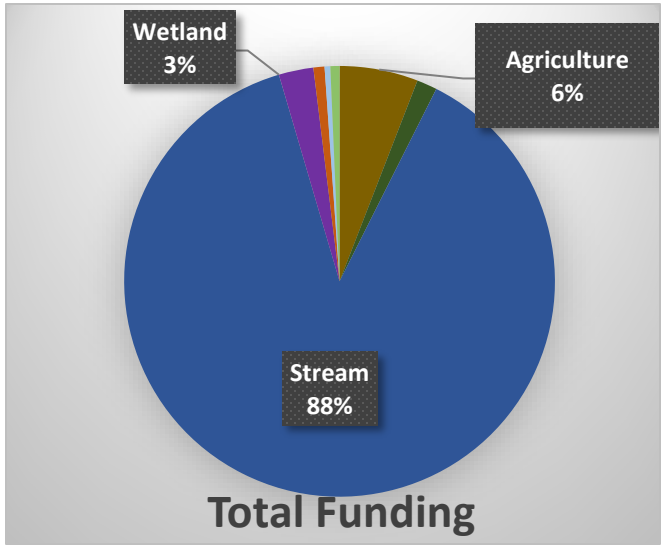
Funding Level	Description	Estimated Annual Average	Estimated Plan Total (10 years)
Baseline:	Local baseline funding	$1,044,924	$10,439,247
WBIF:	Watershed-based Implementation Funding	$179,587	$1,795,874
Other:	Other funding sources including competitive grants and partner funding (i.e. NRCS, State, Federal)	$1,576,108	$15,761,084
	Total	$2,799,619	$27,996,205

Table 11.3: Estimated watershed-based implementation funding for the Nemadji 1W1P (per program)

Implementation Program	Estimated Annual Average	Estimated Plan Total (10 years)
Conservation Programs	$168,797	$1,687,974
Land Use Management	$240	$2400
Education and Outreach	$6,700	$67,000
Monitoring	$3,850	$38,500
Total	$179,587	$1,795,874

The variety of funding sources available to implement this plan vary with each topic area (Figure 11.2). Actions addressing the road/stream interface can be funded using various road funding, including County State Aid, Township Bridge Funds and Federal sources depending on the road. Stream projects make up a large portion of the plan's budget due to the cost of these large projects. Forestry implementation and planning can be largely funded through established DNR Cost-share programs. There are many cost-share programs available that fund cost sharing for agricultural best management practice construction, but there is a gap in engineering and technical resources that are needed to get projects on the ground. This accounts for the relatively large percentage of Watershed -based implementation funding being planned for agriculture practices. Wetland practices are not easily funded through any current funding, and planned field assessments will guide where to best target future restoration projects.





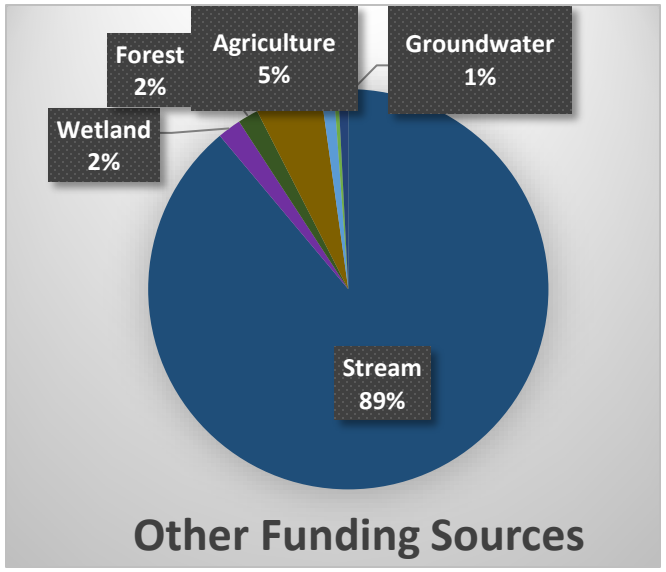


Figure 11.2. Funding sources vary by topic area. A large percentage of stream funding will come from road funding sources and make up a large portion of the total funding, but a smaller percentage of watershed-based implementation funding. Agricultural funding makes up a larger percentage of Watershed-based implementation funding to help design best management practices that can be funded through established cost-share programs.

Table 11.4: Funding sources available for implementing the Nemadji 1W1P

Source	Organization	Program/Fund Name	Type of Assistance	Form of Assistance	Conservation	Land Use Policy	Research, Data, Monitoring	Education & Outreach
STATE FUNDING	BWSR	Clean Water Fund	Financial	Grant	✦			✦
	BWSR	Reinvest in Minnesota (RIM)	Financial	Easement	✦			
	BWSR	Natural Resources Block Grant	Financial	Grant	✦	✦		
	BWSR	SWCD Local Capacity Service Grants	Financial	Grant	✦		✦	✦
	BWSR	Erosion Control & Mgmt Program	Financial	Grant	✦			✦
	DNR	Conservation Partners Legacy	Financial	Grant	✦			
	DNR	Aquatic Invasive Species Control	Financial/ Technical	Grant	✦			✦
	DNR	Forest Stewardship Program	Financial/ Technical	Cost Share	✦			
	DNR	Aquatic Management Area, Wildlife Management Area	Financial	Fee Title Acquisition	✦			
	DNR/ Dept. Revenue	Sustainable Forest Incentive Act	Financial	Incentive payment	✦			
	MPCA	Clean Water Partnership	Financial	Grant	✦		✦	✦
	MPCA	State-Revolving Fund	Financial	Grant	✦			
	MPCA	Surface Water Assessment Grant	Financial	Grant			✦	
	MDH	Source Water Protection Grant	Financial	Grant	✦		✦	
	MDA	Nitrate Testing	Technical	Monitoring			✦	✦
	MDA	Agricultural BMP Loan Program	Financial	Loan	✦			
	MDA	MAWQC Program Cost Share	Financial	Cost Share	✦			
	LSOHC	Outdoor Heritage Funds	Financial	Grant	✦			

Source	Organization	Program/Fund Name	Type of Assistance	Form of Assistance	Conservation	Land Use Policy	Research, Data, Monitoring	Education & Outreach
	LCCMR	Environmental Trust Fund	Financial	Grant	✦			
	Legislature	Bonding	Financial	Bond	✦			
	MN DOT	County State Aid Highway	Financial	Allocation	✦			
	MN DOT	Township Bridge Funds	Financial	Allocation	✦			
FEDERAL FUNDING	FSA	Conservation Reserve Program	Financial	Cost Share	✦			
	FSA	Grassland Reserve Program	Financial	Cost Share	✦			
	FHWA	Emergency Relief Program, Federal aid	Financial	Allocation	✦			
	NRCS	Conservation Innovation Grant	Financial	Grant	✦			
	NRCS	EQIP	Financial	Cost Share	✦			
	USGS	Stream Gaging Network	Technical	Monitoring			✦	
	USACE	Planning Assistance	Technical	Planning	✦			
	Varies	Great Lakes Restoration Initiative	Financial	Grant	✦			✦
	EPA	319 Small Watershed Program	Financial	Grant	✦			✦
	EPA	State Revolving Fund	Financial	Loan	✦			
Other	Trout Unlimited		Financial/ Technical	Easement/Cost Share	✦			
	The Nature Conservancy		Financial	Easement	✦			
	Minnesota Land Trust		Financial	Easement	✦			
	Township		Financial	Allocation	✦			

Local Funding

Funding derived from either the local property tax base or in-kind services of any personnel funded from the local tax base is local revenue. Local funding excludes general operating funds obtained from BWSR, fees for service and grants, or partnership agreements with the federal government or other conservation organizations.

Local funds will be used for locally focused programs where opportunities for state and federal funding are lacking because of misalignment of a program's purpose with state or federal objectives. These funds will also be used for matching grants where statutory authority already exists. Some examples include:

Water Planning Authority for Special Projects (Minnesota Statute 103B.355):

- Counties have the authority to levy funds for priority projects and assist SWCDs with program implementation.

Road Authorities:

- Counties can provide limited local funding to assist with the local share of road-stream interface and some floodwater-retention projects.

Drainage System Costs (Minnesota Statute 103E):

- There are no 103E drainage ditch systems in the watershed.

State Funding

Leadership from the state agencies that are tasked with protection and restoration of Minnesota's water resources came together and agreed on a set of high-level state priorities that align their programs and activities working to reduce nonpoint source pollution. The resulting Nonpoint Priority Funding Plan outlines a criteria-based process to prioritize Clean Water Fund investments. These high-level state priority criteria include:

1. Restoring those waters that are closest to meeting state water quality standards
2. Protecting those high-quality unimpaired waters at the greatest risk of becoming impaired
3. Restoring and protecting water resources for public use and public health, including drinking water

State funding includes funds derived from the State tax base for state cost-share and regulatory purposes. State funding excludes general operating funds obtained from BWSR, counties, fees for service and grants, or partnership agreements with the federal government or other conservation organizations.

Collaborative Grants

The fiscal agent will apply for collaborative grants on behalf of the Nemadji 1W1P Policy Committee, which may be competitive or non-competitive. The assumption is that future base support for implementation will be provided to the Nemadji 1W1P as one or more non-competitive implementation watershed-based funding allocations. Where the purpose of an initiative aligns with the objectives of various state, local, non-profit, or private programs, these dollars will be used to help fund the implementation programs described by this plan. Funding sources that are currently available at the time of developing this plan are listed in Table 11.4.

Federal Funding

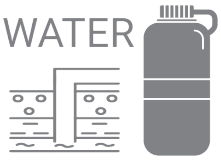
Federal funding includes all funds derived from the federal tax base. This includes programs such as the EQIP administered by NRCS and road project funds through the Federal Highway Administration. Federal funding does not include general operating funds obtained from BWSR, counties, fees for service and grants or partnership agreements with state government or other conservation organizations.

Federal agencies can be engaged following the approval of this plan and prior to implementation, to create an avenue to access federal resources for implementation. Opportunity may exist to leverage state dollars through some form of federal cost-share program. Where the purpose of an implementation program aligns with the objectives of various federal agencies, federal dollars will be used to help fund the implementation programs described by this plan. For example, the NRCS will likely provide support for agricultural best management practices, while the FSA may provide land-retirement program funds such as CRP (Table 11.4).

Other Funding Sources

Foundations, nonprofit organizations, and private contributions (including landowners and corporate entities) will be sought for plan implementation activities. Local foundations may fund education, civic engagement, and other local priority efforts. Several conservation organizations are active in the watershed, such as The Nature Conservancy, Trout Unlimited, MN Deer Hunters Association, Pheasants Forever, National Wild Turkey Federation, and local co-ops (i.e., Breakfast on the Farm). These organizations acquire funding of their own and may have project dollars and technical assistance that can be leveraged. Major cooperators and funding sources are private landowners who typically contribute 25% of project costs and many donate land, services, or equipment for projects or programs.

Table 11.5. Funding sources by topic area.

Topic	Funding Sources
STREAM 	County State Aid, County Road Tax, Township Bridge Funds, Watershed-based Implementation Funding, Federal Highway Administration, Great Lakes Restoration Initiative Grants, DNR Grants, LCCMR Grants, Clean Water Fund Grants, 319 Small Watershed Grants, State Bonding
WETLANDS 	County and SWCD funding, Watershed-based Implementation Funding, DNR Grants, MPCA, TNC, LCCMR Grants, Great Lakes Restoration Initiative, 319 Small Watershed Grants, Clean Water Fund
	SWCD Funding, Watershed-based Implementation Funding, DNR Cost Share, NRCS Cost Share, Landowners
FARM 	Minnesota Agriculture Water Quality Certification Program, Watershed-based Implementation Funding, NRCS Cost Share, MAWQCP Cost Share, Landowners
DRINKING WATER 	County Funding, Watershed-based Implementation Funding, NRCS Cost Share, MPCA, MDH, MDA
	County, Watershed-based Implementation Funding, MPCA, Clean Water Fund Grants
PROTECTION 	Sustainable Forest Incentives Act Payments, Watershed-based Implementation Funding, TNC, Lessard Sams, GLRI

Work Planning

This plan envisions collaborative implementation. Biennial work planning will be completed to align the priority issues addressed, the availability of funds, and the roles and responsibilities for implementation.

Local Work Plan

The Nemadji 1W1P Steering Committee will be responsible for completing a biennial work plan based on the targeted implementation schedule. Adjustments to the biennial work plan will be made through self-assessments. Then the biennial work plan will be presented to the Policy Committee, who is ultimately responsible for its approval. The purpose of these biennial work plans is to obtain BWSR watershed-based implementation funding, maintain collaborative progress towards completing the targeted implementation schedule and reaching the outcomes prescribed in the plan.

Funding Request

The Nemadji 1W1P Steering Committee will collaboratively develop, review, and submit a watershed-based funding request from this plan. This request will be submitted to and ultimately approved by the Policy Committee prior to submittal to BWSR. The watershed-based funding request will be developed based on the 2021-2022 priority projects outlined in the targeted implementation schedule and any adjustments made through self-assessments.

Assessment, Evaluation, and Reporting

Accomplishment Assessment

The Advisory Committee will provide the Policy Committee with an annual update on the progress of the plan's implementation. For example, any culverts replaced will be tracked so that each year the Advisory Committee will report how many additional stream miles were connected in the watershed. A tracking system will be used to measure progress and will serve as a platform for plan constituents and the public. Tracking these metrics will also make them available for supporting future work plan development, progress evaluation, and reporting.

Partnership Assessment

Biennially, the Advisory Committee will review the Nemadji 1W1P goals and progress toward implementation, including fulfillment of committee purposes and roles, efficiencies in service delivery, collaboration with other units of government, and success in securing funding. During this review process, feedback will be solicited from the boards, Policy Committee, Citizen Committee, and partners such as state agencies and non-governmental organizations. This feedback will be presented to the Policy Committee to set the coming biennium's priorities for achieving the plan's goals and to decide on the direction for grant submittals. Also, this feedback will be documented and incorporated into the five-year evaluation. The Nemadji 1W1P Steering Committee intends to pursue watershed-based funding to meet goals and plan implementation schedules.

Five-Year Evaluation

Beginning in 2021, this plan will be in effect for ten years. Over the course of the plan's life cycle, progress toward reaching goals and completing the implementation schedule may vary. New issues may emerge as the plan progresses, and/or new monitoring data, models, or research may become available. Therefore, in 2026-2027, a five-year evaluation will be undertaken, as per the BWSR Order approving it, to determine if the current course of actions is sufficient to reach the goals of the plan, or if a change in the course of actions is necessary. At the 10-year mark, and every five years after, the plan will be fully re-evaluated.

Reporting

LGUs have several annual reporting requirements. Some of these reporting requirements will remain a responsibility of the LGUs. Reporting related to grants and programs developed collaboratively and administered under this plan will be reported by the plan's fiscal agent (Table 11.1). In addition to annual reporting, the Nemadji 1W1P Steering Committee will also develop a biennial *State of the Watershed Report* to present to the Policy Committee. This report will document progress toward reaching goals and completing the targeted implementation schedule and will describe any new emerging issues of priorities. The information needed to biennially update the *State of the Watershed Report* will be developed through the annual evaluation process.

The fiscal agent is responsible for submitting all required reports and completing annual reporting requirements for the Nemadji 1W1P as required by state law and policy. The Advisory Committee will assist in developing the required reports and roles and responsibilities will be defined in the MOA Bylaws.

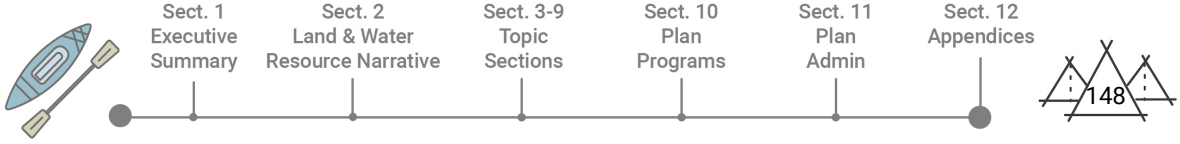
Plan Amendments

The Nemadji 1W1P is effective through 2031 per the BWSR Order approving it. Activities described in this plan are voluntary, not prescriptive, and are meant to allow flexibility in implementation. An amendment will not be required for addition, substitution, or deletion of any of the actions, initiatives, and projects if those changes will still produce outcomes that are consistent with achieving the plan goals. This provision for flexibility includes changes to the activities except for those of capital improvement projects.

During the time this plan is in effect, it is likely that new data giving a better understanding of watershed issues and solutions will be generated. Administrative authorities, state policies, and resource concerns may also change. New information, significant changes to the projects, programs, or funding in the plan, or the potential impact of emerging concerns and issues may require activities to be added to the plan. If revisions are required or requested, the Policy Committee will initiate a plan amendment process following their MOA Bylaws.

Formal Agreements

The Nemadji 1W1P Policy Committee is a coalition of Carlton County, Carlton SWCD, Pine County and Pine SWCD. The Policy Committee previously entered into a Memorandum of Agreement (MOA) for planning the One Watershed One Plan for the LWR Watershed (Appendix E). The entities will draft a MOA for purposes of implementing this plan. The Policy Committee is advisory to the individual county and SWCD boards under the umbrella of the MOA.



Section 12: Appendices

APPENDIX B. EXPLANATION OF ST. MARY'S TOOL

Nemadji River Watershed Habitat Assessment using LiDAR Data Tool Summary

An important tool used for the Nemadji 1W1P process was the *Nemadji River Watershed Habitat Assessment using LiDAR Data* produced by Saint Mary's University of Minnesota GeoSpatial Services. The Wisconsin Department of Natural Resources received a grant through the Environmental Protection Agency using Great Lakes Restoration Initiative Area of Concern noncompetitive funding to develop the tool. This tool identifies priority habitat restoration and protection sites for forests, wetlands and riparian areas in the Nemadji Watershed using many GIS datasets/analyses. A stakeholder group made up of resources professionals helped develop the tool priorities and stressors in the watershed. The Stakeholder group included:

Tom Bernthal (WDNR)
Karen Evens (MPCA)
Faith Fitzpatrick (USGS)
Mike Gardner (NorthFLow Inc.)
Cherie Hagen (WDNR)
Tom Hollenhorst (EPA)
John Jereczek (MDNR)
Lucinda Johnson (UMD)
Matt Steiger (WDNR)
Steve Kloiber (MDNR)
Ted Koehler (USFWS)
Ryan Magana (WDNR)
Brad Matlack (Carlton SWCD)
Christine Ostern (Douglas County)
Sue O'Halloran
Melissa Sjolund (MN DNR)
Michelle Wheeler (WDNR)

For the Nemadji 1W1P process, the main analyses used were the Forest Management Protection and Wetland Restoration tools. An additional analysis included the Wetland Functional Assessment which provided an important dataset for both tools. The Wetland Functional Assessment helps predict where wetlands are likely to perform a given set of wetlands functions, using methods from the National Wetlands Inventory (Cowardin classification) and a classification system developed by Tiner et al (1). In addition, a potentially restorable wetland dataset was created using the process used by Start and Robertson (2) which uses soils, soils wetness and ditch data.

Details of the data used to score Forest Protection and Wetland Restoration can be found in the following two tables. A higher score corresponds to a higher value for either forest protection or wetland restoration.

1. Tiner, R. W. 2011. Dichotomous keys and mapping codes for wetland landscape position, landform, water flow path, and waterbody type descriptors: Version 2.0. U.S. Fish and Wildlife Service, Hadley, Massachusetts.
2. Stark, K. J. and A. Robertson. 2013. A watershed framework for the assessment of wetland functions in the Lake Superior Basin portion of Douglas County, Wisconsin. Saint Mary's University of Minnesota, GeoSpatial Services, Winona, Minnesota.

Table 1. Management Protection Criteria

Parameter/Criteria	Datasets	Scoring	Weight
Erosive areas	Stream power Index & Land Cover Costal Change Analysis Program (C-CAP)	High Stream Power Index (top 25% for the watershed) = 5 All others = 0	1
Open lands (non-forested or recently harvested forests)	Community GIS Dataset LIDAR analysis	Open lands >60% = 4 Open lands 50-60% =5 Open lands 40-50% = 3 Open lands <40% =1	2
Peak discharge scaled by watershed size	Streamstats – Peak 2-year discharge rate	By percentile	2
Natural habitat in proximity to forest	C-CAP and Wetland Functional Assessment	<100 m to habitat = 5 >100 m to habitat = 1	1
Forested slopes	Land Cover Costal Change Analysis Program (C-CAP) & slope	Slope >27% = 5 Slope 15-26% = 3 Slope 8-15% = 2 Slop < 8% =1	2
Forested wetlands	Wetland Functional Assessment	Forested wetlands = 5 All others = 0	1
Presence of White Cedar	Geological Survey Gap Analysis Program & WiscLand 2 Landcover	White Cedar = 1 Others = 0	1
Proximity to public ownership	Public lands	<100 m to public land =5 >100m to public land = 0	1

Table 2. Wetland Management Restoration Criteria

Parameter/Criteria	Datasets	Scoring	Weight
Peak discharge scaled by watershed size	Streamstats	By percentile	2
High erosion potential	Stream Power Index	High Stream Power Index = 5 All others = 0	1
Proximity to natural habitat	C-CAP and Wetland Functional Assessment	<100 m to habitat = 5 >100 m to habitat = 1	1
Current storage capacity	Wetland Functional Assessment	<40% storage capacity = 5 40-50% = 4 50-60% = 3 >60% = 1	1
Lost storage capacity	Potentially restorable wetlands	Lost Capacity > 30% = 5 20-30% = 4 10-20% = 3 < 10% = 0	2
Proximity to wetlands with significant streamflow maintenance	Wetland Functional Assessment	< 100 feet = 5 100-200 feet = 3 > 200 feet = 0	1
Proximity to wetlands with significant sediment retention	Wetland Functional Assessment	As above	1
Proximity to wetlands with significant surface water retention	Wetland Functional Assessment	As above	1
Proximity to wetlands with significant shoreline stabilization	Wetland Functional Assessment	As above	1
Proximity to current wetlands	Wetland Functional Assessment	As above	1
Proximity to public ownership	Public lands	As above	1
Direct hydrologic connection to streams/rivers	24k Hrdro flow line	< 100 feet = 5 >100 feet = 0	1
Recently harvested hydro	Community GIS Dataset LIDAR analysis	Within = 5 All others = 0	1

APPENDIX C. PUBLIC SURVEY RESULTS

Nemadji Kickoff Bus Tour

In July 2019, a bus tour was held a kickoff the Nemadji One Watershed, One Plan Process. The goal was to highlight some of the watershed's valuable resources while also gathering public input for the plan. Several topics were highlighted including lakes, forests, streams, wetlands and farms. Along the way, tour goers completed a survey, helping to understand their priorities and concerns for each topic. At the end of the tour, participants sampled food grown in the watershed.

Left: The tour started at the Historic Scott House on the shores of Lac la Belle. Here, lake resources and concerns were discussed.

Below: The first stop on the tour was a family forest along the Nemadji River. Participants learned about the importance of forest management in protecting water quality and saw a recently completed young forest habitat project.

Top: A stop along a recently replaced culvert on Stony Brook helped explain the importance of stream connectivity for aquatic life and water quality.

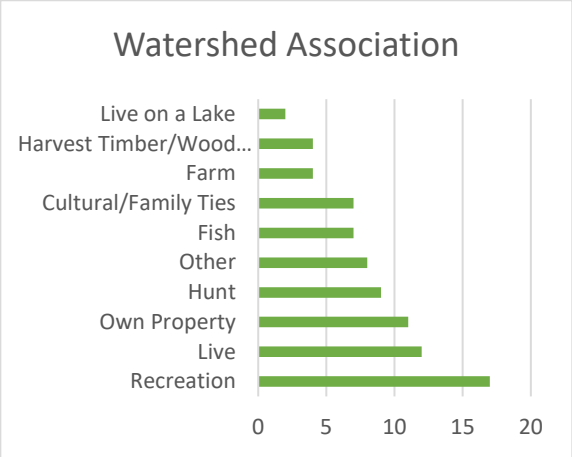
Middle: Bus stops along the way included a livestock exclusion project along Elim Creek, a planned stream restoration on Skunk Creek and a wetland site on Mud Creek.

Bottom: The last stop was at Northern Harvest where tour goers learned about what farmers are doing to protect and improve water quality.

All Photos: After the tour, participants enjoyed sampling food grown in the watershed. They were invited to view watershed maps and provide additional input on specific areas of concern or value.

Nemadji Watershed Kick Off Bus Tour Survey Results Summary

Who Attended?



Other Responses:

- I work in the watershed
- Carlton County Commissioner
- I live close to the watershed

Lakes

81% Agreed that Lakes are an important resource

The two largest barriers to protecting and restoring lake water quality are:

- Lakeshore owners are not aware of lake best management practices
- More cost assistance is needed to help land owners complete projects on their property

The two highest responses for what the ideal future of lake quality would look like are:

- Increased local knowledge of lake best management practices
- Lake transparency trends steady or improving (3-way tie)
- A higher percentage of natural shoreline on each lake
- Reduced number of failing septic systems

Forests

100% Agreed that forests are an important resource

The two highest barriers that prevent private forest owners from participating in forestry programs are:

- Land owners are unaware of forestry protection programs such as forest management plans, SFIA and 2C
- There is a lack of technical experts to help interested land owners get started

The two highest responses for the ideal future of forestry are:

- A diverse forest with different age and species of trees
- A higher percentage of actions implemented in forestry management programs

Fish

89% of people felt that trout habitat was an important resource.

The two highest barriers to protecting or improving fish habitat were:

- There is not enough funding for habitat and stream connectivity projects
- Flooding, rainfall changes and/or climate changes are impacting streams and fish habitat

The two highest responses for the ideal future of fish habitat are:

- More miles of streams connected
- Local increased knowledge of location and importance of trout streams

Wetlands	Farms
92% of people felt that wetlands are an important resource *The two highest barriers to protecting and restoring wetlands are:* • People do not understand the importance of wetlands in water quality • People think there are already enough wetlands or that wetlands are functioning as they should The two highest Reponses to what the ideal future of wetlands would look like include: • Wetlands are resorted/protected where they will most help slow the slow • Increased local knowledge of the value of wetlands	89% of people thought that farms and farm management was important *The two highest barriers to farmers participating in conservation activities are:* • Farmers are worried about regulations • Farmers are unaware of programs or resource concerns The two highest responses to the ideal future of farm management are: • Increased use of cover crops, no till or grazing management • Increased local knowledge of farm best management practices

What would you like the Nemadji Watershed to look like in 50 years?

Nemadji One Watershed, One Plan Kickoff Tour Survey Results

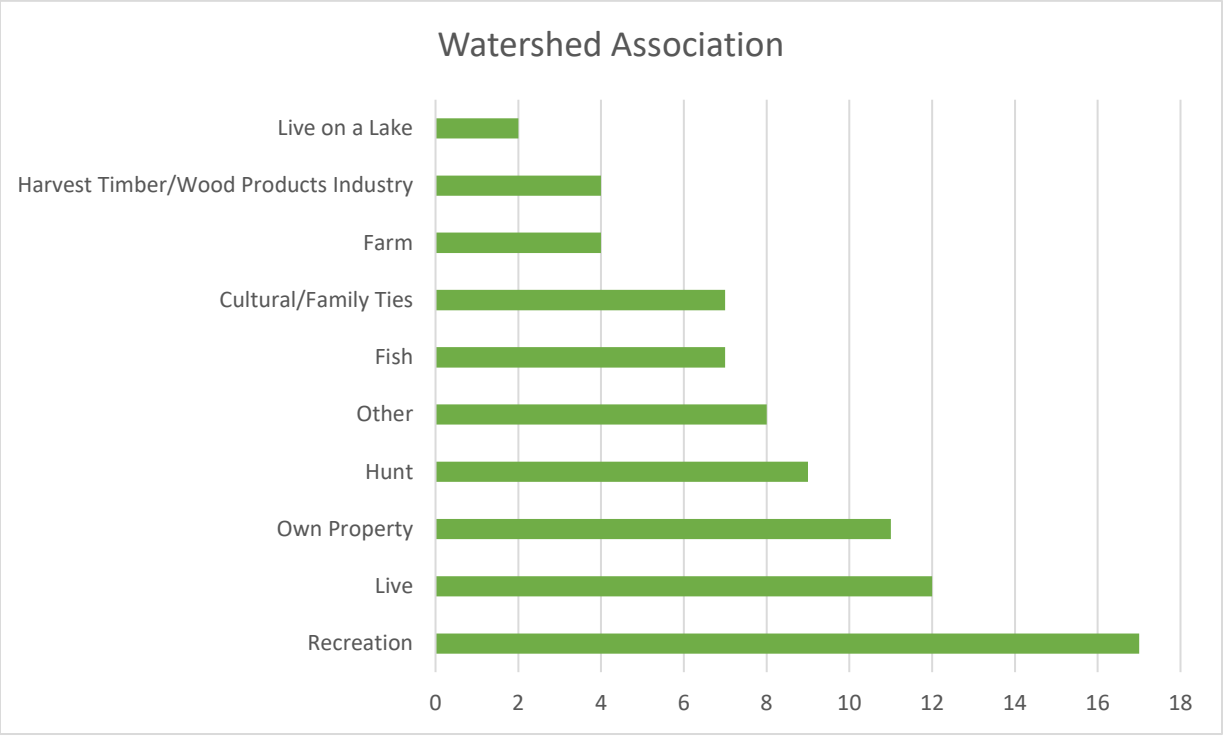
Tour Statistics

- Total Tour Participants: 52
- Total Registered: 63
- Total Cancelled: 5
- Total No Shows: 4
- Kids: 4
- Total Surveys: 37

** Some attendees with government agencies asked not to have their responses included. Some couples opted to take the survey together.

Results

1. How do you associate with the watershed?



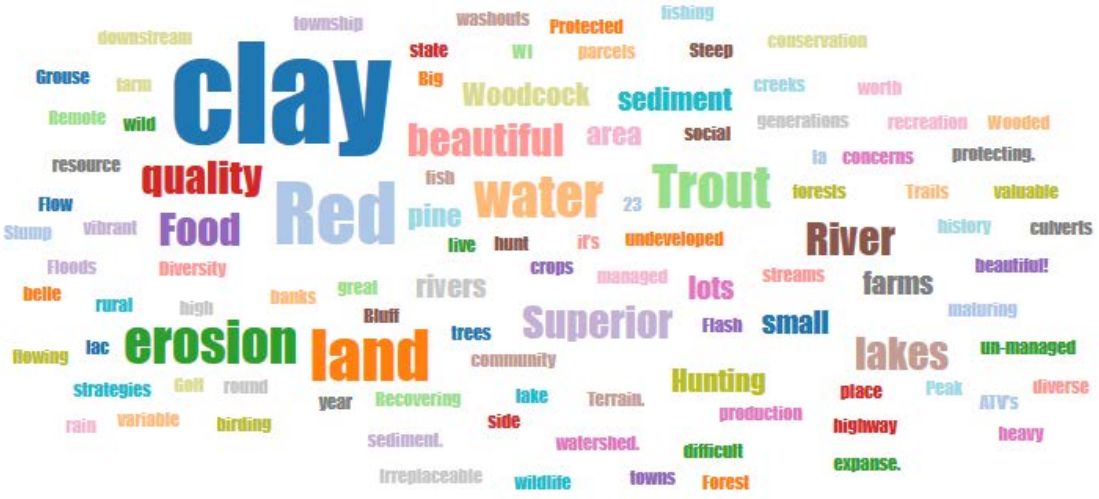
“Other” responses are displayed on the table below.

Response	Count
I work in the watershed	2
Carlton County Commissioner	1
I am working on the projects in the watershed, WRAPS for MPCA	1
I work in the St. Louis River watershed and I’m interested in Nemadji Ri ver water quality	1
I work on watershed planning on the WI side	1
Live close to the watershed	1

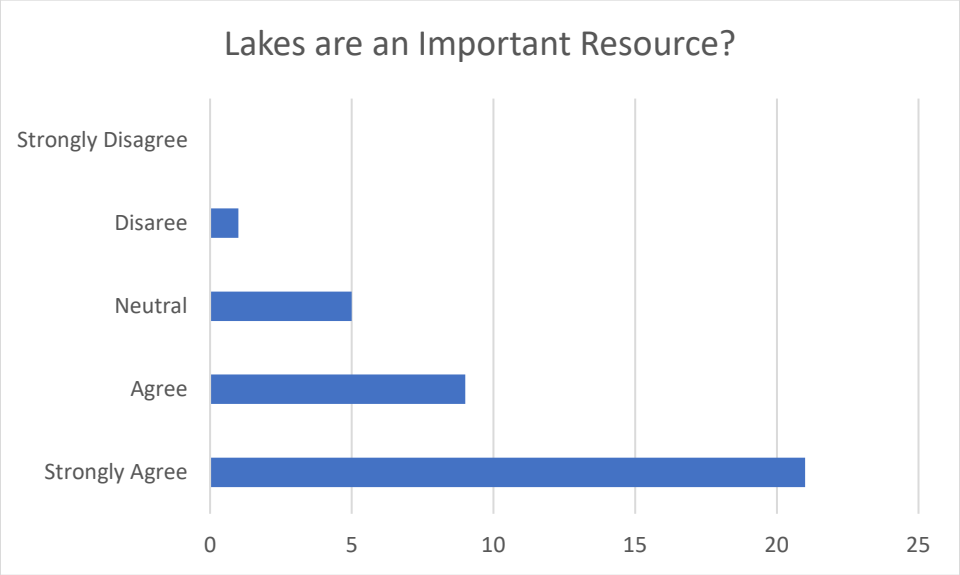
Answered: 36 Skipped: 1

2. Using just 4 or 5 words, when you think of the Nemadji, what comes to mind – Pre Tour

Word Cloud from Responses



3. Lakes are an important resource in the Nemadji Watershed



4. What are the barriers to protecting and restoring lake water quality?

Answers	Count	Percentage
Lakeshore owners are not aware of lake best management practices and how they effect water quality	22	59.46%
More cost assistance is needed to help land owners complete projec ts on their property	15	40.54%
There is a lack of technical experts to help land owners get started	9	24.32%
Other	9	24.32%
The greatest impacts to water quality are coming from the larger wat ershed, not the shoreline area	5	13.51%

Answered: 32 Skipped: 5

Other Responses are listed on the table below:

Response	Count
I'm not aware enough of the issues or barriers surrounding water quality and lakes in the area	1
Lack of will power to implement change with landowners.	1
More education to everyone in the watershed to protect it.	1
Over development in shoreline.	1
the impacts to the lakes are both the shoreline and watershed landuse	1

Answered: 32 Skipped: 5

5. What would your ideal future of lakes look like?

Answers	Count	Percentage
Increased local knowledge of lake best management practices	17	45.95%
Lake transparency trends steady or improving	13	35.14%
A higher percentage of natural shoreline on each lake	13	35.14%
Reduced numbers of failing septic systems	13	35.14%
No new lakes with Aquatic Invasive Species	10	27.03%
Other	5	13.51%
Maintaining what is here today	1	2.70%

Answered: 36 Skipped: 1

Other responses listed in the table below:

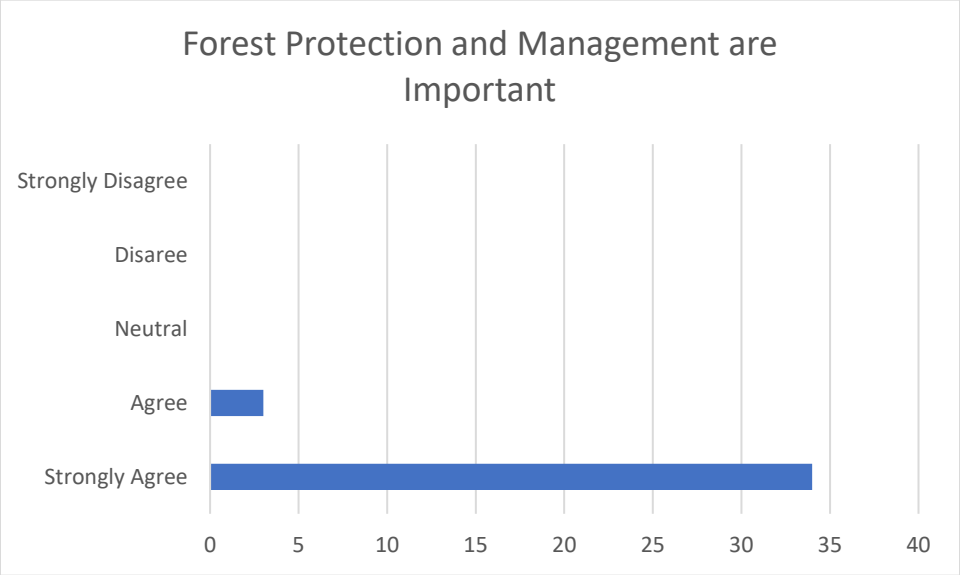
Response	Count
Increased knowledge of BMP and reduced failing septics	1
More BMPs and reduced failing septics	1
Reduce Subdivisions of lake and river property. AIS, more natural shoreline, increased knowledge of BMP, reduced failing septics	1

Answered: 36 Skipped: 1

6. In a sentence or two, what do you think could be done to protect or improve lake water quality?

- Aware if impacts of landowner decisions/actions
- Buffers 15 feet on all lakes (enforced), good wetland and culvert management
- Educate adjacent owners, buffer the inflow areas to the lakes
- Educate people who live and recreate on the water
- Educate! Educate! Educate!
- Education is probably biggest
- Education on lakeshore stewardship
- Helping lakeshore owners maintain healthy shoreline. Helping farmers understand how runoff affects lakes.
- Improve knowledge of the ecosystem
- Improve, increase watershed protections
- Limit travel between lakes by boaters
- Make sure septic systems are up to date
- More education provided to lakeshore owners
- More natural shorelines
- Septic system checks/updates, shoreline management committed activities, citizen monitoring on all lakes
- Septic system on regular checks
- Strong Lake Associations to educate landowners on and nearby lakes. More zoning rules to include large parcel sizes to minimize the number of people building new lakeshore homes. If there were zoning regulations around the lakeshores that wouldn't allow a landowner to build homes unless they owned a large amount, then the amount of homes around the lakes wouldn't keep increasing.
- Technical assistance to homeowners. Demo projects in visible places
- Don't dump fish bait, buffer zone near ag activity, fixing failing septics

7. Forest Protection and management is important to the Nemadji Watershed



8. What are the barriers that prevent private forest owners from participating in forestry programs?

Answers	Count	Percentage
Land owners are unaware of forestry protection programs such as for est management plans, SFIA or 2C?	27	72.97%
There is a lack of technical experts to help interested land owners ge t started	15	40.54%
Other	10	27.03%
People don't want to work with current agencies	8	21.62%
More funding is needed for cost share	7	18.92%

Answered: 36 Skipped: 1

Other Responses:

- Belief that timber harvest is bad
- Education on life expectancy of the forest
- Given the cost/benefit of jumping through all the hoops, it is not worth it. With modern technology it really should be easier to enter a program. I have my own ideas and really don't think a formal process is required for a probable exact same outcome.
- Many landowners are ignorant of why forests need to be managed.
- Negative perception of active forest management
- People aren't implementing BMPs
- People don't fully understand the positive effects of forestry
- People don't understand what a healthy forest landscape looks like

- Technical experts to help implement the plan after it is written, checking in with landowners who have plans.

9. What would your ideal future of forestry look like?

Answers	Count	Percentage
A diverse forest with different ages and species of trees	30	81.08%
A higher percentage of actions implemented in forestry managemen t plans	17	45.95%
More acres of forest protected with working land easements (such as SFIA, 2C)	9	24.32%
More private forest owners receiving forest management plans	7	18.92%
Other	6	16.22%
Maintaining what is here today	1	2.70%

Answered: 35 Skipped: 2

Other Responses:

Response	Count
healthy forest mosiac with key targets well understood - slow the flow - improve wetland protection - protect riparian areas	1
More forestry protection and more management plans	1
more protected forests, more management plans, more implemented plans	1
Voluntary changes, less large scale immediate result projects	1

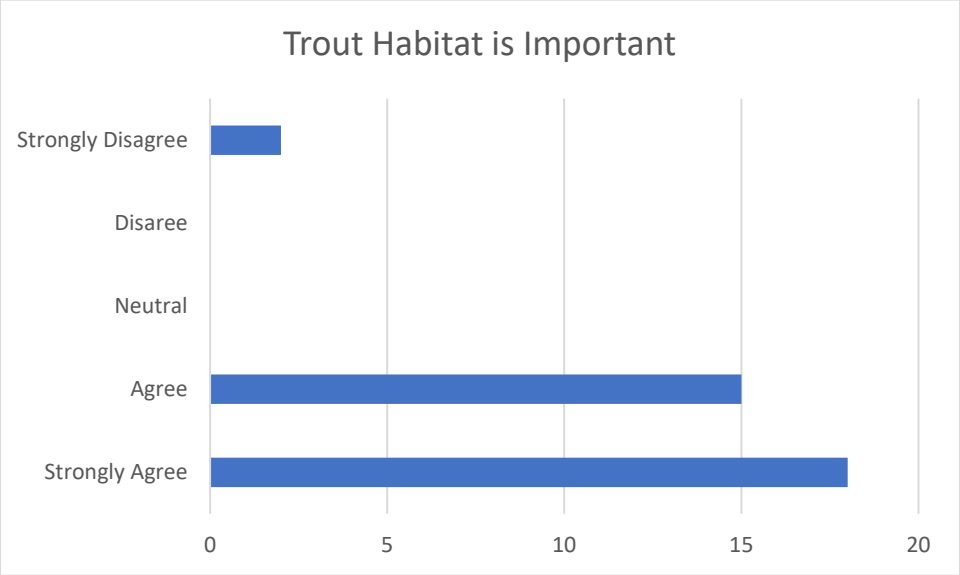
Answered: 35 Skipped: 2

10. In a sentence or two, what do you think could be done to improve or protect forests?

- tax relief provided to private owner's property in extremo for taking part in an in-service about forestry health and implementing a plan on their property.
- Continued active management in areas where it makes sense. Some areas should be intensively managed, other areas where ground may not be quite as good could receive less intense management, and other areas left alone (especially where ground for logging equipment might be a big challenge)
- continues forest outreach via tours.
- Convincing and helping private landowners to implement their stewardship plans.
- Education. Change the message based on audience.

- Get people to follow their management plans. Provide financial support
- Good forest management, multi-growth forest management
- Good program for private forest management
- Harvest more acres
- Have adjoining landowners work in concert to effectively manage large tracts. Educate and engage absentee landowners.
- helping landowners diversify forest land over time by helping them set up steps to implement actions in plans.
- Increase interaction with local wood industries.
- Make sure loggers are educated on the latest forest practices.
- Management for diversity. Discontinuing mono culture pine plantings
- More incentives to implement disturbance practices in forests. Reduce human population through access to contraception and reproductive choice. Human population increases are driving most environmental degradation and destruction. Like the Pope said, we can't keep breeding like rabbits. In two words: Carrying capacity.
- More white pine
- Push for biodiversity
- Reduce quaking aspen numbers
- Strategic timber harvest.
- The biggest detriment to forestland in my experience was the property tax classification changed private forest lands in to Rural Vacant in 2008 when property taxes doubled. I saw clear cutting and selling of lands to recreational landowners after that tax increase. Most people don't see the forest for the trees & really don't think about the long term process. I didn't think about it at first, I just accepted my property was a primarily a crappy aspen woodland b/c that was the product of interest by the former owners and a policy encouraged by the state for that industry. Now I see it differently. Guidelines for forest rehab would be helpful. Using existing research, monitoring the percent of timber harvest in the sub watersheds should be tracked to avoid over harvest. I understand that only recommendations could be given to landowners. I also would love to see the near inaccessible ravine like river slopes be left to return to an old growth style of forest - bigfoot needs a home.
- Try to educate land owners on options available
- Work with country foresters to manage land for more than a cash crop. Find additional funding sources for counties.
- Zoning regulations to prevent too much development
- need to plan for the next 50-100 years Now. Diversity foremost. Don't know what pests/stressors will be on out future forests

11. Trout habitat protection and restoration is important to the Nemadji watershed



12. What are the barriers to improving/protecting fish habitat in the Nemadji Watershed?

Answers	Count	Percentage
There is not enough funding for habitat improvement and stream connectivity projects	19	51.35%
Flooding, rainfall changes and/or climate changes are impacting streams and fish habitat	19	51.35%
People don't know about the value of trout and other fish species	13	35.14%
Local road and trail managers don't know how to size/place culverts properly	11	29.73%
Stream corridors are not protected	5	13.51%
Other	3	8.11%

Answered: 35 Skipped: 2

Other Responses:

Response	Count
Climate change	1
Limited finding for projects.	1
money	1

Answered: 35 Skipped: 2

13. What would your ideal future of fish habitat look like?

Answers	Count	Percentage
More miles of stream connected	22	59.46%
Local increased knowledge of location and importance of trout streams	22	59.46%
More streams protected through easements	12	32.43%
More trout in high priority streams	7	18.92%
Other	4	10.81%
Maintaining what is here today	3	8.11%

Answered: 35 Skipped: 2

Other Responses:

Response	Count
6	1
nice trout friendly road crossings (culverts)	1
Voluntary landowner involvement	1

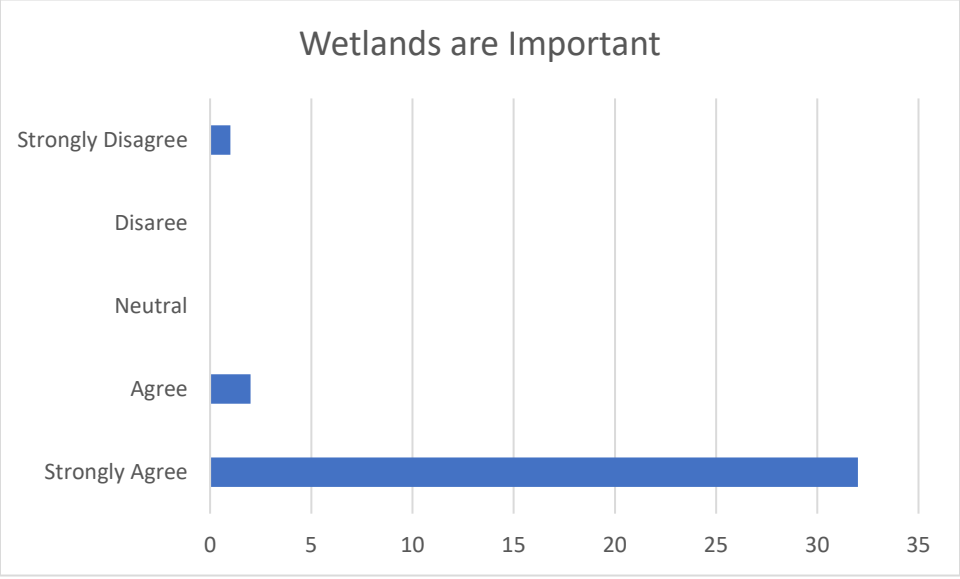
Answered: 35 Skipped: 2

14. In a sentence or two, what do you think could be done to improve or protect fish habitat?

- Attention to roadside waterways
- Continued connectivity/culvert work
- Create education events and petitions
- Culvert and road management as a county priority
- Culvert improvements, Riparian corridors protected

- Culvert management
- Forest management along streams. Continued culvert work
- Good culvert/fish management along with good forestry management
- Improving stream habitat and reduce streambank erosion
- Installing the correct sized culvert
- Interact with more angler organizations to gain more exposure for local streams
- Keep connecting streams by installing correctly and properly sized culverts. Good job on culverts so far! I also think helping slow the flow of water will protect fish habitat.
- Keep replacing culverts to proper size
- More involvement by fish groups
- Prioritize protection and maintenance of streams with groundwater inputs to help with climate resilience.
- Proper sizing of culverts
- Protect the stream banks from 4-wheeler traffic in and near the stream
- Reduce pollution from chemicals, sediments and thermal sources. Quit burning fossil fuels or we will lose all our cold water fisheries to climate disruption
- Riparian protection
- Stream easements
- The two things above (connectivity & trout friendly road culverts) plus buffers around streams to keep temperatures cool. Buffers are beautiful! Headwater protection allow more leaky beaver dams where possible. Wetland mitigation – nothing about that was covered.
- Work on zoning set back rules. Manage and maintain forests to preserve water quality.
- I'm not a fisherman, but good trout streams means good water quality, healthy food web.

15. Wetlands are important to the Nemadji Watershed



16. What are the barriers to protecting and restoring wetlands?

Answers	Count	Percentage
People do not understand the importance of wetlands in water quality	27	72.97%
People think there are already enough wetlands or that wetlands are functioning as they should	26	70.27%
More funding is needed to restore/protect wetlands	8	21.62%
More research is needed to understand the effectiveness of wetland restoration	5	13.51%
Other	4	10.81%

Answered: 35 Skipped: 2

Other Responses:

Response	Count
Also, people want to trap beaver and remove them when I think beaver can have a positive impact on water quality.	1
does tax policy drives negative views of wetlands?	1
We need an enforced no net loss of wetlands law and laws to restore wetlands for wildlife, aquifer recharge, recreation.	1

Answered: 35 Skipped: 2

17. What would your ideal future of wetlands look like?

Answers	Count	Percentage
Wetlands are restored/protected where they will most help slow the f low	24	64.86%
Increased local knowledge of the value of wetlands	21	56.76%
Wetlands are restored/protected where they will most protect infastr ucture	12	32.43%
Wetlands are restored/protected where they will best buffer streams during low flow periods	11	29.73%
Other	3	8.11%
Maintaining what is here today	2	5.41%

Answered: 35 Skipped: 2

Other Responses:

Response	Count
Voluntary landowner involvement	1
We need to be able to manage what we have, then build to restore ot hers	1

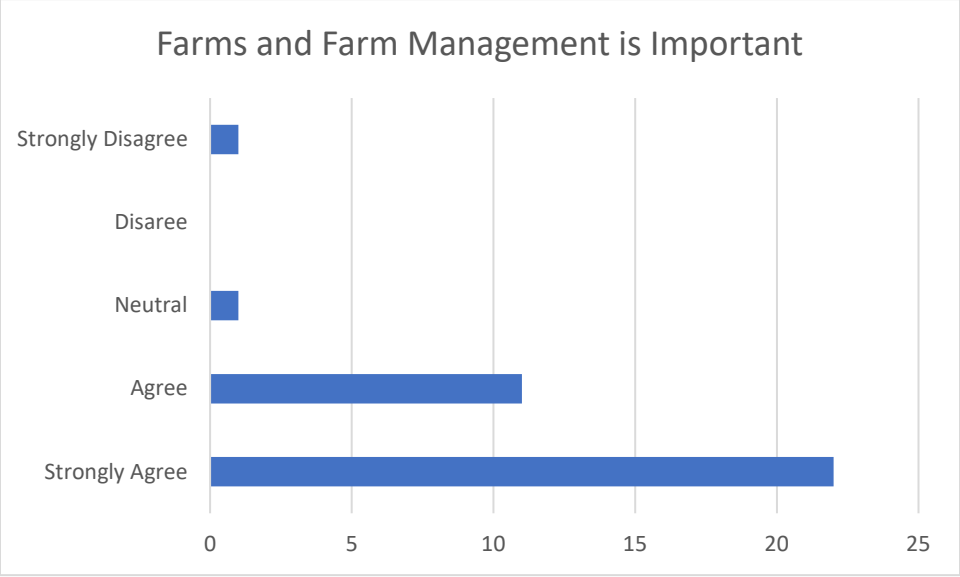
Answered: 35 Skipped: 2

18. In a sentence or two, what do you think could be done to improve or protect wetlands?

- A better understanding of the value of beaver
- Again the best is education
- As with all these, education is key. Understanding the value of wetlands makes the public more likely to support
- Awareness
- Beavers
- Better understanding of existing wetlands laws
- By restoring their functionality through practices used by the Beavers. Also, holding firm on building near and on wetlands.
- Educate people on wetland impacts
- Educating the public of the importance of our wet lands.
- Education on the importance of wetlands and also how beaver can play a positive role in maintaining wetlands.
- Enforced no net loss of wetlands and law to restore 50 percent of wetlands lost.

- evaluate whether ditching along roads drain some wetlands unnecessarily rather than just keeping the road high & dry? tax relief for ecological services of both wetlands and forest cover along streams
- I'm not very knowledgeable about wetlands management
- Increase knowledge of the importance of wetlands.
- Increase the number of wetlands
- Tours of wetland. Help people understand the biodiversity in wetlands, and impact on slowing flow to protect water quality and infrastructure. Financial value of wetlands and storage volume. How many rain barrels = x acres of wetland. O provide visuals data in a context that makes it understandable.
- Understand/map wetland function to prioritize wetland restoration.
- Wetland management, good culvert management and local and county follow-up
- Wetlands are critical water filters and are ecosystem with beautiful plants and animals that need to be appreciated.

19. Farms and farm management are important to the Nemadji watershed



20. What are the barriers to farmers participating in conservation activities?

Answers	Count	Percentage
Farmers are worried about regulations	19	51.35%
Farmers are unaware of programs or resource concerns	17	45.95%
There is too much paperwork/too many hoops to jump through to e nroll in conservation programs	13	35.14%
Other	9	24.32%
There is not enough cost share	5	13.51%
Timelines/Deadlines are too strict	4	10.81%

Answered: 34 Skipped: 3

Other Responses:

- dad did it that way
- farm policy is still catching up with sustainability and "down stream" damages of traditional agribusiness.
- I am unaware of what barriers farmers might face.
- Market incentives. follow dollars
- Not knowledgeable about this subject

21. What would your ideal future of farm management look like?

Answers	Count	Percentage
Increased use of cover crops, no till or grazing management	21	56.76%
Increased local knowledge of farm best management practices	19	51.35%
Reduced livestock access to lakes and streams	18	48.65%
Increased feedlot and/or nutrient management	12	32.43%
Other	2	5.41%
Maintaining what is here today	1	2.70%

Answered: 34 Skipped: 3

Other responses:

Response	Count
integrated grazing with temporary wetlands or dry season wetland grazing practices (flash grazing)	1

Answered: 34 Skipped: 3

22. In a couple of sentences, are there things that could be done to improve or protect water quality?

- Awareness, outreach
- buffers culverts
- Community awareness
- Conservation tillage, water flow management, nutrient management.
- Erosion control and nutrient run off control
- Funding? More outreach and peer to peer education or training.
- Help farmers reduce polluted runoff; increase stream buffers with payments to landowners for losses; restore more wetlands.
- I think streambank stabilization and slowing down the flow will help with sediment erosion. Sounds like the upcoming projects are going to be great. Hopefully we can do more of them.
- in regard to large farms that receive winter biosolids applications in the winter, I would like to see wide shallow swales/berms around the fields to contain the run off that the MPCA claims does not occur. These would be designed as part of the field, navigable by farm equipment. Or require injected application rather than surface application.
- Incentivize improved farmer practices
- Increase awareness and provide incentive to preserve wetlands.
- Keep cattle away from lakes and streams
- Limiting animals / livestock access to water on farmland, and using conservation tillage
- More cover crops in the none growing season.
- More participation in conservation programs.
- Riparian area management and plantings that consider slope and runoff
- We need to increase money for farmers to start sustainable agriculture specifically crops/farms that will grow our tax base, populate out schools, feed our community

23. Considering the current rate of land use change in the watershed, what do you think the Nemadji will look like in 50 years?

24. What would you like the watershed to look like in 50 years?

25. Using just 4 or 5 words, when you think of the Nemadji, what comes to mind – Post Tour

26. Are there any topics/resources that we didn't cover during the tour?

- A stop to get out and view streambank stabilization projects.
- controlled burning
- How sediment erosion into Lake Superior is leading to algae blooms on the south shore, something that's a new phenomenon and a bit alarming.
- More emphasis on terrestrial wildlife. Good job Mel and Will !
- More forestry stops and alternate management styles would have been nice.
- Nothing was mentioned about current wetland mitigation rules forestry practices have depleted soils as much as the hay cutting example at the organic farm example - humans, always taking (I noticed mesh laid down around the culverts & unless it is biodegradable, it is a known turtle trap & I thought conservationists had passed this along)
- Tax issues for private land owners in addition to SFIA and 2C. How do tax dollars spent on "restoration" impact the national debt.
- You were fantastic. Thank you!

APPENDIX D. ORDINANCES AND STANDARDS

General Ordinance Standards	Carlton County	Pine County	Comments
County Wide Zoning Ordinance	Yes	Partially	Pine: Optional for townships to have their own ordinances: Kerrick (Township Zoning) Nickerson (County Zoning), New Dosey: (County Zoning) Carlton County: All Nemadji Townships follow County Zoning
Department of Natural Resources Approved Shoreland Ordinance	Yes	Yes	Carlton: Red Clay Overlay *
Subsurface Septic Treatment Systems Point of Sale – County Wide	No	Yes	Carlton – Point of sale inspections only required in shoreland (1000 feet from a lake, 300 feet from a river or stream)
Subsurface Septic Treatment Systems – Holding Tanks	Yes	Yes	Pine-allowed for seasonal dwellings Carlton- where Type I Subsurface Septic Treatment Systems cannot be feasibly installed
Subdivision Ordinance	Yes	Yes	
Wetland Conservation Act	Yes	Yes	Both Follow MN Rules 8420
Permit Compliance Checks	Yes	Yes	Pine: Every permit has a pre, post and spot check Carlton: Site visit at time of issuing permit and post-construction required
Shoreline Standards			
Grading & Filling - (Shoreland)	Yes	No	Carlton: Zoning Permit required for grading & filling activities within 300 feet of a lake, river, or stream if the activity exceeds certain limits. The most limited being 5 to 10 cubic yards within a bluff or steep slope.
Grading & Filling - Interim Use Permit (IUP) - Red Clay Overlay*	Yes	No	Carlton: Interim Use Permit for more than 10 cubic yards in red clay overlay*
Fences	Yes	No	Carlton: Privacy fence requires a permit and must meet setback from Ordinary High Water Level. Other fence types do not need a permit but must meet setback from Ordinary High Water Level.

General Ordinance Standards	Carlton County	Pine County	Comments
Meets Minimum Ordinary High Water Level Setbacks	Yes	Yes	Carlton: Shoreland mitigation Plans are a required condition when requesting a variance from the set back from the Ordinary High Water Level of a classified lake or stream. Pine: Minimum Standards in MN Rules 6120 are followed
Meets Minimum Lot Size Requirements	Yes	Yes	
Meets Minimum Subsurface Septic Treatment Systems Ordinary High Water Level Setbacks	Yes	Yes	
Patios in Setback Area Permit	Yes	Yes	Carlton: Size restriction in shoreline zone; one water oriented accessory structure per shoreline lot
Retaining Walls Allowed	Yes	No	Carlton- Not allowed in the shore impact zone
Riprap-Permits	Yes	Yes	Grading and fill rules above Ordinary High Water Level
Stormwater	Yes	Yes	
Vegetation Removal - Bluff/Steep Slopes	Yes	Yes	Carlton: Red Clay overlay*
Vegetation Removal	Yes	Yes	Carlton: Defined size of clearing standards- within building setback area
Walkway/Access Path	Yes	No	
Watercraft Access Ramps	Yes	Yes	

*Red clay overlay: The red clay areas are those that correspond with the Ontonagon Silty Clay, Campia-Ontonagon Complex, Bergland Clay, Campia Silt Loam, and Udorthents soil types found within the County as shown on the Carlton County Soil Survey. The Red Clay Overlay District is intended to establish additional requirements that reflect the unstable and highly erodible soil characteristics of several clayey soil associations within the Nemadji and St. Louis River basins.

APPENDIX E. MEMORANDUM OF AGREEMENT

NEMADJI WATERSHED
MEMORANDUM OF AGREEMENT

This AGREEMENT is made and entered into by and between the following PARTIES:

> The Minnesota Counties of Carlton and Pine, by and through their respective County Board of Commissioners, and the Carlton and Pine Soil and Water Conservation Districts, by and through their respective Soil and Water Conservation District Board of Supervisors, collectively referred to as the "Parties";

WHEREAS, the Counties of this Agreement are political subdivisions of the State of Minnesota, with authority to carry out environmental programs and land use controls, pursuant to Minnesota Statutes Chapter 375 and as otherwise provided by law; and

WHEREAS, the Soil and Water Conservation Districts (SWCDs) of this Agreement are political subdivisions of the State of Minnesota, with statutory authority to carry out erosion control and other soil and water conservation programs, pursuant to Minnesota Statutes Chapter 103C and as otherwise provided by law; and

WHEREAS, the parties to this Agreement have a common interest and statutory authority to prepare, adopt, and assure implementation of a comprehensive watershed management plan in the Nemadji Watershed (Attachment A-map) to conserve soil and water resources through the implementation of practices, programs, and regulatory controls that effectively control or prevent erosion, sedimentation, siltation and related pollution in order to preserve natural resources, ensure continued soil productivity, protect water quality, reduce damages caused by floods, preserve wildlife, protect the tax base, and protect public lands and waters; and

WHEREAS, with matters that relate to coordination of water management authorities pursuant to Minnesota Statutes Chapters 103B, 103C, and 103D with public drainage systems pursuant to Minnesota Statutes Chapter 103E, this Agreement does not change the rights or obligations of the public drainage system authorities.

WHEREAS, the Parties have formed this Agreement for the specific goal of developing a plan pursuant to Minnesota Statutes § 103B.801, Comprehensive Watershed Management Planning, also known as *One Watershed, One Plan*.

NOW, THEREFORE, the Parties hereto agree as follows:

1. **Purpose:** The Parties to this Agreement recognize the importance of partnerships to plan and implement protection and restoration efforts for the Nemadji River Watershed (see Attached A-map). The purpose of this Agreement is to collectively develop and adopt, as local government units, a coordinated watershed management plan for implementation per the provisions of the Plan. Parties signing this agreement will be collectively referred to as the Nemadji Watershed One Watershed One Plan Policy Committee.
2. **Term:** This Agreement is effective upon signature of all Parties in consideration of the Board of Water and Soil Resources (BWSR) Operating Procedures for One Watershed, One Plan; and will remain in effect until adoption of the Plan by all parties OR the end date of the Board of Water and Soil Resources Grant Agreement, unless canceled according to the provisions of this Agreement or earlier terminated by law.

3. **Adding Additional Parties:** A qualifying party desiring to become a member of this Agreement shall indicate its intent by adoption of a board resolution prior to *December 31st, 2018*. The party agrees to abide by the terms and conditions of the Agreement; including but not limited to the bylaws, policies and procedures adopted by the Policy Committee.
4. **Withdrawal of Parties:** A party desiring to leave the membership of this Agreement shall indicate its intent in writing to the Policy Committee in the form of an official board resolution. Notice must be made at least 30 days in advance of leaving the Agreement.
5. **General Provisions**:
    a. **Compliance with Laws/Standards:** The Parties agree to abide by all federal, state, and local laws; statutes, ordinances, rules and regulations now in effect or hereafter adopted pertaining to this Agreement or to the facilities, programs, and staff for which the Agreement is responsible.
    b. **Indemnification:** Each party to this Agreement shall be liable for the acts of its officers, employees or agents and the results thereof to the extent authorized or limited by law and shall not be responsible for the acts of any other party, its officers, employees or agents. The provisions of the Municipal Tort Claims Act, Minnesota Statute Chapter 466 and other applicable laws govern liability of the Parties. To the full extent permitted by law, actions by the Parties, their respective officers, employees, and agents pursuant to this Agreement are intended to be and shall be construed as a "cooperative activity." For the purpose of liability, as set forth in Minnesota Statutes § 471.59, subd. 1a(a). It is the intent of the Parties that they be considered a "single government unit;" that the total liability for the participating governmental units and the joint board, if established, shall not exceed the limits on governmental liability for a "single governmental unit;" and that this Agreement does not create any liability or exposure of one party for the acts or omissions of any other party.
    c. **Records Retention and Data Practices:** The Parties agree that records created pursuant to the terms of this Agreement will be retained in a manner that meets their respective entity's records retention schedules that have been reviewed and approved by the State in accordance with Minnesota Statutes § 138.17. The Parties further agree that records prepared or maintained in furtherance of the agreement shall be subject to the Minnesota Government Data Practices Act. At the time this agreement expires, all records will be turned over to the Carlton County Soil and Water Conservation District and/or the County of Carlton for continued retention.
    d. **Timeliness:** The Parties agree to perform obligations under this Agreement in a timely manner and keep each other informed about any delays that may occur.
    e. **Extension:** The Parties may extend the termination date of this Agreement upon agreement by all Parties.
6. **Administration:**
    a. **Establishment of Committees for Development of the Plan.** The Parties agree to designate one representative and one or more alternate(s), who must be an elected member of the governing board, to a Policy Committee for development of the watershed-based plan. Parties also may appoint of one or more technical representative(s) to an Advisory Committee for development of the Plan in consideration of the Board of Water and Soil Resources Operating procedures for *One Watershed, One Plan*.

i. The Policy Committee will meet as needed to decide on the content of the plan, serve as a liaison to their respective boards, and act on behalf of their Board. Each representative shall have one (1) vote.

ii. Each governing board may choose one or more alternate(s) to serve on the Policy Committee as needed in the absence of the designated member.

iii. The Policy Committee will establish bylaws within 6-months of the date of the Board of Water and Soil Resources, One Watershed, One Plan Planning Grant Agreement to describe the functions and operations of the committee(s).

iv. The Advisory Committee will meet as needed to assist and provide technical support and make recommendations to the Policy Committee on the development and content of the plan. Members of the Advisory Committee may not be a current board member of any of the Parties.

b. Submittal of the Plan. The Policy Committee will recommend the plan to the Parties of this Agreement. The Policy Committee will be responsible for initiating a formal review process for the watershed-based plan conforming to Minnesota Statutes Chapters 103B and 103D, including public hearings. Upon completion of local review and comment, and approval of the plan for submittal by each party, the Policy Committee will submit the watershed-based plan jointly to Board of Water and Soil Resources for review and approval.

c. Adoption of the Plan. The Parties agree to adopt and begin implementation of the plan within 120 days of receiving notice of state approval, and provide notice of plan adoption pursuant to Minnesota Statutes Chapters 103B and 103D.

7. **Fiscal Agent**: Carlton County Soil and Water Conservation District will act as the fiscal agent for the purposes of this Agreement and agrees to:
   - **a.** Accept all responsibilities associated with the implementation of the Board of Water and Soil Resources grant agreement for developing a watershed-based plan.
   - **b.** Perform financial transactions as part of grant agreement and contract implementation.
   - **c.** Annually provide a full and complete audit report.
   - **d.** Provide the Policy Committee with the records necessary to describe the financial condition of the Board of Water and Soil Resources agreement.
   - **e.** Retain fiscal records consistent with the agent's records retention schedule until termination of the agreement (at that time, records will be turned over to the Carlton County Soil and Water Conservation District).
8. **Grant Administration**: The Carlton County Soil and Water Conservation District will act as the grant administrator for the purposes of this Agreement and agrees to provide the following services:
   - **a.** Accept all day-to-day responsibilities associated with the implementation of the Board of Water and Soil Resource grant agreement for developing a watershed-based plan, including being the primary Board of Water and Soil Resources contact for the *One Watershed, One Plan* Grant Agreement and being responsible for Board of Water and Soil Resources reporting requirements associated with the grant agreement.
   - **b.** Provide the Policy Committee with the records necessary to describe the planning condition of the BWSR grant agreement.
9. **Secretary:** Carlton County Soil and Water Conservation District will act as the secretary for the purposes of this Agreement and agrees to provide the following services to the Parties:

a. Assist with data compilation, meeting facilitations, and plan writing.
b. Coordination and facilitation of Policy Committee meetings, including establishing date, location, time, and any necessary accommodations such as refreshments.
c. Coordination and facilitation of Advisory Committee meetings including establishing date, location, time, space, technology needs, and any necessary accommodations such as refreshments.

10. **Multiple Counterparts:** The Parties may sign multiple counterparts of this Agreement. Each signed counterpart shall be deemed an original, but all of them together represent the same Agreement.

11. **Authorized Representatives:** The following persons will be the primary contacts for all matters concerning this Agreement:

Carlton Soil & Water Conservation District
Melanie Bomier or successor as assigned by the District Manager
Water Quality Technician
803 3rd St, Carlton, MN 55718
Melanie.Bomier@carltonswcd.org
218-384-3891 Ex. 4#

Carlton Soil & Water Conservation District
_____
Board Member
803 3rd St, Carlton, MN 55718
_____
218-384-3891 ext 4#

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **Carlton Soil & Water Conservation District**

APPROVED:

BY: _____

Board Chair Date

BY: _____

District Manager/Administrator Date

PARTNER: **Carlton County**

APPROVED:

BY: Barbara Dahl 2/11/19

Board Chair Date

BY: 2/11/19

District Manager/Administrator Date

IN TESTIMONY WHEREOF the Parties have duly executed this agreement by their duly authorized officers.

PARTNER: **Carlton Soil & Water Conservation District**

APPROVED:

BY: _____

Board Chair Date

BY: _____

District Manager/Administrator Date

PARTNER: **Carlton County**

APPROVED:

BY: _____ 1/8/2019

Board Chair Date

BY: _____ 1-8-19

~~District Manager/Administrator~~ Date

County Auditor

PARTNER: **Pine Soil & Water Conservation District**

APPROVED:

BY: _____

Board Chair Date

BY: _____

District Manager/Administrator Date

PARTNER: **Pine County**

APPROVED:

BY: _____ 11/20/18

Board Chair Date

BY: _____ 11/20/18

Administrator Date

PARTNER: **Pine Soil & Water Conservation District**

APPROVED:

BY: _____
Board Chair Date

BY: Jim Carlier 12/6/18
District Manager/Administrator Date

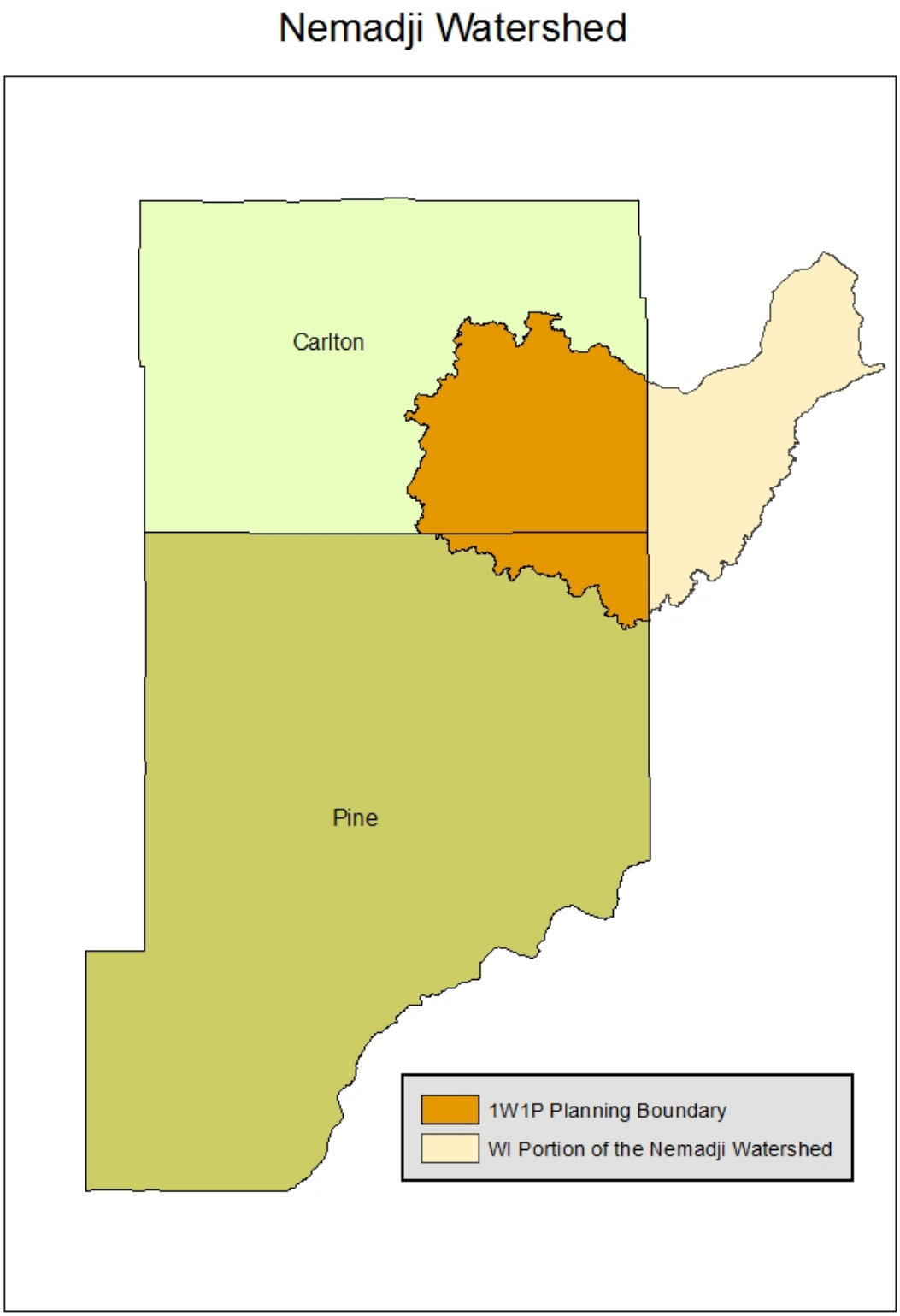
PARTNER: **Pine County**

APPROVED:

BY: _____
Board Chair Date

BY: _____
Administrator Date

Attachment A



APPENDIX F. GLOSSARY

HSPF (Hydrological Simulation Program – FORTRAN): A model for simulation of watershed hydrology and water quality for pollutants. This model was run for the Nemadji River Watershed during the 2017 Watershed Restoration and Protection Strategy (WRAPS).

Impairment: Waterbodies are listed as impaired if they do not meet the state water quality standard for designated uses including aquatic life, aquatic recreation, and aquatic consumption.

Index of Biological Integrity (IBI): A way of measuring the biological community (fish and aquatic macroinvertebrates) in the water body. The index is a scale of 0 to 100 with 0 being the lowest quality and 100 being the highest quality.

Mud Volcano: Also known as sediment volcanoes, these features are caused by groundwater upwelling from springs that pick up fine clay sediments as the water moves to the stream surface. They were likely caused when dynamite was used to destroy a nearby beaver dam (Mossberger, 2010).

Phosphorus Sensitivity: The lake's sensitivity to phosphorus as determined by the DNR. Sensitivity means that added phosphorus would affect the clarity in these lakes the most (Radomski 2018).

Protected: Protected land uses include public lands, public waters, wetlands on private lands, easements, other conservation lands, Sustainable Forest Incentive Act (SFIA).

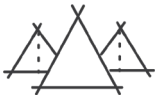
Red Clay Dam: Earthen dams built as part of the 1970s Red Clay project designed to reduce peak flows and/or to collect stream sediments. The structures have passed their designed lifespan and are now failing or have failed, see Appendix I.

Secchi Depth: a measure of water clarity that can indicate the overall health of a lake. A black and white metal disc is lowered into the water on a rope until it can't be seen anymore and raised to the point it can be seen. The depth of the disk to the surface of the water is the Secchi Depth.

St. Mary's Tool: the *Nemadji River Watershed Habitat Assessment using LiDAR Data* produced by Saint Mary's University of Minnesota GeoSpatial Services for the Wisconsin Department of Natural Resources. For detailed information, see Appendix B of this plan.

Trend Analysis (Mann Kendall statistic): a way to test the probability of a trend in data being real versus just happening by chance.

TMDL (Total Maximum Daily Load): the amount of a particular pollutant that a body of water can handle without violating state water quality standards.



TSI: Trophic State Index is a measurement of overall lake productivity (nutrient enrichment). It is a scale from 0 to 100 with 0 being the lowest productivity and 100 being the highest productivity.

Watershed: A land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean.

WRAPS (Watershed Restoration and Protection Strategy): A watershed approach to restoring and protecting Minnesota's rivers, lakes, and wetlands implemented by the Minnesota Pollution Control Agency on a 10-year cycle. https://www.pca.state.mn.us/water/watershed-approach-restoring-and-protecting-water-quality

APPENDIX G. REFERENCES

Carlton County Water Plan. 2010-2020, updated 2014

Pine County Water Plan. 2015 - 2020

Watershed Restoration and Protection Strategy. 2017. Minnesota Pollution Control Agency

Erosion and Sedimentation in the Nemadji River Basin. Natural Resource Conservation Service & United States Forest Service.

USDA - NRCS Rapid Watershed Assessment Beartrap-Nemadji

Impacts of land use conversion on bankfull discharge and mass wasting (Riedel, Verry & Brooks, 2005)

Land Use Impacts on Stream Channel Processes in the Nemadji Watershed (Mark Reidel 1998)

Northeast Landscape Forestry Plan. Minnesota Forest Resources Council. 2014

Exploring the relationship between wetlands and flood hazards in the Lake Superior Basin. Wisconsin Wetlands Association. 2018

Section 404 of the Clean Water Act. United States Environmental Protection Agency.

Nemadji River Watershed Habitat Assessment Using LiDAR. Saint Mary's University of Minnesota GeoSpatial Services. 2018

Dichotomous keys and mapping codes for wetland landscape position, landform, water flow path, and waterbody type descriptors: Version 2.0. U.S. Fish and Wildlife Service. (Tiner, 2011)

A watershed framework for the assessment of the wetland functions in the Lake Superior Basin portion of Douglas Cunty, Wisconsin. Saint Mary's University of Minnesota GeoSpatial Services. 2013

Current and Historic Sediment Loading in the Nemadji River Basin (Wisconsin DNR and Tetra Tech)

Potential for Slumps, Sediment Volcanoes, and Excess Turbidity in the Nemadji River Basin. University of Minnesota Thesis (Mossberger 2010)

Predicting stream channel erosion in the lacustrine core of the upper Nemadji River, Minnesota (USA) using stream geomorphology metrics. Environmental Geology. (Magner 2007)

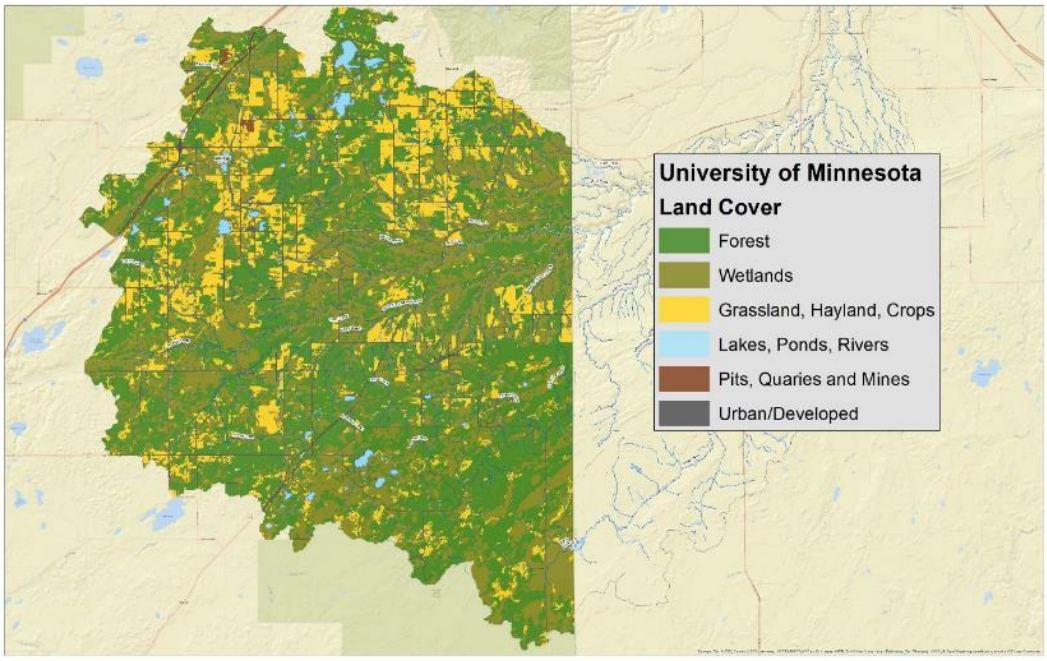
Climate Change Impacts in the United States. Chapter 18 Midwest. National Climate Assessment. U.S. Global Change Research Program. (Pryor, 2014)

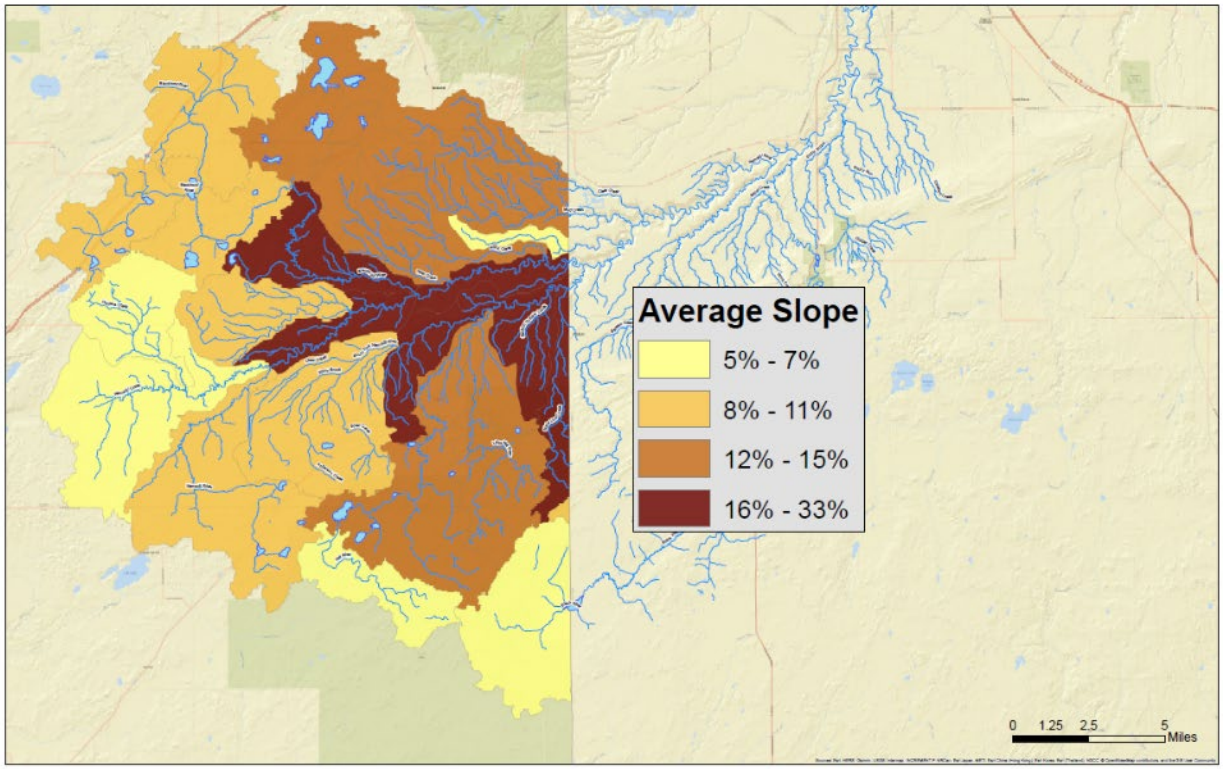
Fishwerks. Web-based GIS platform to help maximize the efficiency of habitat improvement projects for migratory fish species in the Great Lakes basin. University of Wisconsin & Wisconsin Institute for Discovery

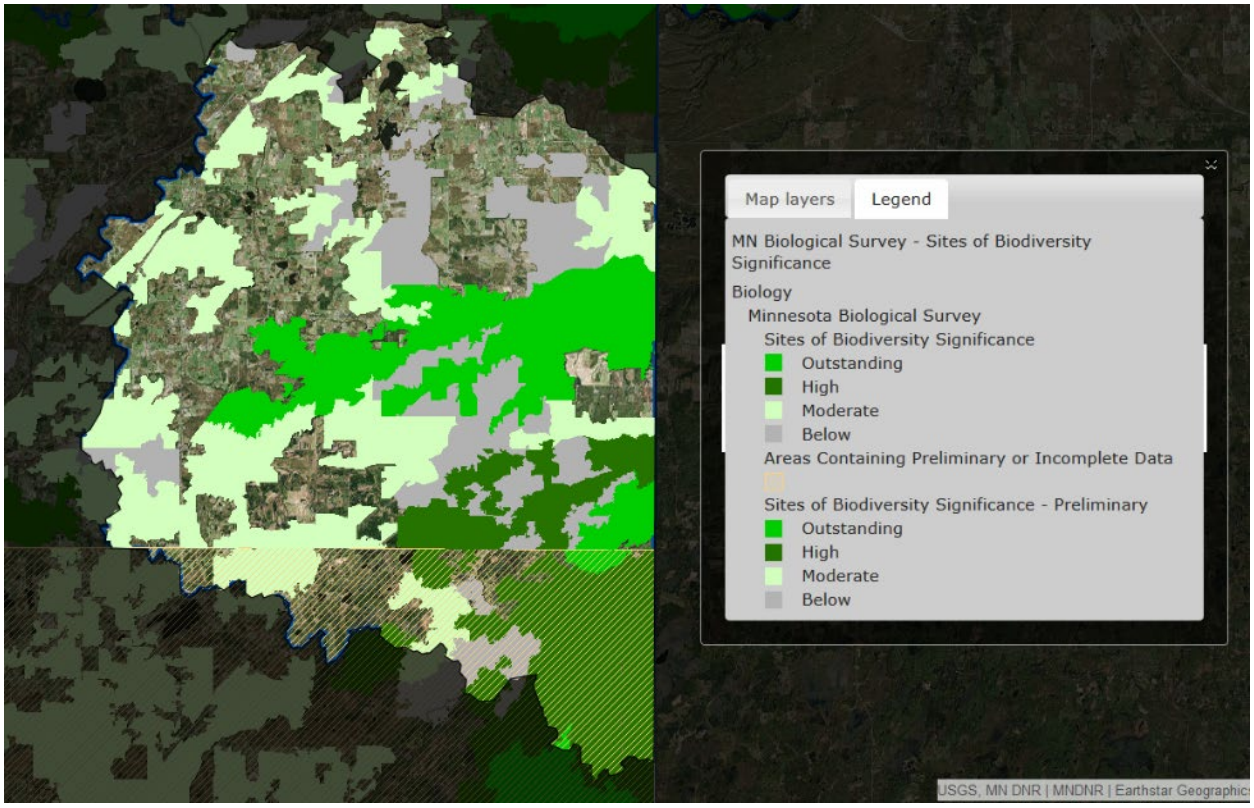
Minnesota forest ecosystem vulnerability assessment and synthesis: a report from the Northwoods Climate Change Response Framework project. United States Forest Service. (Handler, 2014)

Draft Nemadji Groundwater Restoration and Protection Strategy. Minnesota Department of Health. 2019

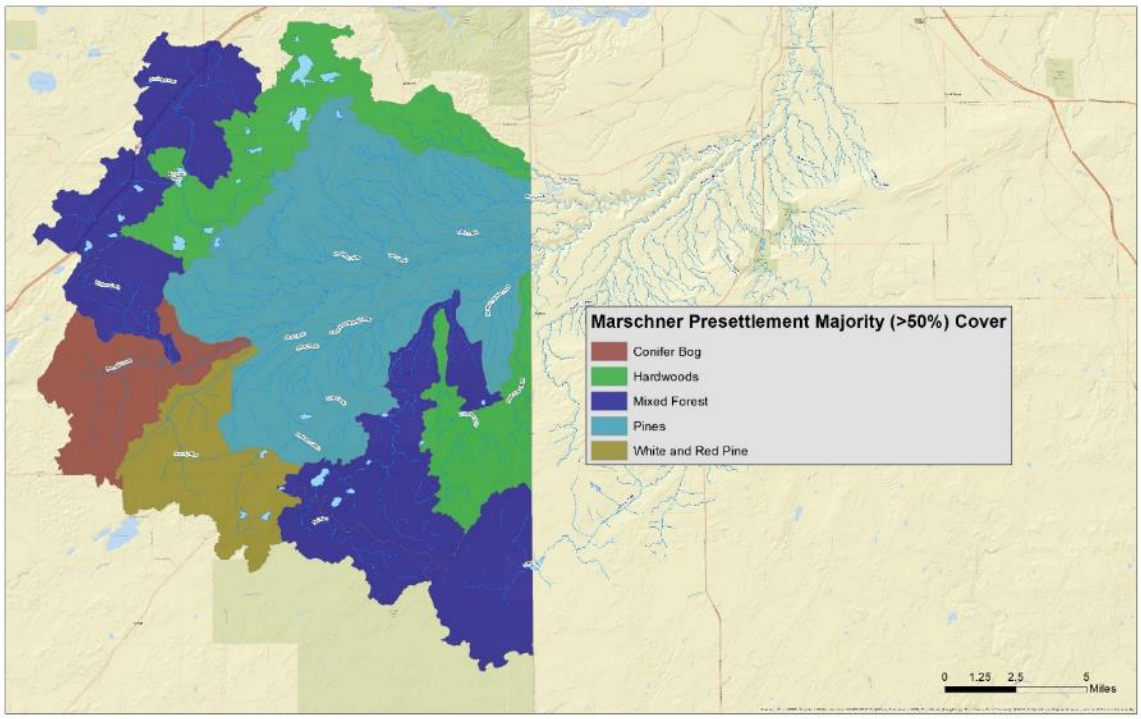
APPENDIX H. ADDITIONAL MAPS AND DATA



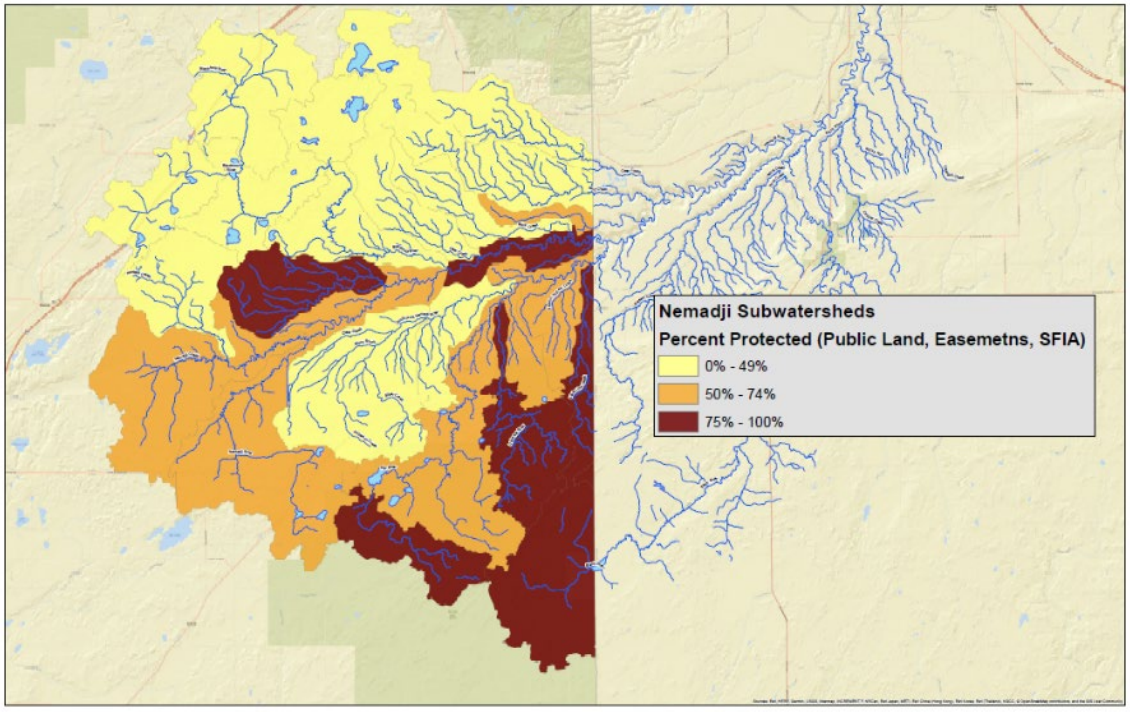




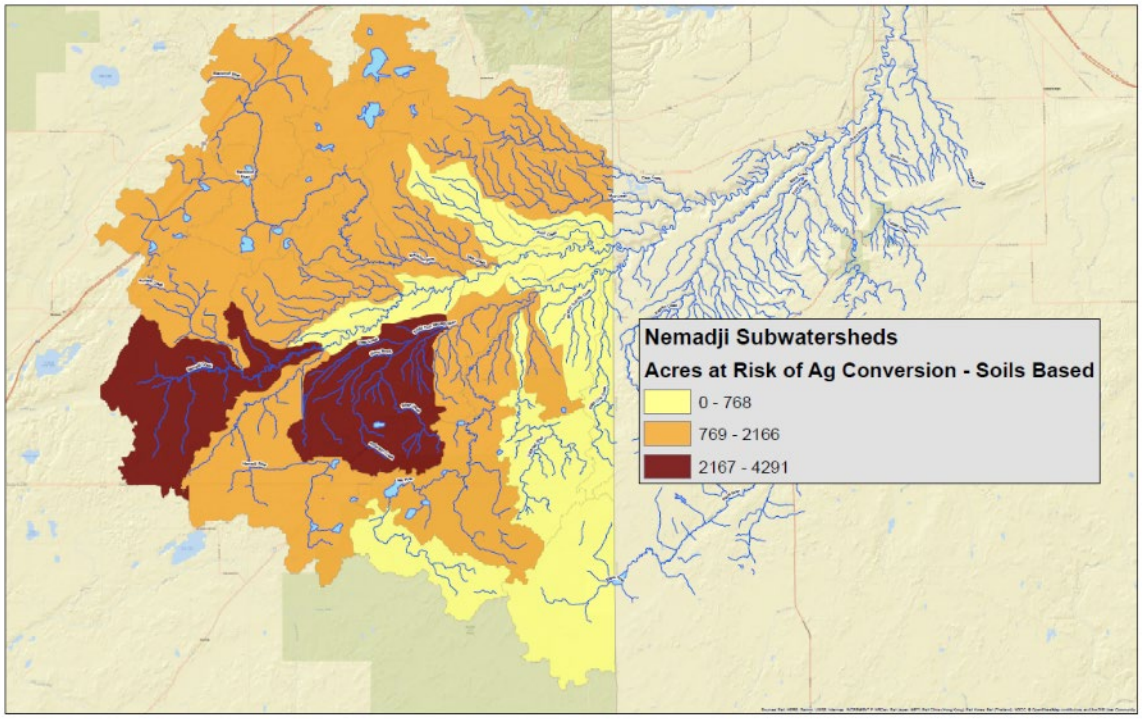
Source: MN DNR Watershed Health Assessment Framework



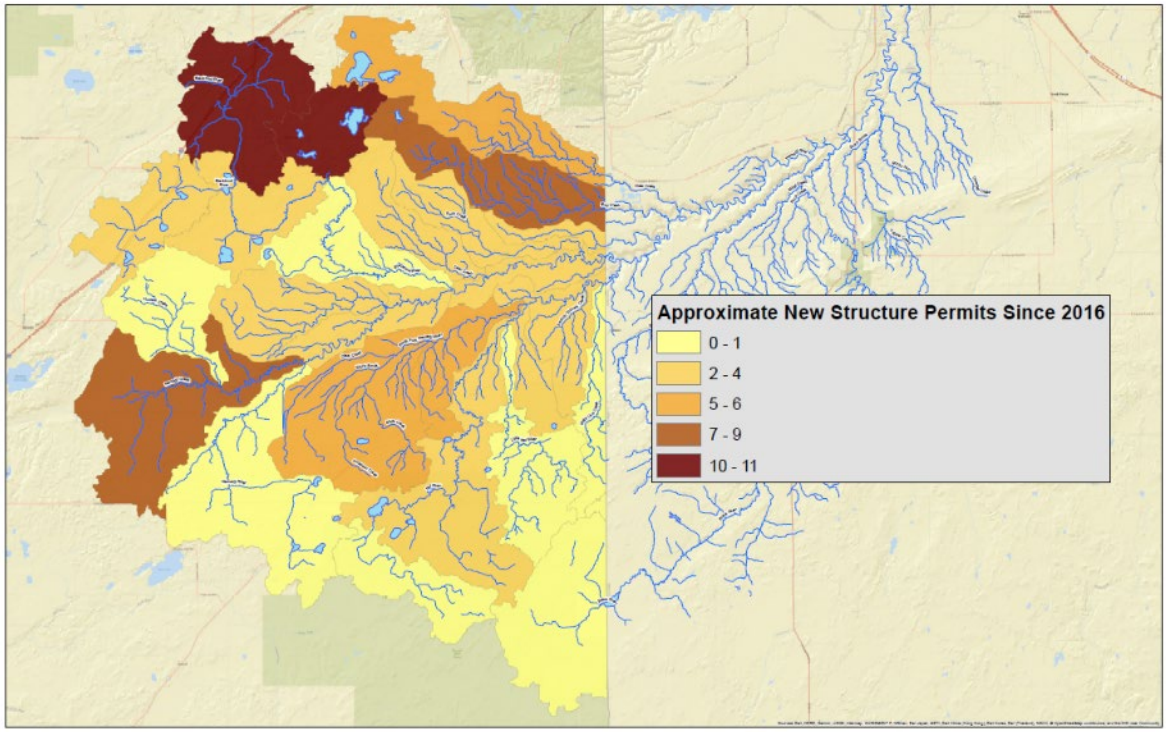
Data source: MN DNR Presettlement data based on Marschner's original analysis of Public Land Survey notes.



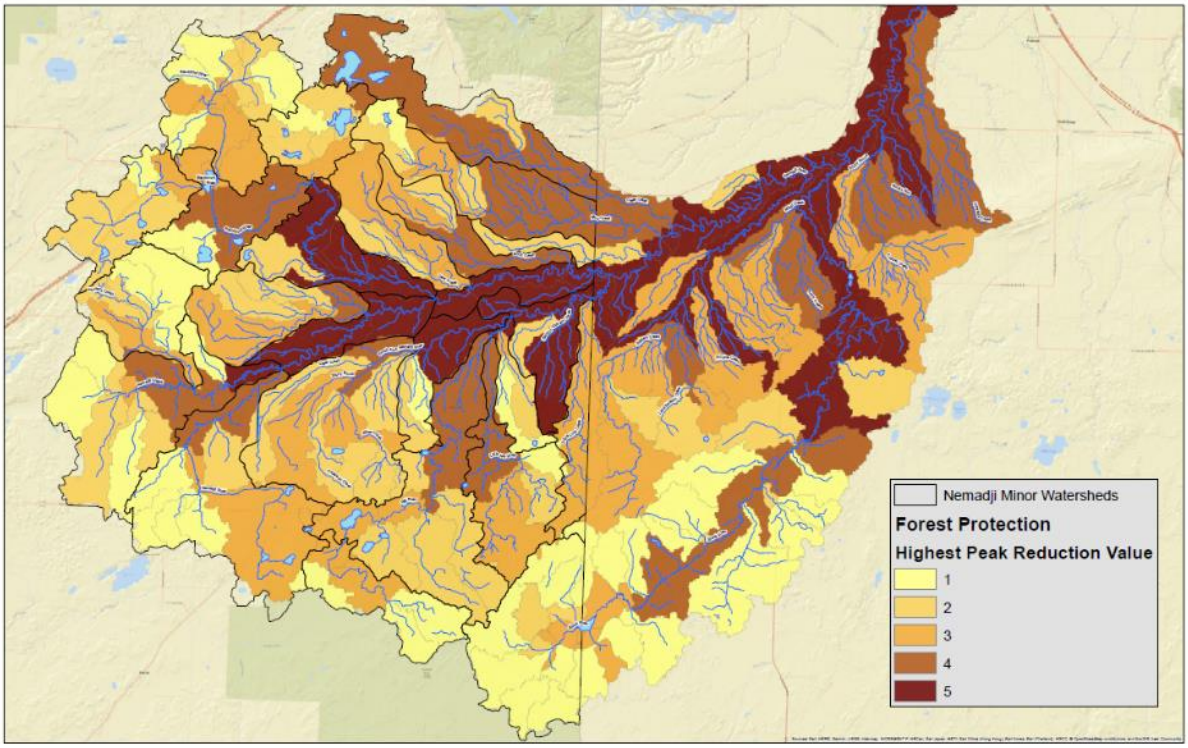
Data source: Carlton and Pine County parcel layers.



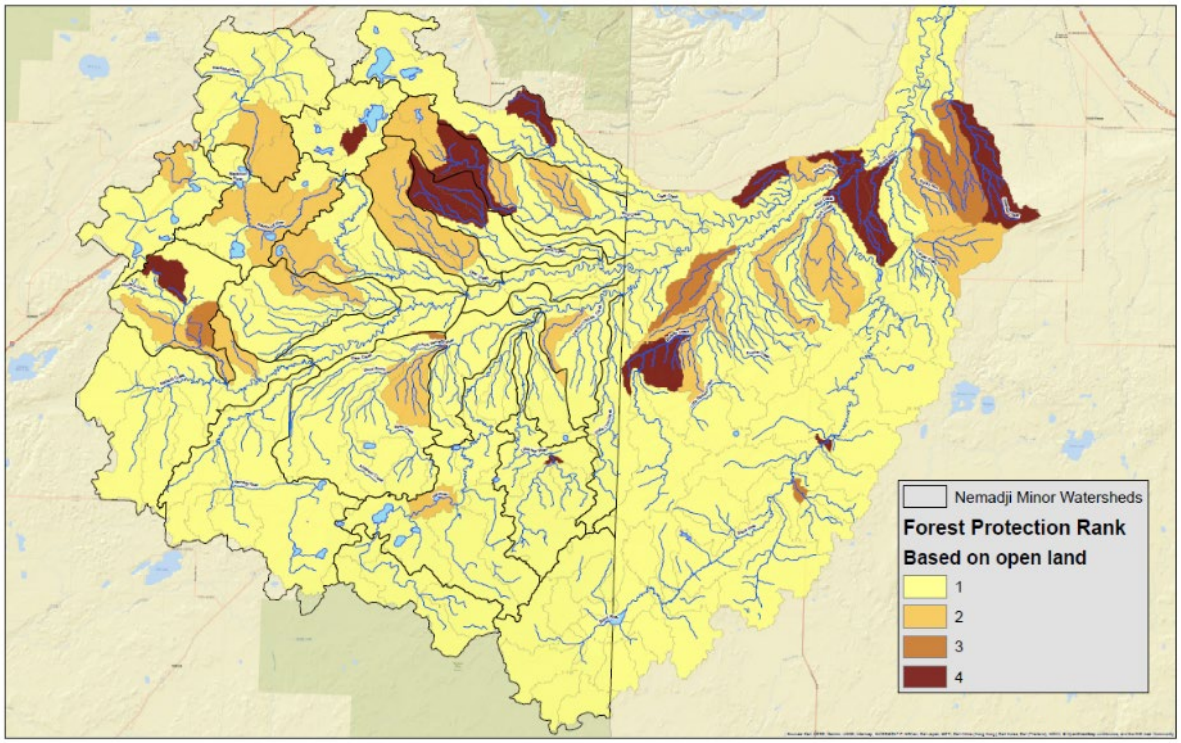
Data source: USDA Soils data



Data source: Carlton and Pine County GIS Departments



Data source: Nemadji River Watershed Habitat Assessment using LiDAR Data Tool



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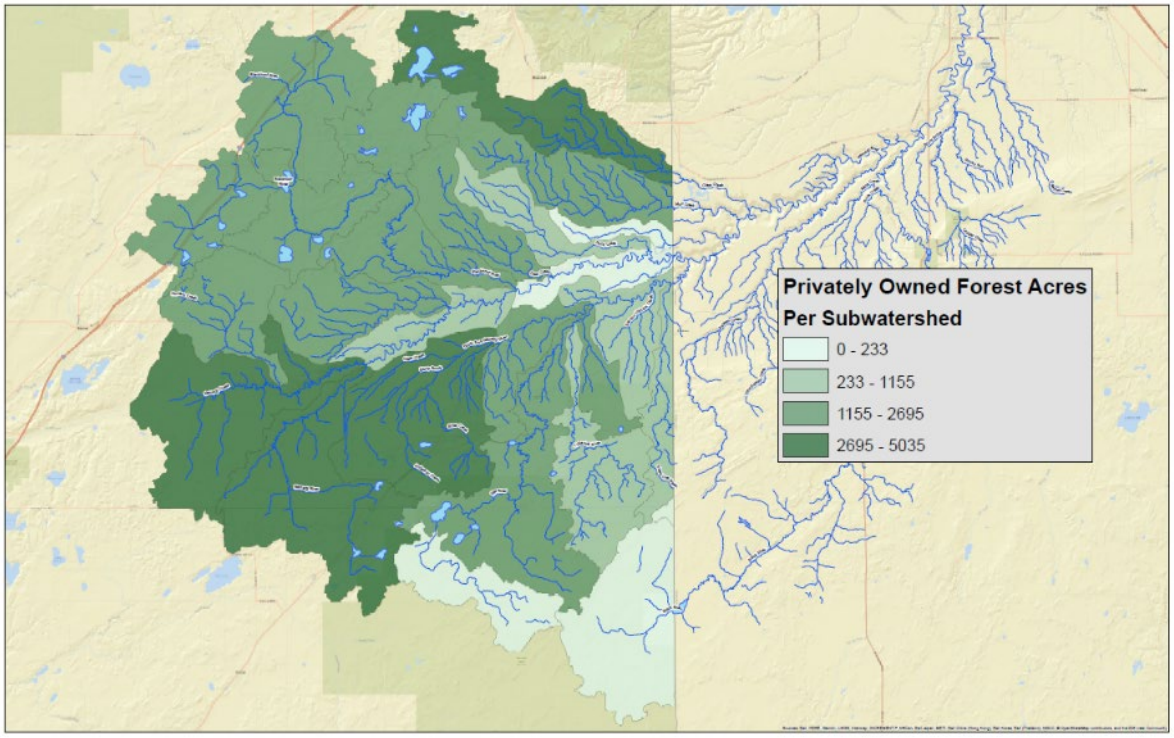
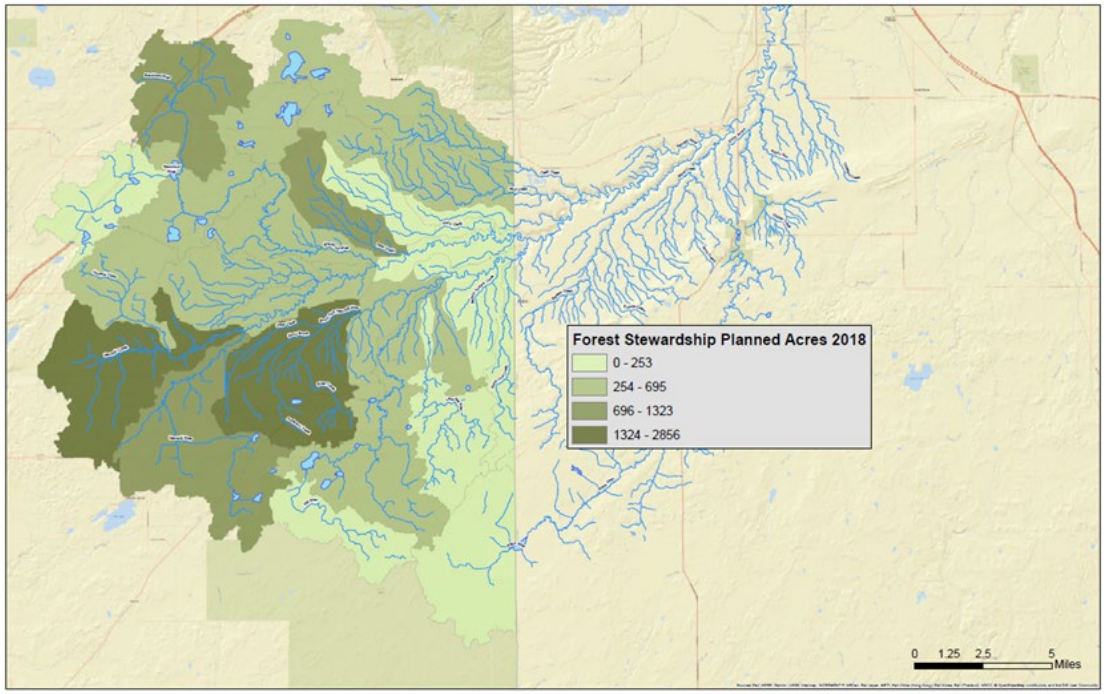
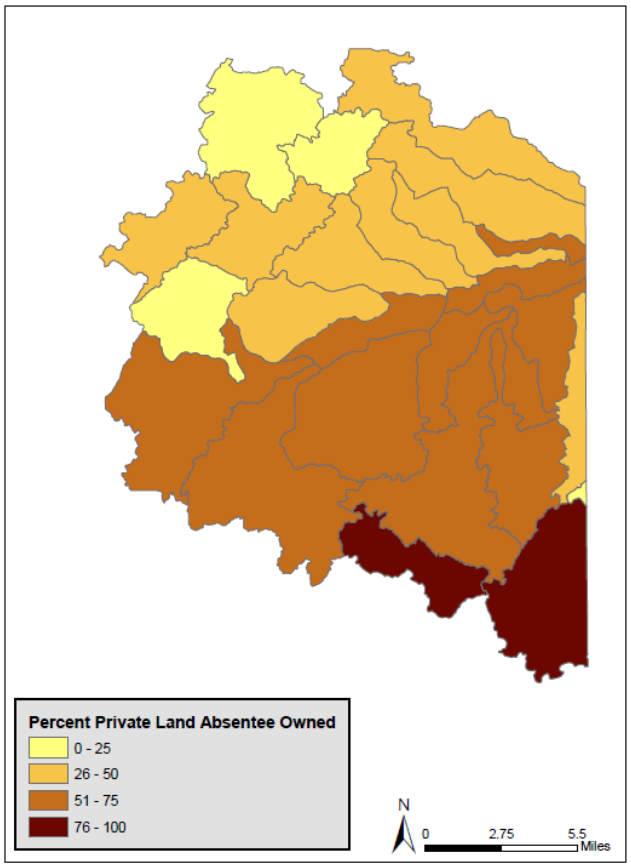


Data source: Carlton and Pine County Parcel data and UMN Land Cover data



Data source: DNR Forest Stewardship planned forests



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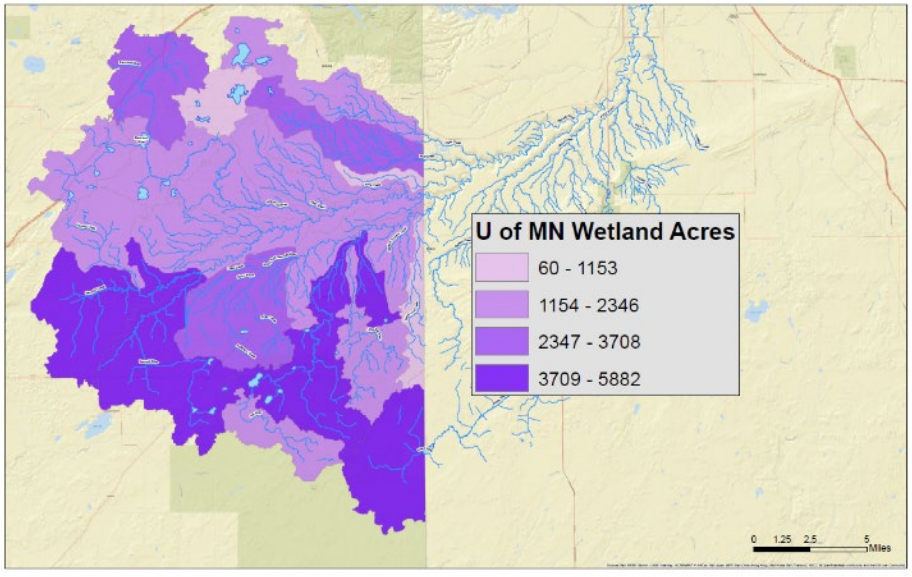
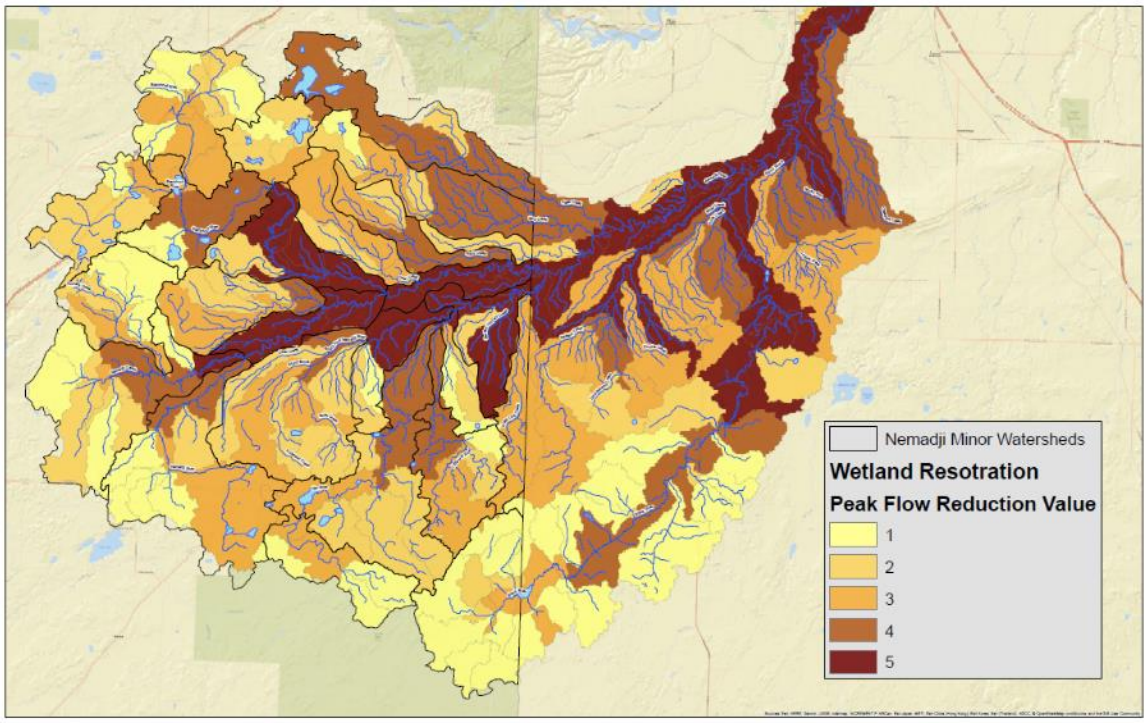


Data source: UMN Land Cover 2013



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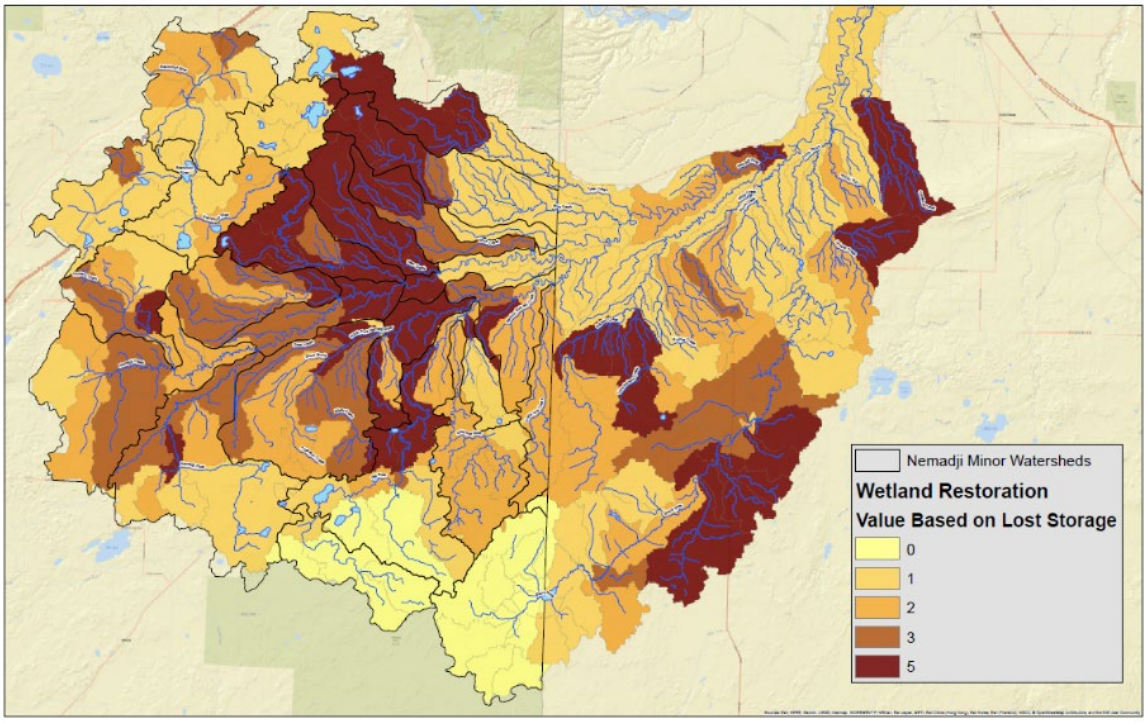

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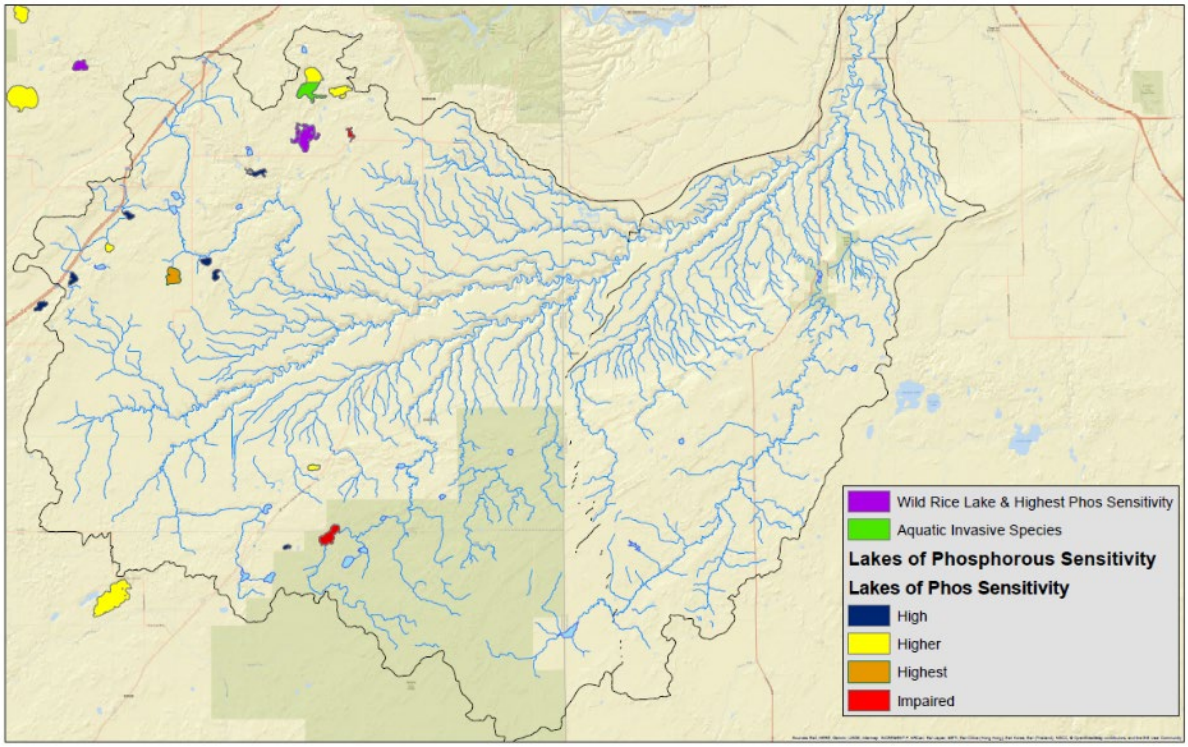
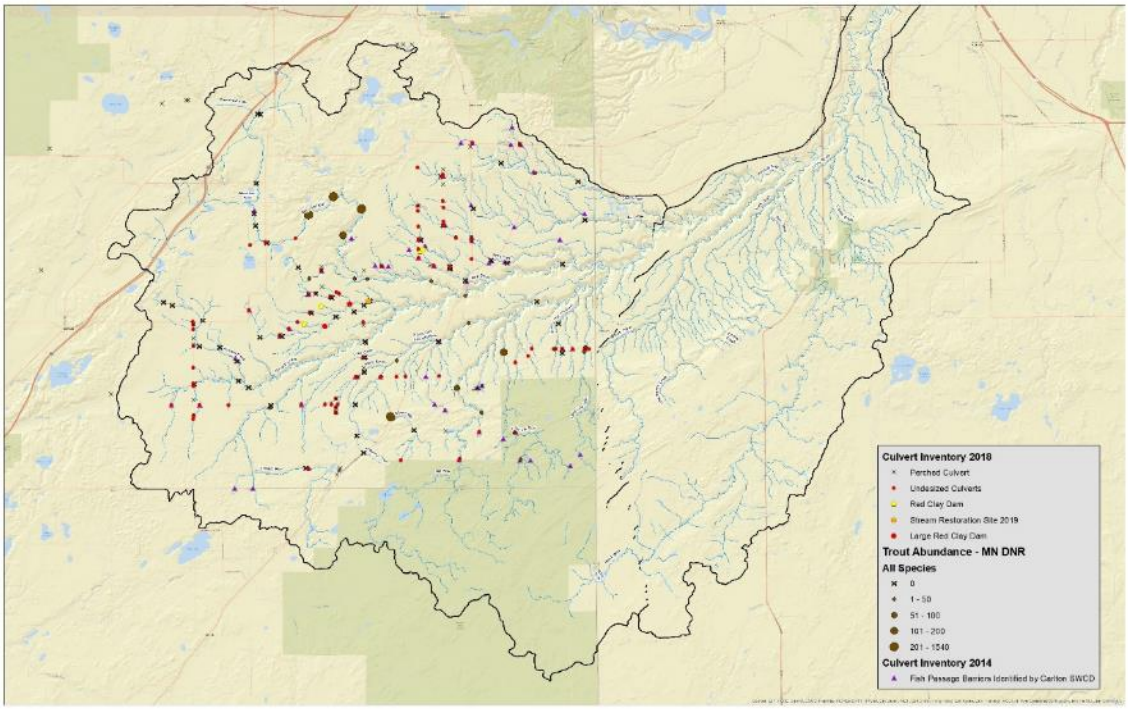
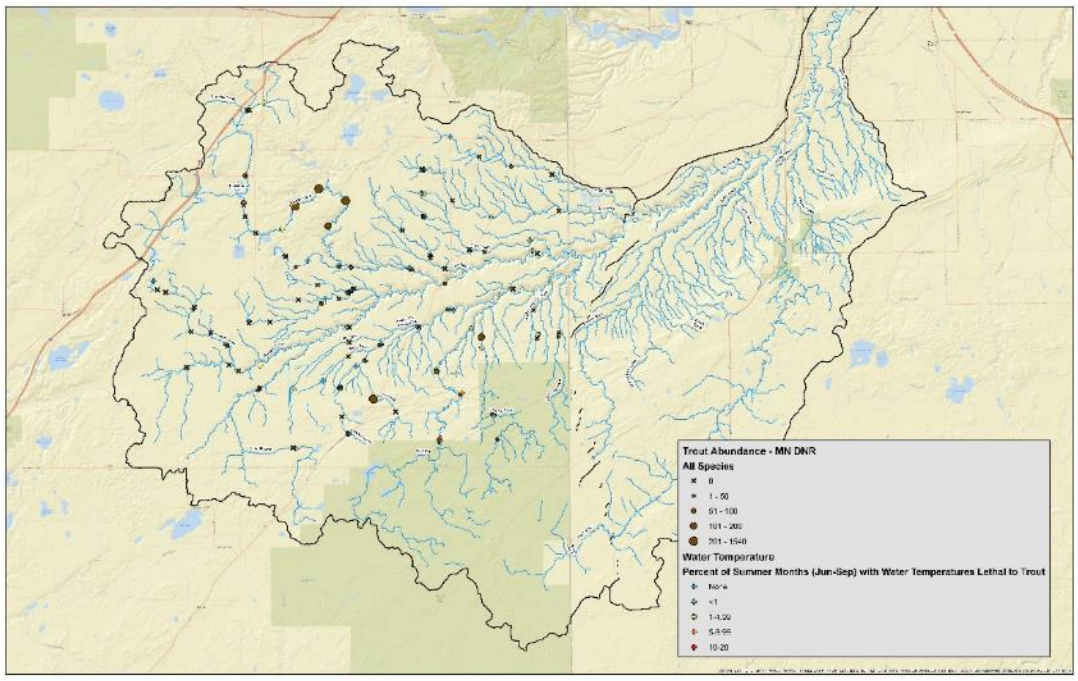


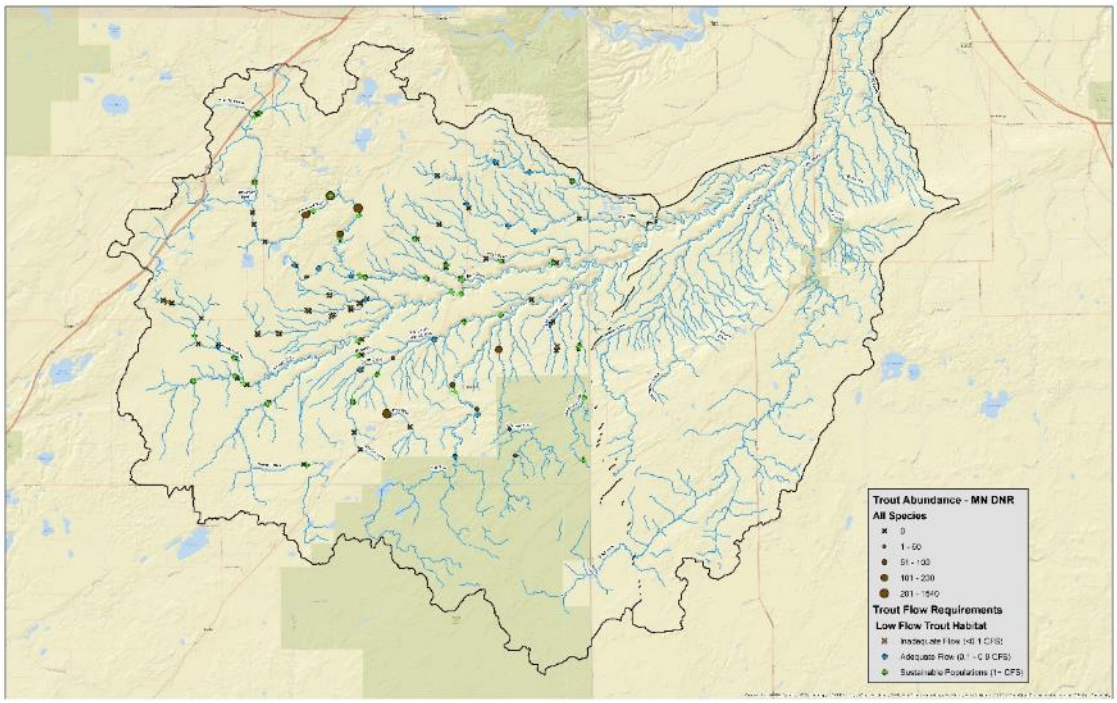
Data source: MN DNR



Data source: MN DNR Fisheries, Carlton County Transportation Department, Carlton SWCD



Data source: MN DNR Fisheries



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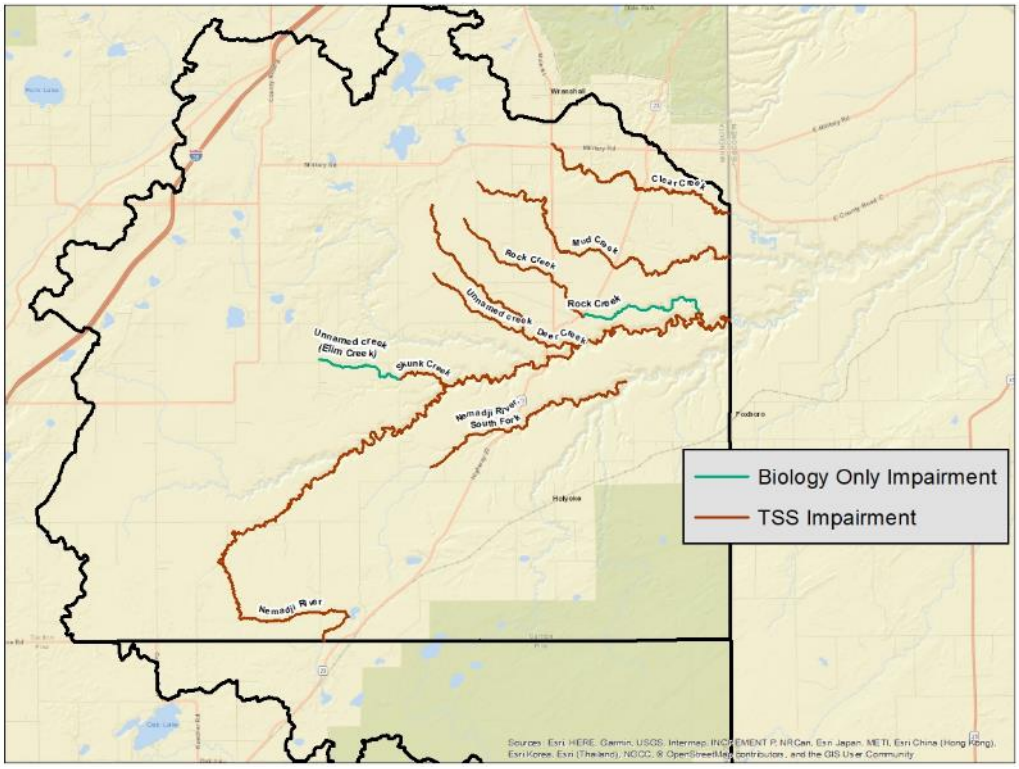
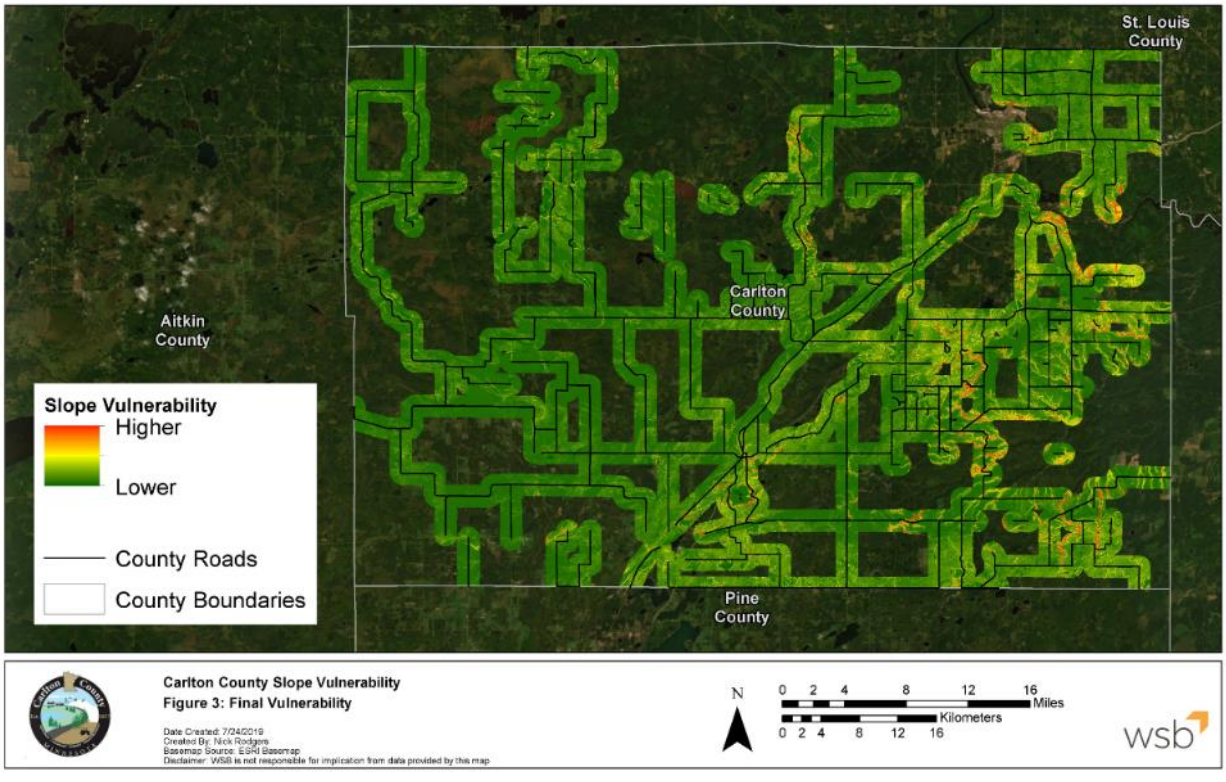
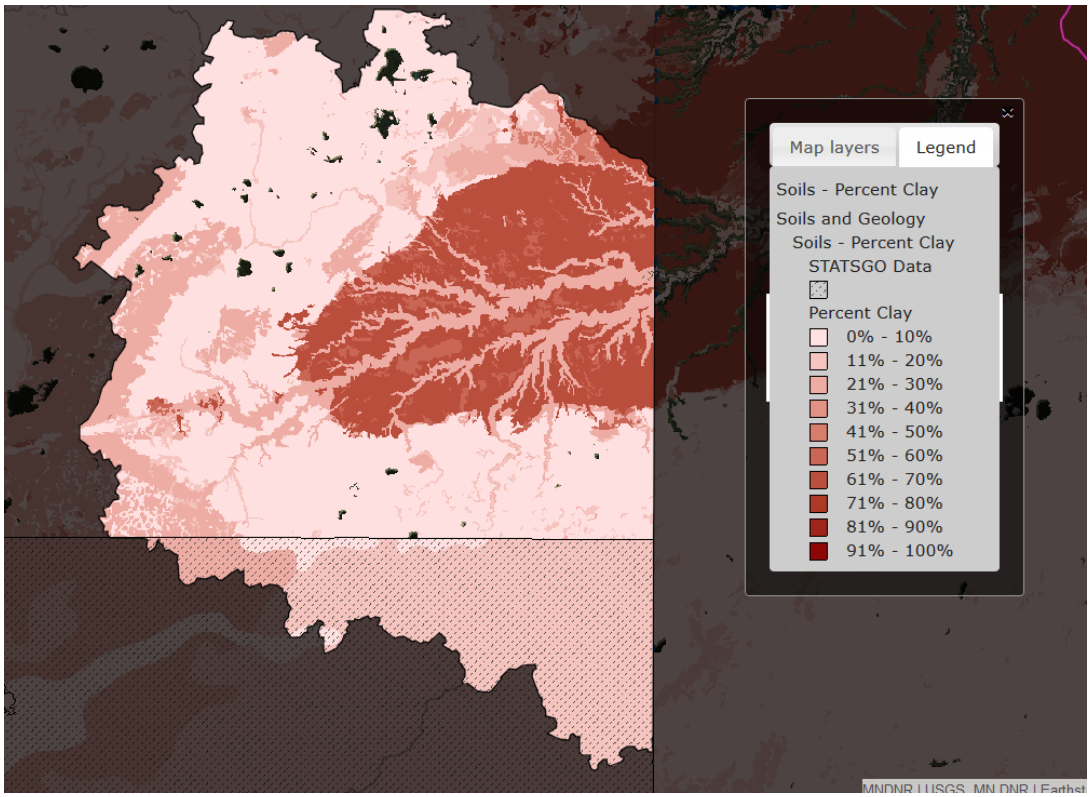


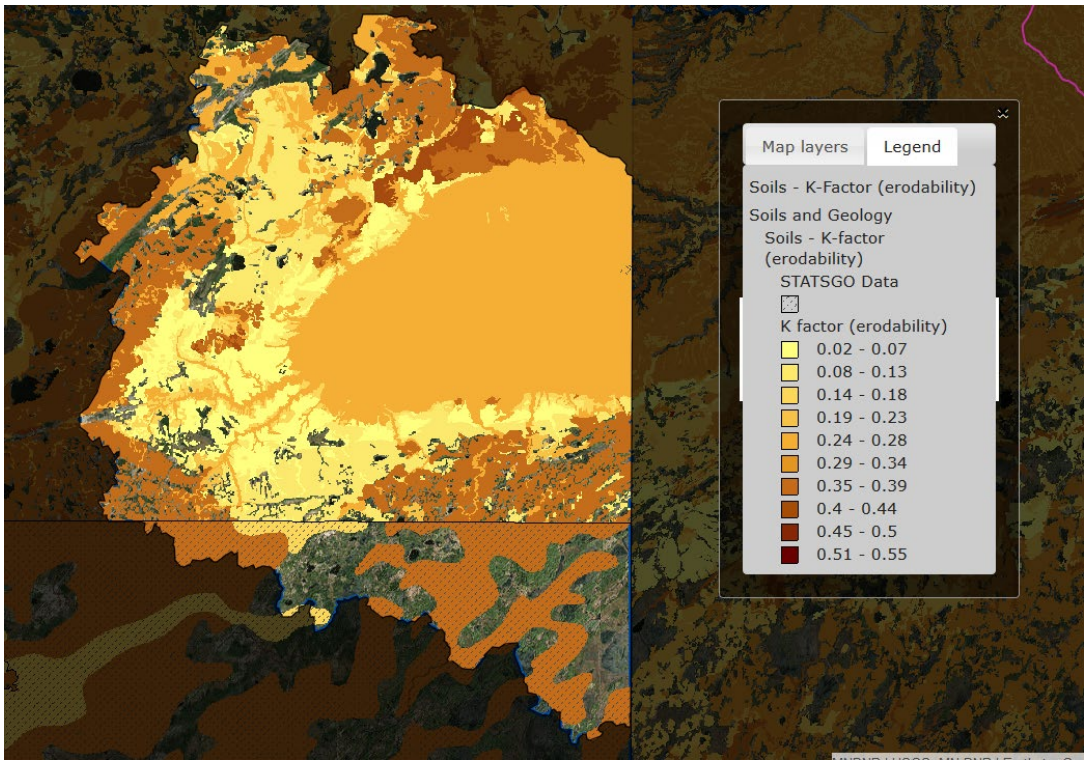
Data Source: MPCA



Data Source: Carlton County Transportation Department



Source: MN DNR Watershed Health Assessment Framework



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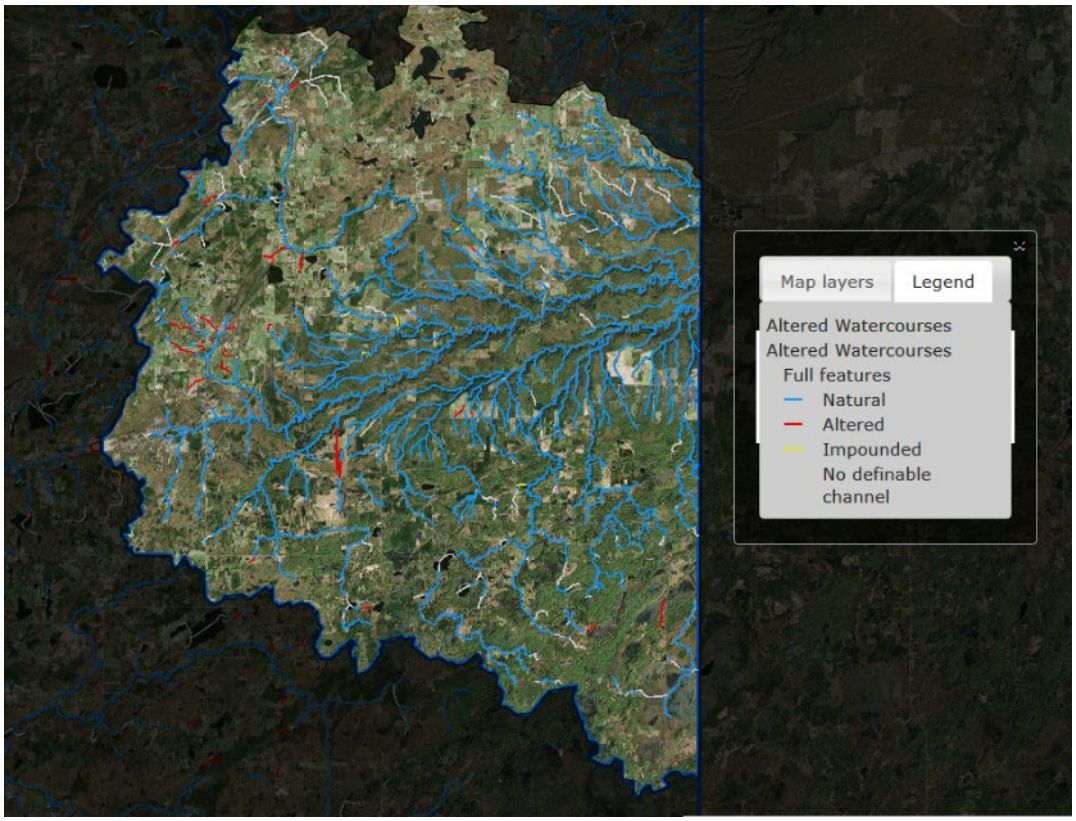

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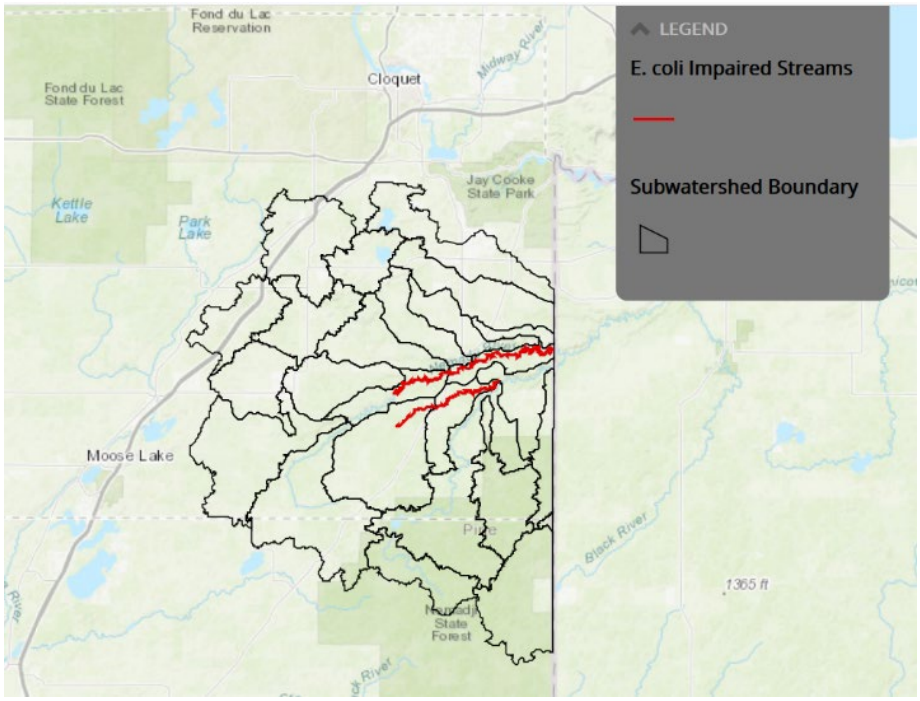

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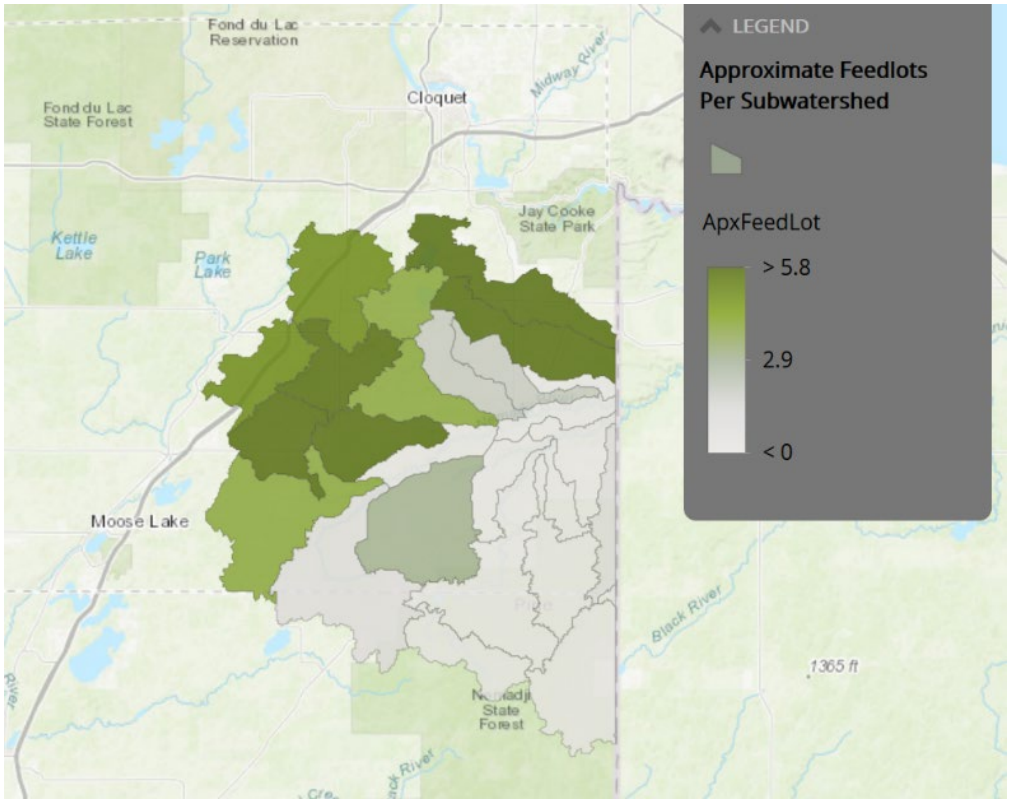

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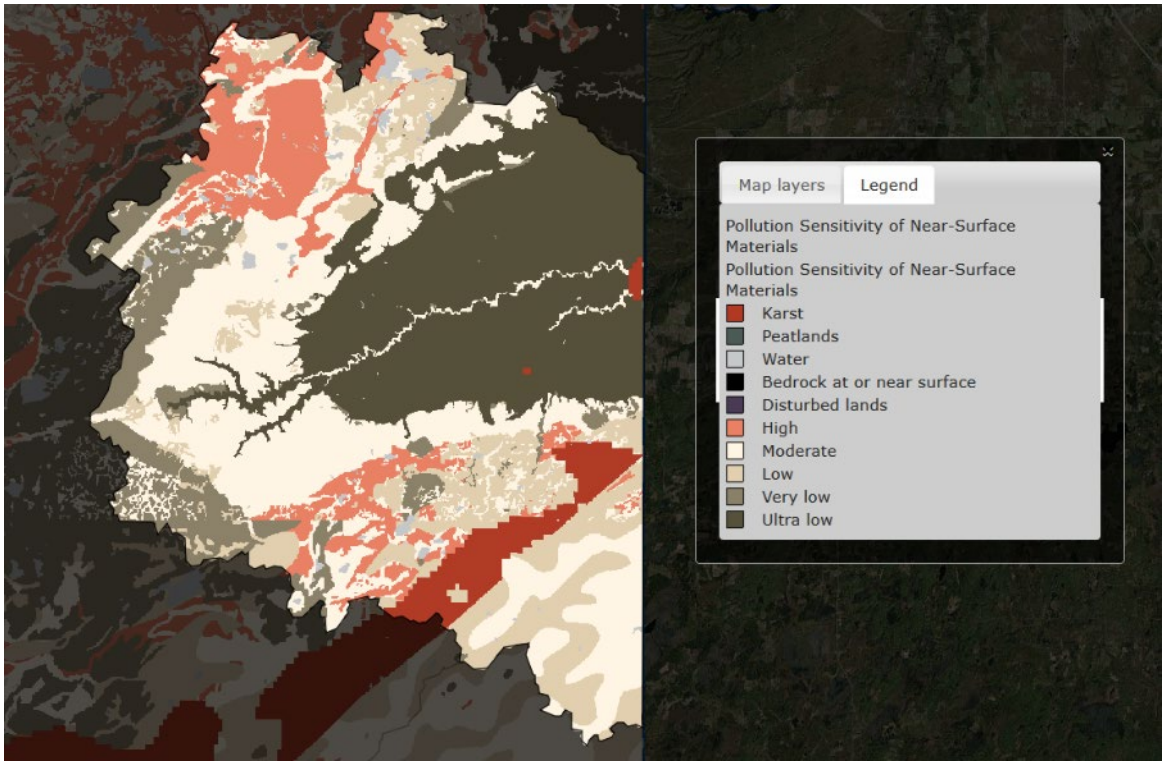

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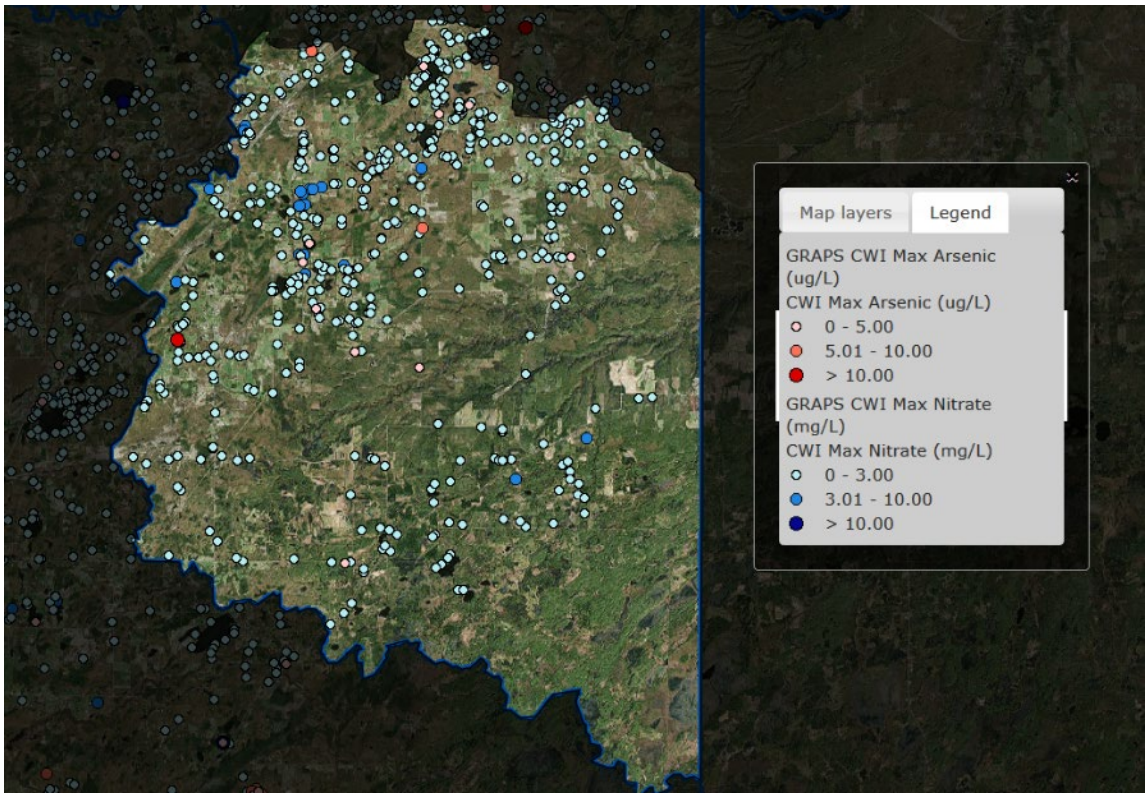

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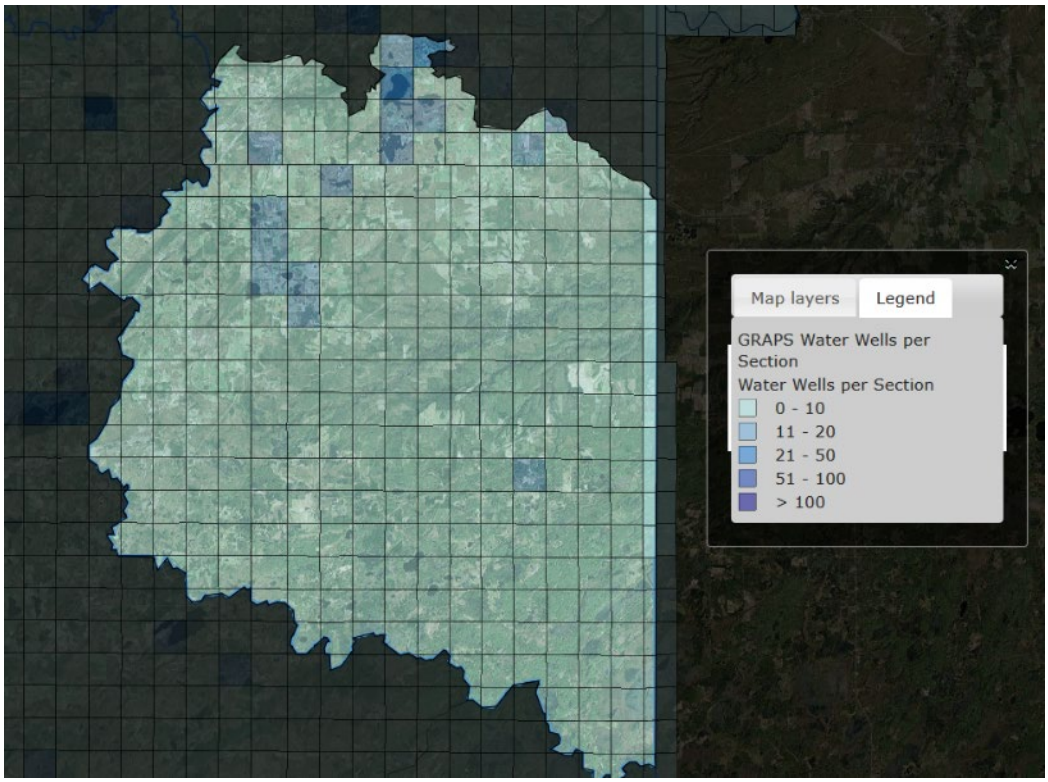

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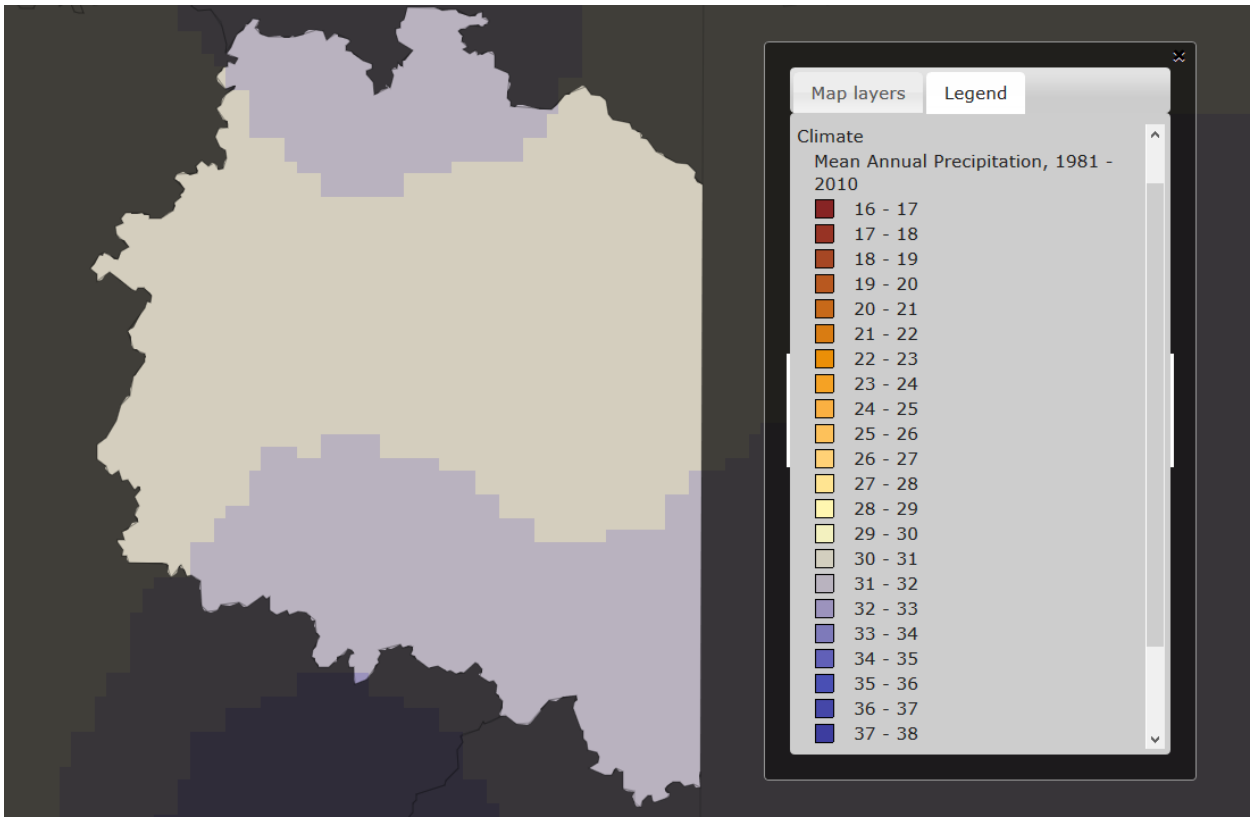

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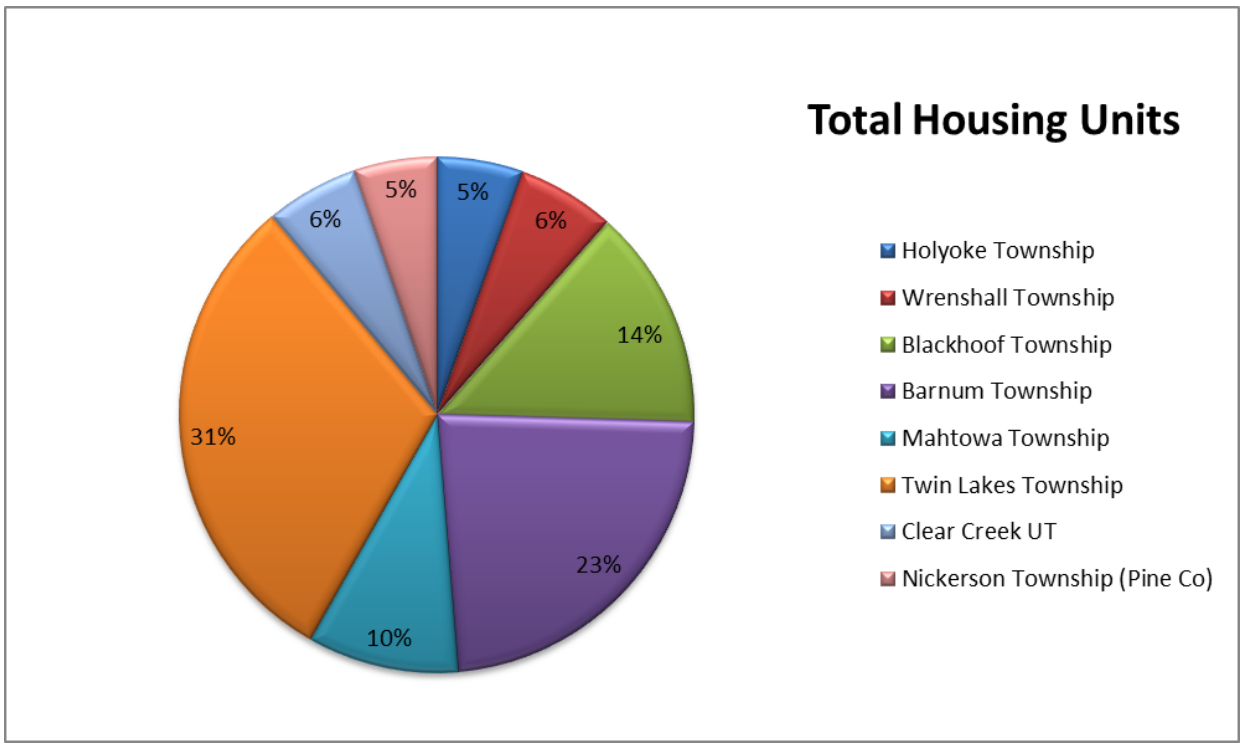

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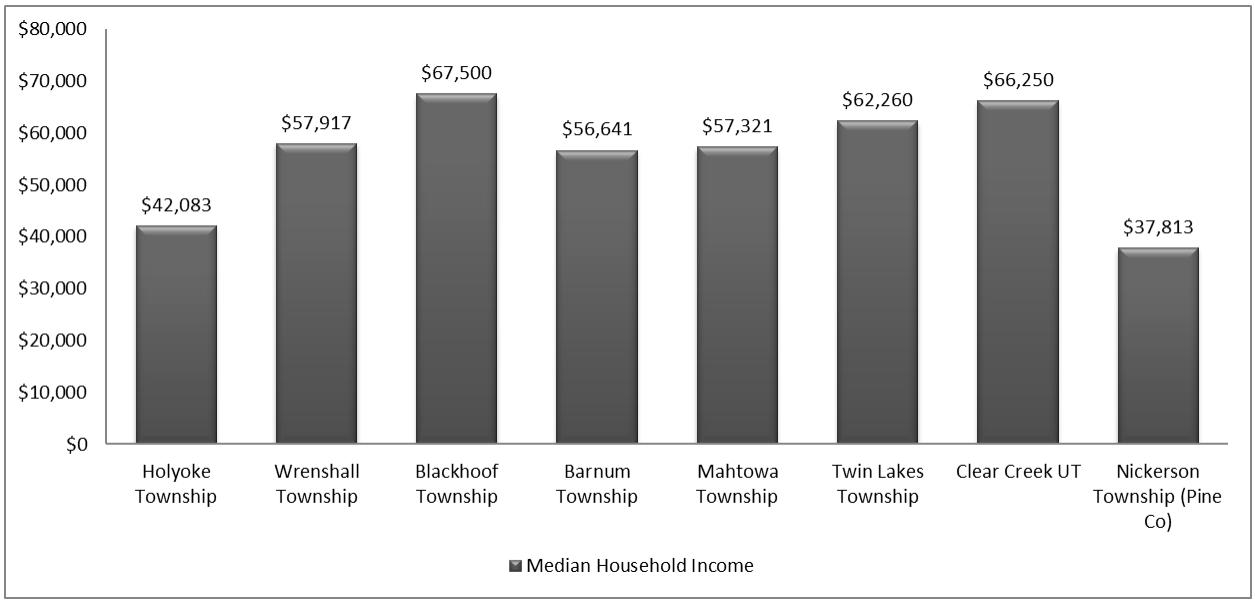

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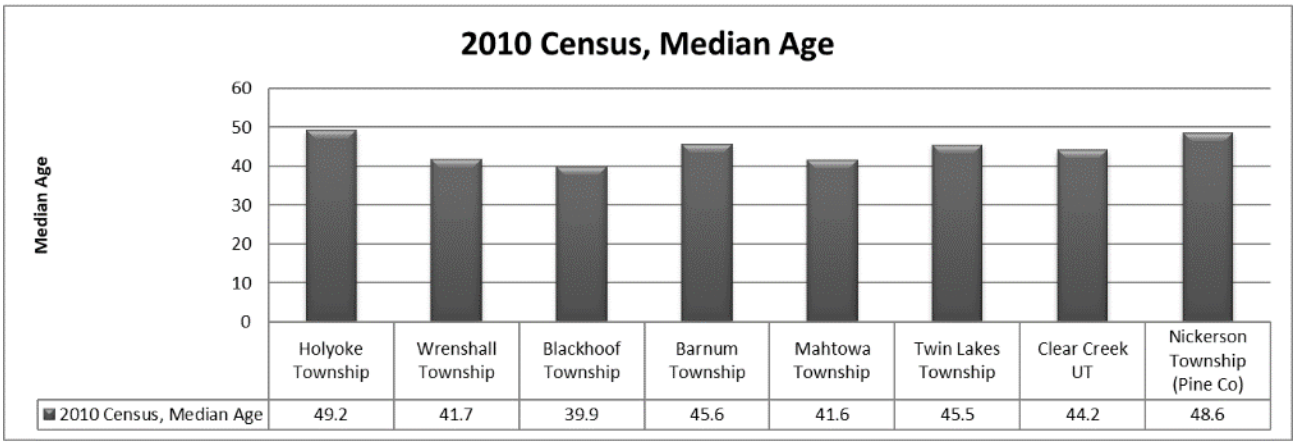

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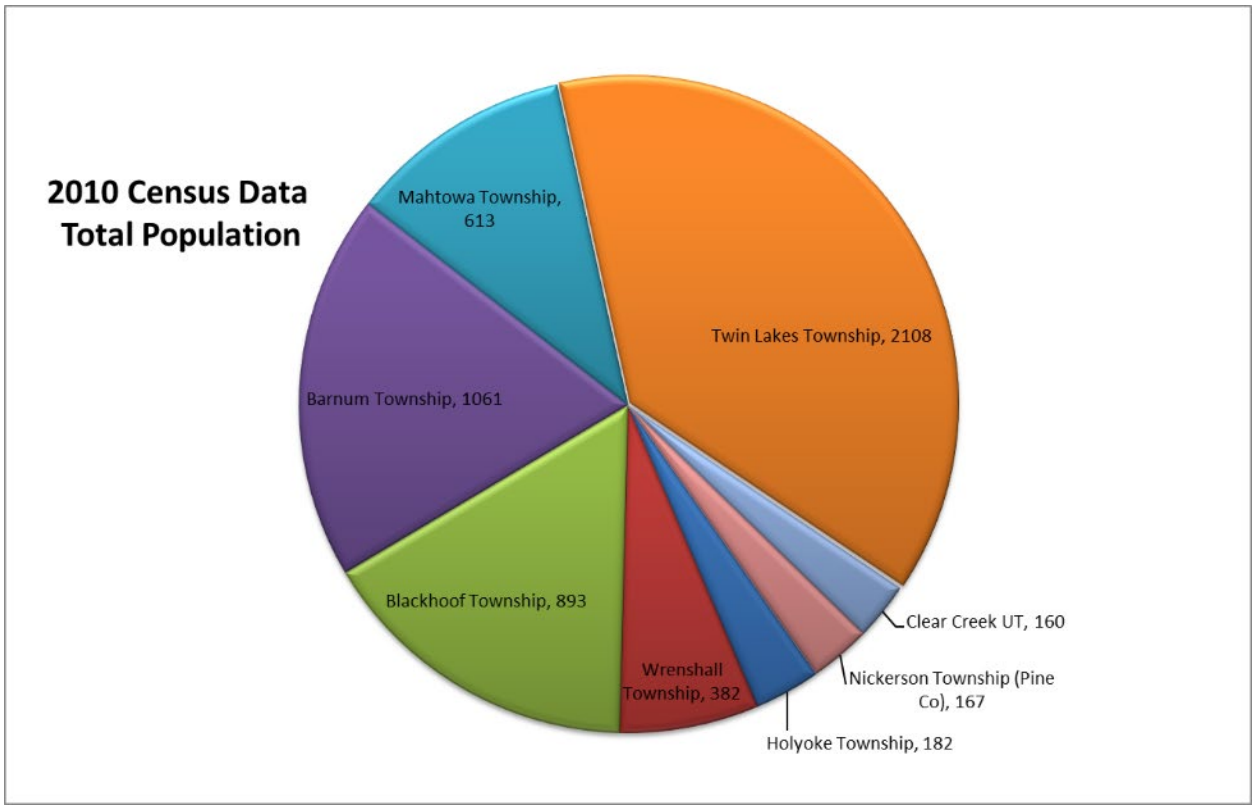


Data Source: United States 2010 Census

APPENDIX I. THE RED CLAY PROJECT

The Red Clay Project was a 1970's era project that encompassed watersheds in the Lake Superior Basin portion of North East Minnesota and Northern Wisconsin. Primary partners included the Soil Conservation Service (SCS) (now the Natural Resources Conservation Service (NRCS)) and the Environmental Protection Agency (EPA) with local Soil and Water Conservation District support. The goal of this project? Reduce sediment erosion throughout the watershed.

In Minnesota efforts focused on constructing peak flow reduction and sediment retention structures in two sub watersheds of the Nemadji River Basin, Skunk Creek and Deer Creek in Carlton County. Sixteen structures were constructed in the Skunk Creek Watershed and four structures were constructed in the Deer Creek Watershed (see map on reverse side). The project also constructed several ditch stabilization projects. The design life of these structures was 10 – 25 years depending on the specific project and all were installed on private land. These structures worked as they were designed, storing sediment and reducing peak flows by 39—50%!

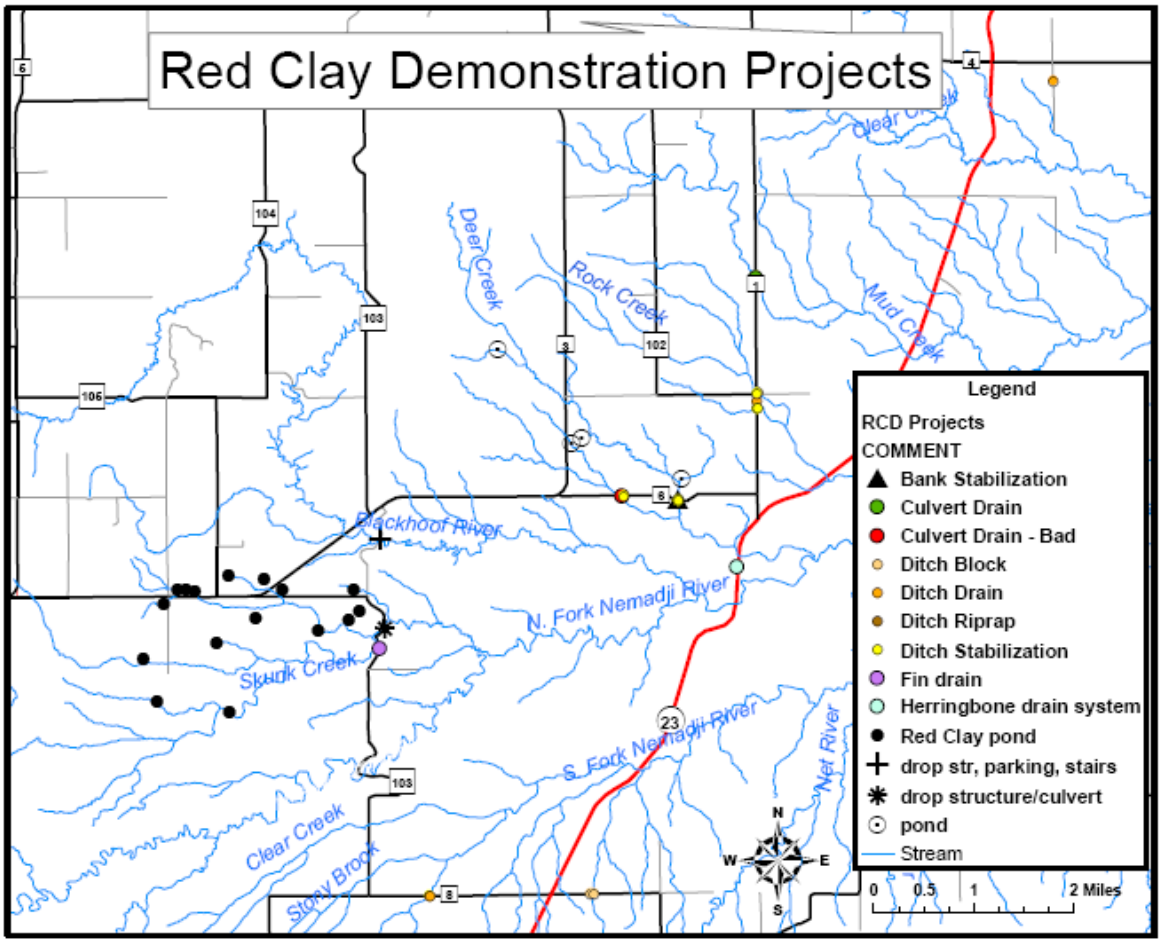
Photos above and Right: Projects constructed during the Red Clay Project in the 1970s.

Unfortunately there were two main problems with these projects. All of dam structures were installed on trout streams, which eliminated valuable fish habitat once they were constructed. In addition, no plans were made for funding future maintenance, and over time, these structure have started to fail, releasing tons of sediment into the watershed as a result.

The Carlton SWCD with many grant funding partners is working to restore streams where failed or failing dams are effecting water quality. As of 2019, two restorations are already complete, and a third project on County Road 103 is planned for this summer.

Photos Above and Left: The dams constructed as part of the Red Clay Project have exceeded their designed life expectancy. Some are failing and others have failed.

808 3rd Street | Carlton MN 55718 | 218-384-3891


Red Clay Demonstration Projects
Deer Creek
Rock Creek
Mud Creek
Blackhoof River
N. Fork Nemadji River
Skunk Creek
S. Fork Nemadji River
Net River
Clear Creek
Stony Brook
Legend
RCD Projects
COMMENT
Bank Stabilization
Culvert Drain
Culvert Drain - Bad
Ditch Block
Ditch Drain
Ditch Riprap
Ditch Stabilization
Fin drain
Herringbone drain system
Red Clay pond
drop str, parking, stairs
drop structure/culvert
pond
Stream
0 0.5 1 2 Miles
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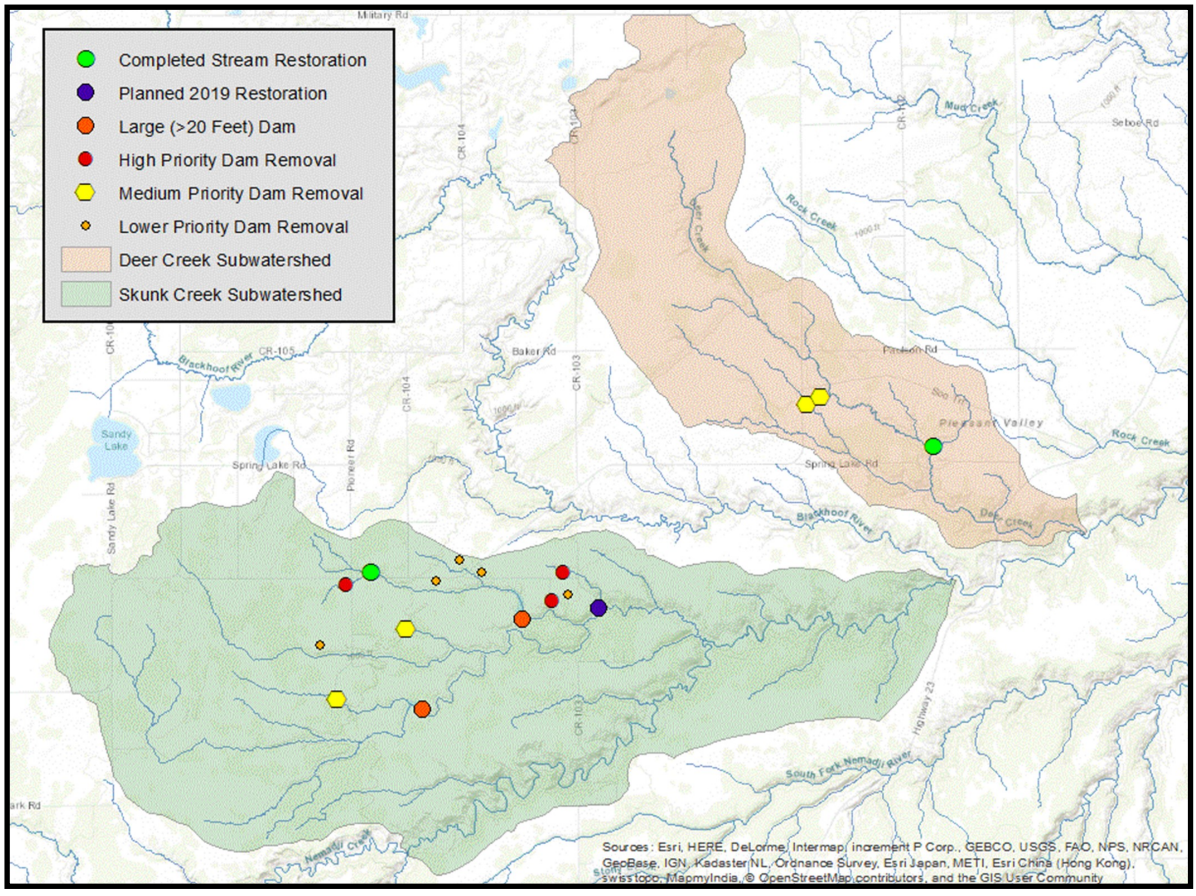
Completed Stream Restoration
Planned 2019 Restoration
Large (>20 Feet) Dam
High Priority Dam Removal
Medium Priority Dam Removal
Lower Priority Dam Removal
Deer Creek Subwatershed
Skunk Creek Subwatershed
Military Rd
Mud Creek
Rock Creek
Blackhoof River
Baker Rd
Pleasant Valley
Spring Lake Rd
Sandy Lake
Sandy Lake Rd
Pioneer Rd
South Fork Nemadji River
Highway 23
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community