Long Prairie River Watershed Restoration and Protection Strategies

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Minnesota Pollution Control Agency

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Key Terms and Acronyms

Assessment Unit Identifier (AUID): The unique water body identifier for each river reach comprised of the USGS eight-digit HUC plus a three-character code unique within each HUC.

Aquatic life impairment: The presence and vitality of aquatic life is indicative of the overall water quality of a stream. A stream is considered impaired for impacts to aquatic life if the fish Index of Biotic Integrity (IBI), macroinvertebrate IBI, dissolved oxygen, turbidity, or certain chemical standards are not met.

Aquatic recreation impairment: Streams are considered impaired for impacts to aquatic recreation if fecal bacteria standards are not met. Lakes are considered impaired for impacts to aquatic recreation if total phosphorus, chlorophyll-a, or Secchi disc depth standards are not met.

BWSR: Board of Soil and Water Resources

DNR: Minnesota Department of Natural Resources

HSPF: The hydrologic and water quality model **H**ydrologic **S**imulation **P**rogram **F**ortran.

Hydrologic Unit Code (HUC): A Hydrologic Unit Code (HUC) is assigned by the USGS for each watershed. HUCs are organized in a nested hierarchy by size. For example, the Mississippi River Basin is assigned a HUC-4 of 0701 and the Long Prairie River Watershed is assigned a HUC-8 of 07010108.

Impairment: Water bodies are listed as impaired if water quality standards are not met for designated uses including aquatic life, aquatic recreation, and aquatic consumption.

Index of Biotic integrity (IBI): A method for describing water quality using characteristics of aquatic communities, such as the types of fish and invertebrates found in the waterbody. It is expressed as a numerical value between 0 (lowest quality) to 100 (highest quality).

IWM: MPCA's **I**ntensive **W**atershed **M**onitoring, which includes chemistry, habitat, and biological sampling.

MDA: Minnesota Department of Agriculture

MPCA: Minnesota Pollution Control Agency

MSHA: Minnesota Stream Habitat Assessment

Protection: This term is used to characterize actions taken in watersheds of waters not known to be impaired to maintain conditions and beneficial uses of the waterbodies.

Restoration: This term is used to characterize actions taken in watersheds of impaired waters to improve conditions, eventually to meet water quality standards and achieve beneficial uses of the waterbodies.

Source (or Pollutant Source): This term is distinguished from 'stressor' to mean only those actions, places or entities that deliver/discharge pollutants (e.g., sediment, phosphorus, nitrogen, pathogens).

Stressor (or Biological Stressor): This is a broad term that includes both pollutant sources and non-pollutant sources or factors (e.g., altered hydrology, dams preventing fish passage) that adversely impact aquatic life.

Total Maximum Daily Load (TMDL): A calculation of the maximum amount of a pollutant that may be introduced into a surface water and still ensure that applicable water quality standards for that water are met. A TMDL is the sum of the wasteload allocation for point sources, a load allocation for nonpoint sources and natural background, an allocation for future growth (i.e., reserve capacity), and a margin of safety as defined in the Code of Federal Regulations.

Executive Summary

The Long Prairie River Watershed covers 882 square miles in the west-central part of the Upper Mississippi River Basin in central Minnesota. The watershed includes parts of Douglas, Morrison, Otter Tail, Todd, and Wadena Counties. The Long Prairie River begins at Lake Carlos in east-central Douglas County. It flows approximately 96 miles through Todd and Morrison Counties where it enters the Crow Wing River approximately one mile south-east of Motley. The dominant land use in this watershed is agriculture at 47%. The rest is a combination of grasslands, forests, surface waters, and urban areas. Portions of the Fish Trap Creek, Stony Brook, Turtle Creek, Shamineau Lake and Alexander Lake HUC 12 watersheds are within 10 miles of the Camp Ripley Boundary and/or within Camp Ripley (Figure 12). Camp Ripley abounds with plant and animal life unique to central Minnesota. Wildlife species of particular interest include the white-tailed deer, black bear and timber wolf.

Biological, chemistry, and flow monitoring data collection for the Watershed Restoration and Protection Strategies (WRAPS) effort began in the watershed in 2011. This WRAPS report summarizes those data and culminates in a table of implementation strategies designed to help restore areas where pollutants violate standards and/or help protect those areas that currently meet water quality standards.

Water quality is generally good to very good in the watershed, with many high-quality recreational lakes. Changes in land use including increased development, wetland removal, and agriculture have all contributed to sediment and pollutant loadings to surface waters, thus reducing popluations of sensitive aquatic species. Assessment results (Table 10: Impaired Lakes and Streams in the Long Prairie River Watershed) indicate that at least 10 lakes and 13 stream/river reaches have pollution impairments present, most notably phosphorus in the lakes and bacteria and low dissolved oxygen (DO) in the streams. Total Maximum Daily Load (TMDL) studies for DO (completed in 2005) and a bacteria and nutrient TMDL (2016) address both point and nonpoint sources for these impairments.

Below is a table of lakes and streams in the Long Prairie River Watershed where protection efforts should be focused, including lakes of outstanding biological significance, Cisco (Tullibee) refuge lakes and first-ranked waterbodies. If already impaired, waterbodies were ranked due to their ability to be easily restored. Similarly, exceptional waters with potential protection concerns were also given the highest priority.

Table 1: First ranked waterbodies, lakes of outstanding biological significance and Tier 2 Tullibee Refuge lakes in the Long Prairie River Watershed- impaired waterbodies highlighted in red.

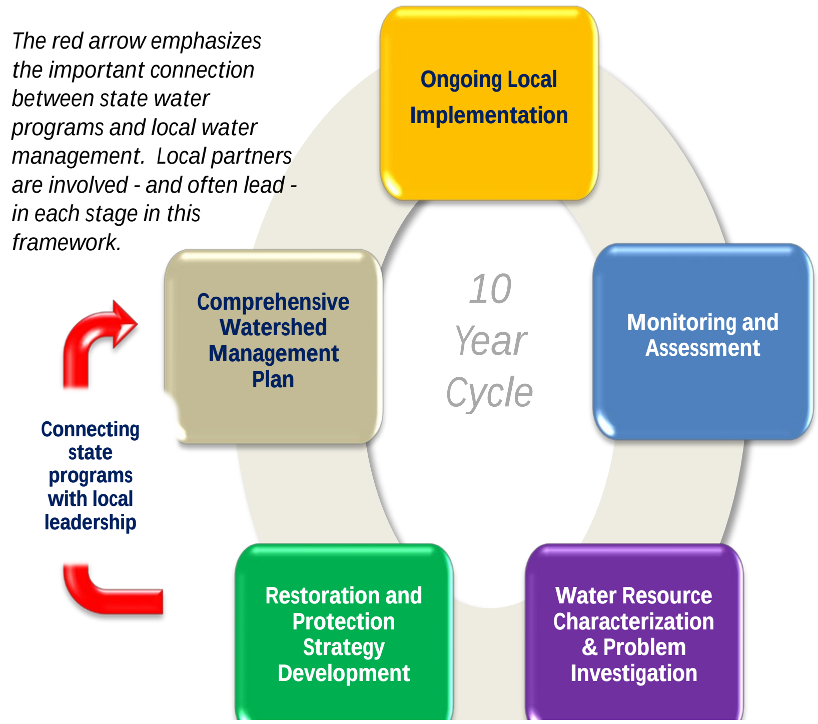
HUC 10 Subwatershed	Waterbody Name	Lake or Stream ID	First ranked waterbodies in implementation table	Outstanding Biological Significance	Cisco Tier 2 Refuge Lakes
Lake Carlos 0701010801	Latoka	21-0106-00	X	X	X
	Mina	21-0108-00		X	X
	Miltona	21-0083-00	X		
	Ida	21-0123-00	X		
	Pocket	21-0140-00	X		

HUC 10 Subwatershed	Waterbody Name	Lake or Stream ID	First ranked waterbodies in implementation table	Outstanding Biological Significance	Cisco Tier 2 Refuge Lakes
Lake Carlos 0701010801	Mary	21-0092-00	X		
	Round	21-0197-00	X		
	Lobster	21-0144-00	X		
	Nelson	21-0551-00	X		
	Le Homme Dieu	21-0056-00	X		
Spruce Creek-Long Prairie River 0701010802	Charlotte	77-0120-00		X	X
	Spruce Creek	07010108-512	X		
Turtle Creek 0701010804	Rice	77-0061-00		X	
	Turtle	77-0088-00		X	
	Rogers	77-0073-00		X	
	Mud	77-0087-00		X	
	Long	77-0069-00		X	
Moran Creek-Long Prairie River 0701010805	Moran Creek	07010108-511	X		
Fish Trap Creek 0701010806	Ham	49-0136-00	X		
	Fish Trap	49-0137-00	X	X	
	Alexander	49-0079-00	X	X	
	Round	49-0131-00	X		
	Crookneck	49-0133-00	X		
	Shamineau	49-0127-00	X		
	Fish Trap Creek	07010108-514	X		
Long Prairie River 0701010807	West Nelson	77-0005-00		x	

Protection strategies targeted in the implementation tables in Section 3.3 include riparian pasture management, shoreland development ordinances, Best Management Practice (BMP) adoption, nutrient management and stormwater management. Due to issues with channelization in the watershed, stream restoration projects are also an important strategy for both protection and restoration.

Restoration strategies for already impaired waterbodies involve cropland nutrient reductions through agricultural BMPs, feedlot runoff reductions, riparian pasture management, shoreland protection through natural plantings, buffers and shoreland stabilization projects.

What is the Watershed Restoration and Protection Strategies (WRAPS) Report?



The state of Minnesota has adopted a "watershed approach" to address the state's 80 "major" watersheds (denoted by 8-digit hydrologic unit code or HUC). This watershed approach incorporates **water quality assessment, watershed analysis, civic engagement, planning**, **implementation**, and **measurement of results** into a 10-year cycle that addresses both restoration and protection.

As part of the watershed approach, waters not meeting state standards are still listed as impaired and TMDL studies are performed, as they have been in the past, but in addition the watershed approach process facilitates a more cost-effective and comprehensive characterization of multiple water bodies and overall watershed health. A key aspect of this effort is to develop and utilize watershed-scale models and other tools to help state agencies, local governments and other watershed stakeholders determine how to best proceed with restoring and protecting lakes and streams. This report summarizes past assessment and diagnostic work and outlines ways to prioritize actions and strategies for continued implementation.

Purpose

- Support local working groups and jointly develop scientifically-supported restoration and protection strategies to be used for subsequent implementation planning
- Summarize Watershed Approach work done to date including the following reports:
  - *Long Prairie River 2014 Watershed Monitoring and Assessment*
  - *Long Prairie River 2014 Watershed Stressor Identification*
  - *Long Prairie River 2016 Watershed Total Maximum Daily Load for Nutrients and Bacteria*
  - Long Prairie River 2005 Watershed TMDL for Dissolved Oxygen

Scope

- Impacts to aquatic recreation and impacts to aquatic life in streams
- Impacts to aquatic recreation in lakes

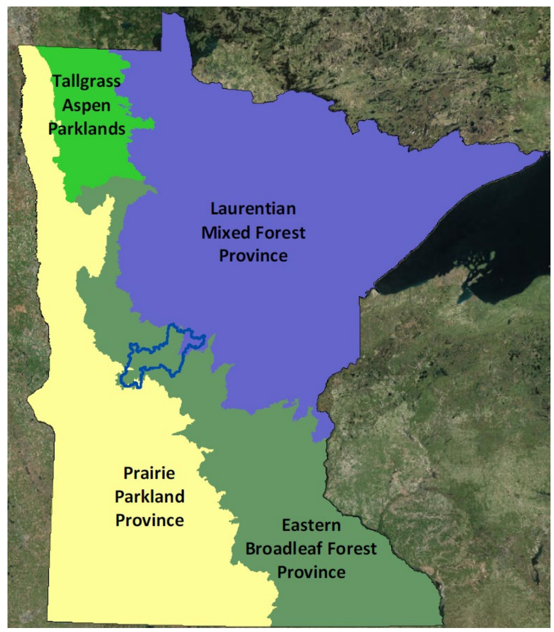
Audience

- Local working groups (local governments, SWCDs, watershed management groups, etc.)
- State agencies (MPCA, DNR, BWSR, etc.)

1. Watershed Background & Description

The Long Prairie River Watershed covers 882 square miles of Douglas, Morrison, Otter Tail, Todd and Wadena Counties in west central Minnesota (Figure 1). Flowing from west to east the Long Prairie River is over 96 miles long and joins the Crow Wing River near its junction with the Mississippi River south of Brainerd, Minnesota. The watershed spans three ecological provinces, moving from the edges of the Prairie Parkland, through the Eastern Broadleaf Forest, and including portions of the Laurentian Mixed Forest. The dominant land use within the watershed is 47% agricultural, while grasslands and forests make up 28%, water and wetlands 18%, and urban 7%. Land use varies along ecological provinces with the agricultural uses of the highly productive prairie soils in the headwaters contrasting with the recreational development focused around the lakes, which are often in the steep and rolling woodlands of the glacial moraines.

Municipalities located within the watershed include two regional shopping and services centers, the cities of Long Prairie and Alexandria. Douglas and Morrison Counties have several high value recreational lakes in the Long Prairie River Watershed that are focal points for development and services. These areas have seen above average growth for the past few decades and are projected to grow further as platted lots continue to sell. Water quality is generally good to very good in the watershed, with many high-quality, recreational lakes. Changes in land use patterns including increased development, wetland removal, and agriculture have all likely contributed to sediment and pollutant loadings to surface waters, thus reducing populations of sensitive aquatic species.

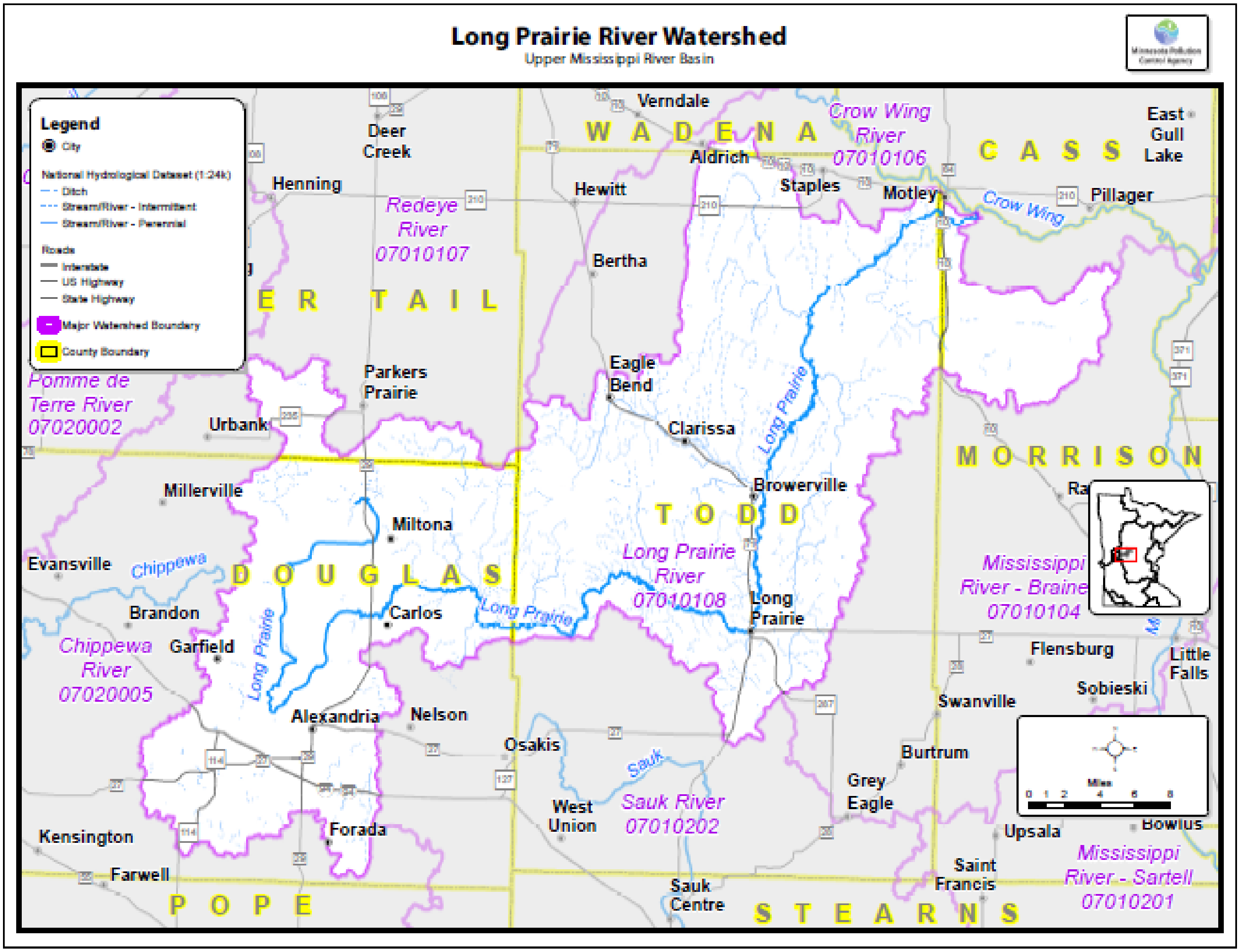


Additional Long Prairie River Watershed Resources

USDA Natural Resources Conservation Service (NRCS) Rapid Watershed Assessment for the Long Prairie River Watershed http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_021797.pdf

Minnesota Department of Natural Resources (DNR) Watershed Health Assessment Framework for the Long Prairie River Watershed http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/context_report_major_14.pdf and http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/ReportCard_Major_14.pdf

Figure 1: Map of Long Prairie River Watershed



2. Watershed Conditions

Land use varies across the watershed with the western end predominately row crop agriculture, transitioning to pasture and then forest as you travel east (Figure 2). Several high quality recreational lakes that exceed a thousand acres each are found in this portion of the watershed, which includes the headwaters of the watershed. Significant urban areas and widespread lakeshore development are focused around these resources with shoreline properties on Lakes Ida and Carlos both exceeding $2 million valuation. In total, over $2 billion of shoreline development is clustered around the lakes in the Alexandria area. This concentration of development supports thriving and growing service and retail sectors. This portion of the watershed has seen above average population growth; there are six townships in Douglas County projected to grow at a rate of 30%, and 7 of the 100 fastest growing townships in Minnesota are found around the Douglas County lakes. Alexandria was labeled the fastest growing micropolitan area in Minnesota in 2013 with growth of 11% from 2008 to 2012. The presence of major industries and commercial activity contribute to a consistently high statewide ranking for population growth, development potential, and business expansion.

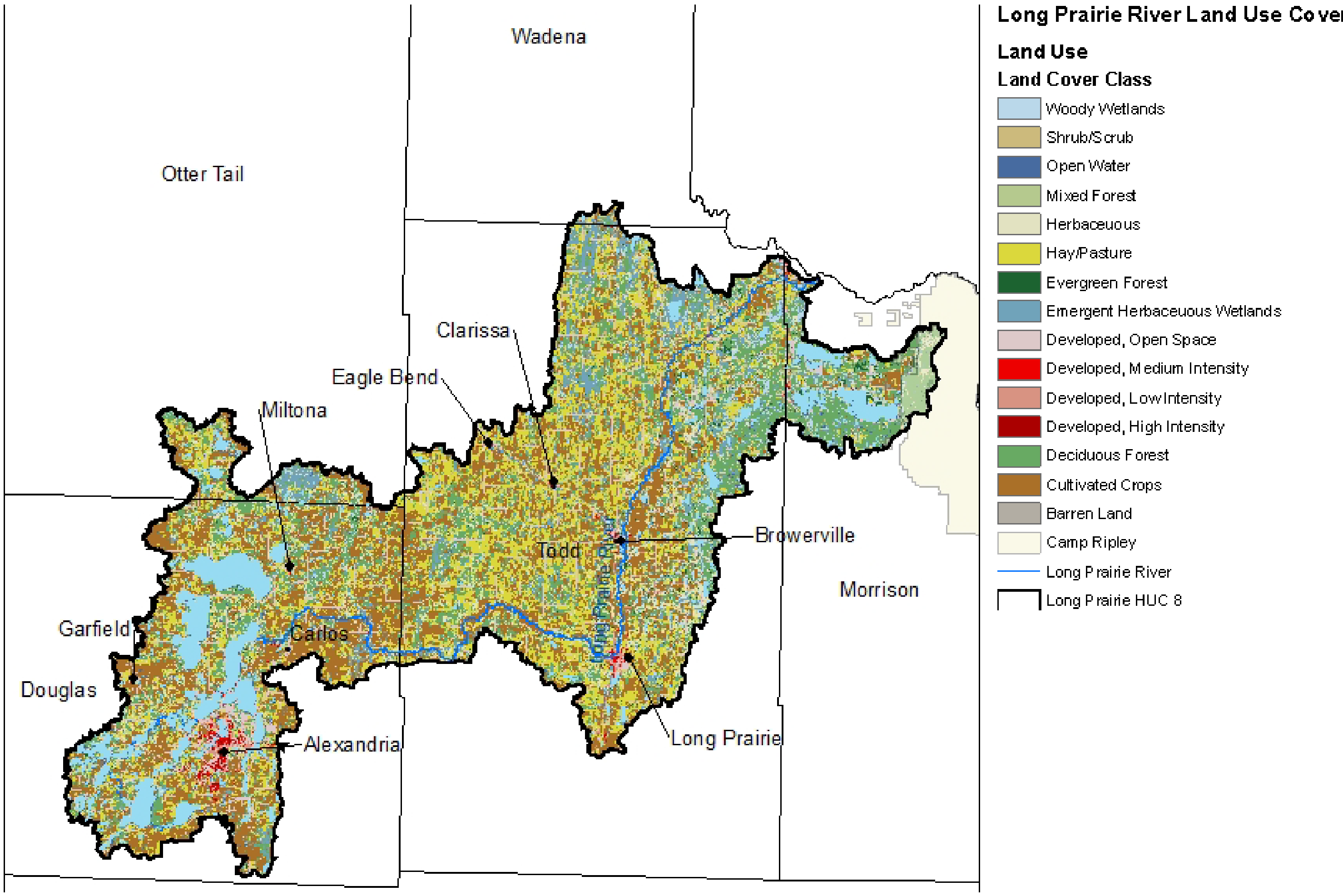


Figure 2: Land Use Cover in Long Prairie River Watershed

Land use pressure is very high in the upper/western portion of the watershed with disturbance levels over 50% and very low protection levels. The Minnesota Department of Natural Resource (DNR) lakes framework (DNR 2013) predicates that watershed disturbance measures water quality by proxy. When watershed disturbance is below 25%, water quality is usually high. Therefore, a disturbance level of 50% indicates possible water quality issues. Fortunately, many of the lakes are naturally well-protected from water quality degradation due to their alignment in a connected chain, their deep nature, and most lakes having very little direct runoff. Some of the lakes assessed were found to be sensitive to changes in nutrient loading and land use; several lakes in the upper and middle portions of the watershed are noted as impaired due to excessive nutrients. Water quality in some unimpaired lakes has been observed to vary with changes in nutrient loading and runoff. As land use rapidly intensifies in this portion of the watershed water quality will be harder to maintain and protection activities increasingly necessary.

Land use in the central portion of the watershed is generally a mix of row crop agriculture, pasture, and woodlands with some urban areas. Lakes in this portion of the watershed vary greatly based on their glacial setting. Some lakes are primarily groundwater fed and isolated from their watershed and have high water quality, while others have very large well-connected watersheds with lower water quality. The city of Long Prairie is the commercial and industrial hub of this area and sits astride its namesake river in central Todd County. Here the river turns north on its way to join the Crow Wing River near Motley.

To the east lie the hills of the St. Croix Moraine of the Superior Lobe (Figure 3) where lakes become more frequent again. Along this stretch the Turtle, Moran, and Fish Trap Creek Subwatersheds join the Long Prairie River mainstem from the east. Lakes in this area have significant development and provide quality recreational opportunities. Lake watersheds here generally have significant levels of disturbance but the sandy soils of the Superior lobe help protect water quality from direct runoff. Some very high quality minimally impacted lakes are found in this portion of the watershed. Lakes Alexander and Shamineau in particular have mainly forested watersheds and excellent water quality.

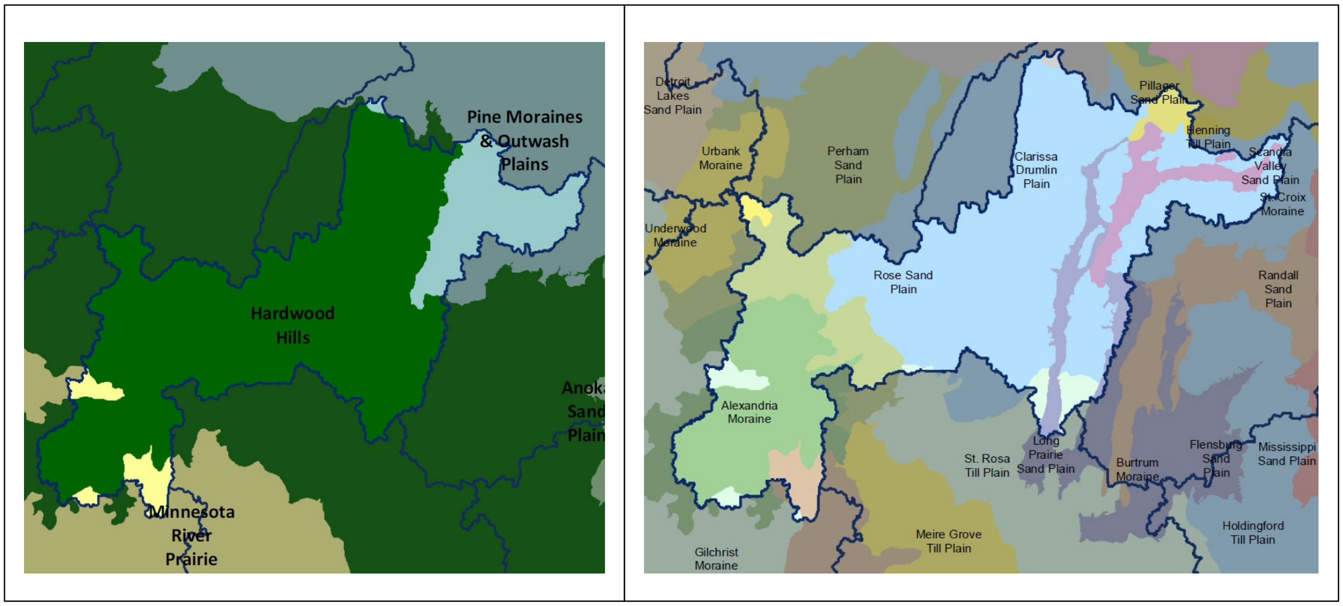


Figure 3: Ecological Classification System Subsection and Land Type Associations in Long Prairie River Watershed

2.1. Condition Status

This section summarizes impairment assessments for streams and lakes in the Long Prairie River Watershed at the hydrologic unit code (HUC) 10 scale (see Figures 4 and 5 below). Waters that are not listed as impaired will be subject to protection efforts (see Section 2.5 and 3.3). Some of the waterbodies in the Long Prairie River Watershed are impaired by mercury; however, this report does not cover toxic pollutants. For more information on mercury impairments please refer to the statewide mercury TMDL at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/statewide-mercury-tmdl-pollutant-reduction-plan.html.

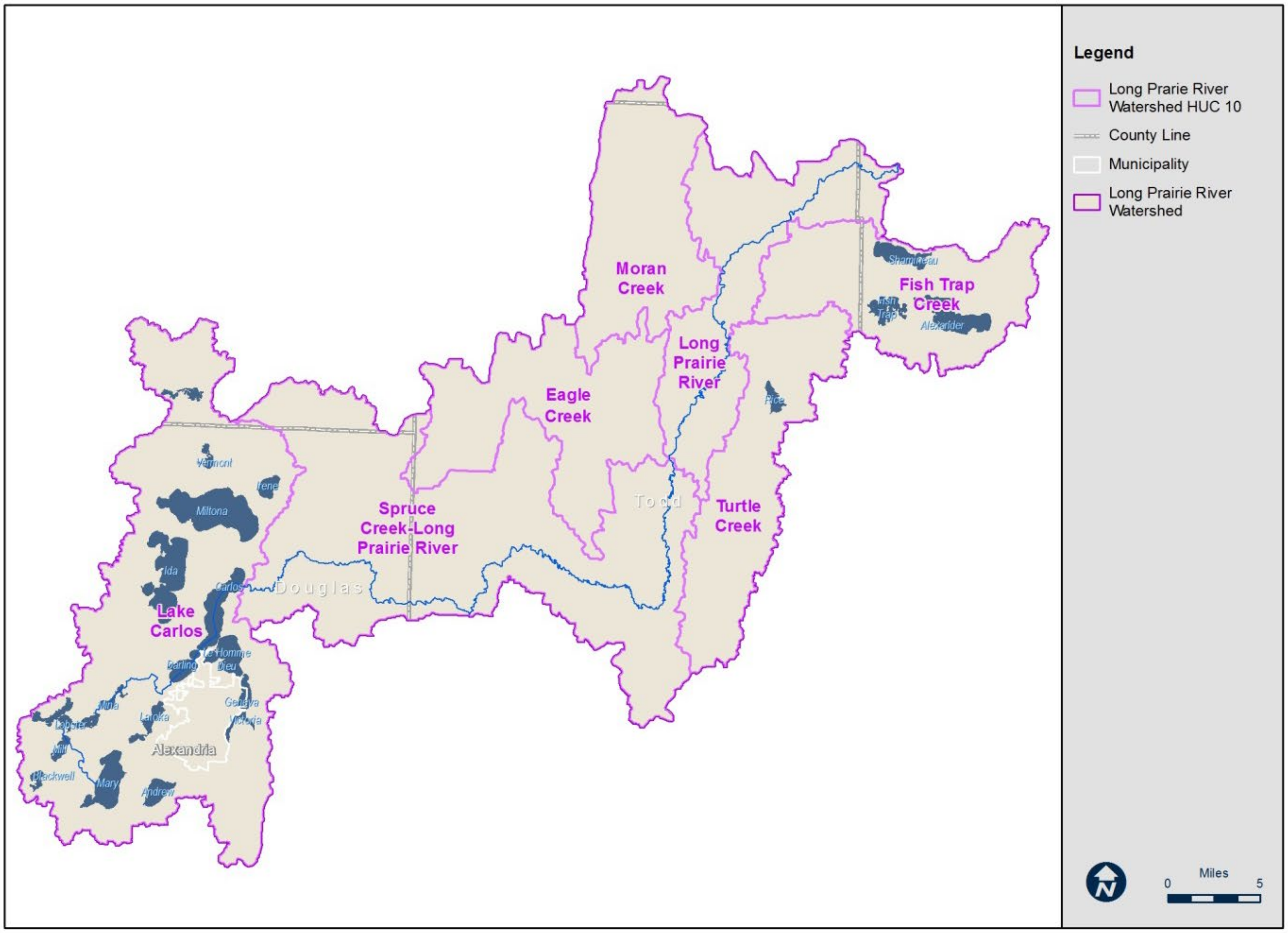
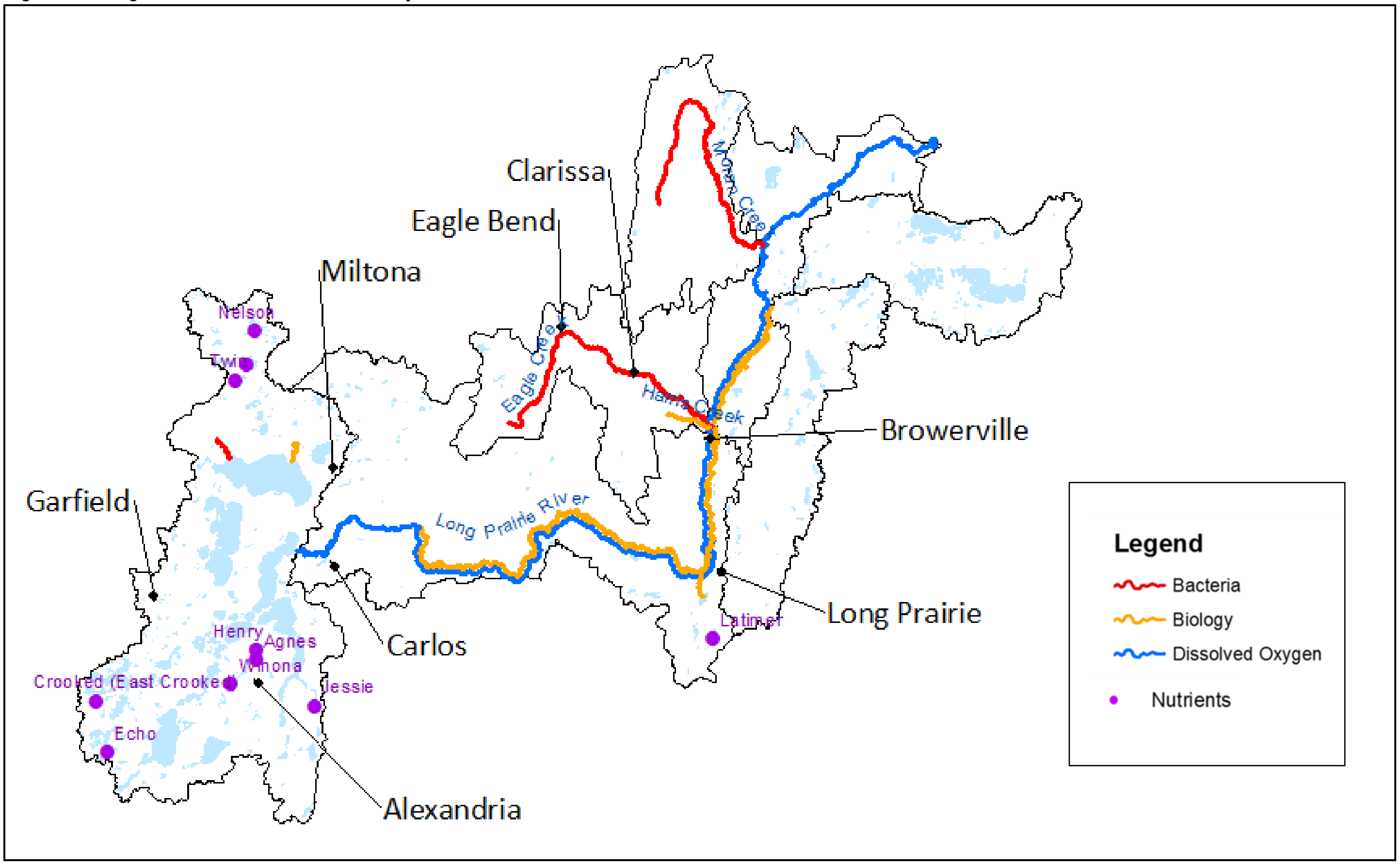


Figure 4: Long Prairie Watershed HUC 10 Map

Nineteen unique stream segments and 60 lakes were assessed through the joint efforts of the Minnesota Pollution Control Agency (MPCA), Morrison, Douglas, and Todd County Soil and Water Conservation Districts (SWCDs), and the Otter Tail County Coalition of Lake Associations as part of the 2014 MPCA Long Prairie Watershed Monitoring and Assessment Report. Not all waterbodies are monitored for assessment due to limited resources; furthermore, some monitored waterbodies do not have sufficient data for assessment. An additional six unique stream segments (AUIDs) were not assessed for aquatic biology because the reach was over 50% channelized and appropriate assessment criteria were not yet in place for these types of stream reaches. As future watershed monitoring continues, additional data will be collected and Tiered Aquatic Life Use (TALU) criteria will be adopted allowing for an increase in the number of assessed surface waterbodies.

Figure 5: Long Prairie River Watershed Impaired Lakes and Streams



Streams

Aquatic life use impairments include:

- Low fish index of biotic integrity (Fish IBI; which means an unhealthy fish community is present),
- Low macroinvertebrate index of biotic integrity (Invertebrate IBI; which means an unhealthy macroinvertebrate community is present),
- DO levels too low to support fish or macroinvertebrate life.

Aquatic recreation use impairments include *Escherichia coli* ((*E. Coli*) a bacteria indicator of fecal pollution) levels that are too high for safe human contact (wading or swimming).

As a result of findings during the Intensive Watershed Monitoring phase, one AUID was delisted of its current impairment status: Eagle Creek (07010108 - 507) for F-IBI and M-IBI. The Eagle Creek Minnesota Stream Habitat Assessment (MSHA) scores rate from fair to good, specifically scoring high for fish cover and channel morphology. In addition, Channel Condition and Stability Index (CCSI) ratings indicate that Eagle Creek is fairly stable at all sample locations, especially the upper and lower banks. In response to the high quality stream characteristics, the F-IBI and M-IBI scores all meet their respective thresholds. The channelized reach within this AUID met biological thresholds and had good habitat scores, but it did receive the lowest F-IBI and M-IBI scores in the subwatershed. These lower scores may be a result of the site being channelized (and so were not assessed) and possible urban stressors given the sites location within the town of Clarissa. As a result of these assessments, the previous F-IBI and M-IBI impairments on AUID

07010108-507 were removed. However, Eagle Creek exceeded the standard for bacteria and is considered impaired for aquatic recreation use.

Table 2 below summarizes the ability of the stream reaches to support aquatic life uses and aquatic recreation uses in the Long Prairie River Watershed based on the 2014 Monitoring and Assessment Report. Of the assessed streams, eight fully support aquatic life and three streams fully support aquatic recreation. Eleven AUIDs are non-supporting of aquatic life and three are non-supporting for aquatic recreation. All assessed reaches are included in **Appendix A**.

Table 2: Stream Aquatic Life Use and Aquatic Recreation Use Assessment Summary

HUC 10 Subwatershed	Total Assessed Stream Reaches	Aquatic Life Use				Aquatic Recreation Use			
		SUP	IMP	IF	NA	SUP	IMP	IF	NA
Lake Carlos	**2**	1	1	-	-	-	1	-	1
Eagle Creek	**2**	1	1	-	-	-	1	-	1
Spruce Creek - Long Prairie River	**8**	2	6	-	-	1	-	1	6
Turtle Creek	**1**	1	-	-	-	1	-	-	-
Moran Creek	**2**	2	-	-	-	-	1	-	1
Long Prairie River	**4**	1	3	-	-	1	-	1	2
Total	**19**	**8**	**11**	**0**	**0**	**3**	**3**	**2**	**11**
SUP = found to meet the water quality standard									
IMP = does not meet the water quality standard and therefore is impaired									
IF = the data collected was insufficient to make a finding									
NA = not assessed									

Source: 2014 Long Prairie River Watershed Monitoring and Assessment Report

Numbers in each column indicate the number of streams within each HUC 10 watershed that are within each category.

Lakes

The Long Prairie River Watershed is rich with lakes with approximately 219 lakes greater than 10 acres. The vast majority of the Long Prairie River Watershed lies within the North Central Hardwood Forest (NCHF) ecoregion with a small section in the Northern Lakes and Forest (NLF) ecoregion near the watershed outlet point into the Crow River Watershed. Long Prairie River Watershed lakes were assessed relative to the NCHF Class 2B ecoregion water quality standards (Table 3). In general, lake water quality data is readily available in the watershed due to a good network of local sampling partners with many lakes having a sufficient record (at least 8 samples collected over at least 2 years from a 10 year period) of water quality data required for assessment.

Lakes are assessed for aquatic recreation uses based on ecoregion specific water quality standards for total phosphorus (TP), chlorophyll-a (chl-*a*), and Secchi transparency depth. To be listed as having impaired aquatic recreation use, a lake must not meet water quality standards for TP and either chl-*a* or Secchi depth.

Table 3: Minnesota's ecoregion specific lake eutrophication standards

Ecoregion	TP (ug/L)	Chl-a (ug/L)	Secchi (m)
NLF – Aquatic Rec. Use (Class 2B)	< 30	< 9	> 2.0
NCHF – Aquatic Rec. Use (Class 2B)	< 40	< 14	> 1.4
NCHF – Aquatic Rec. Use (Class 2B) Shallow lakes	< 60	< 20	> 1.0

The MPCA received data from 65 lakes in the watershed as part of the 2014 Monitoring and Assessment Report from which they were able to assess 60 lakes for aquatic recreation use. Table 3 below summarizes the ability of assessed lakes to support aquatic recreation uses in the Long Prairie River Watershed. Of the assessed lakes, 50 supported aquatic recreation and 10 of the assessed lakes did not support aquatic recreation. Also, three of the assessed lakes were considered impaired for aquatic life use due to elevated chloride levels. All assessed lakes are included in **Appendix B**.

Table 4: Lake Aquatic Recreation Use Assessment and Impairment Summary

HUC 10 Subwatershed	Total Lakes > 10 acres	Aquatic Recreation Use				Major Lakes
		SUP	IMP	IF	NA	
Lake Carlos	**109**	34	9	4	62	Lobster, Miltona, Ida, Carlos, Le Homme Dieu, Mary, Darling
Eagle Creek	**2**	-	-	-	2	
Spruce Creek - Long Prairie River	**26**	2	1	-	23	Latimer, Charlotte
Turtle Creek	**28**	5	-	-	23	Rice, Thunder
Moran Creek	**8**	1	-	-	7	
Fish Trap Creek	**35**	7	-	1	27	Shamineau, Fish Trap, Alexander
Long Prairie River	**14**	1	-	-	13	
Total	**222**	50	10	5	157	

SUP = found to meet the water quality standard
IMP = does not meet the water quality standard and therefore is impaired
IF = the data collected was insufficient to make a finding
NA = not assessed

Source: 2014 Long Prairie River Watershed Monitoring and Assessment Report

Numbers in each column indicate the number of lakes within each HUC 10 watershed that are within each category.

2.2. Water Quality Trends

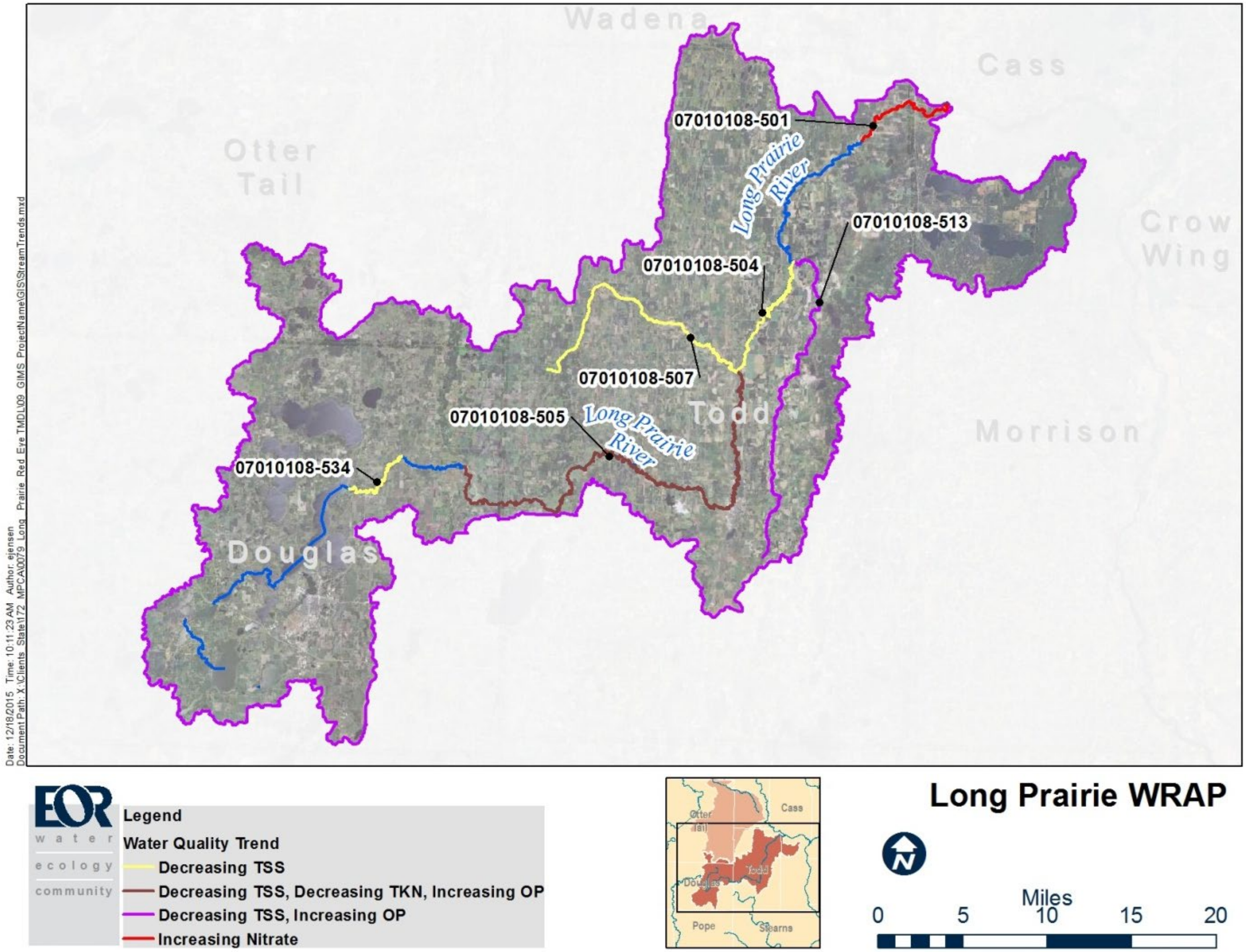
Seasonal and annual Kendall trends analysis were performed on stream and lake sampling locations with long term datasets (minimum of 10 years) using R Statistical Software. Trends were only reported that had statistical confidence of at least 95% (meaning that there is at least a 95% chance that the data are showing a true trend and at most a 5% chance that the trend is a random result of the data), contained at least 10 years of data, and were missing no more than 25% of the samples from the entire period. Statistically significant water quality trends were identified for several waterbodies (Tables 5 and 6, and Figures 6 and 7).

Table 5: Stream monitoring stations in the Long Prairie River Watershed with statistically significant water quality trends. Green shading denotes improved water quality; red shading denotes degraded water quality.

Stream Name	Station/ AUID	Parameter	Data Range	Season	Trend
Long Prairie River at US-10	S000-282 07010108-501	Nitrate	1976-2013	All	**Increasing**
Long Prairie River at Oak Ridge Road	S002-911 07010108-504	Total Suspended Solids	1999-2013	All	**Decreasing**
Long Prairie River at CSAH 14	S002-910 07010108-505	Orthophosphate	1997-2013	March- May	**Increasing**
		Total Suspended Solids	1997-2013	All	**Decreasing**
Long Prairie River at Riverside Drive	S002-904 07010108-505	Kjeldahl Nitrogen	1997-2013	March- May	**Decreasing**
		Orthophosphate	1997-2013	June- August	**Increasing**
		Total Suspended Solids	1997-2013	March- August	**Decreasing**
Eagle Creek at CSAH 21	S002-902 07010108-507	Total Suspended Solids	1997-2013	All	**Decreasing**
Turtle Creek at Oak Ridge Road	S002-901 07010108-513	Orthophosphate	1997-2013	June- August	**Increasing**
		Total Suspended Solids	1997-2013	All	**Decreasing**
Long Prairie River at Miltona Carlos Road	S002-905 07010108-534	Total Suspended Solids	1998-2013	All	**Decreasing**

Several reaches of the Long Prairie River show statistically significant trends (decreases) in suspended solids with increases in ortho-phosphorus. This trend may be a result of increases in the intensity of agricultural subsurface tile drainage, which generally reduces overland flow and sediment export, yet increases soluble phosphorus loss. Frequently tile discharge is in a clear water state, which upon entering the stream will often pick up sediment from the stream bottom and/or banks, displacing sediment in ways that is not reflected in Total Suspended Solids (TSS) concentrations, but is reflected in bed load. Further study would be necessary to identify the root cause of this trend.

Figure 6: Water quality trends in streams in Long Prairie River Watershed

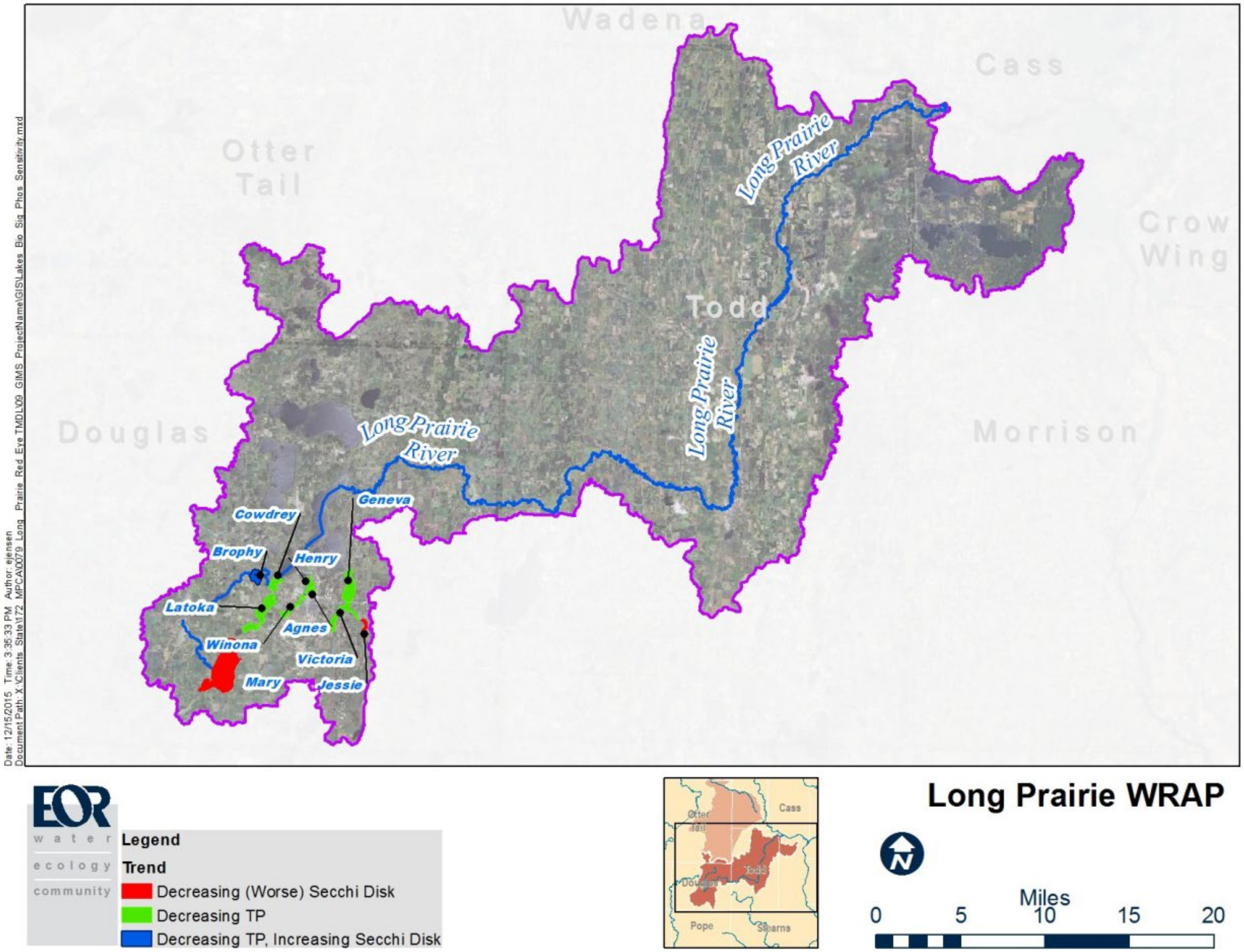


Most of the statistically significant water quality trends for lakes only had sufficient data for one parameter. When considering lake water quality, at least two parameters should be considered out of three (secchi disk depth, TP and chl-*a*). There was not a significant trend found for the other parameters for the lakes listed. Therefore, Brophy is the only lake with a significantly improved water quality trend, as it had both a decrease in TP, and an increase in Secchi Disk Depth, which indicates an increase in water clarity. A decrease in Secchi Disk Depth indicates a decrease in water clarity.

Table 6: Lakes in the Long Prairie River Watershed with statistically significant water quality trends. Green shading denotes improved water quality; red shading denotes degraded water quality.

Lake Name (Lake ID)	Parameter	Data Range	Trend
Agnes (21-0053-00)	Total Phosphorus	1977-2012	**Decreasing**
Brophy (21-0102-00)	Total Phosphorus	1984-2012	**Decreasing**
	Secchi Disk Depth	1990-2013	**Increasing**
Cowdrey (21-0103-00)	Total Phosphorus	1984-2012	**Decreasing**
Geneva (21-0052-00)	Total Phosphorus	1984-2012	**Decreasing**
Henry (21-0051-00)	Total Phosphorus	1977-2012	**Decreasing**
Jessie (21-0055-00)	Secchi Disk Depth	1998-2013	**Decreasing**
Latoka, South Bay (21-0106-02)	Total Phosphorus	1984-2012	**Decreasing**
Mary (21-0092-00)	Secchi Disk Depth	1992-2013	**Decreasing**
Victoria (21-0054-00)	Total Phosphorus	1977-2012	**Decreasing**
Winona (21-0081-00)	Total Phosphorus	1976-2012	**Decreasing**

Figure 7: Water quality trends in lakes in Long Prairie River Watershed



Observed lake water quality has generally followed one of three anecdotal transparency patterns, unrelated to the tables and map above (Henry, S. private conversation):

1. Many lakes had observed water quality minimums in the late 1970s and early 1980s when water quality testing first established a dataset. These lakes improved in transparency as time passed until reaching a maximum transparency in the early to mid-1990s. Since that time, many point sources such as failing lakeshore septic systems and riparian feedlots have been eliminated. However, nonpoint stresses seem to be contributing to the current decline in transparency. Lakes that fit this pattern include Mary, Andrew, Ida, Le Homme Dieu, Geneva, Pocket, and Shamineau.
2. Several lakes have had observed water quality that has been poor over the entire time of record. Both nonpoint and point sources are high in some of these systems. Lakes that fit this pattern include Jessie, Echo, Winona, and Latimer.
3. A group of lakes has exhibited good to very good clarity over the entire period of record despite changing land use and hydrology over time. These lakes deserve attention to maintain the substantial recreational benefits they provide but may not be focal points for water quality. Many of these lakes are supplied with major clean water inflows from adjacent upstream lakes and very little surface runoff keeping nonpoint stress low. As long as upstream waterbodies remain unimpaired, these systems will be unlikely to see appreciable water quality changes. Lakes in this group include Cowdrey, Darling, Carlos, Louise, and Mina.

2.3. Stressors and Sources

In order to develop appropriate strategies for restoring or protecting waterbodies, the stressors and/or sources impacting or threatening them must be identified and evaluated. Biological stressor identification (SID) is done for streams with either fish or macroinvertebrate impairments and encompasses both evaluation of pollutants and non-pollutant-related (e.g. altered hydrology, fish passage, habitat) factors as potential stressors. Pollutant source assessments are done where a biological SID process identifies a pollutant as a stressor, as well as for the typical pollutant impairment listings. For more details on the Long Prairie River Watershed stressors and the process used to identify the stressors causing the biological impairments, please consult the 2014 Long Prairie River Watershed SID Report, found at https://www.pca.state.mn.us/sites/default/files/wq-ws5-07010108.pdf. This report summarizes five candidate causes that were evaluated in each of the subwatersheds, which contained new biological impairments.

Stressors of Biologically-Impaired Stream Reaches

The primary stressors identified in streams with aquatic life impairments in the Long Prairie River Watershed include: low DO concentrations due to nutrient enrichment; loss of habitat due to excess bedded sediment; altered hydrology/channelization resulting in elevated levels of TSS; loss of connectivity due to impoundments or improper placement of culverts; and lack of woody debris leading to reduced habitat diversity and abundance of species requiring woody debris (Table 7).

Table 7: Primary stressors to aquatic life in biologically impaired reaches in the Long Prairie River Watershed

Waterbody name	AUID	Biological Impairment	Stressors					
			Daily DO Minimum	Bedded Sediment	Altered Hydrology/ Channelization	Lack of Woody Debris	Connectivity	Excess Nutrients (TP)
Unnamed Creek to Lake Miltona	**-595**	Fish, Inverts		¡	¡		¡	
Harris Creek	**-592**	Inverts	¡	¡	X	X	¡	¡
Spruce Creek	**-512**	Fish, Inverts		¡	¡	¡	¡	
Venewitz Creek	**-568**	Fish	¡	¡	X		¡	

¡ = Primary Stressor, X = Secondary Stressor

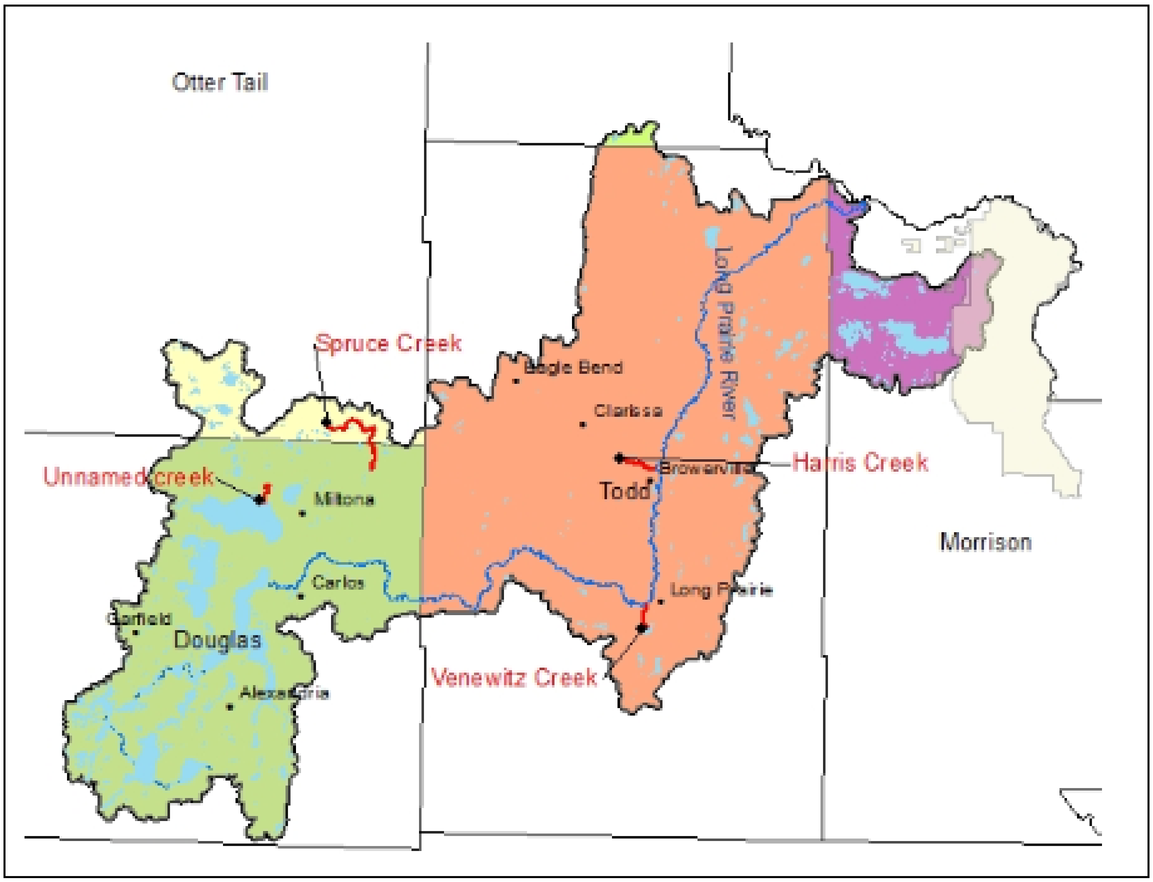


Figure 8: Map of Stream Reaches where Stressor ID was completed (reaches in red)

Pollutant sources

This section summarizes the potential sources of pollutants (such as phosphorus, bacteria or sediment) to lakes and streams in the Long Prairie River Watershed, including point sources (such as sewage treatment plants) or nonpoint sources (such as runoff from the land).

Point Sources

Point sources are defined as facilities that discharge stormwater or wastewater to a lake or stream and have a National Pollutant Discharge Elimination System (NPDES) or State Disposal System (SDS) Permit (Permit). There are 8 municipal wastewater facilities, 25 industrial stormwater facilities, and 11 large animal feeding operations that require NPDES permitting located in the Long Prairie River Watershed (Table 8).

Table 8: NPDES permitted point sources in the Long Prairie River Watershed

HUC 10 watershed	Point Source			Pollutant reduction needed beyond current permit conditions/limits?	Drains to
	Name	Permit #	Type		
Lake Carlos	UPS - Alexandria - SW	MNRNE 365Q	Industrial Stormwater	No	Jessie Lake
	SunOpta Aseptic Inc - ISW	MNR05 3645	Industrial Stormwater	No	Lake Winona
	Alexandria Light & Power	MNG25 0004	Industrial Stormwater	No	Lake Winona
	Jack's Family Recycling Center LLC - Geneva - ISW	MNRNE 33GN	Industrial Stormwater	No	Connie Lake
	Alexandria Lakes Area Sanitary District (ALASD)	MN004 0738	Municipal Wastewater	No*	Lake Winona
	Garfield WWTP	MN002 3515	Municipal Wastewater	No	Lake IDA via CD 23
	ITW Heartland Parts - SW	MNRNE 33MX	Industrial Stormwater	No	Lake Winona
	Doege Precision Machining Inc - ISW	MNRNE 33V6	Industrial Stormwater	No	Lake Winona
	Alexandria Municipal Airport-Chandler Field - ISW	MNR05 35DQ	Industrial Stormwater	No	Lake Winona
	Quality Printing Co - ISW	MNRNE 3776	Industrial Stormwater	No	Lake Winona
	Pfeninger Warehousing LLC ISW	MNRNE 37PH	Industrial Stormwater	No	Lake Andrew
	3M - Alexandria - SW	MNR05 34BZ	Industrial Stormwater	No	Connie Lake
	Alexandria Extrusion Co - SW	MNR05 349M	Industrial Stormwater	No	Lake Winona

HUC 10 watershed	Point Source			Pollutant reduction needed beyond current permit conditions/limits?	Drains to
	Name	Permit #	Type		
	Hubbard Feeds Inc ISW	MNR05 33V4	Industrial Stormwater	No	Lake Agnes
	Jack's Family Recycling Center LLC - ISW	MNR05 33GQ	Industrial Stormwater	No	Lake Victoria
	Douglas Machine Inc - ISW	MNR05 222X	Industrial Stormwater	No	Lake Winona
Eagle Creek	Jennie-O Turkey Store - Toddco Green	153-50008	Feedlot	No	Harris Creek
	Jennie-O Turkey Store - Toddco Blue	153-50007	Feedlot	No	Harris Creek
	Korfe Home Farm	153-82618	Feedlot	No	CD 31 via unn. stream
	Clarissa WWTP	MNG58 0008	Municipal Wastewater	No	Eagle Cr via unn. stream
	Eagle Bend WWTP	MN002 3248	Municipal Wastewater	No	Eagle Cr.
	Jerry & Linda Korfe Hog Farm	153-81169	Feedlot	No	Eagle Cr via unn. stream
Spruce Creek - Long Prairie River	Dairyridge Inc	153-50004	Feedlot	No	Unn. Cr to Latimer Lake
	Brenton Engineering - ISW	MNR05 36YX	Industrial Stormwater	No	Long Prairie River Headwaters
	Custom Transfer Inc - ISW	MNR05 364N	Industrial Stormwater	No	Charlotte Lake
	Gourley Premium Pork	153-117967	Feedlot	No	Dismal Cr
	Long Prairie Packing Pre-Treatment Facility	MN002 0303	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Carlos WWTP	MN002 3019	Municipal Wastewater	No	Long Prairie River Headwaters
	Long Prairie Ground Water Remediation	MNG79 0134	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Browerville WWTP	MN002 2926	Municipal Wastewater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Long Prairie WWTP - Municipal	MN006 6079	Municipal Wastewater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Miltona WWTP	MN002 4155	Municipal Wastewater	No	Unn. Cr to Long Prairie River Headwaters
	Long Prairie Leader - ISW	MNRNE 36P7	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr

HUC 10 watershed	Point Source			Pollutant reduction needed beyond current permit conditions/limits?	Drains to
	Name	Permit #	Type		
Spruce Creek - Long Prairie River	Cathedral Press Inc - ISW	MNRNE 34Q5	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Todd County Demolition Landfill - ISW	MNR05 37C8	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Long Prairie Packing Co - ISW	MNR05 35FB	Industrial Stormwater	No	Long Prairie River - Spruce Cr to Eagle Cr
	Skip's Deluxe Auto Parts Inc - SW	MNR05 34CZ	Industrial Stormwater	No	Long Prairie River Headwaters
	Contech Construction Products Inc - Alexandria ISW	MNR05 3499	Industrial Stormwater	No	Long Prairie River Headwaters
Moran Creek	Two Moore Farms	153-50003	Feedlot	No	Unn. Cr to Moran Cr
	Patrick & Jody Lunemann Farm - North Site	153-82617	Feedlot	No	Unn. Cr to Moran Cr
	Patrick & Jody Lunemann Farm - Pat's Site	153-81165	Feedlot	No	Unn. Cr to Moran Cr
	Twin Eagle Dairy LLP	153-81164	Feedlot	No	Unn. Cr to Moran Cr
Long Prairie River	D&D CNC Machining Inc - ISW	MNRNE 37PM	Industrial Stormwater	No	Long Prairie River – Moran Cr to Fish Trap Cr

*ALASD is currently meeting permit conditions. Once the Lake Winona TMDL is approved, they will have until March 30, 2021 to achieve compliance with the new TP effluent limit.

Nonpoint Sources

Nonpoint sources of pollution are diffuse sources, unlike point source pollution that typically comes from individual industrial and sewage treatment plant discharge pipes. Nonpoint source pollution is the result of water caused by rainfall or snowmelt moving over and through the ground. As the water moves, it picks up natural and human-made pollutants and carries them into lakes and streams. Common nonpoint pollutant sources in the Long Prairie River Watershed are:

- **Fertilizer runoff**: Fertilizer typically contains phosphorus and nitrogen, which can runoff into adjacent waterbodies when improperly managed or over-applied to agricultural fields or residential lawns.
- **Manure runoff**: Manure contains high concentrations of phosphorus, nitrogen, and bacteria, which when improperly managed or over-applied to agricultural fields can runoff into adjacent water bodies.
- **Field and stream erosion**: Field erosion can deliver sediment and phosphorus when soil is disturbed or exposed to wind and rain; stream erosion can deliver sediment from destabilized banks or transport of deposited sediment in the stream during high flows.

- **Peatlands/wetlands**: Peatlands and wetlands in the Long Prairie River Watershed have high levels of phosphorus and low levels of DO that can impact downstream streams and lakes.
- **Runoff from near-shore development:** Many of the lakes in the Long Prairie River Watershed have developed shorelines. Impervious surfaces and lawns can be direct sources of phosphorus, nitrogen, and bacteria from runoff.
- **Failing septic systems**: Septic systems that are not maintained or failing near a lake or stream can contribute excess phosphorus, nitrogen, and bacteria.
- **Internal loading**: Lake sediments often contain large amounts of phosphorus that can be released into the lake water through physical mixing or under certain chemical conditions.
- **Upstream lakes and streams**: Some lakes and streams receive most of their pollutants from upstream waterbodies. For these lakes, restoration and protection efforts should focus on improving the water quality of the upstream contributing lake or stream.
- **Wildlife fecal runoff**: Dense or localized populations of wildlife, such as beavers or geese, can contribute phosphorus and bacteria pollutants to streams or ponds.

Table 9 displays the relative magnitude of various nonpoint pollutant sources in lakes and streams throughout the watershed. These sources were determined with various methodologies during the TMDL study for nutrients and bacteria and DO; the completed reports can be found at https://www.pca.state.mn.us/sites/default/files/wq-iw8-49e.pdf and https://www.pca.state.mn.us/water/tmdl/long-prairie-river-watershed-low-dissolved-oxygen-tmdl-project. According to those reports, fertilizer and/or manure runoff, field and stream erosion, and upstream loading were identified as common nonpoint pollutant sources to impaired streams. Fertilizer runoff, in-lake sediment phosphorus release (internal loading), and upstream lake loading were identified as common nonpoint pollutant sources to impaired lakes.

Table 9: Relative Magnitude of Contributing Nonpoint Pollutant Sources in the Long Prairie River Watershed.

HUC-10 Subwatershed	Pollutant	Watershed of Impaired Stream/Reach (AUID) and/or Lake (ID)	WWTP effluent	Urban runoff	Fertilizer and/or manure run-off	Failing septic systems	Internal loading	Upstream lake loading	Livestock overgrazing	Wildlife fecal runoff
Lake Mary	TP	Echo Lake (21-0157-00)			~	™				
		Crooked Lake, East (21-0199-02)			~	™				
Fish Lake	TP	Nelson Lake (56-0065)			~		›			
		Fish Lake (56-0066)			›		›	™		
		Twin Lake (56-0067)			™		›	~		
	Bacteria	Unnamed Creek (CD 11 to Lake Miltona, 07010108-552)							~	™

HUC-10 Subwatershed	Pollutant	Watershed of Impaired Stream/Reach (AUID) and/or Lake (ID)	WWTP effluent	Urban runoff	Fertilizer and/or manure run-off	Failing septic systems	Internal loading	Upstream lake loading	Livestock overgrazing	Wildlife fecal runoff
Lake Victoria	TP	Lake Jessie (21-0055)			˜	™	›			
Lake Le Homme Dieu	TP	Lake Winona (21-0081)	˜	›			˜			
		Lake Agnes (21-0053)		™				˜		
		Lake Henry (21-0051)		™				˜		
	Chloride	Lake Winona (21-0081)	˜	›						
		Lake Agnes (21-0053)		™				˜		
		Lake Henry (21-0051)		™				˜		
Long Prairie River – City of Carlos	NBOD/ CBOD/ SOD	Long Prairie River (Lake Carlos to Spruce Creek, 07010108-506)		›	˜					
Long Prairie River – Freemans Creek		Long Prairie River (Spruce Creek to Eagle Creek, 07010108-505)		›	˜					
Long Prairie River		Long Prairie River (Fish Trap Creek to Crow Wing River, 07010108-501)			˜					
Long Prairie River – Eagle Creek to Turtle Creek		Long Prairie River (Eagle Creek to Turtle Creek, 07010108-504)		™	˜					
Long Prairie River – Stony Brook		Long Prairie River (Turtle Creek to Moran Creek, 07010108-503)			˜					
		Long Prairie River (Moran Creek to Fish Trap Creek, 07010108-502)			˜					
Headwaters Eagle Creek/ Eagle Creek	Bacteria	Eagle Creek (07010108-507)							˜	™
Venewitz Creek	TP	Latimer Lake (77-0105)			›	™	›			
Moran Creek	Bacteria	Moran Creek (07010108-511)							˜	™

Key: ˜ = High › = Moderate ™ = Low. TP = Total Phosphorus; NBOD = Nitrogenous Biochemical Oxygen Demand; CBOD = Carbonaceous Biochemical Oxygen Demand; SOD = Sediment Oxygen Demand

Note: All sources listed in the table were identified in completed TMDL studies in the Long Prairie River Watershed. The symbols in the table differentiate the relative ranking of implementation targeting for the more significant sources within each subwatershed. Refer to the Long Prairie River Watershed webpage for further information regarding specific sources.

2.4. TMDL Summary

A TMDL is a calculation of how much pollutant a lake or stream can receive before it becomes unfishable, unswimmable, or unusable. These studies are required by the federal Clean Water Act and state Clean Water Legacy Act (CWLA) for all impaired lakes and streams. There are eight impaired lakes and nine impaired streams in the Long Prairie River Watershed with completed TMDL studies. Tables 11 through 13 summarize the individual TMDL wasteload and load allocations and percent reductions needed to meet water quality standards and goals for each impaired lake or stream.

Table 10 summarizes past, current and future TMDL Studies in the Long Prairie River Watershed, as well as all currently listed impaired lakes and streams.

Table 10: Impaired Lakes and Streams in the Long Prairie River Watershed and TMDL status

AUID/ Lake ID	Name	Location/Reach Description	Designated Use Class	Listing Year	Target Start/ Completion	Impairment addressed by:	Affected Use: Pollutant/Stressor
21-0053	Lake Agnes	In Alexandria	2B, 3C	2010	2011/2017	Future TMDL*	*Aquatic Life:* Chloride
21-0051	Lake Henry	At Alexandria	2B, 3C				
21-0081	Lake Winona	In Alexandria	2B, 3C				
21-0081	Lake Winona	In Alexandria	2B, 3C	2002	2012/2017	Lake Winona TMDL	*Aquatic Recreation*: Nutrient/ Eutrophication Biological Indicators (Phosphorus)
21-0053	Lake Agnes	In Alexandria	2B, 3C	2014	2011/2015	Future TMDL**	
21-0051	Lake Henry	At Alexandria	2B, 3C	2014	2011/2015		
21-0199-02	Crooked Lake (East)	1 mile NW of Holmes City	2B, 3C	2014	2011/2015	Long Prairie TMDL for Nutrients and Bacteria	
21-0157-00	Echo Lake	2 miles W of Carlos	2B, 3C				
56-0066	Fish Lake	W of Parkers Prairie	2B, 3C				
21-0055	Jessie Lake	4 miles E of Alexandria	2B, 3C				
77-0105	Latimer Lake	3 miles S of Long Prairie	2B, 3C				
56-0065	Nelson Lake	W of Parkers Prairie	2B, 3C				
56-0067	Twin Lake	W of Parkers Prairie	2B, 3C				
07010108-507	Eagle Creek	Headwaters to Long Prairie River	2B, 3C	2014	2011/2015	Long Prairie TMDL for Nutrients	*Aquatic Recreation*: *E. coli*
07010108-511	Moran Creek	Headwaters to Long Prairie River	2B, 3C				

AUID/ Lake ID	Name	Location/Reach Description	Designated Use Class	Listing Year	Target Start/ Completion	Impairment addressed by:	Affected Use: Pollutant/Stressor
070101 08-552	Unnamed Creek	CD11 to Lake Miltona	2B, 3C			and Bacteria	
070101 08-512	Spruce Creek	T131 R36W S31, north line to Unnamed Lake 21-0034	1B, 2A, 3B	2014	2011/2015	This WRAPS	*Aquatic Life:* Fish or macro-invertebrate bioassessments
070101 08-568	Venewitz Creek	Charlotte Lake to Long Prairie River	2B, 3C				
070101 08-592	Harris Creek	Unnamed creek to Eagle Creek	2B, 3C				
070101 08-595	Unnamed Creek	Headwaters to Lake Miltona	2B, 3C				
070101 08-501	Long Prairie River	Fish Trap Creek to Crow Wing River	2B, 3C	2002	TMDL approved 2005 Implementation underway		*Aquatic Life:* Dissolved oxygen
070101 08-502	Long Prairie River	Moran Creek to Fish Trap Creek	2B, 3C				
070101 08-503	Long Prairie River	Turtle Creek to Moran Creek	2B, 3C				
070101 08-504	Long Prairie River	Eagle Creek to Turtle Creek	2B, 3C				
070101 08-505	Long Prairie River	Spruce Creek to Eagle Creek	2B, 3C				
070101 08-506	Long Prairie River	Lake Carlos to Spruce Creek	2B, 3C				

*Additional monitoring is needed to address the chloride impairments for Lake Winona, Agnes and Henry; these TMDLs will be completed at a future date.

**Lake Winona is the headwater lake of the Winona-Agnes-Henry Lake chain. In-lake phosphorus concentrations of Lake Agnes and Lake Henry are strongly influenced by the water quality of Lake Winona. Therefore, the nutrient impairments in Lake Agnes and Lake Henry are being deferred until the Lake Winona TMDL is fully implemented.

Table 11: Allocation summary for completed low dissolved oxygen stream TMDLs in the Long Prairie River Watershed

Stream/ Reach (AUID)	Pollutant	Source	Existing Load (lbs/day)		Allocated Load (lbs/day)		Load Reduction %	
			CBOD	NBOD	CBOD	NBOD	CBOD	NBOD
Long Prairie River Fish Trap Creek to Crow Wing River (07010108-501)	BOD	Fish Trap Creek	243	48	243	48	0%	0%
		Nonpoint Sources	1276	320	1276	320	0%	0%
Long Prairie River Moran Creek to Fish Trap Creek (07010108-502)	BOD	Moran Creek	93	62	93	62	0%	0%
		Nonpoint Sources	682	171	682	171	0%	0%
Long Prairie River Turtle Creek To Moran Creek (07010108-503)	BOD	Turtle Creek	238	129	238	129	0%	0%
		Nonpoint Sources	620	156	620	156	0%	0%

Stream/ Reach (AUID)	Pollutant	Source	Existing Load (lbs/day)		Allocated Load (lbs/day)		Load Reduction %	
			CBOD	NBOD	CBOD	NBOD	CBOD	NBOD
Long Prairie River Eagle Creek to Turtle Creek (07010108-504)	BOD	Eagle Creek Residual Point Source Loads	204	209	204	209	0%	0%
		Eagle Creek Nonpoint Sources	645	43	587	40	9%	8%
		Nonpoint Sources	1,586	398	1,442	362	9%	9%
Long Prairie River Spruce Creek to Eagle Creek (07010108-505)	BOD	Long Prairie - Superfund	48	17	48	17	0%	0%
		Long Prairie WWTF	1,431	12,545	275	838	81%	93%
		Browerville WWTF	542	1,295	542	504	0%	61%
		Spruce Creek	96	32	87	29	9%	10%
		Dismal Creek	19	33	17	30	11%	8%
		Nonpoint Sources	5,862	533	5,329	484	9%	9%
Long Prairie River Headwaters -Lake Carlo to Spruce Creek (07010108-506)	BOD	Carlos WWTF	233	254	233	254	0%	0%
		LPR Headwaters @ RM89.9	161	55	161	55	0%	0%
		Nonpoint Sources	1,115	81	999	68	10%	10%

BOD = Biochemical Oxygen Demand, CBOD= Carbonaceous Biochemical Oxygen Demand, NBOD= Nitrogenous Biochemical Oxygen Demand

The 2005 DO TMDL addressed both point as well as nonpoint sources (https://www.pca.state.mn.us/water/tmdl/long-prairie-river-watershed-low-dissolved-oxygen-tmdl-project). Nonpoint source load reductions on the order of 10% were indicated for the upper and middle portions of the Long Prairie River (reaches 07010108-504 through -506). Reductions in the upper reaches should result in improvements in the lower portion of the river, so no load reductions were indicated for reaches -501 through -503.

Significant accomplishments have been made since that time. The Long Prairie Wastewater Treatment Plant (WWTP) has made upgrades to their facilities, resulting in a reduction of ammonia discharged to the river, which should result in improved conditions for aquatic life due to increased DO and reduction of toxicity from un-ionized ammonia. In addition, the Project eliminated the direct discharge of wastewater from the Long Prairie Packing Company pond system, which did not provide additional treatment for phosphorus. The reduction in phosphorus loadings provided by the Project should also help to improve the DO conditions of the Long Prairie River and waters downstream. Long Prairie WWTP is currently significantly under its permitted load for CBOD (3.2 lbs per day) and NBOD (14 lbs per day).

Nonpoint sources were addressed through two Clean Water Act Section 319 grants with Todd SWCD. In the first grant, they had three focus areas - vegetation establishment, animal agriculture activities and structural changes. Vegetation establishment included reforestations, shelterbelt and shelterbelt renovation, riparian tree planting and lakeshore restoration. Animal Agriculture included installing a cattle travel lane, agricultural waste pits, pond closures and wastewater and feedlot runoff control.

Structural practices included a bioretention basin, unused well sealing and a stream barb project. In the second grant 28 different BMPs were put in place, including a sediment basin, well decommissioning, ag waste systems, prescribed grazing plan, bio-retention projects, shelterbelt, field windbreak, pond abandonments, streambank and shoreline protection projects and many reforestations.

Table 12: Allocation summary for completed lake phosphorus TMDLs in the Long Prairie River Watershed

	Total Phosphorus Allocations (kg/year)											
	Wasteload Allocation			Load Allocation						MOS	RC	
Lake (ID)	WWTPs	Construction & Industrial Stormwater	MS4 Communities	Watershed Runoff*	Upstream Lake	Internal P Release	Livestock	Failing Septic Systems	Atmospheric Deposition	Margin of Safety	Reserve Capacity	Percent Reduction
Crooked Lake-East (21-0199-02)	--	2.4	--	48.1	--	49.8	1.7	1.8	11.0	7.0	--	21%
Echo Lake (21-0157-00)	--	5.8	--	137.4	--	--	--	0.0	13.7	17.4	--	30%
Fish Lake (56-0066-00)	--	0.3	--	349.1	128.3	162.1	--	--	53.1	122.3	--	45%
Jessie Lake (21-0055-00)	--	17.1	--	400.7	--	84.9	0.4	0.0	12.0	57.3	--	38%
Latimer Lake (77-0105-00)	--	0.04	--	90.7	--	44.5	58.2	0.0	21.9	23.9	--	63%
Nelson Lake (56-0065-00)	--	0.17	--	223.2	--	20.1	14.4	--	29.5	50.7	--	35%
Twin Lake (56-0067-00)	--	0.27	--	57.8	313.5	107.3	1.5	--	14.5	87.3	--	41%
South Winona (21-0081-00)	665.0	2.32	49.9	4.5	--	8.3	--	--	13.7	6.3	--	55%
North Winona (21-0081-00)	--	1.4	158.2	3.6	587.3	5.2	-	--	1.65	4.20	--	62%

Table 13: Allocation summary for completed stream *E. coli* TMDLs in the Long Prairie River Watershed

Stream/ Reach (AUID)	Pollutant	Flow Zone	Allocations (*E. coli* in billions organisms/day)					Percent Reduction
			Wasteload Allocation		Load Allocation		Margin of Safety	
			WWTPs	Regulated Stormwater	Upstream Outflow	Watershed Runoff		
Eagle Creek 07010108-507	*E. coli*	Very High	14.1	--	--	305.4	35.3	83%
		High	14.1	--	--	87.6	11.3	37%
		Mid	14.1	--	--	38.0	5.8	67%
		Low	14.1	--	--	9.1	2.6	36%
		Very Low	14.1	--	--	0.0	1.3	14%
Moran Creek 07010108-511	*E. coli*	Very High	--	--	--	349.2	38.8	0%
		High	--	--	--	124.0	13.8	0%
		Mid	--	--	--	59.2	6.6	63%
		Low	--	--	--	25.1	2.8	32%
		Very Low	--	--	--	11.6	1.3	42%
Unnamed Creek 07010108-552	*E. coli*	Very High	--	--	--	130.3	14.5	44%
		High	--	--	--	36.9	4.1	82%
		Mid	--	--	--	19.5	2.2	92%
		Low	--	--	--	10.8	1.2	92%
		Very Low	--	--	--	5.5	0.6	n/a

The TMDL for bacteria and nutrients in the Long Prairie River Watershed is currently available: (https://www.pca.state.mn.us/sites/default/files/wq-iw8-49e.pdf). Recommendations from that study are included in this WRAPS report.

There is also a TMDL in progress for Lake Winona for excess nutrients. https://www.pca.state.mn.us/water/tmdl/lake-winona-%E2%80%94-excess-nutrients-tmdl-project

2.5. Protection Considerations

The following section describes specific water resources and/or specific areas within the Long Prairie River Watershed identified for protection based on data collected by the DNR as well as input received from local partners and the public. Protection strategies are identified in Section 3.3 for each of the specific areas and/or water resources listed below.

- Biologically important lakes
- Cisco lakes
- Trout streams
- Camp Ripley Army Compatible Use Buffer (ACUB)
- First ranked lakes in the strategy implementation tables

Lakes of Outstanding Biological Significance

Many of the lakes in the Long Prairie River Watershed are highly valued recreational lakes that are sensitive to changes in nutrient (phosphorus) loading and hydrology. The DNR conducted a statewide analysis of lakes of biological significance in 2015 based on dedicated biological sampling. This analysis identified 11 lakes in the Long Prairie River Watershed that met the criteria for lakes of outstanding biological significance (Figure 9 and Table 14). The criteria included:

- Diverse and high quality aquatic plants and a population of an endangered or threatened plant species.
- Important wild rice lakes.
- Exceptional fishery for selected game fish or an outstanding nongame fish community.
- One or more of the following: endangered or threatened colonial waterbird nesting area, presence of several endangered, threatened, or special concern lake bird species, or six or more lake bird Species of Greatest Conservation Need.

Cisco Refuge Habitat

Cisco (Tullibee) is a cold water fish species that needs clean, cold and well-oxygenated water to survive. Ciscoes are exceptionally vulnerable to reduction in oxygen below the thermocline - the area in a thermally stratified lake that separates the warm surface waters from the cold deep water. Ciscoes are the most well distributed cold-water species across Minnesota lakes. The wide distribution of ciscoes in Minnesota makes ciscoes a great indicator species to understand the potential effects of increased nutrient loading and/or climate change on Minnesota lakes. The DNR has completed an extensive study aimed at identifying and selecting potential cisco refuge lakes under projected warmer climate scenarios (Jacobson and Pereira 2010). The DNR categorized Minnesota lakes with a recorded history of cisco presence into three tiers, Tier 1 lakes have the most suitable cold-water fish habitat, Tier 2 lakes have suitable cold-water fish habitats, and Tier 3 lakes are marginal or unsuitable for cisco. Table 14 and Figure 10 show the three Cisco Tier 2 categorized lakes in the Long Prairie River Watershed (Latoka, Mina and Charlotte).

Trout Streams

A 7.4-mile stretch of Spruce Creek starting at the stream's headwaters and ending at Mill Pond is recognized as a designated trout stream. Several smaller unnamed streams that drain directly to the Spruce Creek headwaters are also recognized as designated trout streams (Figure 11). Spruce Creek is recognized as a class 2A stream (coldwater). The class 2A water quality standard for DO is 7 mg/L. Spruce Creek DO measurements collected in 2013 as part of the stressor ID report occasionally dipped below 7 mg/L.

Camp Ripley Army Compatible Use Buffer and Sentinel Landscape

Portions of the Fish Trap Creek, Stony Brook, Turtle Creek, Shamineau Lake and Alexander Lake HUC 12 watersheds are within 10 miles of the Camp Ripley Boundary and/or within Camp Ripley (Figure 12). Camp Ripley abounds with plant and animal life unique to central Minnesota. Wildlife species of particular interest include the white-tailed deer, black bear and timber wolf. In 2003, the Department of Defense Authorization Act passed the ACUB federal program. This program will allow the Minnesota National Guard to enter into an agreement with Board of Soil and Water Resources (BWSR), DNR, or The Nature Conservancy to limit encroachment on lands neighboring Camp Ripley. The Minnesota National Guard ACUB program for Camp Ripley is known locally as "Central Minnesota Prairie to Pines Partnership preserving our heritage." To date, 2,470 acres within the Long Prairie River Watershed are enrolled in the ACUB program through private conservation easements that limit development. Various land management options including acquisition, perpetual conservation easements, transferred development rights, property tax relief programs, deed restrictions, legislation, and zoning are considered within a ten-mile buffer of Camp Ripley; however, the greatest focus of attention is within three miles of the Camp's boundaries.

In 2015, Camp Ripley was declared a Sentinel Landscape, which is an initiative by the U.S. Departments of Agriculture, Defense and Interior to preserve lands, which are important to the Nation's defense mission, to strengthen those economies, conserve habitat and natural resources and to protect test and training missions within those landscapes.

Local partners like the Minnesota BSWR and the Morrison SWCD will work with willing landowners to provide technical assistance that will strengthen prime working lands, using programs such as the Healthy Forests Reserve Program (HFRP), Agricultural Conservation Easement Program (ACEP), and Environmental Quality Incentives Program (EQIP). Landowners will have the opportunity to access conservation education and enhance their land management practices while maintaining their right to continue agricultural production and protect their lands from development as appropriate within the Sentinel Landscape.

First Ranked Lakes in Strategy Implementation Tables

During the watershed prioritization process discussed in Section 3.2, the local partners also determined priority ranking for certain lakes. The ranking refers to how close a lake/stream was to either becoming impaired or becoming delisted if already impaired. For example, if the dominant waterbody within a HUC 12 watershed contained an impaired waterbody where improvement was feasible, it was given the highest priority. Similarly, exceptional waters with potential protection concerns were also given the highest priority.

Table 14: First Ranked Lakes, Lakes of Outstanding Biological Significance and Tier 2 Cisco Lakes in the Long Prairie Watershed – impaired waterbodies highlighted in red

HUC 10 Subwatershed	Waterbody Name	Lake or Stream ID	First ranked waterbodies in implementation table	Outstanding Biological Significance	Cisco Tier 2 Refuge Lakes
Lake Carlos 0701010801	Latoka	21-0106-00	X	X	X
	Mina	21-0108-00		X	X
	Miltona	21-0083-00	X		
	Ida	21-0123-00	X		

HUC 10 Subwatershed	Waterbody Name	Lake or Stream ID	First ranked waterbodies in implementation table	Outstanding Biological Significance	Cisco Tier 2 Refuge Lakes
Lake Carlos 0701010801	Pocket	21-0140-00	X		
	Mary	21-0092-00	X		
	Round	21-0197-00	X		
	Lobster	21-0144-00	X		
	Nelson	21-0551-00	X		
	Le Homme Dieu	21-0056-00	X		
Spruce Creek-Long Prairie River 0701010802	Charlotte	77-0120-00		X	X
Spruce Creek-Long Prairie River 0701010802	Spruce Creek	07010108-512	X		
Turtle Creek 0701010804	Rice	77-0061-00		X	
	Turtle	77-0088-00		X	
	Rogers	77-0073-00		X	
	Mud	77-0087-00		X	
	Long	77-0069-00		X	
Moran Creek-Long Prairie River 0701010805	Moran Creek	07010108-511	X		
Fish Trap Creek 0701010806	Ham	49-0136-00	X		
	Fish Trap	49-0137-00	X	X	
	Alexander	49-0079-00	X	X	
	Round	49-0131-00	X		
	Crookneck	49-0133-00	X		
	Shamineau	49-0127-00	X		
	Fish Trap Creek	07010108-514	X		
Long Prairie River 0701010807	West Nelson	77-0005-00		x	

Figure 9: Long Prairie River Watershed Lakes of Biological Significance

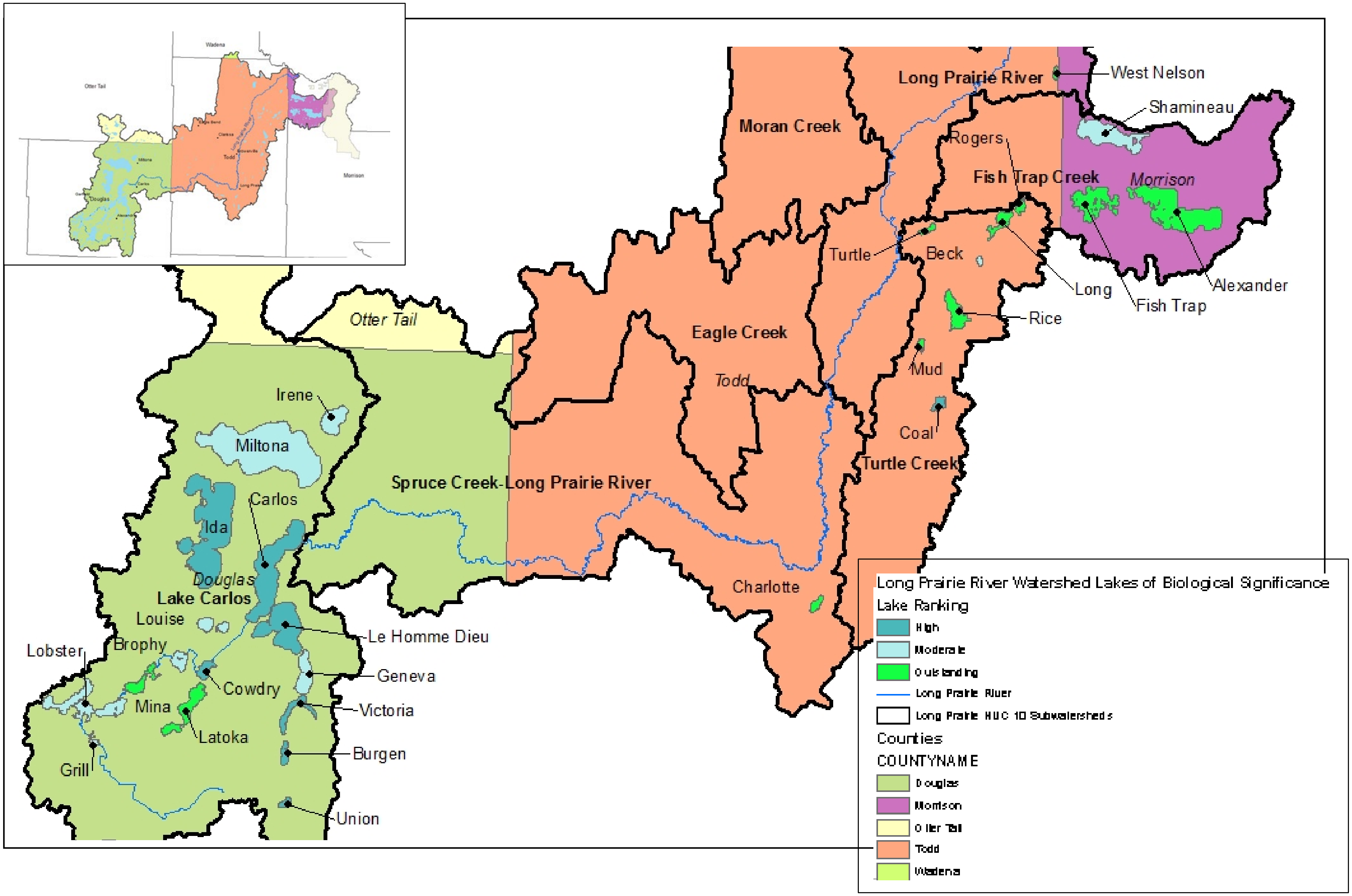


Figure 10: Long Prairie River Watershed Tullibee (Cisco) Tiered Lakes

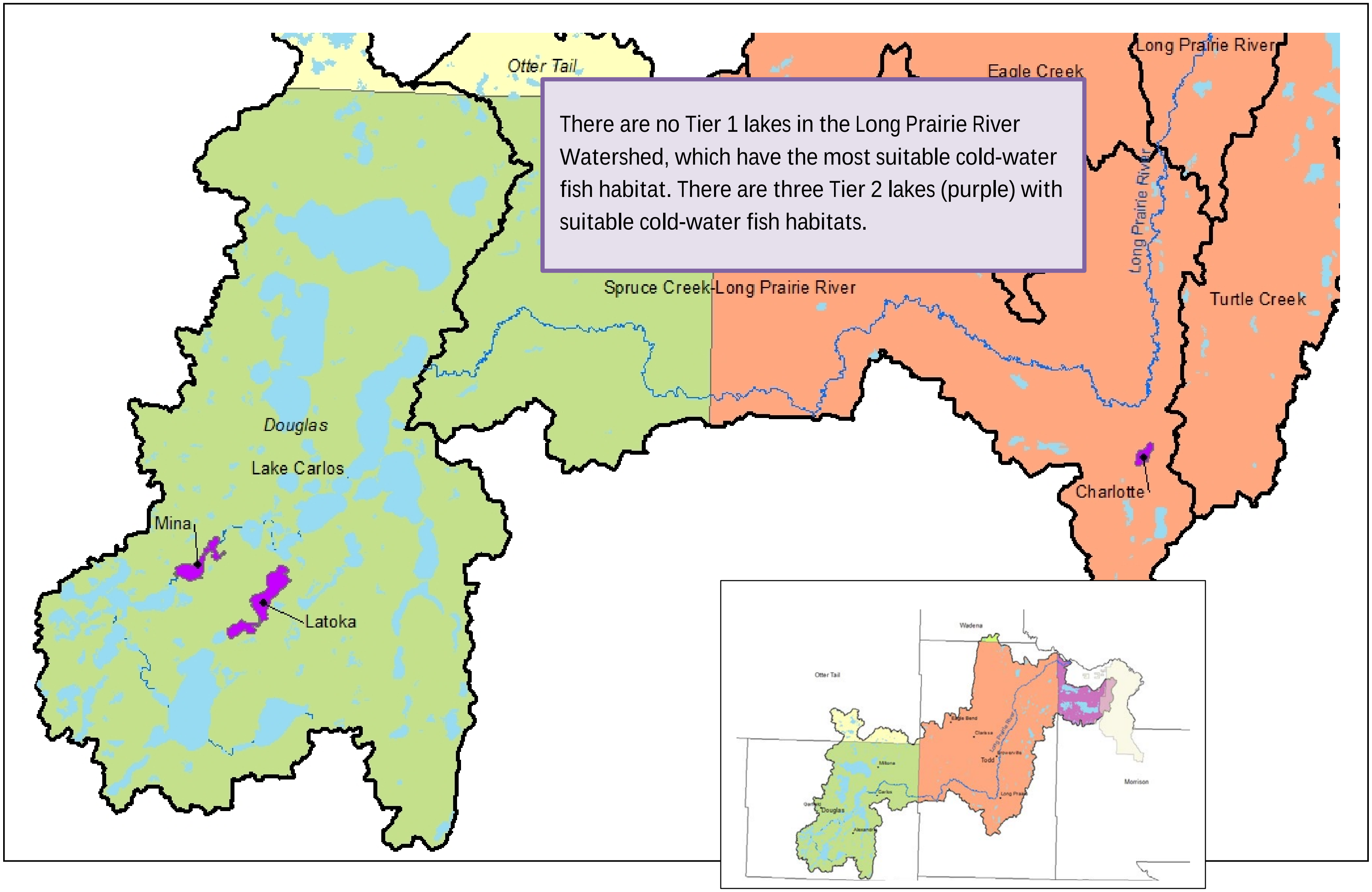


Figure 11: Long Prairie River Watershed Designated Trout Streams

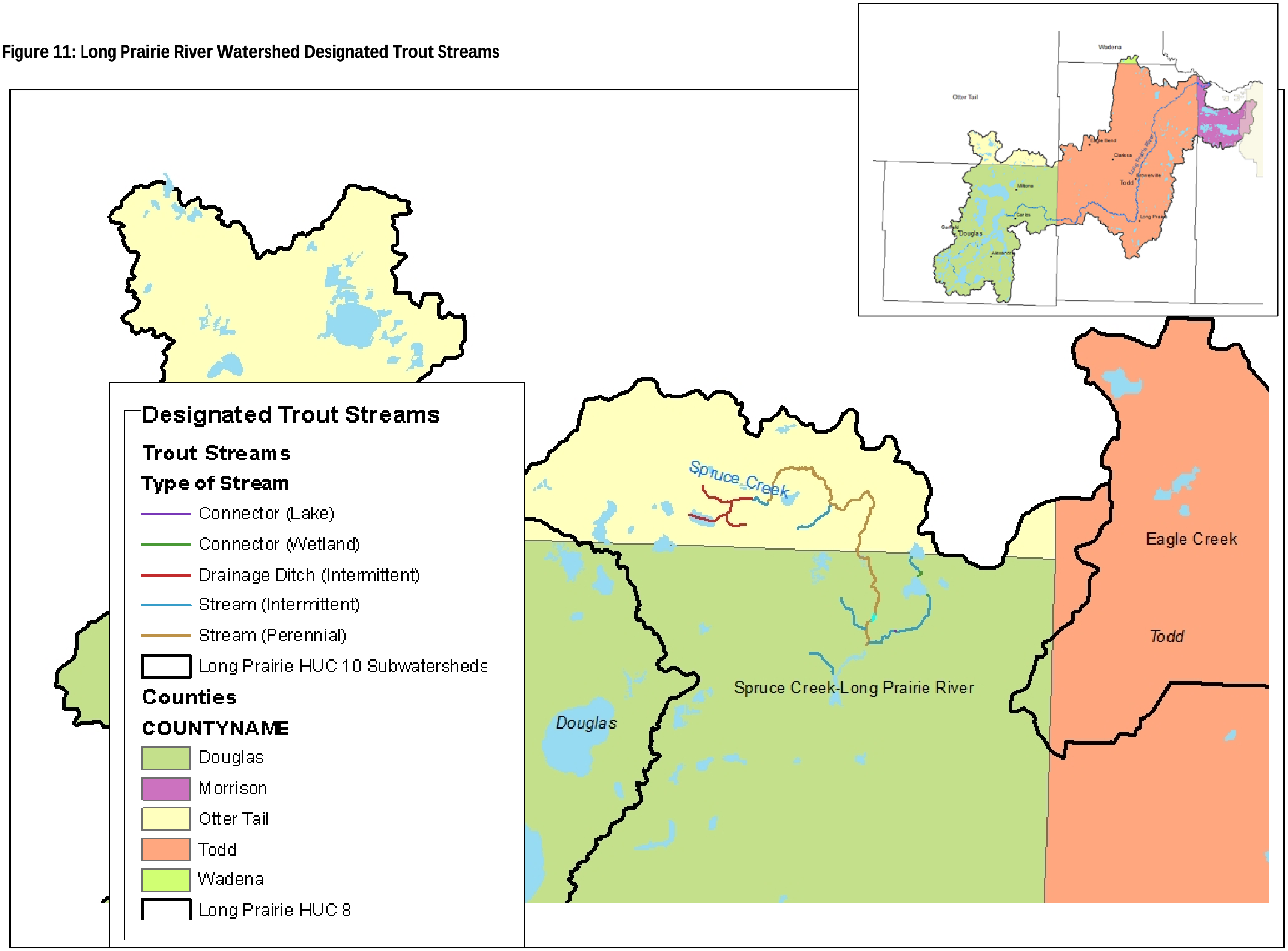
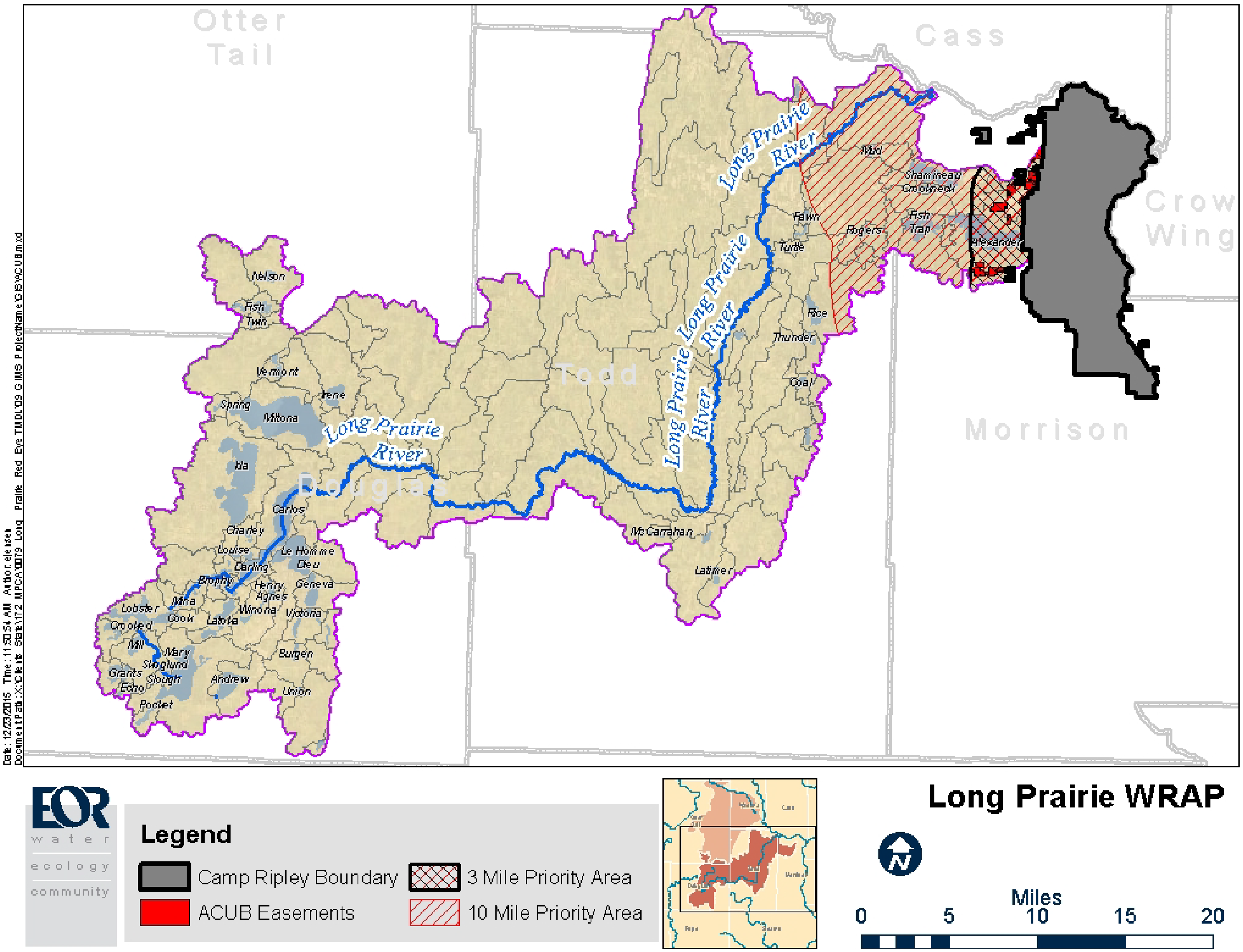


Figure 12: Camp Ripley ACUB Easements and Priority Areas

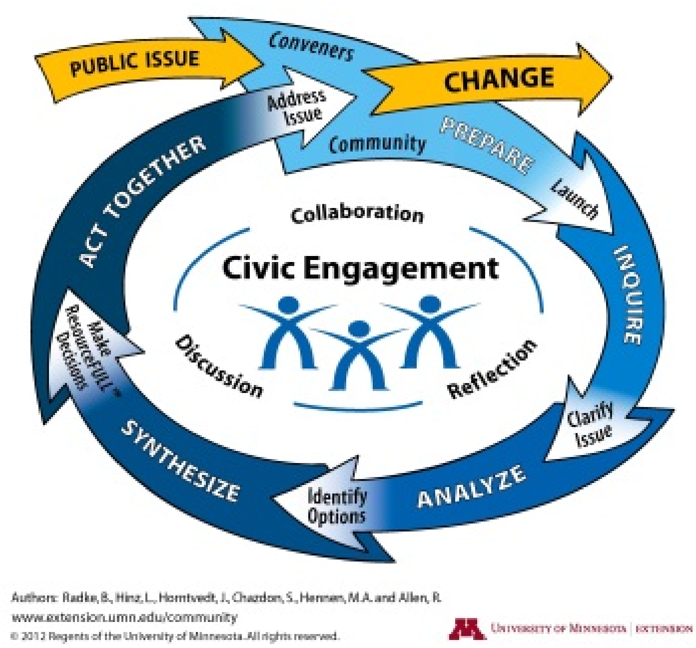


3. Prioritizing and Implementing Restoration and Protection

The CWLA requires that WRAPS reports summarize priority areas for targeting actions to improve water quality, identify point sources and identify nonpoint sources of pollution with sufficient specificity to prioritize, and geographically locate watershed restoration and protection actions. In addition, the CWLA requires including an implementation table of strategies and actions that are capable of cumulatively achieving needed pollution load reductions for point and nonpoint sources.

This section of the report provides the results of such prioritization and strategy development. Because much of the nonpoint source strategies outlined in this section rely on voluntary implementation by landowners, land users and residents of the watershed it is imperative to create social capital (trust, networks and positive relationships) with those who will be needed to voluntarily implement BMPs. Thus, effective ongoing civic engagement is fully a part of the overall plan for moving forward.

3.1. Civic Engagement



A key prerequisite for successful strategy development and on-the-ground implementation is meaningful civic engagement. This is distinguished from the broader term 'public participation' in that civic engagement encompasses a higher, more interactive level of involvement. Specifically, the University of Minnesota Extension's definition of civic engagement is "Making 'resourceFULL' decisions and taking collective action on public issues through processes that involve public discussion, reflection, and collaboration." A resourceFULL decision is one based on diverse sources of information and supported with buy-in, resources (including human), and competence. Further information on civic engagement is available at http://www1.extension.umn.edu/community/civic-engagement/.

3.1.1. Steering Committee Meetings

The Long Prairie Watershed Restoration and Protection Local Project Team is made up of numerous local partners who have been involved at various levels throughout the project including members representing the DNRs, Department of Agriculture (MDA), Counties and SWCDs within the watershed, local Planning and Zoning offices, The Nature Conservancy, and the BWSR. The following table outlines the meetings that occurred regarding the Long Prairie River Watershed monitoring, TMDL development, and WRAPS report development.

Table 15: Summary of Steering Committee Meetings

Date	Location	Meeting Focus
3/21/12	SWCD office in Alexandria, MN	Quarterly Meeting
10/25/12	County Courthouse Long Prairie, MN	Quarterly Meeting
4/10/13	MPCA office Brainerd, MN	Lake and Stream Assessments
6/5/13	County Courthouse Long Prairie, MN	Quarterly Meeting – Impairment Focus
6/19/13	MPCA office Brainerd, MN	Quarterly Meeting – HSPF Focus
12/11/13	MPCA office Brainerd, MN	Quarterly Meeting
12/10/14	County Courthouse Long Prairie, MN	Quarterly Meeting
1/28/15	County Courthouse Long Prairie, MN	Quarterly Meeting – Draft TMDL Focus
5/27/15	County Courthouse Long Prairie, MN	Quarterly Meeting – WRAPS and Civic Engagement Focus
9/30/15	County Courthouse Long Prairie, MN	Decision Maker Symposium focus
10/28/15	County Courthouse Long Prairie, MN	Draft WRAPS focus
12/10/15	County Courthouse Long Prairie, MN	Draft WRAPS focus
12/16/15	County Courthouse Long Prairie, MN	Draft WRAPS focus

3.1.2. Public Meetings

The Long Prairie River WRAPS local partner team engaged with a diverse array of local groups, interested citizens, state agencies, and local government units to guide the informing and development of this restoration and protection plan. Previous and ongoing efforts were also refocused into the WRAPS process. Members of the WRAPS group have provided technical assistance to local government partners and citizens, providing a watershed wide network of connections to build from. These pre-existing civic connections provided a strong base with which to bring in other non-traditional partners as part of the watershed protection and restoration process. A few of the groups engaged include schools, townships, MS4 and NPDES Permit holders, sportsmen's groups, sporting goods retailers, farm groups, recreational service providers, local lodging providers, political, and environmental organizations. Lake and stream sampling volunteers have provided a long term data set for analysis and were utilized to gather data on additional sites to further inform modeling and water quality implementation efforts. Engagement of landowners around lakes targeted for sampling through Surface Water Assessment Grants (SWAG) has also further increased local awareness of water quality issues and protection efforts. Interest in water quality restoration and protection projects has been increasing among local landowners due in part to these efforts. A summary of public meetings hosted by the Local Partner Team is shown below (Table 16).

Public Notice for Comments

An opportunity for public comment on the draft WRAPS report was provided via a public notice in the State Register from February 13, 2017 through March 15, 2017.

Table 16: Summary of public meetings

Date	Location	Meeting Focus
5/22/2003	Browerville Community Center	Long Prairie D.O. TMDL
6/12/2003	Carlos Community Center	Long Prairie D.O. TMDL
4/12/11	Community Center Parkers Prairie, MN	Watershed Project Kick-Off
3/12/14	Public Works Alexandria, MN	Impairments in Douglas County
3/21/14	County Courthouse Long Prairie, MN	Impairments in Todd County
12/17/14	County Courthouse Long Prairie, MN	TMDL status and WRAPS discussion

3.1.3. Accomplishments and Future Plans

The Central Minnesota Land Use Decision Maker Symposium was hosted by eight county SWCDs within the Redeye River and Long Prairie River Watersheds, which included Becker, Cass, Crow Wing, Douglas, Morrison, Otter Tail (West and East), Todd and Wadena on October 7, 2015, in Parkers Prairie, Minnesota. One hundred and fifty local land use decision makers and natural resource managers from eight counties in west-central Minnesota gathered to discuss preserving and enhancing water quality through available watershed tools and the use of local experts. A survey was available to attendees as part of their packet. Groundwater, Erosion, Drinking Water and Shoreland Zoning were the top four water quality concerns of those who responded. In addition, 80% of respondents said the way they make land use decisions would be altered because of attending the event. Of the “no” responses, several had written in their comments they are already making these decisions with water quality in mind. This training will help local decision makers understand how well informed, ongoing local choices form the basis of the Long Prairie Watershed Restoration and Protection Plan.

3.2. Targeting of Geographic Areas

The following section describes the specific tools and methodology that were used in the Long Prairie River Watershed to identify, locate and prioritize watershed restoration and protection actions. Four watershed modeling tools were used and are described in more detail in Table 17:

- The HSPF model developed by Aquaterra (Appendix C, Figures 22 through 25)
- MPCA/DNR’s Lakes of Phosphorus Sensitivity Significance (Appendix C, Figure 26)
- The BWSR Ecological Ranking Tool (Appendix C, Figures 27 through 30), and
- The DNR’s Watershed Health Assessment Framework (Appendix C, Figures 30 through 35).

HSPF modeled watershed sources were used in concert with results from BWSR’s ecological ranking tool and the DNR’s Watershed Health Assessment Framework to target implementation at the HUC-12 scale. Follow-up field ground-truthing will be required to validate the identified areas potentially needing work.

Watershed Priority Ranking

A watershed priority ranking (on a scale from 1 to 3) was assigned to each HUC 12 watershed where a ranking of 1 is for the subwatershed of highest priority. This ranking is based on a review of all targeting tool outputs, protection considerations and local partner input. A priority rank of 3 indicates either a watershed where water quality is poor and improvement is not feasible, or water quality is exceptional and there are no major water quality concerns to address with protection projects. Conversely, a priority rank of 1 indicates either a watershed where water quality is poor but improvement is feasible, or water quality is exceptional and there are water quality concerns to address with protection projects (see Figure 13 and Table 18). Local and other partners can use the priority-ranking map to help prioritize watershed and stream management efforts at the local level. The supporting maps found in Appendix C summarize the conclusions from each of the tools.

Groundwater Protection

Portions of this watershed are known to have high nitrates in groundwater due to the widespread sandy soils and agricultural land use. The MDA has monitored nitrate concentrations in observation wells since 1986 through the pesticide groundwater monitoring program. The monitoring data shows that 62% of the observed wells were over the drinking water limits in the Central Sands region (MDA January 2012). Because of this, MDA found that it was important to expand nitrate monitoring to find out the extent of nitrate concentrations in private drinking water wells. The MDA began to work with the Wadena SWCD and the other counties in the Central Sands Region on the Central Sands Private Well Monitoring Network in 2011. Results showed that a much smaller percentage of private wells were over the health limit versus the observed wells.

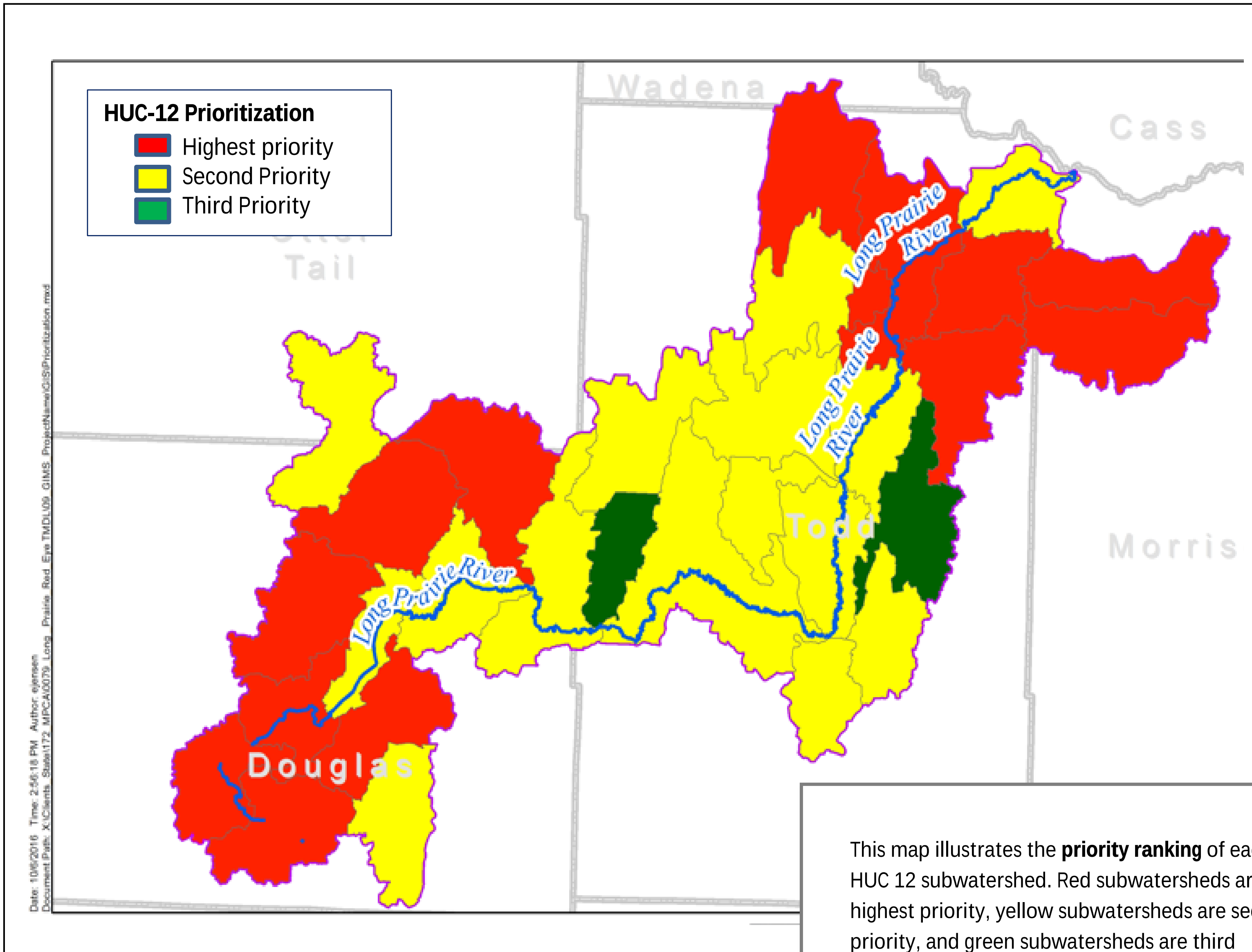
All of the counties in the Long Prairie River Watershed have been identified by the MDA as containing townships vulnerable to groundwater contamination and having significant row crop production. Therefore, these counties are part of the Township Testing Program. The goal of MDA's Township Testing Program is to monitor nitrate levels in private drinking water wells. Between 2014 and 2019, the MDA will offer free nitrate tests to approximately 70,000 private well owners (within 250 to 300 townships across the state).

Appendix C, Figure 39 shows which areas in the Long Prairie Watershed have the highest groundwater vulnerability.

Tool	Description	How can the tool be used?	Notes	Link to Information and data
Hydrological Simulation Program – FORTRAN (HSPF) Model	Simulation of watershed hydrology and water quality for both conventional and toxic organic pollutants from pervious and impervious land. Typically used in large watersheds (greater than 100 square miles).	Incorporates watershed-scale and nonpoint source models into a basin-scale analysis framework. Addresses runoff and constituent loading from pervious land surfaces, runoff and constituent loading from impervious land surfaces, and flow of water and transport/ transformation of chemical constituents in stream reaches.	Local or other partners can work with MPCA HSPF modelers to evaluate at the watershed scale: 1) the efficacy of different kinds or adoption rates of BMPs, and 2) effects of proposed or hypothetical land use changes.	*USGS*
MPCA/DNR Lakes of Phosphorus Sensitivity Significance	In 2015, the MPCA and DNR completed a statewide analysis of lake sensitivity to additional phosphorus loading and the significance of that sensitivity in terms of high-quality, unimpaired lakes at risk of becoming impaired. Lakes were ranked and then assigned to one of three priority classes (high, higher, or highest).	These rankings can be used to identify and prioritize lakes that should be targeted for phosphorus reduction projects in their watersheds.	The phosphorus sensitivity significance index generally produced high values for large, oligotrophic lakes that were vulnerable to phosphorus loading and near their estimated loading threshold and low values for small, hypereutrophic lakes with high estimated phosphorus loading and watershed disturbance.	*DNR*
Ecological Ranking Tool (Environmental Benefit Index - EBI)	Three GIS layers containing soil erosion risk, water quality risk, and habitat quality. Locations on each layer are assigned a score from 0-100. The sum of all three layer scores (max of 300) is the EBI score. This higher the score, the higher the value in applying restoration or protection.	Any one of the three layers can be used separately or the sum of the layers (EBI) can be used to identify areas that are in line with local priorities. Raster calculator allows a user to make their own sum of the layers to better reflect local values.	GIS layers are available on the BWSR website.	*BWSR*
DNR Watershed Health Assessment Framework (WHAF)	Calculates watershed health for all 80 HUC-8 watersheds based on five components: Biology, Connectivity, Geomorphology, Hydrology, and Water Quality	Statewide GIS data is used to calculate scores for each of the five components to provide an overall watershed health report. A portion of the statewide GIS data is available at a finer scale, allowing some relationships to be downscaled to the DNR catchment scale.	Suitable GIS data for each of the five components available at the DNR catchment scale can provide meaningful comparisons between individual DNR catchments within the HUC-8 watershed.	*DNR*

Table 17: Tools and methodology used to prioritize restoration and protection activities in the watershed

Figure 13: Long Prairie River Watershed HUC 12 Ranking for Restoration and Protection



This map illustrates the **priority ranking** of each HUC 12 subwatershed. Red subwatersheds are highest priority, yellow subwatersheds are second priority, and green subwatersheds are third priority.

Table 18: HUC 10 and 12 subwatersheds and their priority ranking within Long Prairie River Watershed

HUC 10 Subwatershed	HUC 12	HUC 12 Name	HUC 12 Priority Ranking
Lake Carlos	070101080101	Fish Lake	2
	070101080102	Lake Miltona	1
	070101080103	Lake Ida	1
	070101080104	Lake Mary	1
	070101080105	Lobster Lake	1
	070101080106	Lake Latoka	1
	070101080107	Lake Victoria	2
	070101080108	Lake Le Homme Dieu	1
	070101080109	Lake Carlos	2
Spruce Creek-Long Prairie River	070101080201	City of Carlos-Long Prairie River	2
	070101080202	Spruce Creek	1
	070101080203	Stormy Creek-Long Prairie River	2
	070101080204	Dismal Creek	3
	070101080205	Freemans Creek-Long Prairie River	2
	070101080206	Venewitz Creek	2
	070101080207	Drayer Creek-Long Prairie River	2
Eagle Creek	070101080301	Headwaters Eagle Creek	2
	070101080302	Harris Creek	2
	070101080303	Eagle Creek	2
Turtle Creek	070101080401	Upper Turtle Creek	2
	070101080402	Middle Turtle Creek	3
	070101080403	Lower Turtle Creek	2
Moran Creek	070101080501	County Ditch No 25	2
	070101080502	Moran Creek	1
Fish Trap Creek	070101080601	Fish Trap Lake	1
	070101080602	Shamineau Lake	1
	070101080603	Fish Trap Creek	1
Long Prairie River	070101080701	Horseshoe Lake-Long Prairie River	2
	070101080702	Stony Brook-Long Prairie River	2
	070101080703	Long Prairie River	2

3.3. Restoration & Protection Strategies

The restoration and protection strategies presented in this section were drafted and compiled via interactions with local units of government over the last several years and have subsequently been incorporated into local plan updates as the WRAPS report was developed. The strategies can be spatially targeted using a number of tools available, some of which are presented and discussed in this report. Eventually, the refined restoration and protection strategies should be incorporated into local water plans, comprehensive watershed plans, and applications for federal and state funds.

Addressing water quality in agricultural watersheds

As agricultural land use practices are a large contributing factor to the pollutant sources and stressors in the Long Prairie River Watershed, reducing contributions from agricultural sources is a high priority. A comprehensive resource for agricultural BMPs is The Agricultural BMP Handbook for Minnesota (MDA 2012). Strategies referenced in the tables below are described in detail in the Handbook. There are some areas in the watershed with groundwater susceptibility concerns (Appendix C, Figure 39) and Nitrogen BMPs from the Nitrogen Fertilizer Management Plan (NFMP) should be applied in those areas in particular. See the NFMP at http://www.mda.state.mn.us/nfmp.

Another program currently ongoing in the watershed and available to landowners and producers to address erosion control, nutrient reduction, or pasture and nutrient management, is the Minnesota Agricultural Water Quality Certification Program (MAWQCP). It is a voluntary opportunity for farmers and agricultural landowners to implement best management and conservation practices that protect water resources. Technical and financial assistance is available to those participating in the program and once certified, participants are granted regulatory certainty for a period of 10 years. Additional information can be found at: http://www.mda.state.mn.us/awqcp. MAWQCP coordinators can work with landowners and producers to promote livestock management practices including rotational grazing, but more broadly, they can assess the current status of the agricultural area and identify BMPs to reduce nutrient and sediment loss, including nutrient management. Other options can be found in MDA's Ag BMP Loan Program http://www.mda.state.mn.us/agbmploans to identify and potentially fund necessary fencing and practices for pasture management as well as practices to address erosion, high nutrients and/or suspended sediment due to agricultural activities in the subwatersheds.

Urban and Residential BMPs

Cities and watershed residents also impact water quality. A comprehensive resource for urban and residential BMPs is the Minnesota Stormwater Manual (MPCA 2014f). This resource is in electronic format and includes links to studies, calculators, special considerations for Minnesota, and links regarding industrial and stormwater programs. Failing and unmaintained septic systems can pollute waters. Information and BMPs for Septic Systems is provided by EPA (EPA 2015).

Lake Watershed Improvement

Initial activity for lake impairments should focus on reducing external loading. Strategies to protect and restore lakes include both strategies to minimize pollutant contributions from the watershed and strategies to implement practices immediately adjacent to and in the lake. Strategies to minimize pollutant contributions from the watershed focus mostly on agricultural and/or stormwater BMPs, depending on the land use and pollutant contributions of the watershed. The DNR supplies detailed information on strategies to implement adjacent to and in the lake via Shoreland Management guidance (DNR 2014b).

What follows is a list of watershed strategies that prevent phosphorus from getting to the lake and are a necessary basis for any restoration work. This is not an exhaustive list nor are all of the strategies applicable or appropriate for all lakes or regions.

- Manage nutrients – carefully planning for and applying phosphorus fertilizers decreases the total amount of phosphorus runoff from cities and fields.

Examples: crop nutrient management, city rules on phosphorus fertilizer use, etc.

- Reduce erosion – preventing erosion keeps sediment (and attached phosphorus) in place. Examples: construction controls, vegetation (see below)
- Increase vegetation – more vegetative cover on the ground uses more water and phosphorus and decreases the total amount of runoff coming from fields and cities. Examples: cover crops, grass buffers, wetlands, prairie gardens/restorations, channel vegetation, etc.
- Install/restore basins – capturing runoff and decreasing peak flows in a basin allows the sediment (and attached phosphorus) to settle out. Examples: water and sediment control basins, wetlands, etc.
- Improve soil health – soils that are healthy need less fertilizer and hold more water. Examples: reduce/no-till fields, diversified plants in fields and yards
- Lake Shore-specific strategies – these strategies are a subset of watershed strategies that can be directly implemented by lakeshore residents.
- Eco-friendly landscaping – poor landscape design and impervious surfaces increase runoff and loading of nutrients into lakes. Examples: aerate, rain barrels or cisterns, rain gardens, permeable pavers, sprinkler and drainage systems, maintain septic systems, etc.
- Manage upland buffer zone vegetation – Upland buffer zone vegetation selection can greatly affect nutrient absorbance, watering needs, erosion potential, need for drainage, etc. Examples: properly landscape, maintain canopy and address terrestrial invasive species that may prevent re-generation of native trees, proper turf grass no mow lawns in highly utilized areas and planting native grasses and forbs with deep root systems in underutilized areas of lawn, reduce watering needs, controlled fertilization and grass clippings.
- Naturalize transition buffer zone – a natural transition buffer zone increases absorption of nutrients and decreases erosion potential of the water-shore interface. Examples: balance natural landscaping by minimizing recreational impact area; utilize natural materials for erosion control bioengineering using wood or biodegradable materials in combination with stabilizing native vegetation to restore a shoreline; minimize the addition of sand to create beaches; draw

down water levels for consecutive seasons to allow existing seed banks to develop deep rooted native vegetation or plant diverse mixes of grasses, sedges, forbs, shrubs and trees to create a complex root mass to hold the bank soils; preserve and restore native emergent aquatic vegetation sedges, rushes, forbs, shrubs and trees; and do not remove natural wood features that supply cover and food sources for aquatic species and invertebrates while serving as a wave break along the shoreline.

- Preserve aquatic buffer zone – The aquatic buffer zone is difficult to restore, so the best approach is preservation and providing best opportunity for aquatic plants through watershed improvements to increase water quality. Draw down water levels to allow natural seed banks of emergent and aquatic vegetation to establish naturally, supplement more plant diversity with lower water levels as restoration of emergent and aquatic vegetation have higher success rates.

  Examples: reduce recreational impact area, minimize control of all types of aquatic plants, reduce dock footprint, preserve and/or restore native emergent and floating-leaf aquatic plants.

In-Lake Management Strategies

In-lake strategies use, remove, or seal internal phosphorus from within the lake. These strategies are only effective if external phosphorus sources are first minimized to the point that water quality of incoming water is not the limiting factor in order to meet water quality standards. Incorporating lakeshore specific strategies are also essential for long term success.

- Biomanipulation – changing the fish population. Rough fish are generally bottom feeders and though feeding activity re-suspend sediments and decrease water clarity; thus, removing rough fish through mechanical or biological methods can improve water clarity, increase aquatic vegetation, and improve water quality overall. Examples: commercial netting (not a standalone tool, implement in conjunction with other fisheries management methods to augment reduced populations for a short term period allowing desirable fish populations to develop adequate size to manage rough fish populations); balanced fish management increasing fish species diversity for a balanced fish population and introducing large predator fish populations; preserve and restore diverse spawning, cover, and feeding habitat that favors specific fish species that maintain a diverse fish population; and reclamation (kill all fish and start over) – note, inlets for rough fish should be considered when planning reclamation to prevent immediate re-introduction. In-lake shore strategies are essential to incorporate to develop habitat for desirable species of fish once the rough fish population is removed.
- Invasive species control of plants and/or animals – invasive species alter the ecology of a lake and can decrease diversity of habitat when a healthy native diversity exists in a lake. Removing native vegetation or incorporating non-native vegetation into landscaping can allow for invasive species to establish and spread taking over larger blocks of native species that maintain the natural systems health, therefore reducing disturbance to near shore habitat is important. Examples: prevention, early detection, lake vegetation management plan (LVMP)
- Chemical treatment to seal sediments – re-suspension of nutrients through wind action can cause internal nutrient loading. Examples: alum treatments. Consider the long-term

effectiveness in shallow lakes that experience wind driven turning, where stratification of the lake does not occur. Incorporating establishment of lakeshore habitat is important to absorb phosphorus in the lake as part of a long term approach to phosphorus level management.

Implementation Tables

In an effort to make it easier to read and reference, the implementation tables were split out by HUC-10 subwatershed, and further divided by prioritization at the HUC- 12 level. Subwatershed maps appear before each subwatershed table in order to orient the reader to the subwatershed, as well as the critical waterbodies that were identified in each table. Table 18 describes goals and strategies that apply to the entire Long Prairie River Watershed. The rest of the tables in this section provide detailed restoration and protection strategies for individual lakes and streams in each HUC 10 subwatershed that restore or protect water quality, and include the following information:

Priority Ranking: Prioritization of HUC 12 watersheds into three priority classes: with 1 as the highest priority and 3 as the lowest priority. Figure 13 and Table 18 at the beginning of Section 3.2: Targeting of Geographic Areas show the priority class for each watershed. Tables 20 through 23 display only first-ranked HUC 12 subwatersheds. Strategies for second and third ranked HUC 12 subwatersheds are in Appendix D. Each Lake or stream also has a priority ranking, which is shown in the tables. Priority ranking for lakes refers to how close a lake/stream was to either becoming impaired or becoming delisted if already impaired. For example, if the dominant waterbody within a HUC 12 watershed contained an impaired waterbody where improvement was feasible, it was given the highest priority. Similarly, exceptional waters with potential projection concerns were also given the highest priority.

Water Quality – Current Conditions: "Current" condition is interpreted as the baseline condition over some evaluation period for the pollutant or non-pollutant stressor identified in the parameter column. This should be a numeric descriptor and unit of measurement. This can be a current load (from TMDL or from the load monitoring program if pursuing a downstream goal and not a local goal), a pollutant concentration (e.g., *E. coli* geometric mean) or a whether or not a waterbody is meeting a certain standard (i.e. DO). In the interests of length and readability for unimpaired waters, professional judgment was used as to which of the potentially many parameters to show.

Water Quality – Goals / Targets: Expressed in the same terms as applied in the previous column (Current Conditions) and will generally be a load target (could be percent reduction or a load value) or a water quality concentration target. For some parameters (e.g. phosphorus reduction in a lake watershed) typically a load target is used. For others (e.g., *E. coli*) a concentration is used. For protection, a numeric goal/target is used if available.

Management Goals: This column is intended to provide the high-level objectives to be used for both protection and restoration. This field is not intended to prescribe specific projects and practices.

Strategies: This column ties to the Management Goals column and outline the method, approach or combination of approaches that could be taken to achieve water quality goals.

Interim 10-yr Milestones: This column describes progress to be made toward implementing the management goal in the first 10 years. This may be provided in the form of a percentage, amount, or narrative descriptor. This milestone will generally be more coincident (relative to the estimated year to achieve water quality targets) with local water planning milestones.

Governmental Units with Primary Responsibility: Identifies the governmental unit with primary responsibility. It should be noted that identifying a responsible party does not imply any newly associated or suggested authority or regulation.

Timeline: This applies to the waterbody, specifically the year it is reasonably estimated that applicable water quality targets will be achieved. Explanatory information may be added either as a footnote or in the preceding narrative providing any assumptions or caveats used in the estimate.

Table 19: Proposed general goals and strategies for the entire Long Prairie River Watershed

Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena, M=Morrison.

Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
			MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
NPDES point source compliance	All point sources.	Full compliance.				•	A	•	•		•	10 yrs
Riparian Buffers	All areas mapped by the SWCD/DNR	Full compliance.	•		A		A	•	•	•	•	5 yrs
Improve Policy	Septic Compliance and Ordinance Review Watershed wide	40 systems abated.				•	A	•	•		•	15 yrs
	Road Salt/Dust Suppressant Ordinances	Review ordinances and current practices of road salt/dust suppressant application				•	A	•	•			15 yrs
	Culvert Sizing and Alignment Requirements. Steady decrease in problem culverts.	Assess stream crossings and connectivity	•			•	A	•	•			15 yrs
	Compliance with well-sealing of unused wells on abandoned farmsteads	Enforce well sealing of all unused wells. Prioritize wells in targeted groundwater protection areas.					A	•	•			Ongoing
	At least 40 abandoned agricultural waste pits in the watershed	Close agricultural waste pits properly following MPCA guidelines and NRCS Field Office Technical Guidelines (FOTG) as technical and financial assistance becomes available.				•	A					Ongoing
Dam removal	Consider removal instead of repair	Complete dam inspections and prioritize for repair,	•				A	•	•		•	Ongoing

Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
			MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
		replacement, modifications, or removal.										
Increased Perennial Veg.	Riparian and Critical Areas	Prioritize sensitive riparian and critical source areas.			A		A	•			•	Ongoing
Improve Education and Increase Public Outreach	Field Demonstration Day	1 highly visible best management practice demonstration site in the Long Prairie River Watershed by 2020 (Public Boat Access)	•	•	A				•			10 Yrs
	K-12 Watershed Education	Reach 10% of students in the watershed annually and 100% within 10 year time period.	•	•	A	•			•	•	•	10 Yrs
	Conduct targeted community messages and education about protecting water quality	Identify and engage 1 new stakeholder group in the watershed every year.	•	•	A	•			•	•	•	Ongoing

Lake Carlos HUC 10 Watershed (0701010801)

Figure 14: HUC 10 Subwatersheds within Long Prairie River Watershed

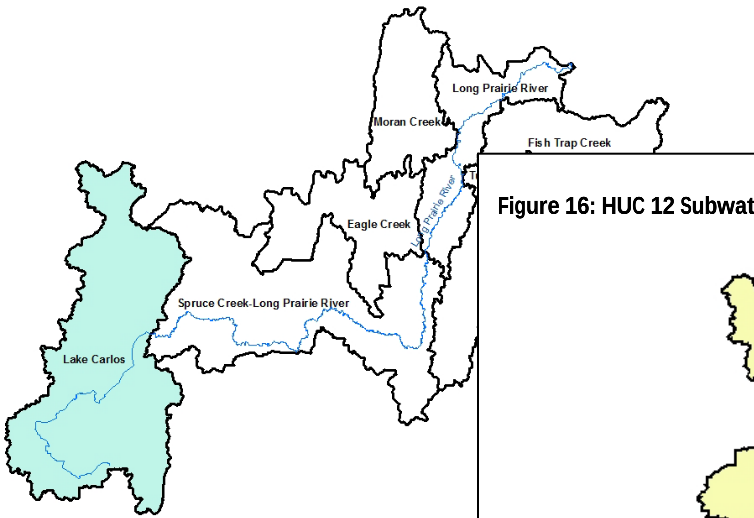


Figure 16: HUC 12 Subwatersheds in Lake Carlos HUC 10

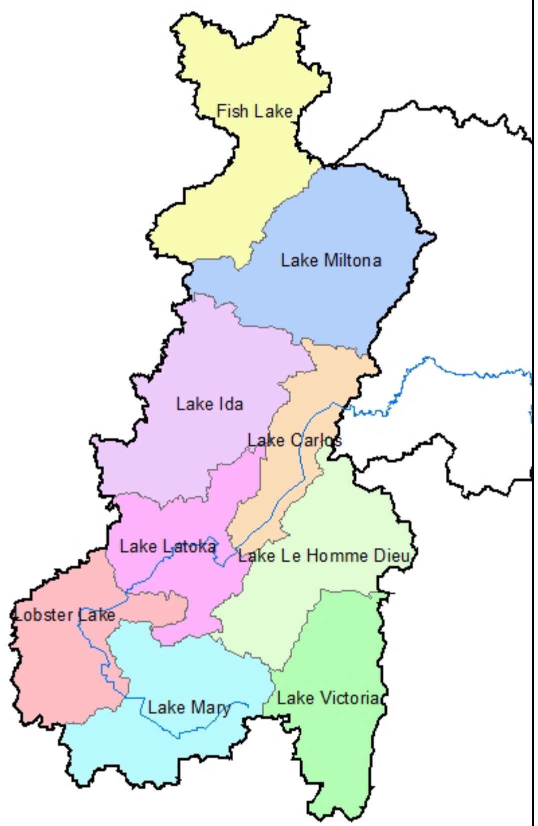


Figure 15: Lakes identified in strategy table

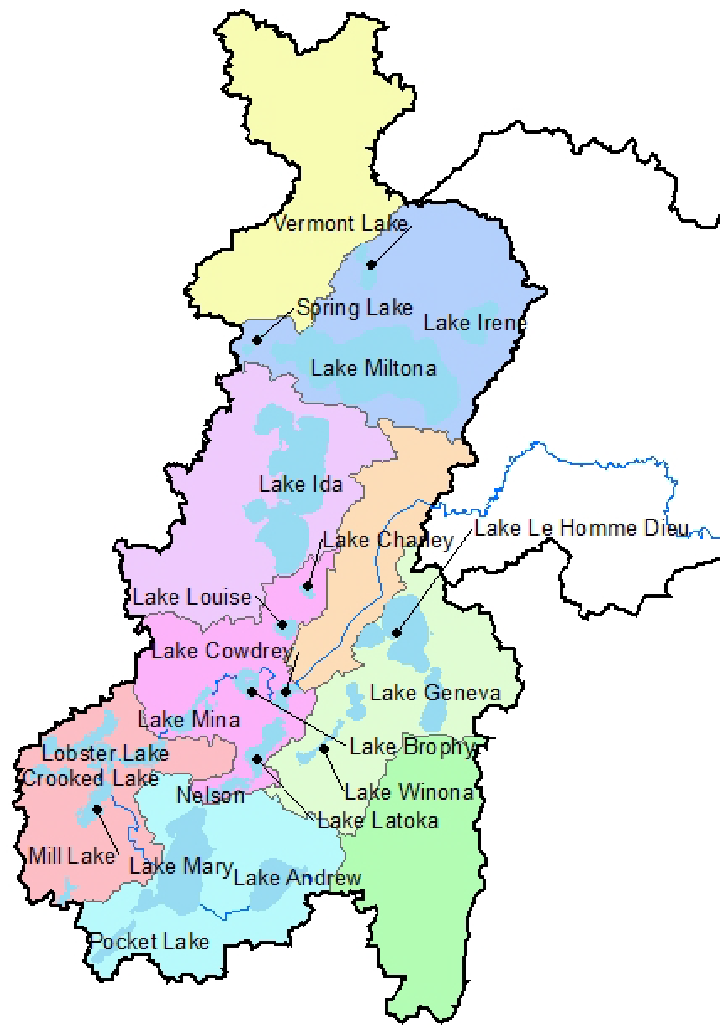


Table 20: Lake Carlos HUC 10 Watershed (0701010801): First Ranked HUC 12 Proposed strategies and actions

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena, M=Morrison.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Miltona 70101080102	Lake Miltona (21-0083)	1	Douglas	Phosphorous	19 ug/L	Maintain	Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D		D				•	10 yrs
							No increase in annual storm water volume.	Stormwater Management, ordinance enforcement	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Miltona Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
							Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, and fisheries and wildlife management.	Maintain status as lake of biological significance through implementation of protection measures.	•			•	D				•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Miltona 70101080102	Lake Miltona (21-0083)	1	Douglas	Phosphorous	19ug/L	Maintain	Mitigate Concentrated Nutrient Sources	Test inflows for nutrient concentrations and volumes.	Collect 2 years of grab sample data (minimum of 15 samples/year during both high flow and baseflow events) at major tributaries to Lake Miltona during the open water season. Combine with continuous flow/stage monitoring equipment to calculate loads from tributaries. Combine tributary monitoring with HSPF outputs to prioritize areas of the watershed for implementation of BMPs.			D	•				•	•	5 yrs
								Riparian Buffers	Full compliance of all areas mapped by the SWCD/DNR			D		D	•	•	•	•	5 yrs
	Spring Lake (21-0130)	2	Douglas	Phosphorous	22 ug/L	Maintain	No increase in annual storm water volume.	Stormwater Management	Ensure stormwater drainage network is not expanded without mitigation. Implement at least one urban BMP (rain garden, shoreline buffer) in the Spring Lake Watershed to serve as a demonstration site.			D		D				•	
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations				•					•	On-going
							Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D		D	•			•	10 yrs
	Lake Vermont (21-0073)	2	Douglas	Phosphorous	16 ug/L	Maintain	Reduce annual storm water volume by 10%	Stormwater Management	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Vermont Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
													•					•	

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Miltona 70101080102							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.										On-going
	Lake Irene (21-0076)	2	Douglas, Otter Tail	Phosphorous	26 ug/L	Maintain	Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		●	D		D				●	10 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures.	●				D				●	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				●					●	On-going
	Unnamed Creek to Lake Miltona 07010108-595	2	Douglas, Otter Tail	Fish IBI	NS Fish	Meet / Exceed Fish and Invert IBI	Stream restoration	Restore/enhance channel, targeting beaver dams, flat slopes, and improperly placed culverts.	Restore degraded sections of stream with goal of improving channel bottom substrate.	●		DO	●	DO	●	●		●	10 yrs
				Invert IBI	NS Invert		Culvert Sizing and alignment	Connectivity identified as a stressor. Unnamed Creek is believed to have a connectivity problem with the culvert located on County Road 14.	Determine if culvert replacement is warranted at County Road 14.	●		DO	●	DO	●	●		●	5 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Ida 70101080103	Lake Ida (21-0123)	1	Douglas	Phosphorous	18 ug/L	14 ug/L (300lb TP Reduction)	Reduce annual storm water volume by 10%. No infrastructure expansion without 100% mitigation.	Stormwater management, ordinance enforcement	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Ida Watershed to serve as a demonstration site.			•		D	•			•	10 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures.	•				D				•	On-going
							Reduce annual phosphorus load by 300 pounds.	Nutrient Management BMPs	Develop and support strategies to target and implement multiple shoreline restorations, wetland restorations, or stream buffer projects by 2025 based on results from inflow monitoring data and HSPF land use loading data.					D					30 Years
							Mitigate Concentrated Nutrient Sources	Test inflows for nutrient concentrations and volumes.	Collect 2 years of grab sample data (minimum of 15 samples/year during both high flow and baseflow events) at major tributaries to Lake Ida			D	•				•	•	5 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Ida 70101080103	Lake Ida (21-0123)								during the open water season. Combine with continuous flow/stage monitoring equipment to calculate loads from tributaries. Combine tributary monitoring with HSPF outputs to prioritize areas of the watershed for implementation of BMPs.										
				Secchi	4 m	Maintain	Reduce annual sediment load by 10%.	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							Reduce Upstream Lake Phosphorus Loads	Support strategies to identify, target and implement nutrient BMPs for upstream waterbodies and/or protect existing forestland from being developed in upstream watersheds.	Implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed and/or obtain a conservation easement on one or more parcels in upstream lake watersheds.	•		D	•	D		•		•	10 yrs
							Feedlot Nutrient Reductions	Address ongoing concerns with feedlot runoff from several operations within the watershed (N, NW)	Implement at least one feedlot BMP (manure management) in the Lake Ida Watershed to serve as a demonstration site.		•	D						•	10 yrs
Lake Mary 70101080104	Pocket Lake (21-0140)	1	Douglas	Phosphorous	38 ug/L	<32 ug/L	All acres have a management plan.	Nutrient Management	Reach 5% of agricultural producers in the watershed annually		•	D						•	20 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Mary 70101080104	Pocket Lake (21-0140)	1	Douglas			85lb P reduction	Reduce annual runoff volume by 10%.	Stormwater Management	Implement at least one urban BMP (rain garden, shoreline buffer) in the Pocket Lake Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
							Reduce sediment delivery by 10%.	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D	•			•	10 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Maintain coverage of diverse multistory vegetation.	Shoreline buffers	Enforce shoreland development ordinances especially on new development to protect nearshore vegetation.	•		D		D				•	On-going
							All acres have a management plan.	Manure Management	Reach 5% of feedlot operators in the watershed annually.		•		•	D				•	20 yrs
	Lake Andrew (21-0085)	2	Douglas	Phosphorous	23 ug/L	20 ug/L	No increase in volume. No infrastructure expansion without mitigation.	Stormwater Management	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Andrew Watershed to serve as a demonstration site.			D		D	•			•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Mary 70101080104	Lake Andrew (21-0085)			Secchi	2.6 m	Maintain	Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							All acres have a management plan	Nutrient Management	Reach 5% of agricultural producers in the watershed annually.		•	D						•	20 yrs
	Lake Mary (21-0092)	1	Douglas	Phosphorous	29 ug/L	27 ug/L Secchi Goal Based	Reduce runoff volume 10%.	Stormwater Management	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Mary Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
							All acres have a management plan	Nutrient Management	Reach 5% of agricultural producers in the watershed annually		•	D						•	20 yrs
							Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding.	Complete two erosion reduction projects that treat more than 10 acres each.	•		D		D	•			•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
				Secchi	1.8 m	>2 m	Mitigate Concentrated Nutrient Sources	Test inflows for nutrient concentrations and volumes.	Collect 2 years of grab sample data (minimum of 15 samples/year during both high flow and baseflow events) at major tributaries to Lake Mary			D	•				•	•	5 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
									during the open water season. Combine with continuous flow/stage monitoring equipment to calculate loads from tributaries. Combine tributary monitoring with HSPF outputs to prioritize areas of the watershed for implementation of BMPs.										
Lake Mary 70101080104	Lake Mary (21-0092)						Mitigate Concentrated Nutrient Sources	Reduce inputs from County Ditch 9 by restoring wetlands or implementation of BMPs.	Make use of LiDAR data to identify, target, prioritize and implement at least one BMP or wetland restoration in the CD 9 watershed using terrain analysis techniques such as stream power index (SPI), compound topographic index (CTI) combined with field verification.			D		D				•	On-going
								Reduce annual loading from concentrated sources.	Develop and support strategies to target and implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 based on results from monitoring data and HSPF land use loading data.			D		D					10 yrs
Lobster Lake 70101080105	Echo Lake (21-0157-00)	2	Douglas	Phosphorous	47.7 ug/L	40 ug/L 150 lb P Reduction	Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D		D				•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lobster Lake 70101080105	Echo Lake (21-0157-00)						Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							All acres have a management plan.	Nutrient Management	Reach 5% of agricultural producers in the watershed annually.		•	D						•	20 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Echo Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							Feedlot Runoff Reductions	Manure management and rotational grazing	Implement at least one feedlot BMP (manure management) in the Echo Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading	Assess in-lake biological health and identify internal loading risks	•			•				•	•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lobster Lake 70101080105	Mill Lake (21-0180)	2	Douglas	Phosphorous	37.4 ug/L	20 ug/L 700 lb P Reduction	Mitigate Concentrated Nutrient Sources	Test inflows for nutrient concentrations and volumes.	Collect 2 years of grab sample data (minimum of 15 samples/year during both high flow and baseflow events) at major tributaries to Lake Mary during the open water season. Combine with continuous flow/stage monitoring equipment to calculate loads from tributaries. Combine tributary monitoring with HSPF outputs to prioritize areas of the watershed for implementation of BMPs.			D	•				•	•	5 yrs
						Secchi Goal Based		Reduce annual loading from concentrated sources.	Develop and support strategies to target and implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 based on results from monitoring data and HSPF land use loading data.			D	•	D					10 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations				•					•	On-going
							Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D		D				•	10 yrs
							All acres have a management plan	Nutrient Management	Reach 5% of agricultural producers in the watershed annually.		•	D						•	20 yrs
				Secchi	2.5 m	Maintain	Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Sediment Reduction	Sediment sources addressed	Identify, target, and implement BMPs on sites that are contributing a disproportional amount of sediment through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.			D		D				•	On-going
Lobster Lake 70101080105	Crooked Lake, East (21-0199)	2	Douglas	Phosphorous	43 ug/L	40 ug/L 40 lb P Reduction	Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							Pasture Management	Riparian pastures managed.	There is only one active pasture on the south side of the lake with less than 10 animal units. Ensure that the owner/operator follows best management practices.		•	D		D				•	10 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Crooked Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							Feedlot Runoff Reductions	Manure management and rotational grazing	Implement at least one feedlot BMP (manure management) in the Crooked Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading	Assess in-lake biological health and identify internal loading risks.	•			•				•	•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lobster Lake 70101080105	Crooked Lake, West (21-0199)	2	Douglas	Phosphorous	19 ug/L	Maintain	Erosion Control	Identify, target, and implement BMPs on sites that are actively eroding through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.	Complete two erosion reduction projects that treat more than 10 acres each.			D		D				•	On-going
							Sediment Reduction	Sediment sources addressed	Identify, target, and implement BMPs on sites that are contributing a disproportional amount of sediment through use of terrain analysis (LiDAR), field verification, and HSPF land use loading information.			D		D				•	On-going
	Round Lake (21-0197)	1	Douglas	Phosphorous	22 ug/L	Maintain	Pasture Management	Riparian pastures managed.	There is only one active feedlot on the south side of the lake with less than 40 animal units. Ensure that the owner/operator follows best management practices.		•	D		D				•	10 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Reduce runoff volume 10%.	Stormwater Management, ordinance enforcement	Implement at least one urban BMP (rain garden, shoreline buffer) in the Round Lake Watershed to serve as a demonstration site.			D		D	•			•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lobster Lake 70101080105	Lobster Lake (West Bay & East Bay) (21-0144)	1	Douglas	Lobster Lake West Bay Phosphorous	26 ug/L	Maintain	Reduce Upstream Lake Phosphorus Loads	Support strategies to identify, target and implement nutrient BMPs for Lake Andrew, Crooked Lake, Round Lake, and Lake Mary and/or protect existing forestland from being developed in these watersheds.	Implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed and/or obtain a conservation easement on one or more parcels in upstream lake watersheds.	•		D	•	D		•		•	10 yrs
				Lobster Lake West Bay Secchi	2.3 m		Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance.	•		D	•	D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
				Lobster Lake East Bay Phosphorous	22 ug/L	Maintain	Wetland Restoration	Prioritize sensitive riparian and critical source areas for wetland restoration.	Implement at least one wetland restoration on restorable wetlands within 500 feet of the lake.			D						•	On-going

HUC-12 Sub-water-shed	Waterbody and Location			Param-eter (incl. non-pollu-tant stres-sors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake / Stream Rank	Location and Up-stream Influ-ence Counties		Cur-rent Condi-tions	Goals / Tar-gets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lobster Lake 70101080105	Crooked (Cook) Lake (21-0111)	2	Douglas	Phosphor-ous	34 ug/L	Main-tain	Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations				•					•	On-going
							Support Lobster Lake Lake Strategies & Protect Shorelines	Support strategies to identify, target and implement nutrient BMPs for Lobster Lake and/or protect existing undeveloped shorelines	Enforce shoreland development ordinances especially on new development to protect nearshore vegetation.	•		D		D				•	On-going
Lake Latoka 70101080106	Nelson Lake (21-0551)	1	Douglas	Phosphor-ous	NA	Main-tain	No infrastructure expansion without 100% mitigation	Stormwater Management, ordinance enforcement.	Implement at least one urban BMP (rain garden, shoreline buffer) in the Nelson Lake Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
	Lake Latoka (21-0106)	1	Douglas	Phosphor-ous	14.5 ug/L	Main-tain	Stormwater Management	Maintain existing facilities; reduce runoff volume 10%, No infrastructure expansion without 100% mitigation.	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Latoka Watershed to serve as a demonstration site. Enforce ordinances requiring mitigation for any stormwater infrastructure expansion.			D		D	•			•	10 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures.	•			•	D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Latoka 70101080106	Lake Brophy (21-0102)	2	Douglas	Phosphor-ous	21 ug/L	Maintain	Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	•		D	•	D				•	On-going
	Lake Charley (21-0120)	2	Douglas	Phosphor-ous	22 ug/L	Maintain	Reduce Upstream Lake Phosphorus Loads	Support strategies to identify, target and implement nutrient BMPs in Lake Ida and/or protect existing forestland from being developed in upstream watersheds.	Implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed and/or obtain a conservation easement on one or more parcels in upstream lake watersheds.	•		D	•	D		•		•	10 yrs
	Lake Louise (21-0094)	3	Douglas	Phosphor-ous	18 ug/L	Maintain	Reduce Upstream Lake Phosphorus Loads	Support strategies to identify, target and implement nutrient BMPs in Lake Ida, Lake Charley and/or protect existing forestland from being developed in upstream watersheds.	Implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed and/or obtain a conservation easement on one or more parcels in upstream lake watersheds.	•		D	•	D		•		•	10 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•		D	•	D				•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollu-tant stres-sors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake / Stream Rank	Location and Up-stream Influ-ence Counties		Cur-rent Condi-tions	Goals / Tar-gets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Latoka 70101080106							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
	Lake Mina (21-0108)	2	Douglas	Phosphorus	15 ug/L	Main-tain	Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•		D	•	D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
	Lake Cow-drey (21-0103)	2	Douglas	Phosphorus	19 ug/L	Main-tain	Stormwater Management	No increase in annual storm water volume. No infrastructure expansion without 100% mitigation.	Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Cowdrey Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•		D	•	D				•	On-going
							Monitor In-Lake TP Concentra-tions	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.			D	•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Le Homme Dieu 70101080108	Lake Le Homme Dieu (21-0056)	1	Douglas	Phosphorous	19 ug/L	Maintain	Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•			•	D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Stormwater Management	Reduce annual stormwater volume by 10% using Low Impact Design and Infiltration Practices. Mandate LID practices on all new development of remaining first tier parcels and all second tier parcels.	Implement multiple stormwater BMP (rain gardens) as part of a larger effort to protect all lakes in the Alexandria Chain of Lakes.				•	D		•		•	20 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement multiple agricultural BMP (cover crops) as part of a larger effort to protect the Alexandria Chain of Lakes.		•	D						•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Le Homme Dieu 70101080108	Lake Geneva (21-0052)	2	Douglas	Phosphorus	22 ug/L	Maintain	Stormwater Management	Reduce annual stormwater volume by 10% using Low Impact Design and Infiltration Practices. Mandate LID practices on all new development of remaining first tier parcels and all second tier parcels.	Implement multiple stormwater BMP (rain gardens) as part of a larger effort to protect the Alexandria Chain of Lakes.				•	D		•		•	20 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, wildlife and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•		D	•	D				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement multiple agricultural BMP (cover crops) as part of a larger effort to protect all lakes in the Alexandria Chain of Lakes.		•	D						•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollu-tant stres-sors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake / Stream Rank	Location and Up-stream Influ-ence Counties		Cur-rent Condi-tions	Goals / Tar-gets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lake Le Homme Dieu 70101080108	Lake Winona (21-0081)	3	Douglas	Phos-phorus	219 ug/L	60 ug/L	Manage internal load	Fisheries management	See Lake Winona TMDL	•						•			5 years
								Restoration of macrophytes		•						•			5 years
								Reconstruction of carp control barrier		•						•			5 years
				Chloride	450 mg/L	230 mg/L	Reduce Chloride Use	Improve Winter Salting techniques	Education campaign throughout lakeshed			D	•	D	•	•		•	On-going
							Improve Policy	Explore alternatives for water softeners within the Alexandria Lake Area Sanitary District (ALASD)	Research feasible alternatives to traditional water softeners including the provision of soft water by the municipal supplier or prohibiting the use of individual water softeners in the ALASD.					D	•	•		•	On-going
	Lake Agnes (21-0053)	3	Douglas	Phos-phorus	95 ug/L	40 ug/L	Reduce Upstream Lake TP Loads	Support strategies to identify, target and implement nutrient BMPs in the Lake Winona Watershed.	Implement multiple BMPs in the Lake Winona Watershed.	•		D	•	D		•		•	On-going
				Chloride	450 mg/L	230 mg/L	Reduce Chloride Use	Improve Winter Salting techniques	Education campaign throughout lakeshed			D	•	D	•	•		•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Improve Policy	Explore alternatives for water softeners within the Alexandria Lake Area Sanitary District (ALASD)	Research feasible alternatives to traditional water softeners including the provision of soft water by the municipal supplier or prohibiting the use of individual water softeners in the ALASD.					D	•	•		•	On-going
Lake Le Homme Dieu 70101080108	Lake Henry (21-0051)	3	Douglas	Phosphorus	56 ug/L	40 ug/L	Reduce Upstream Lake TP Loads	Support strategies to identify, target and implement nutrient BMPs in the Lake Winona Watershed.	Implement multiple BMPs in the Lake Winona Watershed.	•		D	•	D		•		•	On-going
				Chloride	450 mg/L	230 mg/L	Reduce Chloride Use	Improve Winter Salting techniques	Education campaign throughout lakeshed			D	•	D	•	•		•	On-going
							Improve Policy	Explore alternatives for water softeners within the Alexandria Lake Area Sanitary District (ALASD)	Research feasible alternatives to traditional water softeners including the provision of soft water by the municipal supplier, or prohibiting the use of individual water softeners in the ALASD.					D	•	•		•	On-going

Spruce Creek-Long Prairie River (0701010802) Watershed

Figure 17: First-ranked Spruce Creek HUC 12 Subwatershed

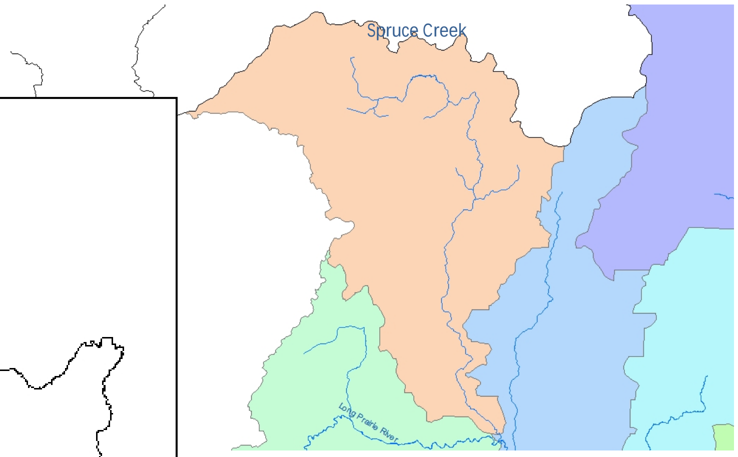


Figure 18: Spruce Creek-Long Prairie River (0701010802) HUC 10 Watershed with HUC 12 subwatersheds identified

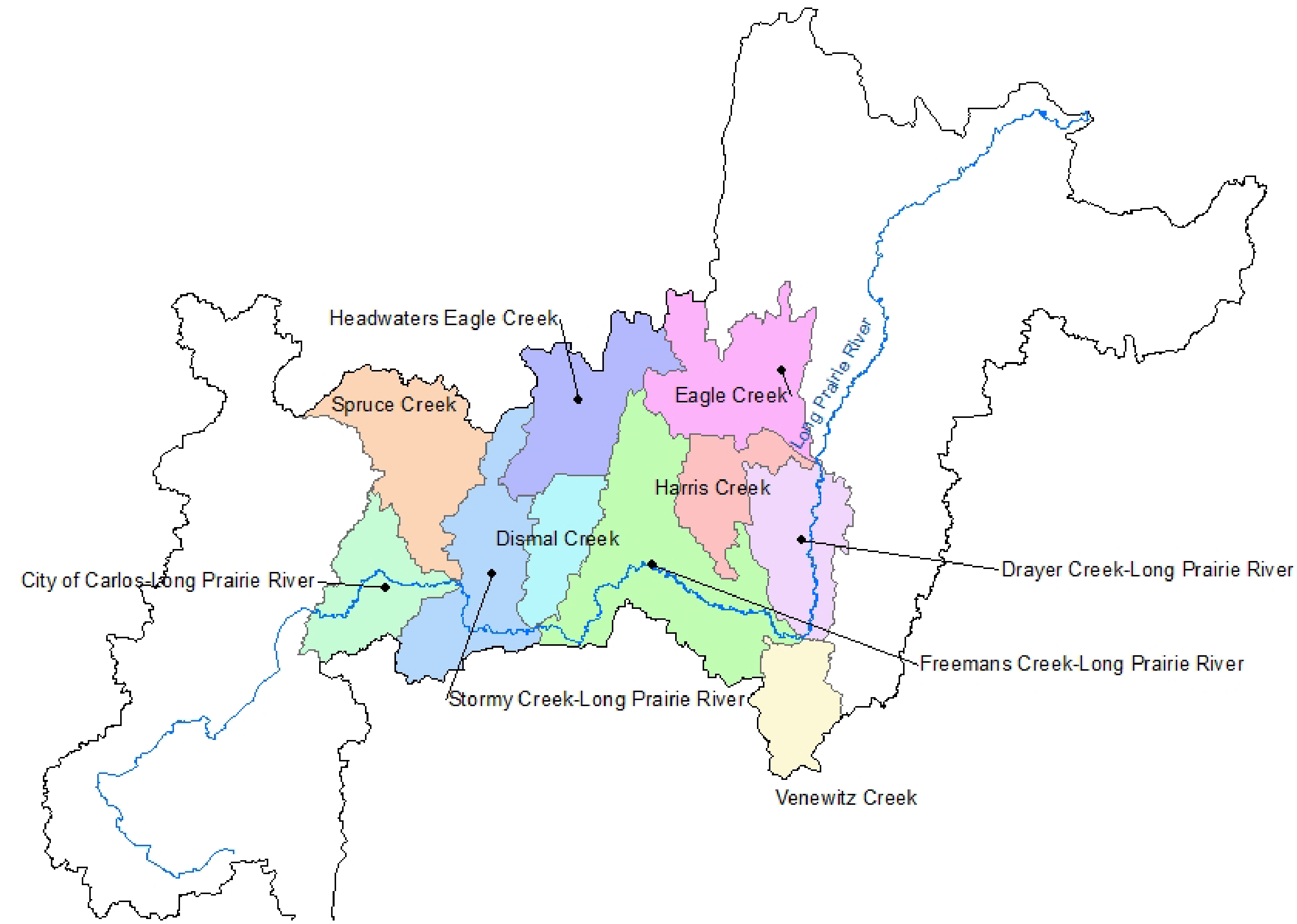


Table 21: (0701010802) Spruce Creek-Long Prairie River HUC 10 Watershed: Proposed strategies and actions for first ranked Spruce Creek HUC 12

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Manage-ment goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water body (ID)	Lake/ Stream Priority Rank-ing	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Spruce Creek 70101080202	T131 R36W S31 north line to Un-named Lake 007010108-512	1	Douglas, Otter Tail	Fish IBI	NS Fish	Meets/ Exceeds Fish and Invert IBI	Stream restoration	Improve riparian vegetation restore/ enhance channel	Restore degraded sections of stream with goal of improving channel bottom substrate.	•		D O	•	D O	•	•		•	10 yrs
							Coldwater Fisheries Protection	Restore natural stream meanders, increase shading of stream, monitor groundwater pumping	Restore degraded sections of stream and monitor groundwater pumping	•	•	D O	•	D O	•			•	10 yrs
				Invert IBI	NS Invert		Dam removal	The dam located on Spruce Centre Drive is acting as a fish barrier	Determine if dam removal or alternative fish passage is a feasible option at Spruce Center Drive.	•		D O	•	D O	•	•		•	5 yrs

Moran Creek-Long Prairie River (0701010805) HUC 10 Watershed

Figure 19: Moran Creek HUC 10 Watershed with HUC 12 Subwatersheds identified

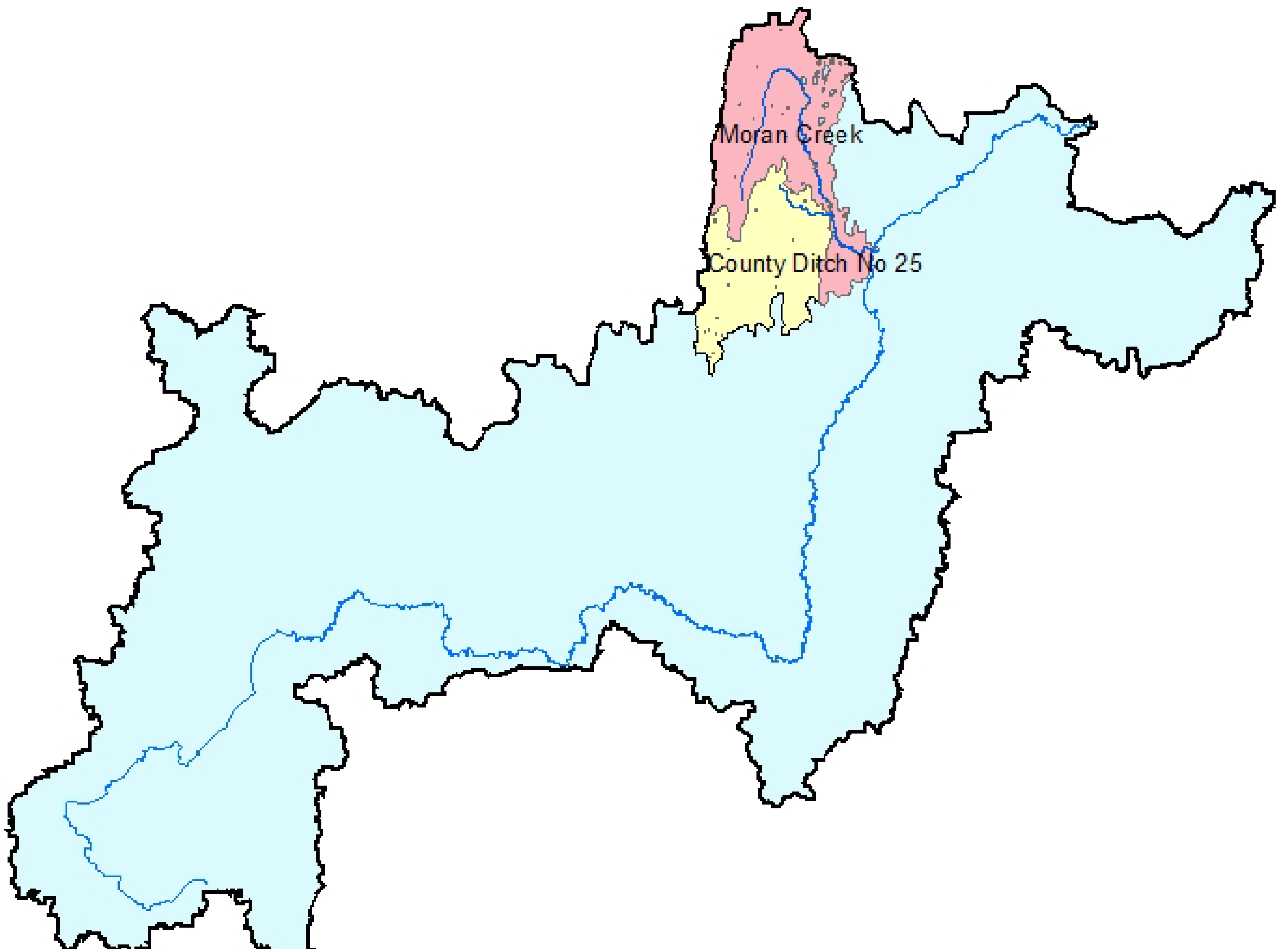


Table 22: (0701010805) Moran Creek-Long Prairie River HUC 10 Watershed: First ranked Moran Creek HUC 12 Proposed strategies and actions

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollut-ant stress-ors)	Water Quality		Manage-ment Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Priority Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Moran Creek 7010108050 2	Moran Creek 07010108-511	1	Todd, Wadena	*E. Coli*		S	Stream Restor-ation / Channel Resto-ration	Restore natural stream meander to areas impacted by ditching, damming and culverts.	Restore degraded sections of stream with goal of improving natural channel flow. Culvert sizing and placement to encourage natural flow.	•		T W		T W	•				10 yrs
							Livestock Access Controls	Restrict direct access to the stream through the use of fences or other barrier.	Identify areas where livestock have direct access to stream. Prioritize areas where fencing is critical to prevent future bank failure.		•	T W						•	10 yrs
							Livestock, pasture and feedlot manage-ment	Manure management and rotational grazing.	Encourage and Develop Nutrient Management & Grazing Plans with 5% of pasture and feedlot operators annually.		•	•							20 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization, shoreland ordinance enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Moran Creek watershed.	•	•	T W	•			•	•	•	10 yrs

Fish Trap Creek HUC 10 Watershed (0701010806)

Figure 20: HUC 12 Subwatersheds of Fish Trap Creek (0701010806)

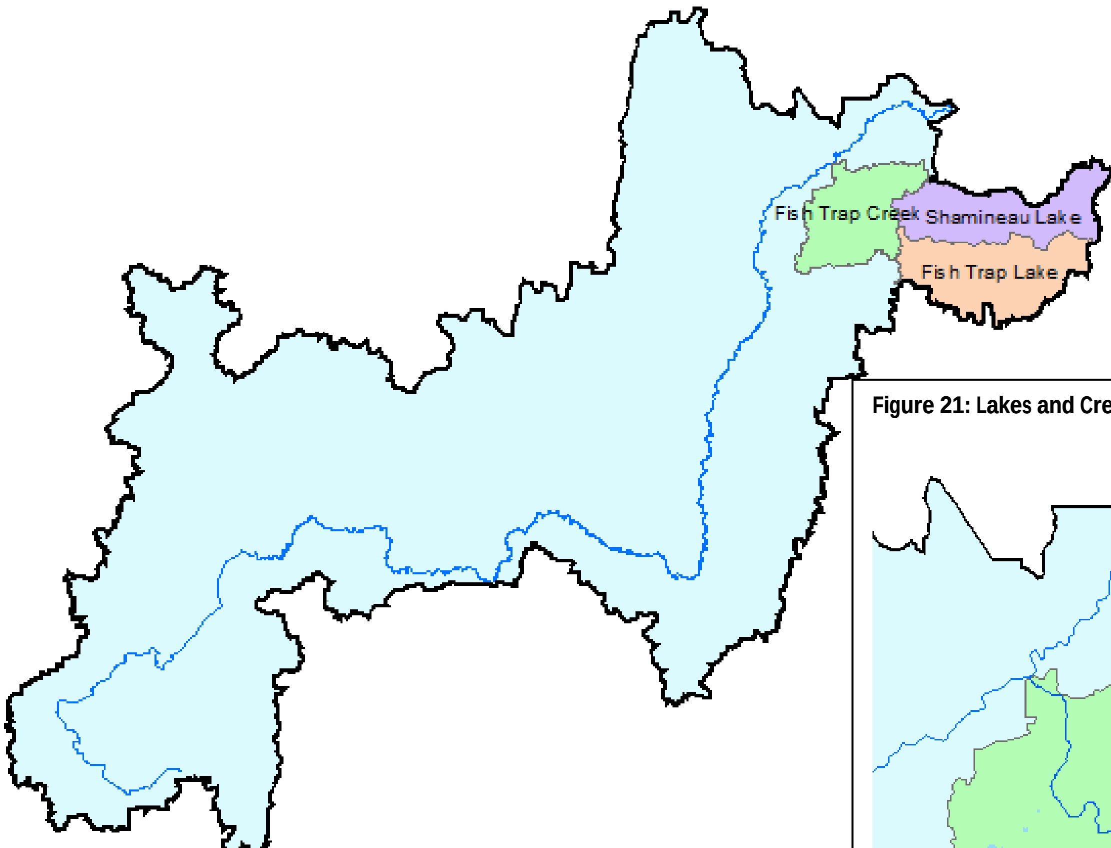


Figure 21: Lakes and Creeks addressed in Fish Trap Creek Strategy Tables

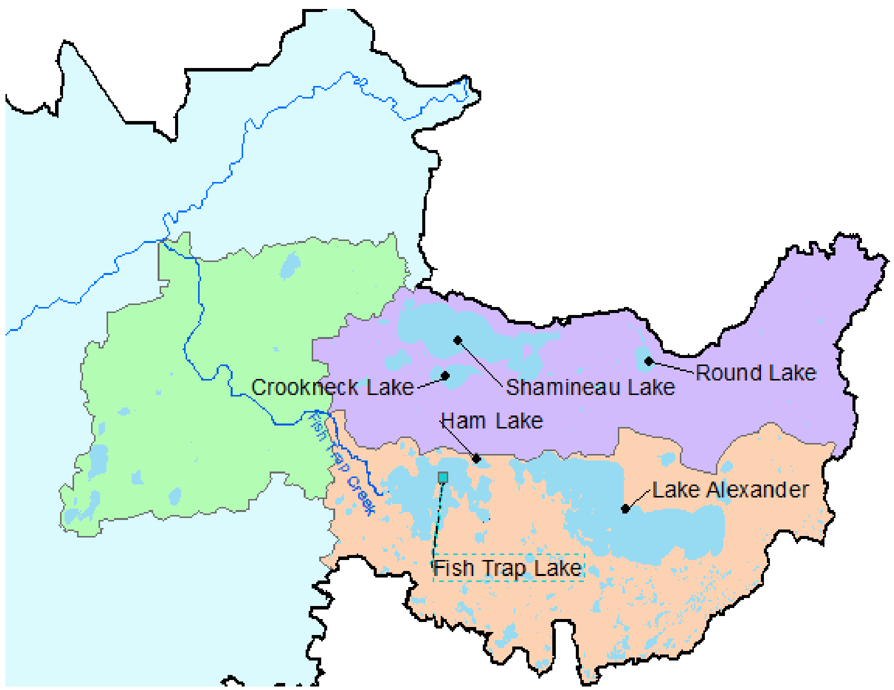


Table 23: (0701010806) Fish Trap Creek-Long Prairie River HUC 10 Watershed: First ranked HUC 12 subwatersheds proposed strategies and actions

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena, M=Morrison.

HUC-12 Sub-watershed	Waterbody and Location: Water-body (ID)	Waterbody and Location: Lake/ Stream Priority Rank	Waterbody and Location: Location and Upstream Influence Counties	Para-meter (incl. non-pollutant stressors)	Water Quality: Cur-rent Condi-tions	Water Quality: Goals / Targets	Management goals	Strategies	Interim 10-yr Milestones	MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	Time-line
Fish Trap Lake 70101 08060 1	Lake Alexan-der (49-0079)	1	Morrison	Total Phos-phorus	18 ug/L	Main-tain	Reduce Watershed Phosphorus Loads and Protect Key Forested Parcels	Add forest acreage focusing on high value upland forests	Acquire a conservation easement on one or more forested parcels.	•		M		M		•	•	•	10 yrs
				Secchi	4.7 m		Conservation Easement or Acquisition	Leverage ACUB/Sentinel Landscape Easements	Continue successful track record of securing conservation easements, focus on parcels that meet dual purposes of military and water quality benefit.	•		M						•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•			•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location			Para-meter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Priority Rank	Location and Upstream Influence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Fish Trap Lake 7010108060 1	Fish Trap Lake (49-0137) 1	1	Morrison	TP	25 ug/L	Maintain	Reduce/ Maintain Upstream Lake Phosphorus Loads	Identify, target and/or protect existing forestland from being developed in upstream watersheds, especially Lake Alexander.	Support strategies to acquire a conservation easement on one or more forested parcels in Lake Alexander's Watershed.	•		M		M		•	•	•	10 yrs
Fish Trap Lake 7010108060 1	Fish Trap Lake (49-0137) 1	1	Morrison	TP	25 ug/L	Maintain	Monitor In-Lake TP Concentra-tions	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
Fish Trap Lake 7010108060 1	Fish Trap Lake (49-0137) 1	1	Morrison	TP	25 ug/L	Maintain	Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, and fisheries management.	Maintain status as lake of biological significance through implementation of protection measures	•			•	M				•	On-going
Fish Trap Lake 7010108060 1	Fish Trap Lake (49-0137) 1	1	Morrison	Secchi	3.4 m	Maintain	In-Lake Nutrient Management	Continue to monitor impacts of lake-wide curly-leaf pondweed endothall applications on water quality.	Update lake vegetation plan annually including mapping of curly-leaf pondweed distribution using point-intercept surveys.	•									On-going
Fish Trap Lake 7010108060 1	Ham Lake (49-0136)	1	Morrison	TP	16 ug/L	Maintain	Reduce/ Maintain Upstream Lake Phosphorus Loads	Identify, target and/or protect existing forestland from being developed in upstream watersheds,	Support strategies to acquire a conservation easement on one or more forested parcels in Lake Alexander's Watershed.	•		M		M		•	•	•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Para-meter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Priority Rank	Location and Upstream Influence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
								especially Lake Alexander.											
							Monitor In-Lake TP Concen-trations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations.				•					•	On-going
Shamineau Lake 701010806002	Round Lake (49-0131)	1	Morrison	Phospho-rous		Maintain	Reduce/ Maintain Upstream Lake Phosphorus Loads	Identify, target and/or protect existing forestland from being developed in upstream watersheds, especially Shamineau Lake	Support strategies to acquire a conservation easement on one or more forested parcels in Shamineau Lake's Watershed.	•		M		M		•	•	•	10 yrs
	Crook-neck Lake (49-0133)	1	Morrison	Phospho-rous	27 ug/L	Main-tain	Shoreland Protection	Maintain the native shoreline	Maintain the native, natural looking shorelines by restricting development.	•		M		M		•			10 yrs
							Monitor In-Lake TP Concentra-tions	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	On-going

HUC-12 Sub-water shed	Waterbody and Location			Para-meter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Priority Rank	Location and Upstream Influence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Shami neau Lake 70101 08060 2	Shamin eau Lake (49-0127)	1	Morrison	Phospho-rous	15 ug/L	Main-tain	Shoreland / Runoff Protection increased from 53% of parcels to 75%	Natural plantings, buffers, bank stabilization, shoreland ordinance enforcement	Implement multiple shoreline restoration projects by 2025 on parcels lacking runoff control.	●		M		M		●		●	10 yrs
							Improve shoreland habitat	Work with local partners & Lake Improvement District to improve shoreland habitat through cost-share & partnerships		●		M		M		●		●	
							Conservation Easement or Acquisition	Leverage ACUB/ Sentinel Landscape Easements	Continue successful track record of securing conservation easements, focus on parcels that meet dual purposes of military and water quality benefit.	●		M						●	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				●					●	On-going
							Maintain In-Lake Aquatic Biology	Shoreland development ordinances, voluntary adoption of BMPs, and fisheries and wildlife management.	Maintain status as lake of biological significance through implementation of protection measures.	●			●					●	On-going

HUC-12 Sub-watershed	Waterbody and Location			Para-meter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Priority Rank	Location and Upstream Influence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Fish Trap Creek 7010108060 3	Fish Trap Creek	1	Morrison Todd	Dissolved Oxygen		Maintain	Stream Channel Resto-ration	Restore natural stream meander to areas impacted by ditching, damming and culverts.	Restore degraded sections of stream with goal of improving natural channel flow.	•		MT	•	MT	•	•		•	10 yrs

Table 24. Strategy Key

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
Total Suspended Solids (TSS)	Improve upland/field surface runoff controls: Soil and water conservation practices that reduce soil erosion and field runoff, or otherwise minimize sediment from leaving farmland	Cover crops
		Water and sediment basins, terraces
		Rotations including perennials
		Conservation cover easements
		Grassed waterways
		Strategies to reduce flow- some of flow reduction strategies should be targeted to ravine subwatersheds
		Residue management - conservation tillage
		Forage and biomass planting
		Open tile inlet controls - riser pipes, french drains
		Contour farming
		Field edge buffers, borders, windbreaks and/or filter strips
		Stripcropping
	Protect/stabilize banks/bluffs: Reduce collapse of bluffs and erosion of streambank by reducing peak river flows and using vegetation to stabilize these areas.	Strategies for altered hydrology (reducing peak flow)
		Streambank stabilization
		Riparian forest buffer
		Livestock exclusion - controlled stream crossings
	Stabilize ravines: Reducing erosion of ravines by dispersing and infiltrating field runoff and increasing vegetative cover near ravines. Also, may include earthwork/regrading and revegetation of ravine.	Field edge buffers, borders, windbreaks and/or filter strips
		Contour farming and contour buffer strips
		Diversions
		Water and sediment control basin
		Terrace
		Conservation crop rotation
		Cover crop
		Residue management - conservation tillage

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
Total Suspended Solids (TSS)	Stream Channel Restoration	Addressing road crossings (direct erosion) and floodplain cut-offs
		Clear water discharge: urban areas, ag tiling etc. – direct energy dissipation
		Two-stage ditches
		Large-scale restoration – channel dimensions match current hydrology & sediment loads, connect the floodplain, stable pattern, (natural channel design principals)
		Stream channel restoration using vertical energy dissipation: step pool morphology
	Improve forestry management	Proper Water Crossings and road construction
		Forest Roads - Cross-Drainage
		Maintaining and aligning active Forest Roads
		Closure of Inactive Roads & Post-Harvest
		Location & Sizing of Landings
		Riparian Management Zone Widths and/or filter strips
	Improve urban stormwater management [to reduce sediment and flow]	See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
Nitrogen (TN) or Nitrate	Implementation of the *Nitrogen Fertilizer Management Plan* and *Minnesota Nutrient Reduction Strategy*	See http://www.mda.state.mn.us/nfmp and https://www.pca.state.mn.us/sites/default/files/wq-s1-80a.pdf
	Increase fertilizer and manure efficiency: Adding fertilizer and manure additions at rates and ways that maximize crop uptake while minimizing leaching losses to surface and groundwater.	Nitrogen rates at Maximum Return to Nitrogen (U of MN rec's)
		Timing of application closer to crop use (spring or split applications)
		Nitrification inhibitors
		Manure application based on nutrient testing, calibrated equipment, recommended rates, etc.
	Store and treat tile drainage waters: Managing tile drainage	Saturated buffers
		Restored or constructed wetlands

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
Nitrogen (TN) or Nitrate	waters so that nitrate can be denitrified or so that water volumes and loads from tile drains are reduced.	Controlled drainage
		Woodchip bioreactors
		Two-stage ditch
	Increase vegetative cover/root duration: Planting crops and vegetation that maximize vegetative cover and capturing of soil nitrate by roots during the spring, summer and fall.	Conservation cover (easements/buffers of native grass & trees, pollinator habitat)
		Perennials grown on marginal lands and riparian lands
		Cover crops
		Rotations that include perennials
		Crop conversion to low nutrient-demanding crops (e.g., hay).
Phosphorus (TP)	Improve upland/field surface runoff controls: Soil and water conservation practices that reduce soil erosion and field runoff, or otherwise minimize sediment from leaving farmland	Strategies to reduce sediment from fields (see above - upland field surface runoff)
		Constructed wetlands
		Pasture management
	Reduce bank/bluff/ravine erosion	Strategies to reduce TSS from banks/bluffs/ravines (see above for sediment)
	Increase vegetative cover/root duration: Planting crops and vegetation that maximize vegetative cover and minimize erosion and soil losses to waters, especially during the spring and fall.	Conservation cover (easements/buffers of native grass & trees, pollinator habitat)
		Perennials grown on marginal lands and riparian lands
		Cover crops
		Rotations that include perennials
	Preventing feedlot runoff: Using manure storage, water diversions, reduced lot sizes and vegetative filter strips to reduce open lot phosphorus losses	Open lot runoff management to meet 7020 rules
		Manure storage in ways that prevent runoff
	Improve fertilizer and manure application management: Applying phosphorus fertilizer and manure	Soil P testing and applying nutrients on fields needing phosphorus
		Incorporating/injecting nutrients below the soil

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
Phosphorus (TP)	onto soils where it is most needed using techniques which limit exposure of phosphorus to rainfall and runoff.	Manure application meeting all 7020 rule setback requirements
	Reduce Phosphorus Loss in Tile Drainage Systems	Treat tile drainage waters: Phosphorus-removing treatment systems, including bioreactors
		Manage soil test phosphorus levels
		Prevent soil from entering tile lines: http://bit.ly/2fqc22J
	Address failing septic systems: Fixing septic systems so that on-site sewage is not released to. Includes straight pipes.	Sewering around lakes
		Eliminating straight pipes, surface seepages
	Reduce in-water loading: Minimizing the internal release of phosphorus within lakes	Rough fish management
		Curly-leaf pondweed management
		Alum treatment
		Lake drawdown
		Hypolimnetic withdrawal
	Improve forestry management	See forest strategies for sediment control
	Reduce Industrial/Municipal wastewater TP	Municipal and industrial treatment of wastewater P
		Upgrades/expansion. Address inflow/infiltration.
	Improve urban stormwater management	See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
E. coli	Reducing livestock bacteria in surface runoff: Preventing manure from entering streams (and potential drinking water sources) by keeping it in storage or below the soil surface and by limiting access of animals to waters.	Strategies to reduce field TSS (applied to manured fields, see above)
		Improved field manure (nutrient) management
		Adhere/increase application setbacks
		Improve feedlot runoff control
		Animal mortality facility

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
E. coli		Manure spreading setbacks and incorporation near wells and sinkholes
		Rotational grazing and livestock exclusion (pasture management)
	Reduce urban bacteria: Limiting exposure of pet or waterfowl waste to rainfall	Pet waste management
		Filter strips and buffers
		See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
	Address failing septic systems: Fixing septic systems so that on-site sewage is not released to ground and surface waters (and potential drinking water sources). Includes straight pipes.	Replace failing septic (SSTS) systems
		Maintain septic (SSTS) systems
	Reduce Industrial/Municipal wastewater bacteria	Reduce straight pipe (untreated) residential discharges
		Reduce WWTP untreated (emergency) releases
Dissolved Oxygen	Reduce phosphorus	See strategies above for reducing phosphorus
	Increase river flow during low flow years	See strategies below for altered hydrology
	In-channel restoration: Actions to address altered portions of streams.	Goal of channel stability: transporting the water and sediment of a watershed without aggrading or degrading.
		Restore riffle substrate
Chloride	Reduce Chloride use through education and smart salting techniques	Strategies currently under development within Twin Cities Metro Area Chloride Management Plan- https://www.pca.state.mn.us/sites/default/files/wq-iw11-06ff.pdf
	Reduce chloride use through permitting	Waste water permitting should follow policies proposed by Chloride Working Group https://www.pca.state.mn.us/sites/default/files/wq-wwprm2-24.pdf

Parameter (incl. non-pollutant stressors)	**Strategy Key**	
	Description	Example BMPs/actions
Altered hydrology; peak flow and/or low base flow (Fish/ Macro-invertebrate IBI)	Increase living cover: Planting crops and vegetation that maximize vegetative cover and evapotranspiration especially during the high flow spring months.	Grassed waterways
		Cover crops
		Conservation cover (easements & buffers of native grass & trees, pollinator habitat)
		Rotations including perennials
	Improve drainage management: Managing drainage waters to store tile drainage waters in fields or at constructed collection points and releasing stored waters after peak flow periods.	Treatment wetlands
		Restored wetlands
	Reduce rural runoff by increasing infiltration: Decrease surface runoff contributions to peak flow through soil and water conservation practices.	Conservation tillage (no-till or strip till w/ high residue)
		Water and sediment basins, terraces
Altered hydrology; peak flow and/or low base flow (Fish/ Macro-invertebrate IBI)	Improve urban stormwater management	See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
	Improve irrigation water management: Increase groundwater contributions to surface waters by withdrawing less water for irrigation or other purposes.	Groundwater pumping reductions and irrigation management
Poor Habitat (Fish/ Macroinverte-brate IBI)	Improve riparian vegetation: Planting and improving perennial vegetation in riparian areas to stabilize soil, filter pollutants and increase biodiversity	50' vegetated buffer on waterways
		One rod ditch buffers
		Lake shoreland buffers
		Increase conservation cover: in/near water bodies, to create corridors
		Improve/increase natural habitat in riparian, control invasive species
		Tree planting to increase shading

Parameter (incl. non-pollutant stressors)	Strategy Key	
	Description	Example BMPs/actions
Poor Habitat (Fish/ Macroinverte-brate IBI)	Improve riparian vegetation (cont'd)	Streambank and shoreline protection/stabilization
		Wetland restoration
		Accurately size bridges and culverts to improve stream stability
	Restore/enhance channel: Various restoration efforts largely aimed at providing substrate and natural stream morphology.	Retrofit dams with multi-level intakes
		Restore riffle substrate
		Two-stage ditch
		Dam operation to mimic natural conditions
		Restore natural meander and complexity
Water Temperature	Urban stormwater management	See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
	Improve riparian vegetation: Actions primarily to increase shading, but also some infiltration of surface runoff.	Riparian vegetative buffers
		Tree planting to increase shading
Connectivity (Fish IBI)	Removal fish passage barriers: Identify and address barriers.	Remove impoundments
		Properly size and place culverts for flow and fish passage
		Construct by-pass
All [protection-related]	Implement volume control / limited-impact development: This is aimed at development of undeveloped land to provide no net increase in volume and pollutants	See MPCA Stormwater Manual: http://stormwater.pca.state.mn.us/index.php

4. Monitoring Plan

Data from three monitoring programs will continue to be collected and analyzed for the Long Prairie River Watershed. These monitoring programs are summarized below:

1. ***Intensive Watershed Monitoring*** collects water quality and biological data throughout each major watershed once every ten years. This work is scheduled for its second iteration in the Long Prairie River Watershed in 2021. This data provides a periodic but intensive “snapshot” of water quality throughout the watershed.
2. The ***Watershed Pollutant Load Monitoring Network (WPLMN)*** intensively collects pollutant samples and flow data to calculate sediment and nutrient loads on either an annual or seasonal (no-ice) basis. A long-term WPLMN stream monitoring station is located on the Long Prairie River on 313th Avenue, north of the town of Philbrook. Intensive water quality sampling occurs year round at this site. Approximately 35 grab samples are collected at the site per year with sampling frequency greatest during periods of moderate to high flow.
3. The ***Citizen Lake and Stream Monitoring Programs*** are a network of volunteers who make monthly lake and river transparency readings. This watershed has many lake associations that collect water quality data independent of agency initiatives. In addition, there are currently 26 volunteers enrolled in the MPCA’s Citizen Lake Monitoring Program (CLMP) that are conducting lake monitoring within the watershed.

In addition to the monitoring conducted in association with the WRAPS process, each local unit of government associated with water management may have their own monitoring plan. Furthermore, there are many citizen monitors throughout the watershed collecting both stream and lake data. All data collected locally should be submitted regularly to the MPCA for entry into the EQuIS database system.

5. References and Further Information

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Long Prairie River Watershed Reports

All Long Prairie River reports referenced in this watershed report are available at the Long Prairie River Watershed webpage: *https://www.pca.state.mn.us/water/watersheds/long-prairie-river.html*

Appendix A: Stream Water Quality Assessment

HUC-10 Subwatershed	AUID (Last 3 digits)	Stream	Reach Description	Aquatic Life				Aq Rec
				Fish Index of Biotic Integrity	Macroinvertebrate Index of Biotic Integrity	Dissolved Oxygen	Turbidity/TSS	Bacteria
Lake Carlos	552	Unnamed Creek	County Ditch 11 to Lake Miltona	NA*	NA*	IF	SUP	IMP
	595	Unnamed Creek	Headwater to Lake Miltona	IMP	IMP	NA	NA	NA
Spruce Creek-Long Prairie River	505	Long Prairie River	Spruce Creek to Eagle Creek	IMP	SUP	IMP	SUP	SUP
	512	Spruce Creek	T131 R36W S31, north line to Unnamed Lake (21-0034-00)	IMP	IMP	NA	NA	NA
	520	Spruce Creek	Unnamed Lake (21-0034-00) to Long Prairie River	SUP	SUP	NA	NA	NA
	522	Stormy Creek	Unnamed Creek to Unnamed Creek	SUP	SUP	NA	NA	NA
	534	Long Prairie River	Headwaters (Lake Carlos 21005700) to end of Wetland (CSAH 65)	SUP	SUP	IMP	SUP	IF
	535	Long Prairie River	End of Wetland (CSAH 65) to Spruce Creek	SUP	SUP	IMP	SUP	NA
	568	Venewitz Creek	Charlotte Lake to Long Prairie River	IMP	NA	NA	NA	NA
	587	Freeman's Creek	County Ditch 4 to Long Prairie River	SUP	IMP	NA	NA	NA
Eagle Creek	507	Eagle Creek	Headwaters to Long Prairie River	SUP	SUP	IF	SUP	IMP
	592	Harris Creek	Unnamed Creek to Eagle Creek	SUP	IMP	NA	NA	NA
Turtle Creek	513	Turtle Creek	Headwaters to Long Prairie River	SUP	SUP	IF	SUP	SUP
Moran Creek	511	Moran Creek	Headwaters to Long Prairie River	SUP	SUP	IMP	SUP	IMP
	603	Unnamed Creek	Unnamed Creek to Unnamed Creek	SUP	SUP	NA	NA	NA
Long Prairie River	504	Long Prairie River	Eagle Creek to Turtle Creek	SUP**	NA	IMP	SUP	NA
	503	Long Prairie River	Turtle Creek to Moran Creek	SUP	SUP	NA**	NA	NA
Long Prairie River	502	Long Prairie River	Moran Creek to Fish Trap Creek	SUP	SUP	IF**	SUP	IF
	501	Long Prairie River	Fish Trap Creek to Crow Wing River	SUP	SUP	SUP	SUP	SUP

* Aquatic life assessments and/or impairments have been deferred until the adoption of Tiered Aquatic Life Uses due to the AUID being predominantly (>50%) channelized or having biological data limited to a station occurring on a channelized portion of the stream.

** Existing impairment

SUP = fully supporting; IMP = Impaired, not supporting; IF = insufficient data to assess; NA = no monitoring data

Appendix B: Lake Water Quality Assessment

HUC-10 Subwatershed	Lake ID	Lake Name	Tropic Status	Aquatic Life Support Status	Aquatic Recreation Support Status
Lake Carlos	21-0053-00	Agnes	E	IMP	IMP
	21-0093-00	Alvin	M	NA	SUP
	21-0085-00	Andrew	M	NA	SUP
	21-0151-00	Blackwell	M	NA	SUP
	21-0102-00	Brophy	M	NA	SUP
	21-0049-00	Burgen	M	IF	SUP
	21-0057-00	Carlos	M	IF	SUP
	21-0120-00	Charley	M	NA	SUP
	21-0111-00	Cook	E	NA	SUP
	21-0103-00	Cowdrey	M	NA	SUP
	21-0199-02	Crooked (East Crooked)	E	IF	IMP
	21-0199-01	Crooked (Northwest Bay)	M	NA	SUP
	21-0080-00	Darling	M	IF	SUP
	21-0157-00	Echo	E	NA	IMP
	56-0066-00	Fish	E	IF	IMP
	21-0052-00	Geneva	E	NA	SUP
	21-0150-00	Grants	M	IF	SUP
	21-0051-00	Henry	E	IMP	IMP
	21-0123-00	Ida	M	NA	SUP
	21-0076-00	Irene	E	NA	SUP
	21-0055-00	Jessie	E	NA	IMP
	21-0106-01	LATOKA (NORTH BAY)	M	IF	SUP
	21-0106-02	LATOKA (SOUTH BAY)	M	IF	SUP
	21-0056-00	Le Homme Dieu	E	NA	SUP
	21-0144-01	LOBSTER (EAST BAY)	M	IF	SUP
	21-0144-02	LOBSTER (WEST BAY)	E	IF	SUP
	21-0105-00	Lottie	M	NA	SUP
	21-0094-00	Louise	M	NA	SUP
	21-0092-00	Mary	E	IF	SUP
	21-0180-00	Mill	E	IF	SUP
	21-0034-00	Mill Pond	E	IF	SUP

HUC-10 Subwatershed	Lake ID	Lake Name	Tropic Status	Aquatic Life Support Status	Aquatic Recreation Support Status
Lake Carlos	21-0083-00	Miltona	M	NA	SUP
	21-0108-00	Mina	M	IF	SUP
	56-0065-00	Nelson	E	NA	IMP
	21-0095-00	North Union	M	NA	SUP
	21-0197-00	Round	M	NA	SUP
	21-0084-00	Skoglund Slough	E	NA	SUP
	21-0130-00	Spring	M	NA	SUP
	21-0101-00	Stony	M	NA	SUP
	56-0067-00	Twin	E	NA	IMP
	21-0041-00	Union	M	IF	SUP
	21-0073-00	Vermont	M	NA	SUP
	21-0054-00	Victoria	M	IF	SUP
	21-0081-00	Winona	H	IMP	IMP
Spruce Creek-Long Prairie River	21-0034-00	Mill Pond	E	IF	SUP
	77-0105-00	Latimer	E	IF	IMP
	77-0120-00	Charlotte	M	IF	SUP
Turtle Creek	77-0046-00	Coal	M	IF	SUP
	77-0050-00	Mill	M	IF	SUP
	77-0061-00	Rice	E	IF	SUP
	77-0066-00	Thunder	E	IF	SUP
	77-0088-00	Turtle	M	IF	SUP
Moran Creek	77-0138-00	Dower	M	IF	SUP
Fish Trap Creek	49-0079-00	Alexander	M	NA	SUP
	49-0133-00	Crookneck	E	NA	SUP
	49-0137-00	Fish Trap	E	NA	SUP
	49-0136-00	Ham	M	NA	SUP
	77-0076-00	Fawn	M	NA	SUP
	77-0077-00	Pine Island	M	NA	SUP
	49-0127-00	Shamineau	M	NA	SUP
Long Prairie River	77-0128-00	Horseshoe	M	IF	SUP

SUP = fully supporting; IMP = Impaired, not supporting; IF = insufficient data to assess; NA = no monitoring data; H = Hypereutrophic; E = Eutrophic; M = Mesotrophic; O = Oligotrophic

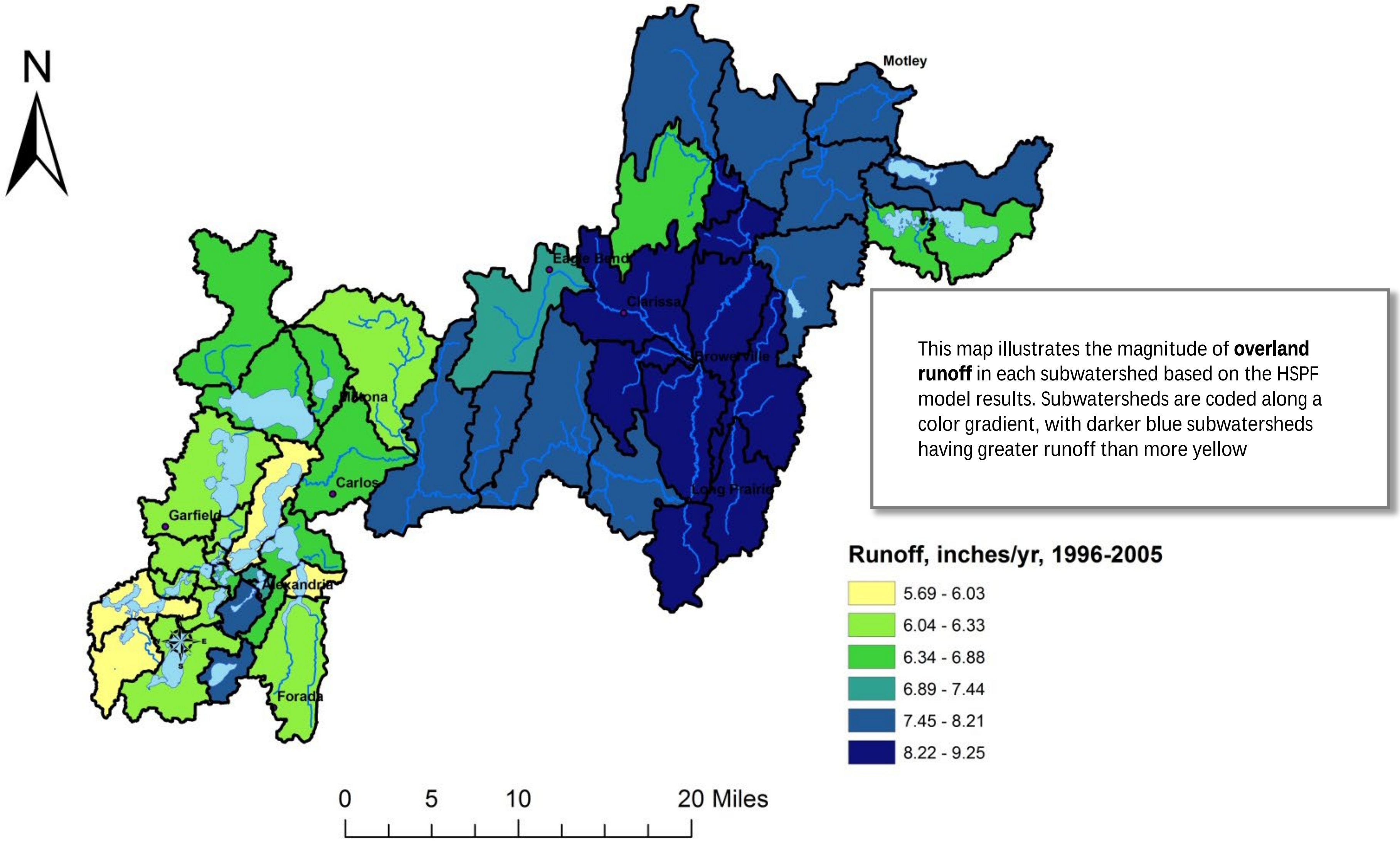


Figure 22: Long Prairie River Watershed HSPF Subwatershed Overland Runoff Volume (inches/year).

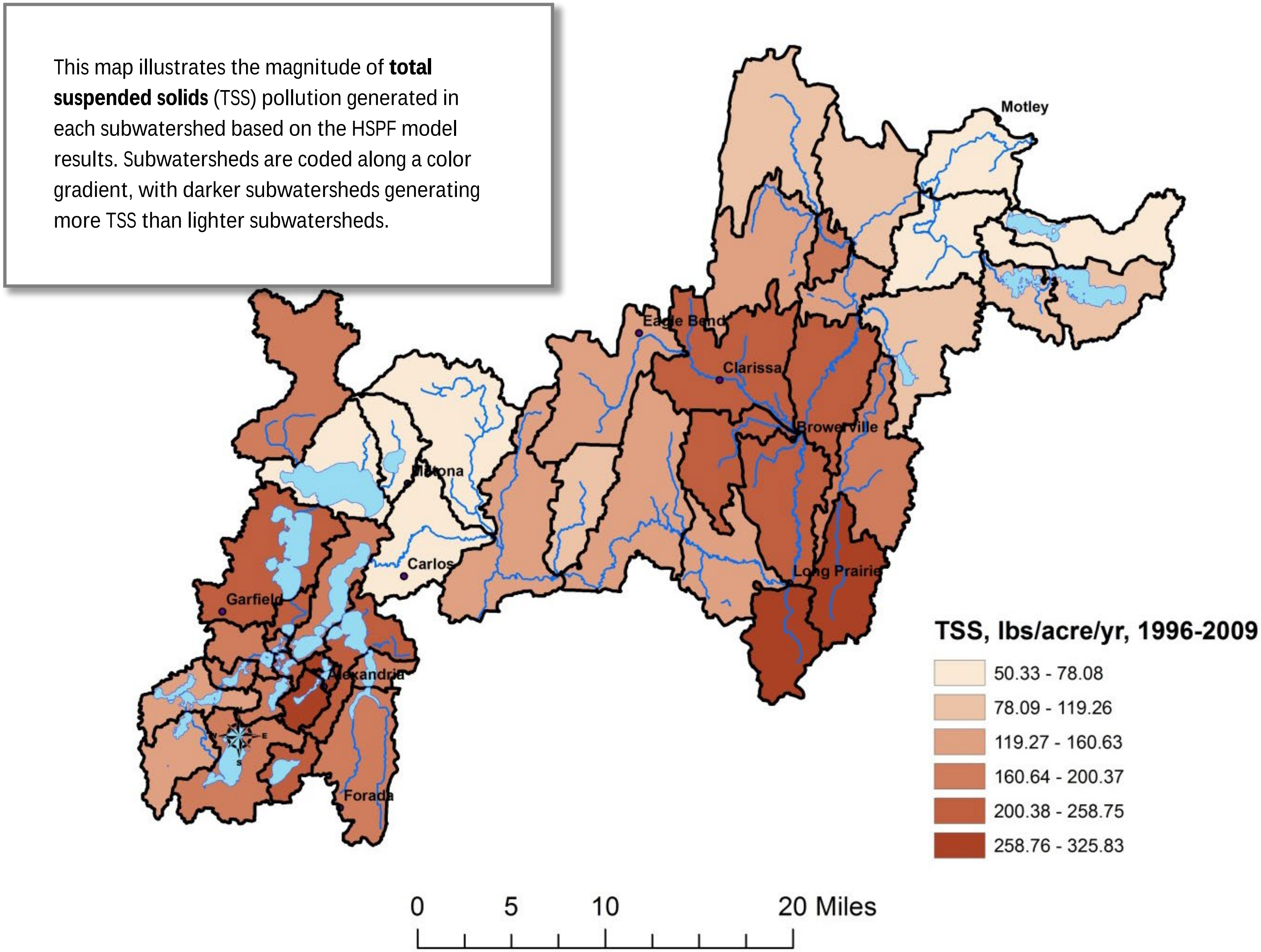
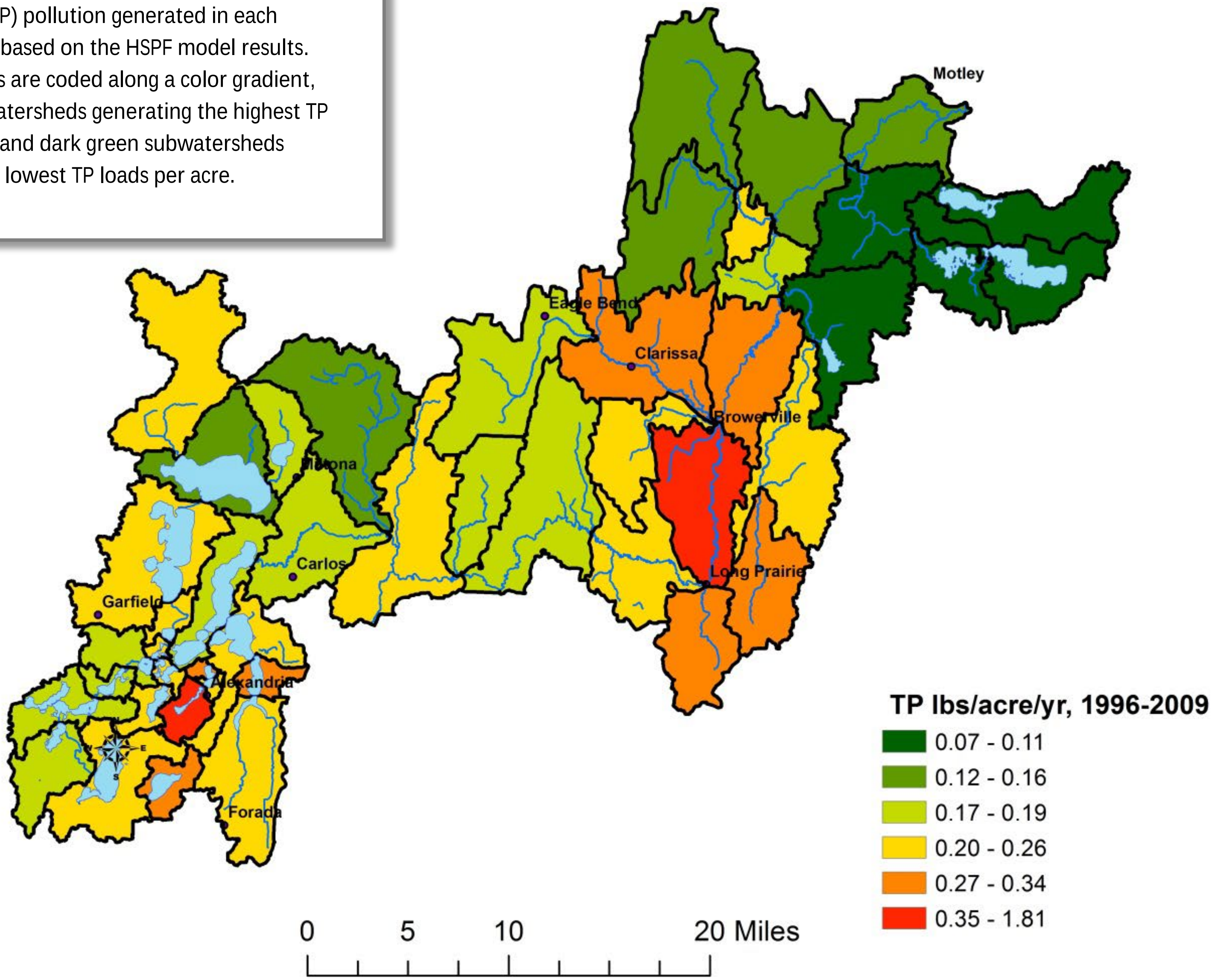


Figure 23: Long Prairie River Watershed HSPF Subwatershed Total Suspended Solids Loads (pounds/acre/year).

This map illustrates the magnitude of **total phosphorus** (TP) pollution generated in each subwatershed based on the HSPF model results. Subwatersheds are coded along a color gradient, with red subwatersheds generating the highest TP loads per acre and dark green subwatersheds generating the lowest TP loads per acre.

Figure 24: Long Prairie River Watershed HSPF Subwatershed Total Phosphorus Loads (pounds/acre/year)



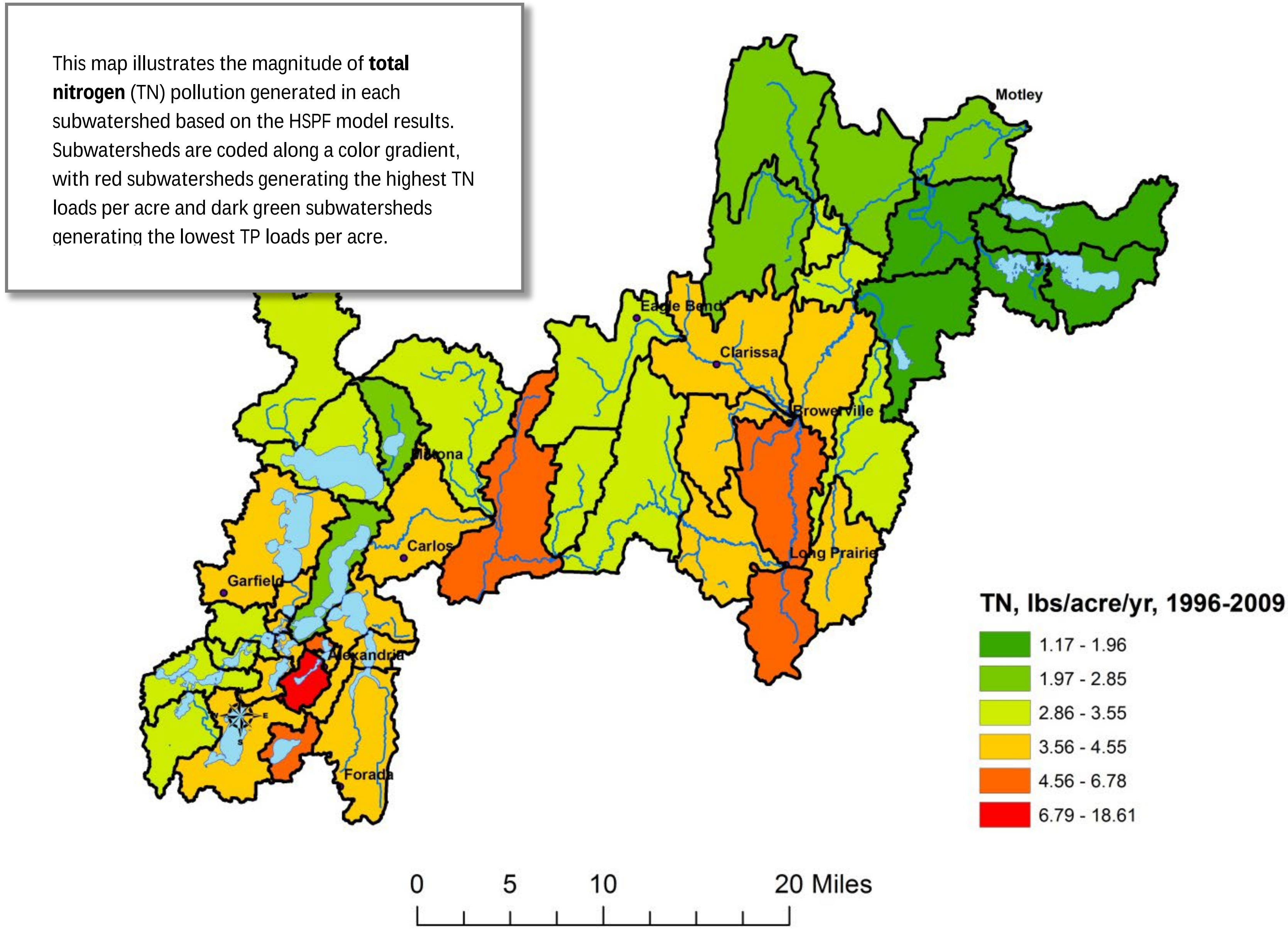


Figure 25: Long Prairie River Watershed HSPF Subwatershed Total Nitrogen Loads (pounds/acre/year)

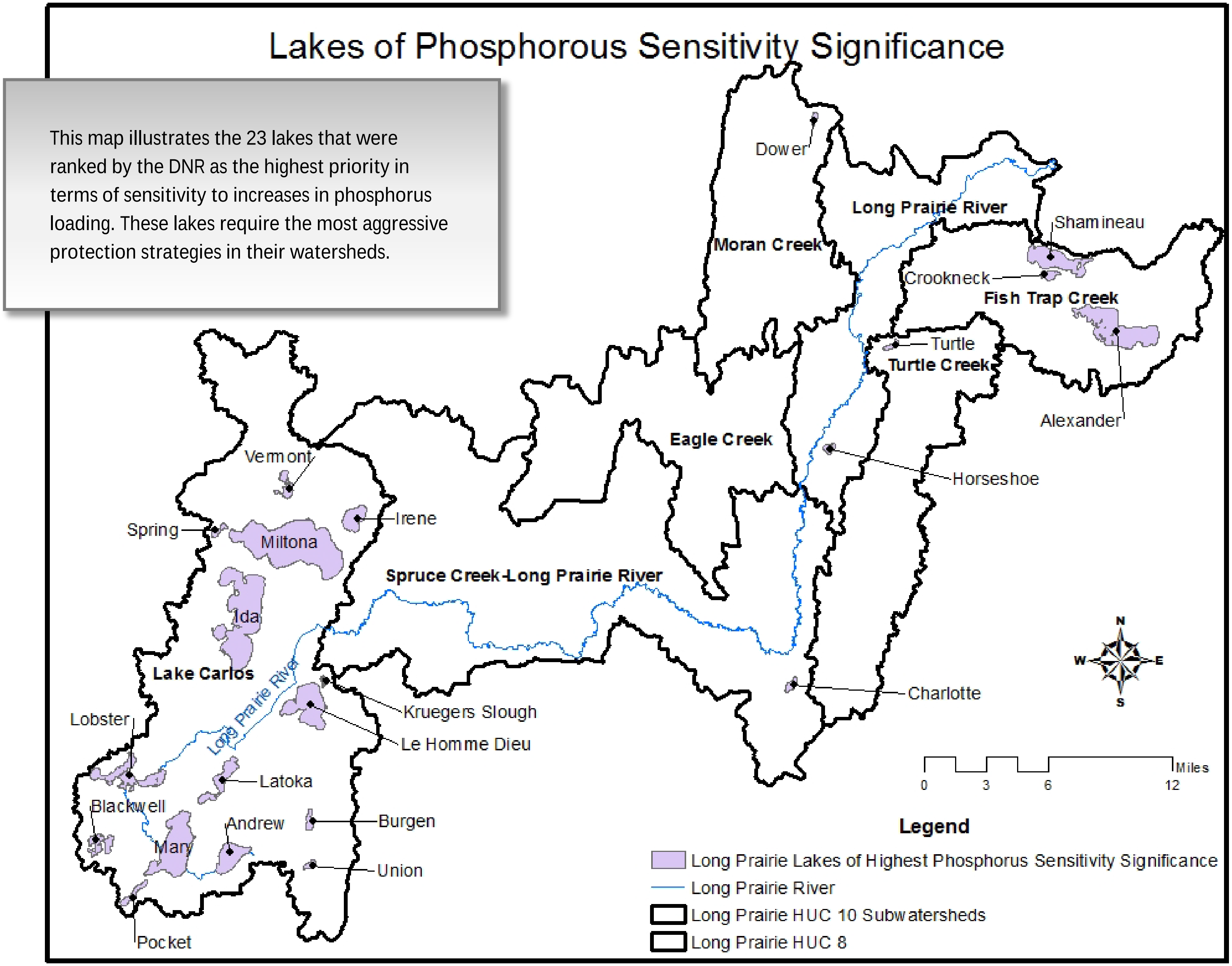


Figure 26: Long Prairie River Watershed Lakes of Highest Phosphorus Sensitivity

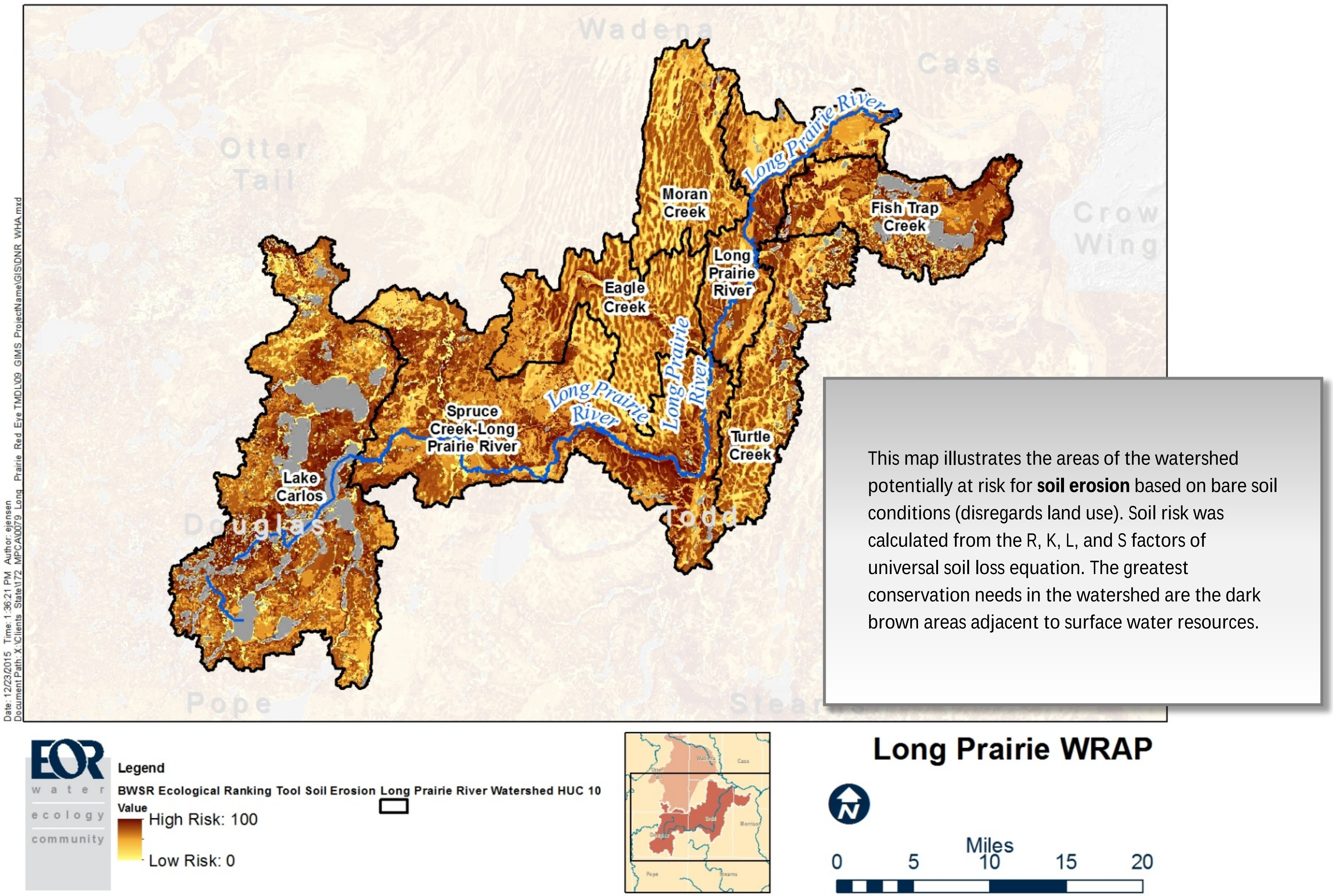


Figure 27: Long Prairie River Watershed Predicted Soil Erosion Risk.

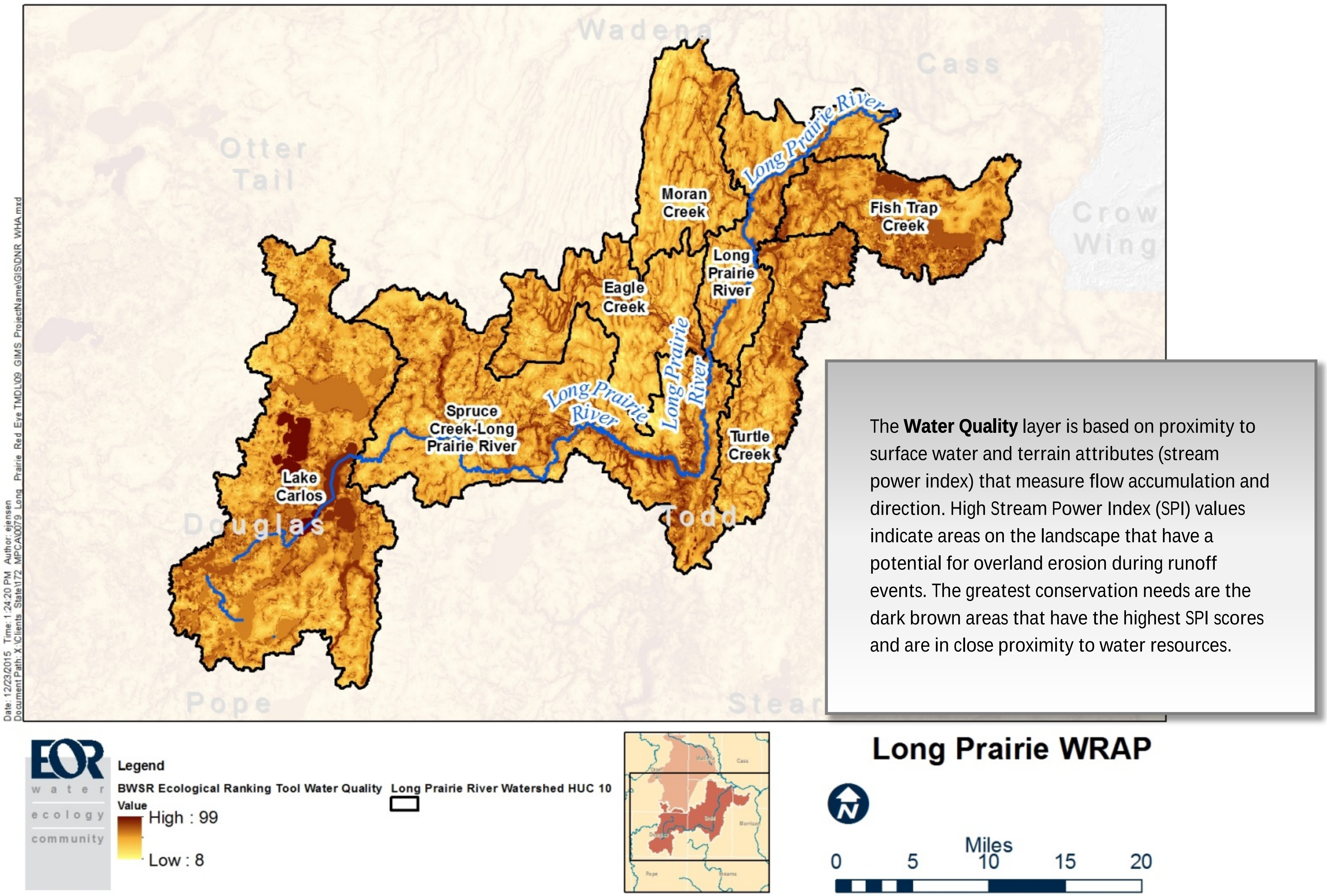


Figure 28: Long Prairie River Watershed Water Quality Degradation Risk.

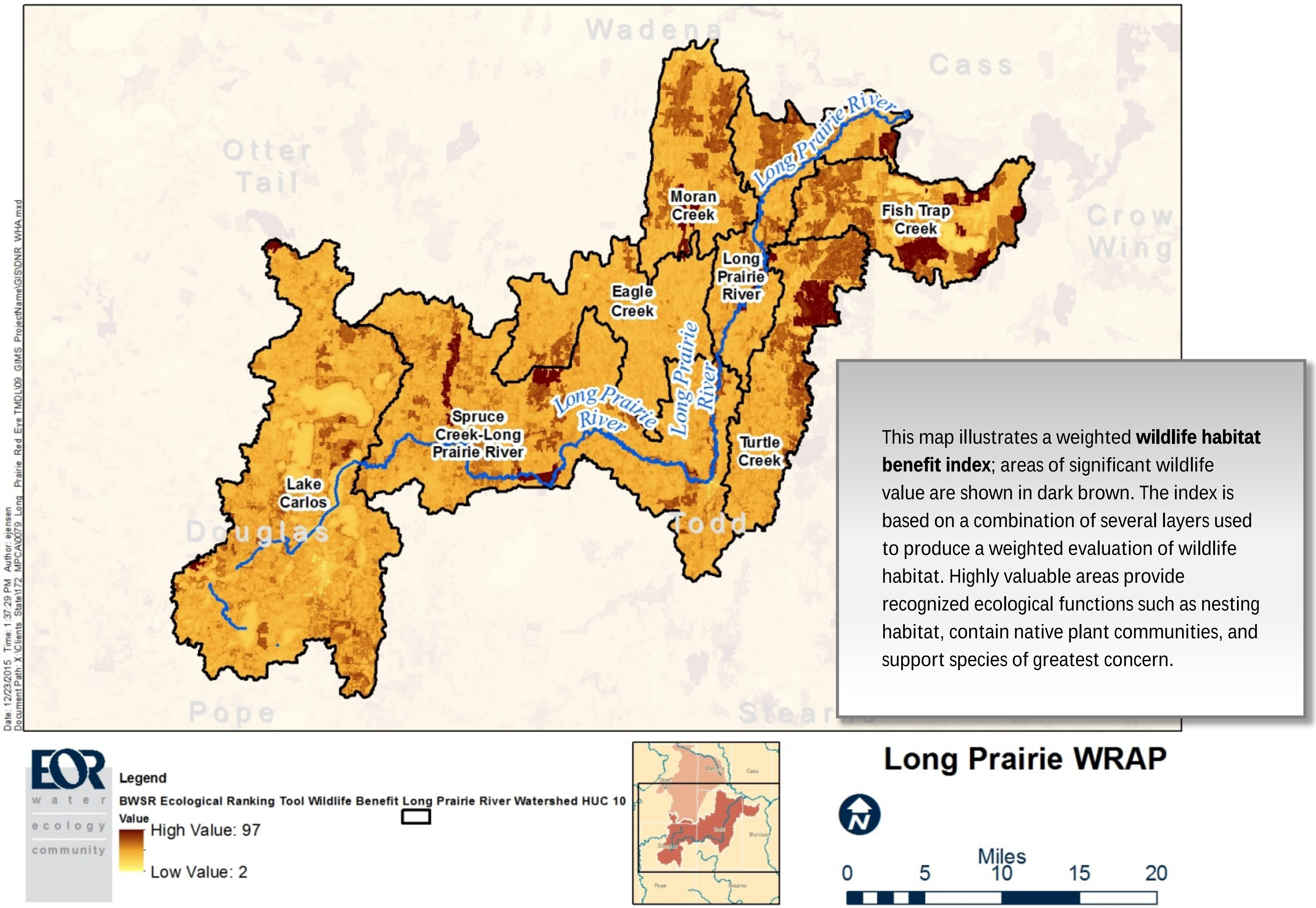


Figure 29: Long Prairie River Watershed Wildlife Habitat Benefit Index.

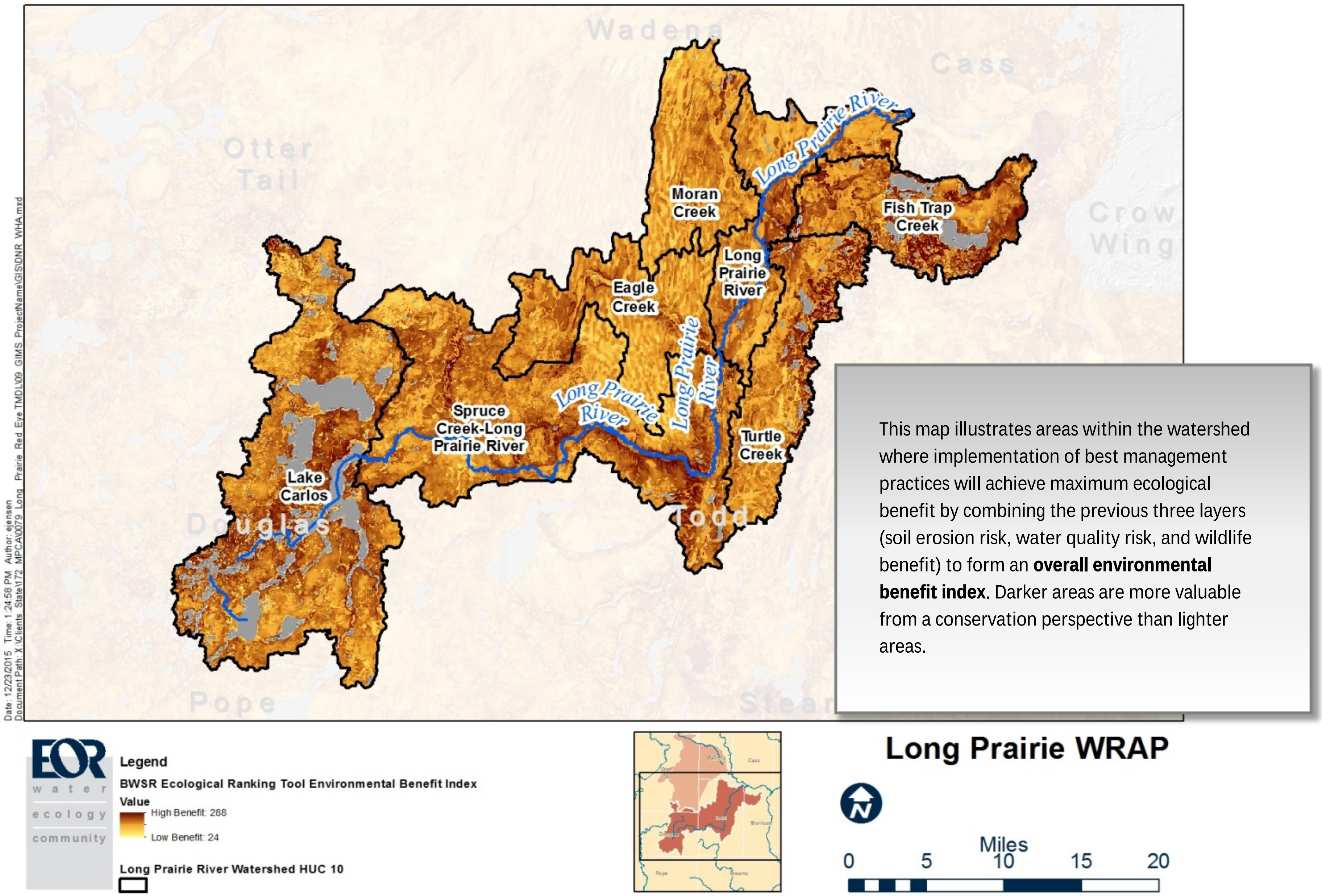


Figure 30: Long Prairie River Watershed Environmental Benefit Index.

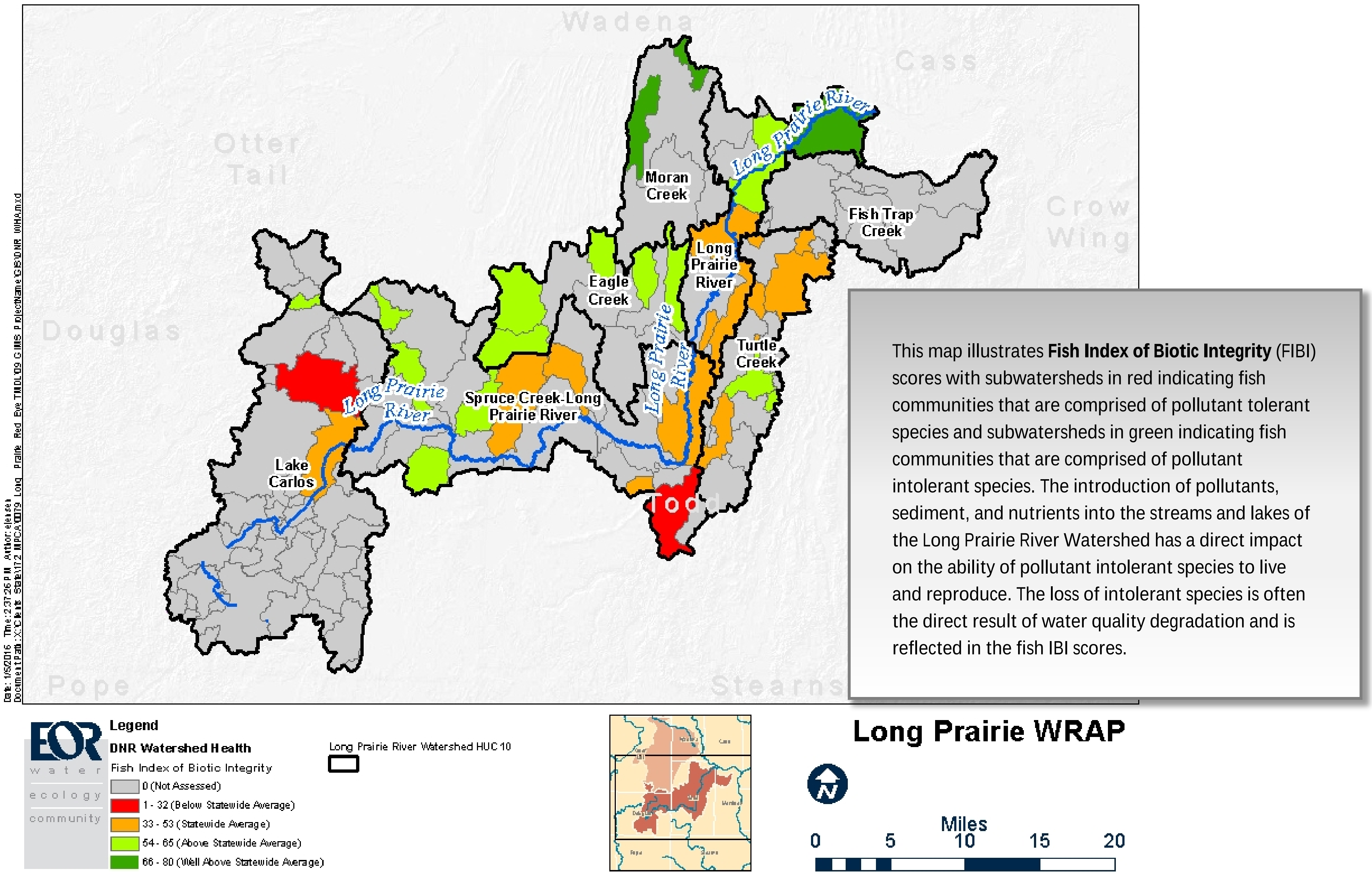
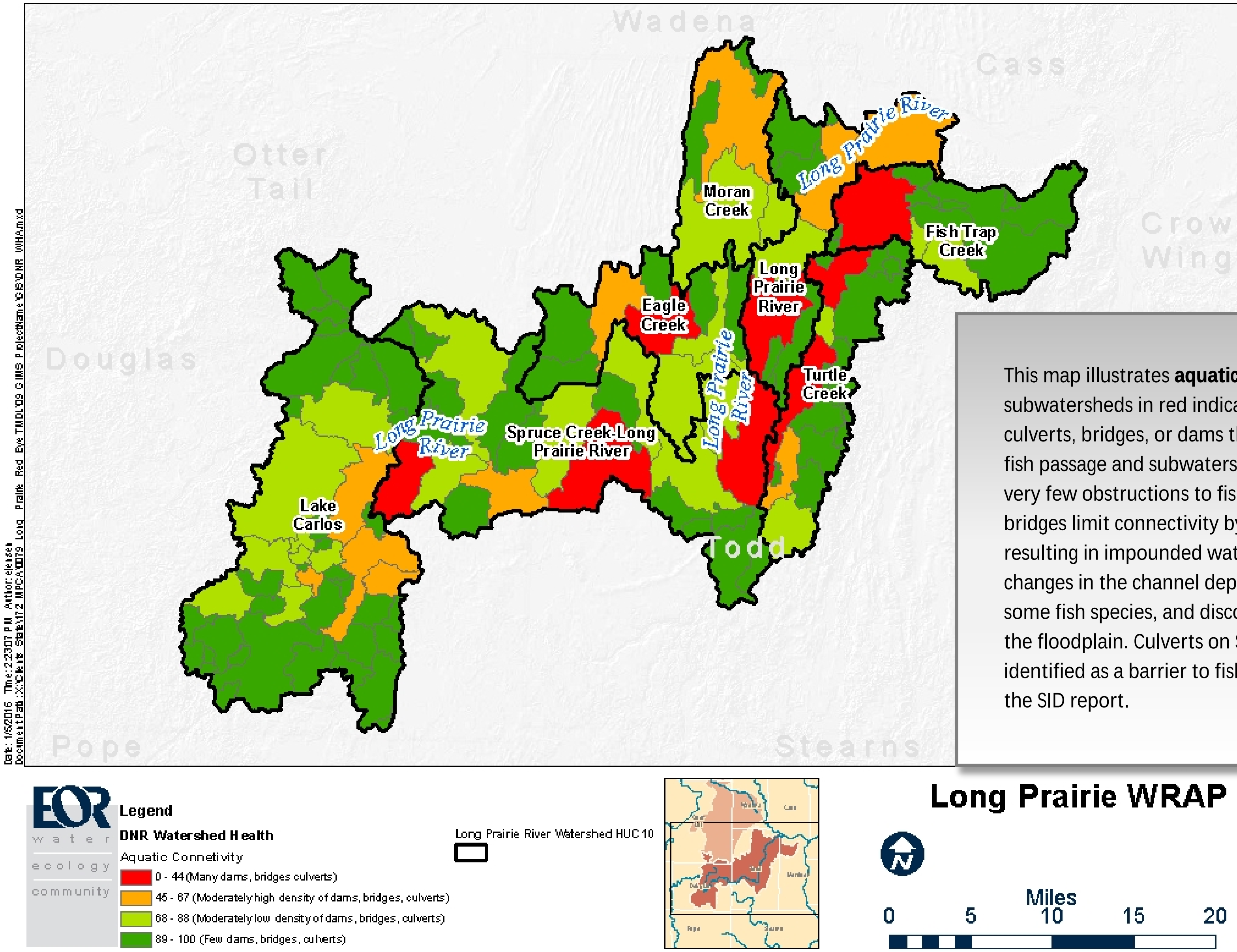
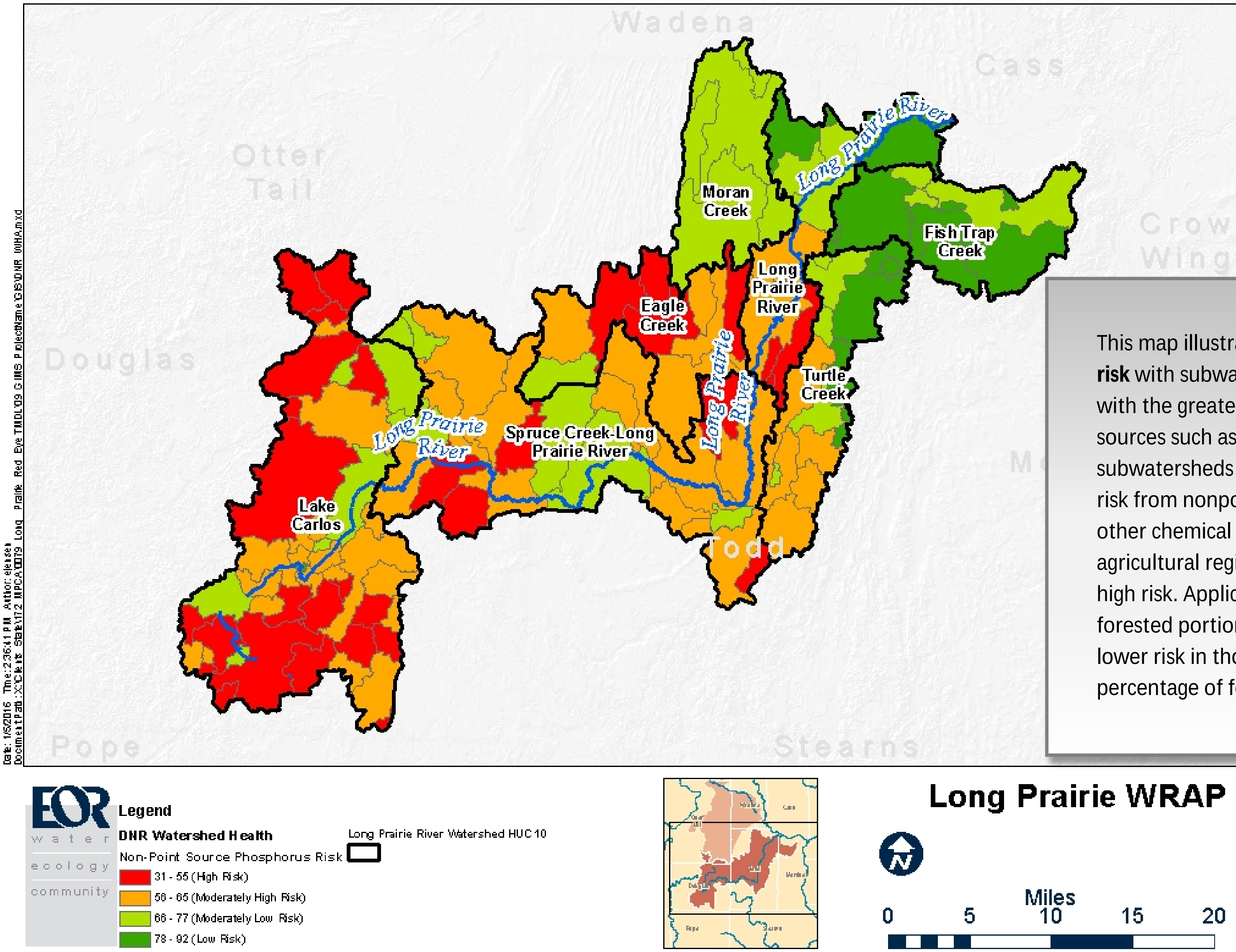


Figure 31: Long Prairie River Watershed Fish Index of Biotic Integrity.



This map illustrates **aquatic connectivity** scores with subwatersheds in red indicating areas with many culverts, bridges, or dams that may be obstructing fish passage and subwatersheds in green indicating very few obstructions to fish passage. Culverts and bridges limit connectivity by constricting the channel resulting in impounded water, creating pools and changes in the channel depth that are impassable to some fish species, and disconnect the stream from the floodplain. Culverts on Spruce Creek have been identified as a barrier to fish migration according to the SID report.

Figure 32: Long Prairie River Watershed Aquatic Connectivity.



This map illustrates **nonpoint source phosphorus risk** with subwatersheds in red indicating areas with the greatest risk for pollution from nonpoint sources such as runoff from agricultural fields and subwatersheds in green indicating areas with less risk from nonpoint source pollution. Nutrient and other chemical application rates are highest in the agricultural regions of the watershed, resulting in high risk. Application rates are much less in the forested portions of the watershed resulting in lower risk in those watersheds with the highest percentage of forests.

Figure 33: Long Prairie River Watershed Nonpoint Source Phosphorus Risk.

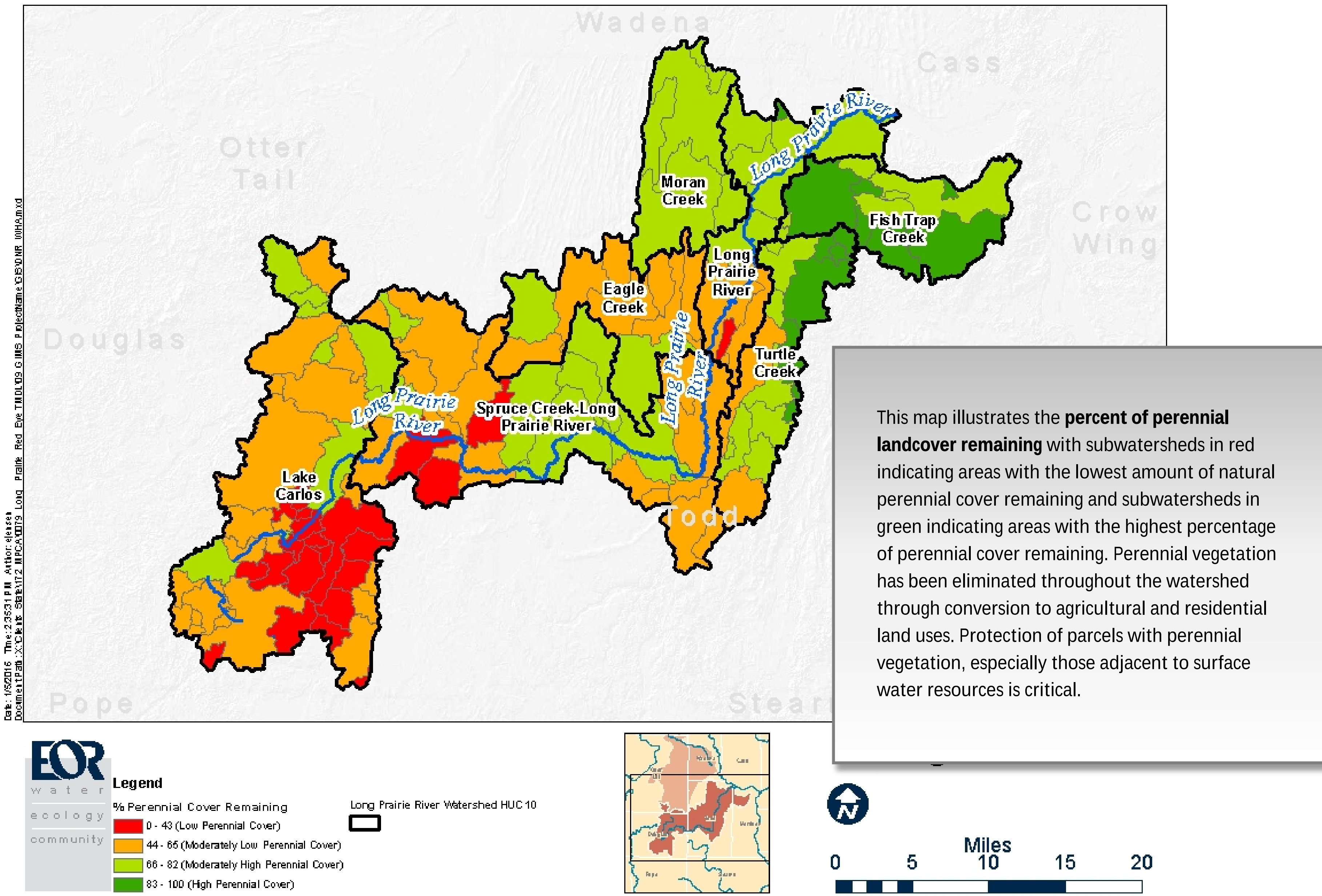
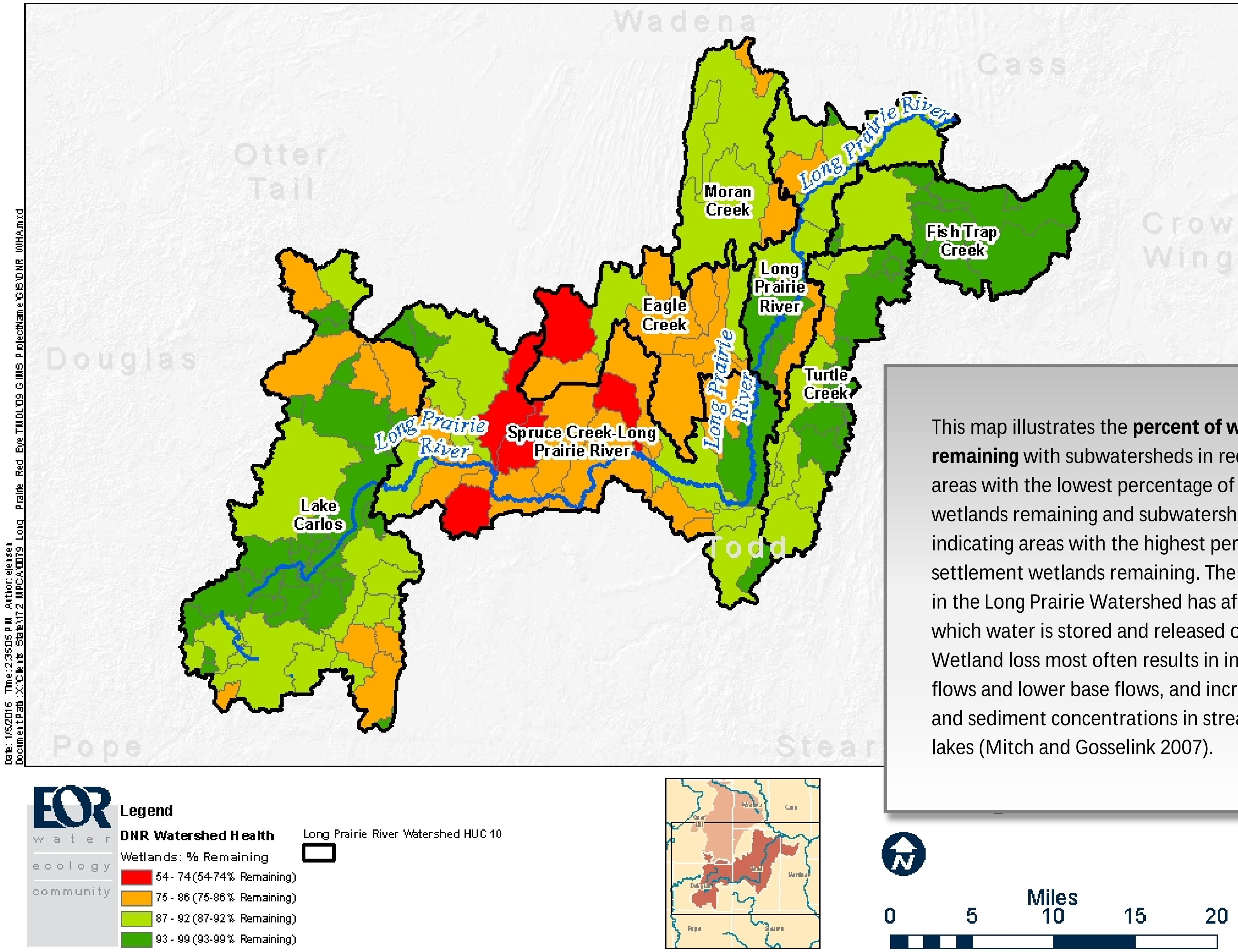


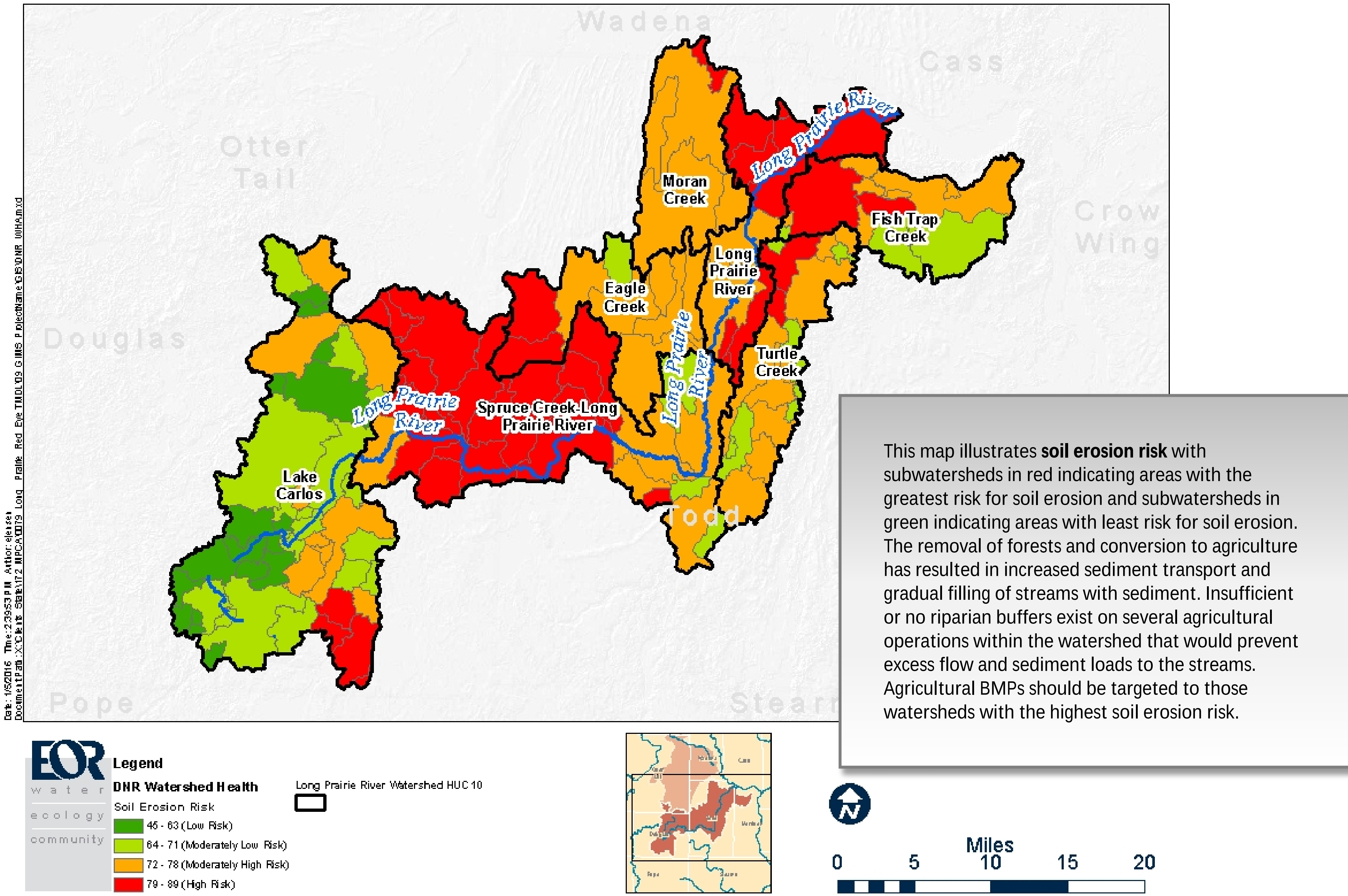
Figure 34: Long Prairie River Watershed Perennial Coverage Remaining.



This map illustrates the **percent of wetlands remaining** with subwatersheds in red indicating areas with the lowest percentage of pre-settlement wetlands remaining and subwatersheds in green indicating areas with the highest percentage of pre-settlement wetlands remaining. The loss of wetlands in the Long Prairie Watershed has affected the way in which water is stored and released on the landscape. Wetland loss most often results in increased peak flows and lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes (Mitch and Gosselink 2007).

Figure 35: Long Prairie River Watershed Remaining Wetlands.

Figure 36: Long Prairie River Watershed Soil Erosion Risk



This map illustrates **soil erosion risk** with subwatersheds in red indicating areas with the greatest risk for soil erosion and subwatersheds in green indicating areas with least risk for soil erosion. The removal of forests and conversion to agriculture has resulted in increased sediment transport and gradual filling of streams with sediment. Insufficient or no riparian buffers exist on several agricultural operations within the watershed that would prevent excess flow and sediment loads to the streams. Agricultural BMPs should be targeted to those watersheds with the highest soil erosion risk.

These maps illustrate the **average environmental benefit index (EBI) scores** (left map) for each HUC-12 watershed in comparison with **HSPF total phosphorus (TP) yields** (right map) and **lakes of phosphorus sensitivity** (both maps). Watersheds with high EBI scores, high TP yields, and lakes of phosphorus sensitivity represent areas to target for implementation.

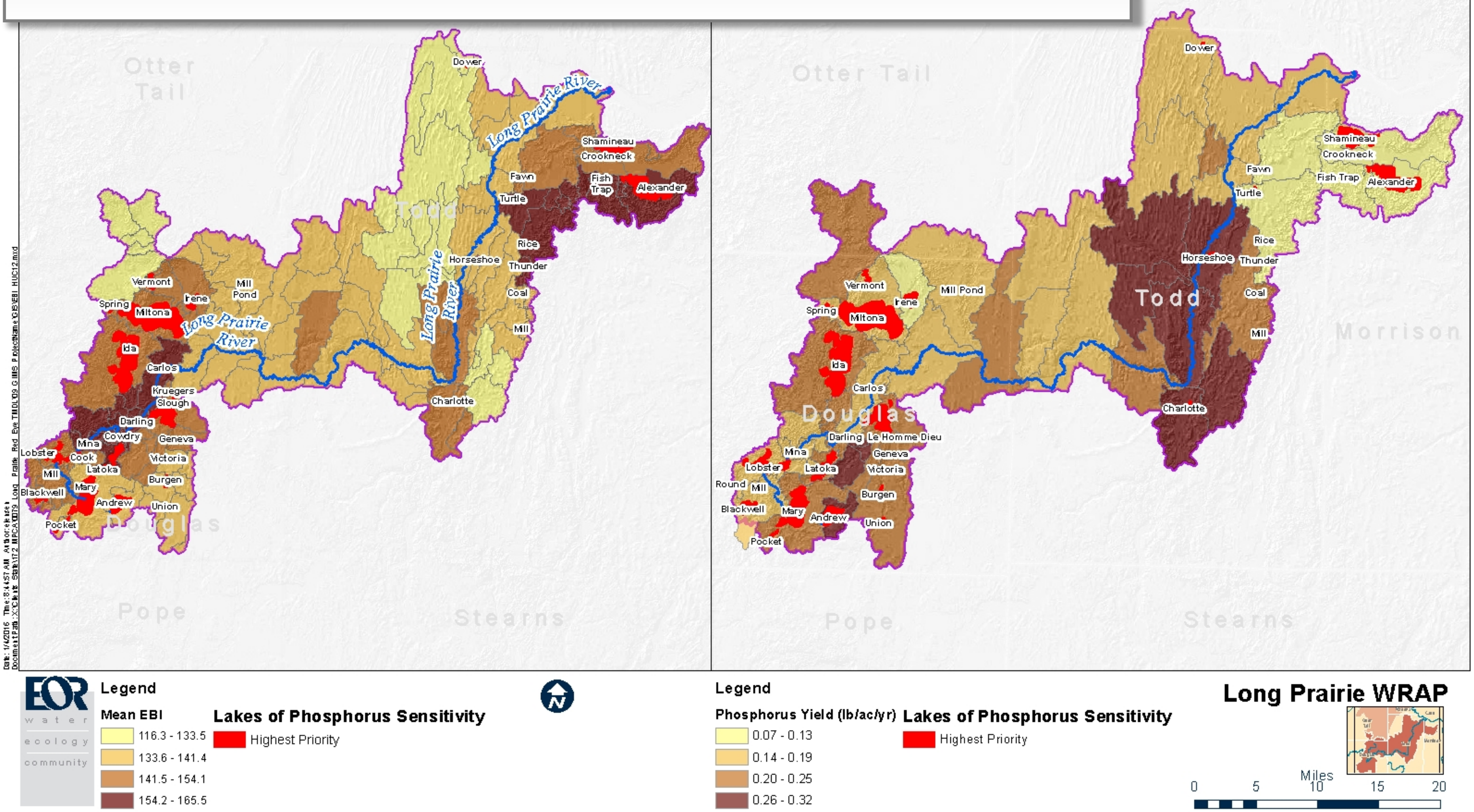


Figure 37: Lakes of Phosphorus Sensitivity overlaid with EBI scores and HSPF total phosphorus yields

Figure 38: Lakes of Biological Significance overlaid with EBI and HSPF total phosphorus yields

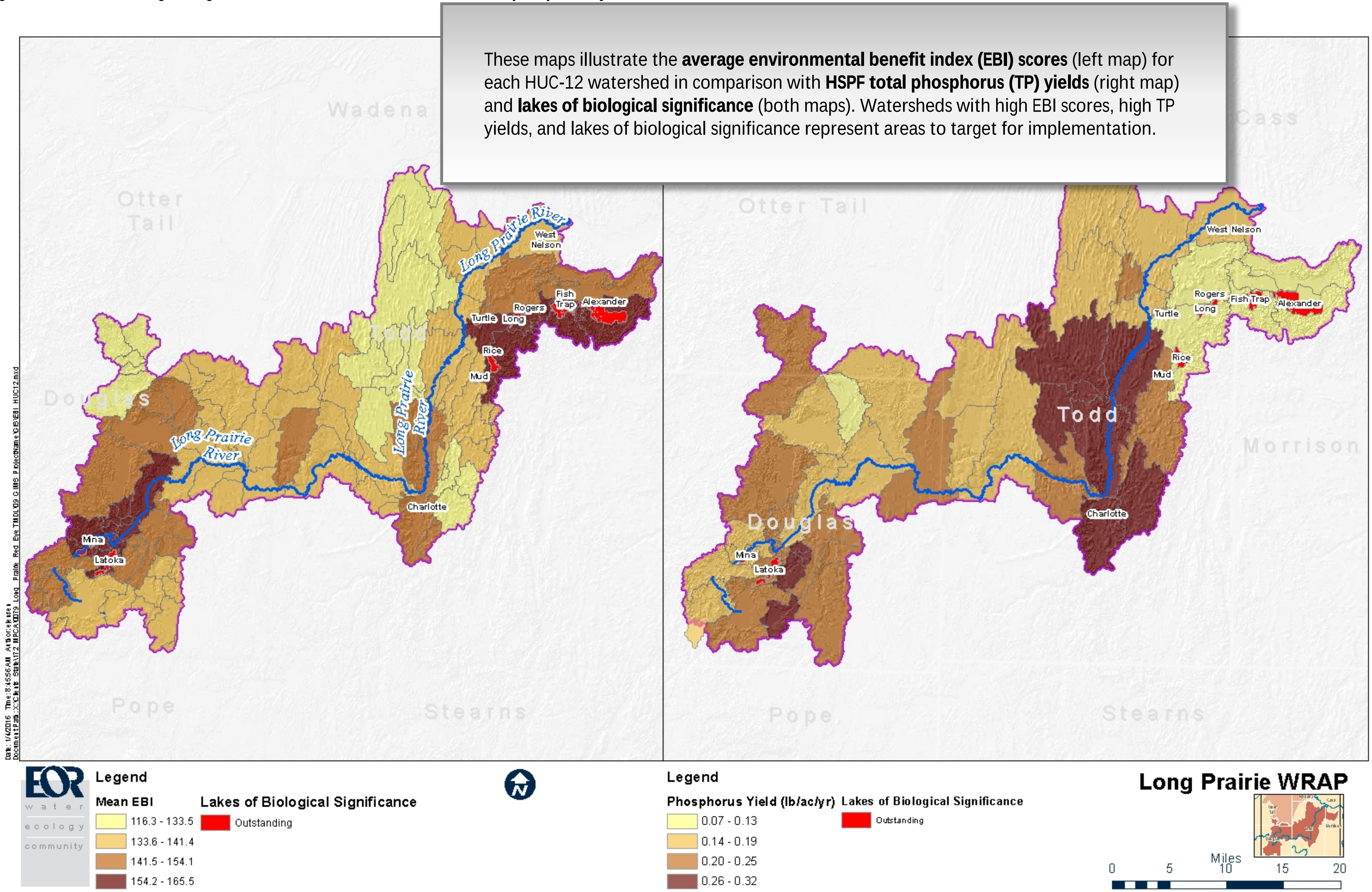
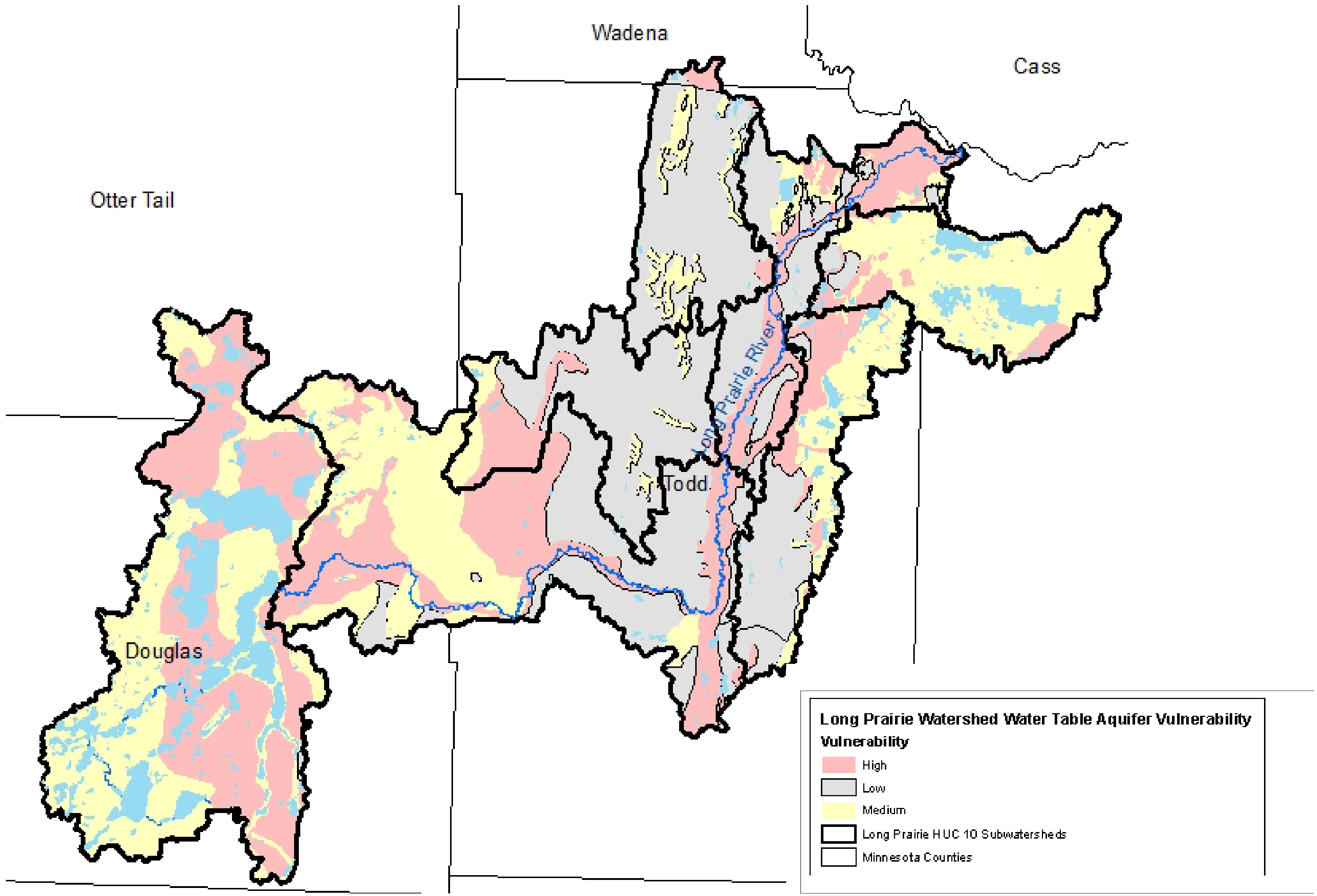


Figure 39: Long Prairie River Watershed Water Table Aquifer Vulnerability Map



Appendix D: Maps and Implementation Tables for second and third ranked HUC12 watersheds

Lake Carlos HUC 10(0701010801); Second ranked HUC 12 subwatersheds and priority waterbodies

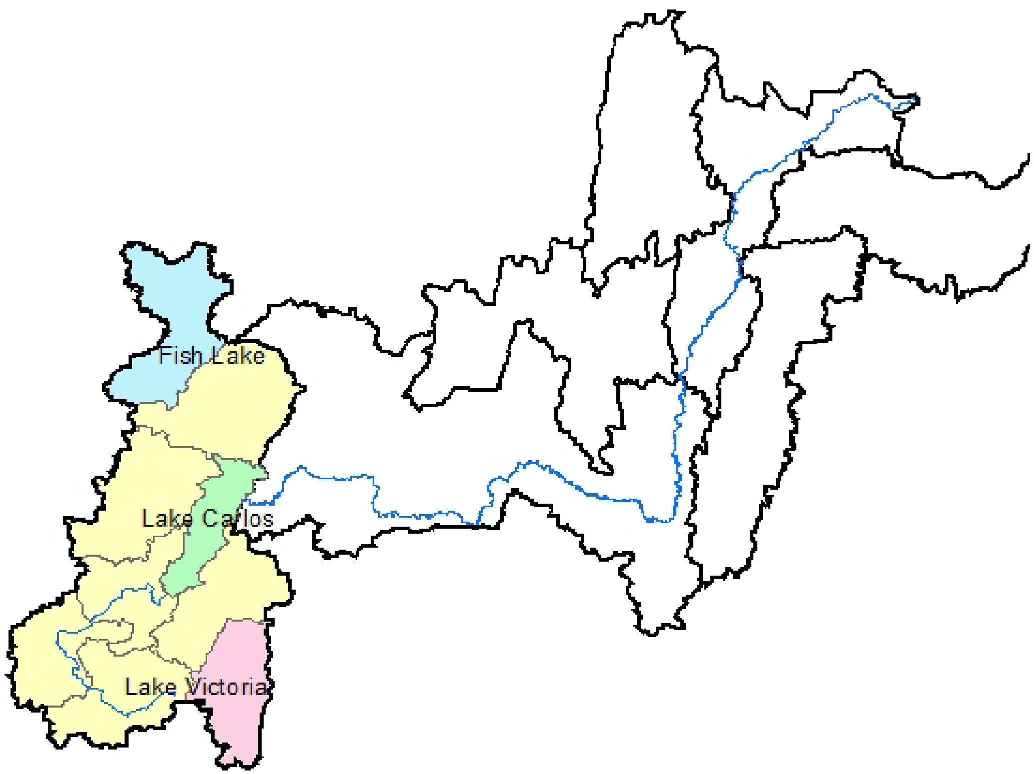


Figure 40: 2nd ranked HUC 12 subwatersheds in the Lake Carlos HUC 10 Watershed

Figure 41: Lakes addressed in strategy tables

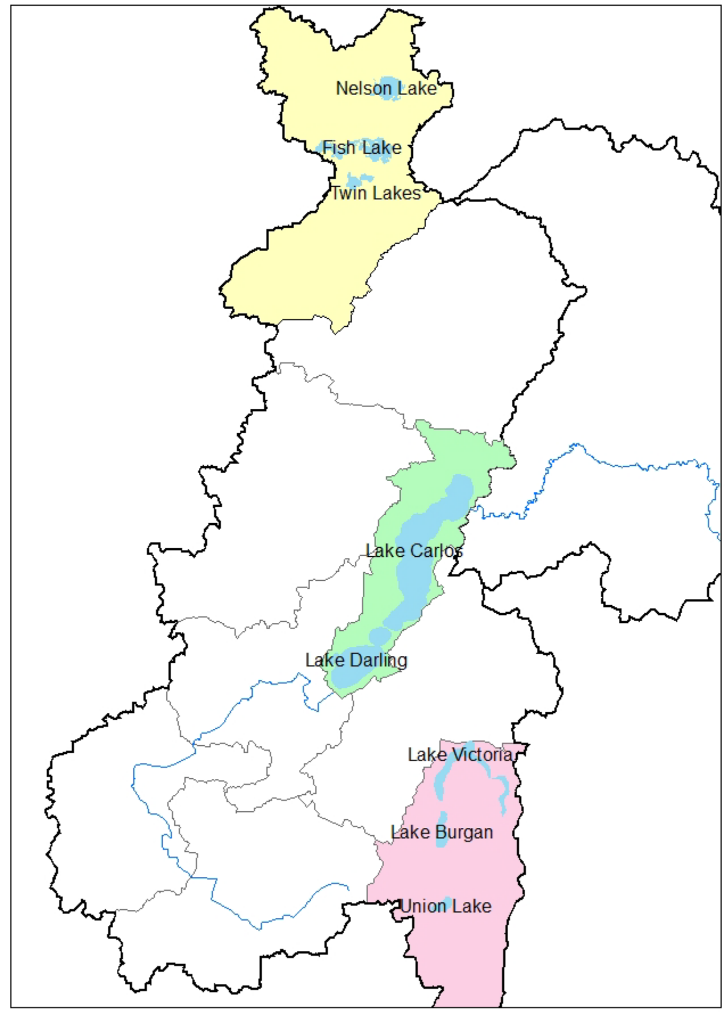


Table 25: Lake Carlos (0701010801) HUC 10 Watershed: Proposed strategies and actions for 2nd ranked HUC-12s

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; D = Douglas, T = Todd, O = Ottertail, W = Wadena, A= Alexandria, LG=La Grande Township.

HUC-12 Sub-water shed	Waterbody and Location			Param eter (incl. non-pollu-tant stress-sors)	Water Quality		Manage-ment Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake / Stream Rank	Location and Up-stream Influ-ence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Fish Lake 07010 10801 01	Dittber ner Creek CD 11 to Lake Miltona	2	Douglas Otter-Tail	E Coli	Im-paired for E Coli	Month-ly geomet ric avg. *E. coli* < 126 org/ 100mL	Pasture Manage ment	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D O		D O				•	10 yrs
	Nelson Lake (56-0065)	2	Otter Tail	TP	73 ug/L	60 ug/L	Urban Runoff Reduc-tions	Biofilters (buffers and vegetated swales), rain gardens, and other infiltration BMPs, shoreland ordinance enforcement	Implement at least one urban BMP (rain garden, shoreline buffer) in the Nelson Lake Watershed to serve as a demonstration site.				•	O		•		•	20 yrs
							Cropland Nutrient Reduc-tions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Nelson Lake Watershed to serve as a demonstration site.		•	O						•	10 yrs
							Feedlot Runoff Reduc-tions	Manure management and rotational grazing,	Implement at least one feedlot BMP (manure management) in the Nelson Lake Watershed to serve as a demonstration site.		•	O						•	10 yrs
							In-Lake Nutrient Manage ment	Improve in-lake biological community and/or reduce internal loading	Assess in-lake biological health and identify internal loading risks.	•			•				•	•	10 yrs
							Monitor-ing	Watershed monitoring of TP and TSS during the open water season	Collect 2 years of grab sample data at major tributaries to Nelson Lake. Combine tributary monitoring data with SWAT/HSPF source assessment to support		•		•				•	•	5 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
									development of a watershed nutrient management plan.										
	Fish Lake (56-0066)	2	Otter Tail	TP	83 ug/L	60 ug/L 1,266 lb P reduction	Monitoring	In-lake monitoring	Conduct in-lake bimonthly monitoring of TP, Chl-a and Secchi depth during the open water season on Nelson Lake.		•		•				•	•	5 yrs
									Collect lake sediment cores to assess potential for internal nutrient load on Nelson Lake.		•		•				•	•	10 yrs
									Conduct aquatic plant and fisheries studies on Nelson Lake to determine if fish or macrophytes are contributing to internal nutrient load.						•		•		5 yrs
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading	Assess in-lake biological health and identify internal loading risks.	•			•				•	•	10 yrs
							Reduce Upstream Lake Phosphorus Loads from Nelson Lake	Support strategies to identify, target and implement nutrient BMPs for upstream waterbodies and/or protect existing undeveloped land from being developed.	Develop and support strategies to identify, target, and implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed.	•	•	O		O				•	20 yrs
	Twin Lake (56-0067)	2	Otter Tail	TP	82 ug/L	60 ug/L	Reduce Watershed and Nearshore Phosphorus Loads	Identify, target, and implement shoreline restoration, wetland restoration, or stream buffer projects in the Twin Lake watershed. Acquire a conservation easement on one or more parcels identified as having a	Implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in the Twin Lake Watershed. Enforce shoreland development ordinances especially on new development to protect nearshore vegetation.	•	•	O		O				•	20 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
								high conservation potential.											
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading	Assess in-lake biological health and identify internal loading risks.	•		O	•				•	•	10 yrs
							Reduce Upstream Lake Phosphorus Loads from Fish Lake and Nelson Lake	Support strategies to identify, target and implement nutrient BMPs for upstream waterbodies and/or protect existing undeveloped land from being developed.	Develop and support strategies to identify, target, and implement at least one shoreline restoration, wetland restoration, or stream buffer project by 2025 in an upstream watershed.	•	•	O		O				•	20 yrs
							Feedlot Runoff Reductions	Manure management and rotational grazing,	Implement at least one feedlot BMP (manure management) in the Latimer Lake Watershed to serve as a demonstration site.		•	O						•	10 yrs
							Monitoring	Watershed monitoring of TP and TSS during the open water season	Collect 2 years of grab sample data at major tributaries to Twin Lake. Combine tributary monitoring data with SWAT/HSPF source assessment to support development of a watershed nutrient management plan.	•			•	O				•	5 yrs
Lake Victoria 0701010801 07	Union Lake (21-0041)	2	Douglas	TP	18 ug/L	Maintain	Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	On-going
							Maintain In-Lake Aquatic Biology	Union Lake is recognized by the DNR as a statewide lake of biological significance.	Maintain status as lake of biological significance through implementation of protection measures (ordinances, voluntary	•			•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location: Water-body (ID)	Waterbody and Location: Lake / Stream Rank	Waterbody and Location: Location and Up-stream Influ-ence Counties	Parameter (incl. non-pollu-tant stress-sors)	Water Quality: Cur-rent Condi-tions	Water Quality: Goals / Targets	Manage-ment Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility: MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	Time-line
									BMPs, fisheries and wildlife management).										
	Lake Burgen (21-0049)	2	Douglas	TP	24 ug/L	Main-tain	Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	On-going
							Storm-water Manage-ment	No Increase in annual volume. Stabilize stormwater channels and outfalls.	Ensure stormwater drainage network is not expanded without mitigation. Implement at least one urban BMP (rain garden, shoreline buffer) in the Lake Burgen Watershed to serve as a demonstration site.			D		D	•			•	10 yrs
	Lake Victoria (21-0054)	2	Douglas	TP	22 ug/L	Main-tain	Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	On-going
							Maintain In-Lake Aquatic Biology	Lake Victoria is recognized by the DNR as a statewide lake of biological significance.	Maintain status as lake of biological significance through implementation of protection measures (ordinances, voluntary BMPs, fisheries and wildlife mgmt).	•		D	•	D				•	On-going
							Storm-water Manage-ment	Reduce annual stormwater volume by 10% using Low Impact Design and Infiltration Practices. Stabilize stormwater channels and outfalls.	Implement necessary Low Impact Design and Infiltration Practices that help to achieve 10% reduction in annual stormwater volume			D		D	•			•	10 yrs
	Lake Jessie (21-0055)	2	Douglas	TP	55 ug/L	40 ug/L	Pasture Manage ment	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually.		•	D		D				•	10 yrs
							Urban Runoff	Implement biofilters (buffers and vegetated	Implement at least one urban BMP (rain garden, shoreline buffer) in				•	D		•		•	20 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Reductions	swales), rain gardens, and other infiltration BMPs in developed ares within Lake Jessie watershed.	the Jesse Lake Watershed to serve as a demonstration site. Enforce shoreland development ordinances especially on new development to protect nearshore vegetation.										
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Jesse Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							Feedlot Runoff Reductions	Manure management and rotational grazing,	Implement at least one feedlot BMP (manure management) in the Jessie Lake Watershed to serve as a demonstration site.		•	D						•	10 yrs
							Monitoring	Watershed monitoring of TP and TSS during the open water season	Collect 2 years of grab sample data at major tributaries to Jesse Lake. Combine tributary monitoring data with SWAT/HSPF source assessment to support development of a watershed nutrient management plan.	•			•	D				•	5 yrs
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading. Explore methods for reducing black bullhead populations including top down control through stocking of desirable gamefish species.	Assess in-lake biological health and identify internal loading risks.	•			•				•	•	10 yrs
Lake Carlos 701080109	Lake Darling (21-0080)	2	Douglas	TP	20 ug/L	Maintain	Stormwater Management	Reduce annual stormwater volume by 10% using Low Impact Design and Infiltration Practices. Mandate	Implement multiple stormwater BMP (rain gardens) as part of a larger effort to protect the Alexandria Chain of Lakes.				•	D	ALG	•		•	20 yrs

HUC-12 Sub-water shed	Waterbody and Location			Param eter (incl. non-pollu-tant stress-sors)	Water Quality		Manage-ment Goal	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake / Stream Rank	Location and Up-stream Influ-ence Counties		Cur-rent Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
								LID practices on all new development of remaining first tier parcels and all second tier parcels.											
							Monitor In-Lake TP Concentr ations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	Ongoi ng
							Cropland Nutrient Reduc-tions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement multiple agricultural BMP (cover crops) as part of a larger effort to protect the Alexandria Chain of Lakes.		•	D						•	10 yrs
	Lake Carlos (21-0057)	2	Douglas	TP	15	Maintai n	Storm-water Manage-ment	Reduce annual stormwater volume by 10% using Low Impact Design and Infiltration Practices. Mandate LID practices on all new development of remaining first tier parcels and all second tier parcels.	Implement multiple stormwater BMP (rain gardens) as part of a larger effort to protect the Alexandria Chain of Lakes.				•	D		•		•	20 yrs
							Monitor In-Lake TP Concentr ations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	Ongoi ng
							Cropland Nutrient Reduc-tions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement multiple agricultural BMP (cover crops) as part of a larger effort to protect the Alexandria Chain of Lakes.		•	D						•	10 yrs

Spruce Creek-Long Prairie River (0701010802) HUC 10 Watershed: 2nd & 3rd ranked HUC 12 subwatersheds and targeted waterbodies

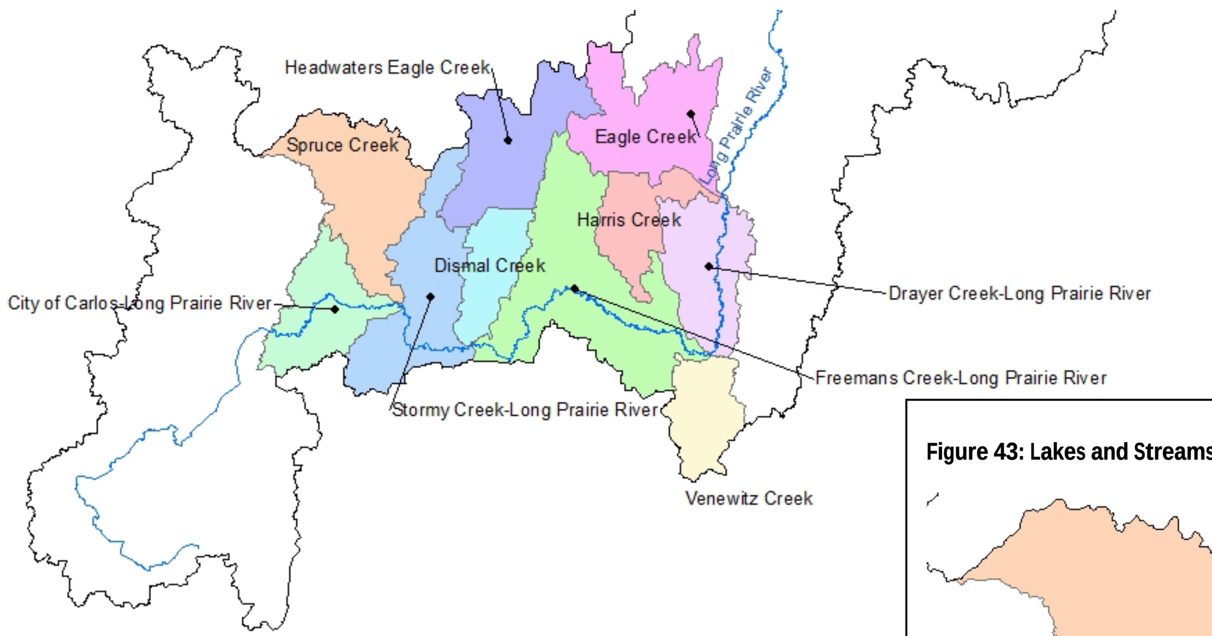


Figure 42: HUC 12 Subwatersheds of Spruce Creek HUC 10 Watershed

Figure 43: Lakes and Streams addressed in strategy tables

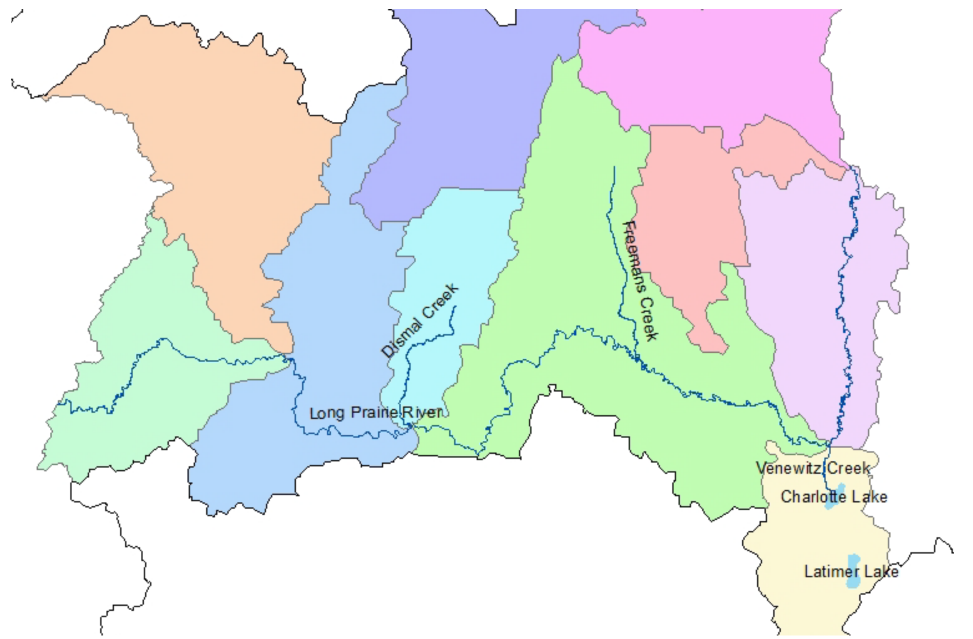


Table 26: Spruce Creek-Long Prairie River HUC 10 Watershed (0701010802): Proposed strategies and actions for second ranked HUC 12 subwatersheds

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Long Prairie River – City of Carlos 70101080201	L.P. River Lake Carlos to Spruce Creek 07010108-506	2	Douglas	DO		Daily Minimum DO >5 mg/L	Point Source Reductions	Permitted facilities work with MPCA to reduce Ammonia Discharges	Continue to work with the MPCA to meet required reductions outlined in 2005 TMDL report				•			•			On-going
Long Prairie River – Stormy Creek 70101080203	L.P. River Spruce Creek to Eagle Creek 07010108-505	2	Douglas Todd	DO	Impaired for DO	Daily Minimum DO >5 mg/L	Wetland Restoration	Wetland Restoration	Encourage landowners to work with Fish and Wildlife, SWCD or Public Easements to restore wetlands	•		D T		D T	•	•			5 yrs
				Fish IBI	NS Fish	Meets / Exceeds Fish IBI													
Long Prairie River – Freemans Creek 70101080205	L.P. River Spruce Creek to Eagle Creek 07010108-505	2	Todd	DO	Impaired for DO	Daily Minimum DO >5 mg/L	Point Source Reductions	Permitted facilities work with MPCA to reduce Ammonia Discharges	Continue to work with the MPCA to meet required reductions outlined in 2005 TMDL report				•			•			On-going
				Fish IBI	NS Fish	Meet/ Exceed Fish IBI	Improve Road Salt Policy - Emphasis on Chloride Reduction	Elevated chloride concentrations identified as a candidate cause for impairment during stressor identification report. Review road salt ordinances.	Review ordinances and current practices of road salt/dust suppressant application				•	T	•	•			15 yrs
							Monitor Chloride	Elevated chloride concentrations identified in the summer. Collect	Collect two years of grab sample data combined with automated stream monitoring				•	T	•	•			15 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Concentrations	samples throughout the entire year to determine if chlorides are stressing aquatic life.	data to support development of chloride management strategy										
	Free-mans Creek	2	Todd	Invert IBI			Wetland Resto-ration	Wetland Restoration	Encourage landowners to work with Fish and Wildlife, SWCD or Public Easements to restore wetlands.	•		T		T	•	•			5 yrs
							Stream / Channel restora-tion	Restore natural stream meander to areas impacted by ditching, damming and culverts.	Restore degraded sections of stream with goal of improving natural channel flow. Culvert sizing and placement to encourage natural flow.	•		T	•	T	•	•		•	10 yrs
							Riparian Buffers	Encourage riparian buffer installation near the confluence of the Long Prairie River.	Full compliance.	•		T		T	•	•	•	•	
							Shoreland Protection	Natural plantings, buffers, bank stabilization, ordinance enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Freemans Creek Watershed.	•		T				•			10 yrs
Vene-witz Creek 70101080206	Latimer Lake (77-0105)	2	Todd	TP	71 ug/L	40 ug/L	Water-shed Monitor-ing	Grab samples and continuous flow/stage monitoring for tributaries	Combine tributary monitoring with SWAT/HSPF outputs to prioritize areas for implementation of BMPs.			T		T			•	•	10 yrs
							Pasture Manage-ment	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually to discuss riparian pasture management strategies.		•	T		T				•	10 yrs
							Urban Runoff Reduc-tions	Implement biofilters (buffers and vegetated swales), rain gardens, and other infiltration BMPs in developed ares within Latimer Lake Watershed. Ordinance enforcement.	Implement at least one urban BMP (rain garden, shoreline buffer) in the Latimer Lake Watershed to serve as a demonstration site.				•	T		•		•	20 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Latimer Lake Watershed to serve as a demonstration site.		•	T						•	10 yrs
							Feedlot Runoff Reductions	Manure management and rotational grazing,	Implement at least one feedlot BMP (manure management) in the Latimer Lake Watershed to serve as a demonstration site.		•	T						•	10 yrs
							In-Lake Nutrient Management	Improve in-lake biological community and/or reduce internal loading. Explore methods for reducing black bullhead populations	Assess in-lake biological health and identify internal loading risks.	•			•				•	•	10 yrs
	Lake Charlotte (77-0120)		Todd	TP	15 ug/L	Maintain	Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP in the Lake Charlotte Watershed to serve as a demonstration site.		•	T						•	10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization	Implement at least one shoreline restoration or stream buffer project by 2025 in the Lower Turtle Creek Watershed. Enforce shoreland development ordinances and setbacks to protect nearshore or nearstream vegetation.	•	•	T	•			•	•	•	10 yrs
							Maintain In-Lake Aquatic Biology	Lake Charlotte is recognized by the DNR as a statewide lake of biological significance.	Maintain status as lake of biological significance through implementation of protection measures (ordinances, voluntary BMPs, fisheries and wildlife management).	•			•					•	On-going
							Monitor In-Lake TP	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the				•					•	On-going

HUC-12 Sub-watershed	Waterbody and Location: Water-body (ID)	Waterbody and Location: Lake/ Stream Rank	Waterbody and Location: Location and Up-stream Influence Counties	Param-eter (incl. non-pollut-ant stress-ors)	Water Quality: Current Condit-ions	Water Quality: Goals / Targets	Manage-ment goals	Strategies	Interim 10-yr Milestones	MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	Time-line
							Concentra tions		second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.										
							Targeted Public Outreach	Conduct targeted community messages and education about protecting water quality	Identify and engage 1 new stakeholder group in the watershed every year.	•	•	T	•			•	•	•	On-going
	Vene-witz Creek 07010108-568		Todd	Fish IBI	NS for fish	FS for fish	Culvert Sizing and alignment	Connectivity identified as a stressor. Culvert elevation inventory conducted by Todd County identified culverts at 2nd Avenue SW and 3rd Avenue SW as potential barriers to fish migration.	Determine if culvert replacement is warranted at 2nd Avenue SW and 3rd Avenue SW.	•		T	•	T	•	•		•	5 yrs
							Stream restora-tion	Bedded sediment identified as a stressor. Areas of bank erosion were observed along the edges of residential and commercial areas downstream from the sampling location	Restore degraded sections of stream with goal of improving channel bottom substrate to support species that require gravel (creek chubs, white sucker) substrate for spawning.	•		T	•	T	•	•		•	10 yrs
							Upstream Wetland Diagnostic Monitor-ing	Low dissolved oxygen identified as a stressor. The low gradient nature of the stream coupled with the upstream wetland impoundment is likely causing low dissolved oxygen levels. Monitor dissolved oxygen and nutrient concentrations in upstream wetlands.	Explore options for enhancing upstream wetland impoundment to reduce diurnal dissolved oxygen fluctuations.	•		T	•	T	•	•		•	15 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Riparian Buffers	25% increase in amount of buffers	Prioritize sensitive riparian and critical source areas. Ensure plans are in place for full compliance throughout the watershed.	•		T		T	•	•	•	•	20 yrs
							Targeted Public Outreach	Conduct targeted community messages and education about protecting water quality	Identify and engage 1 new stakeholder group in the watershed every year.	•	•	T	•			•	•	•	On-going
Long Prairie River – Drayer Creek 70101080207	L.P. River Spruce Creek to Eagle Creek 07010108-505	2	Douglas Todd	DO		Daily Minimum DO >5 mg/L	Shoreland Development Ordinances	Extend the public waters designation to include the whole reach of stream	Protective ordinances are in place that protects the entire stream reach.	•				D T	•	•			2 yrs
				Fish IBI	NS for fish	FS for fish	Shoreland Protection	Natural plantings, buffers, bank stabilization	Implement at least one shoreline restoration project by 2025 in the Drayer Creek Watershed. Enforce shoreland development ordinances and setbacks to protect nearshore or near-stream vegetation.	•		D T		D T		•			10 yrs

Table 27: Spruce Creek-Long Prairie River HUC 10 Watershed (0701010802): Proposed strategies and actions for third ranked HUC 12 Dismal Creek Subwatershed

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
Dismal Creek 70101080204	Dismal Creek	3	Todd				Stream / Channel restoration	Restore natural stream meander to areas impacted by ditching, damming and culverts.	Restore degraded sections of stream with goal of improving natural channel flow.	•		T	•	T	•	•		•	10 yrs
							Wetland Restoration	Encourage landowners to work with DNR Fish and Wildlife, SWCD or Public Easements to restore wetlands		•		T		T	•	•			5 yrs
							Shoreland Protection	Natural plantings, buffers, bank stabilization, shoreland ordinance enforcement.	Implement at least one shoreline restoration or stream buffer project by 2025.	•		T				•			10 yrs

Eagle Creek-Long Prairie River (0701010803) HUC 10 Watershed: Second ranked HUC 12 subwatersheds and targeted waterbodies

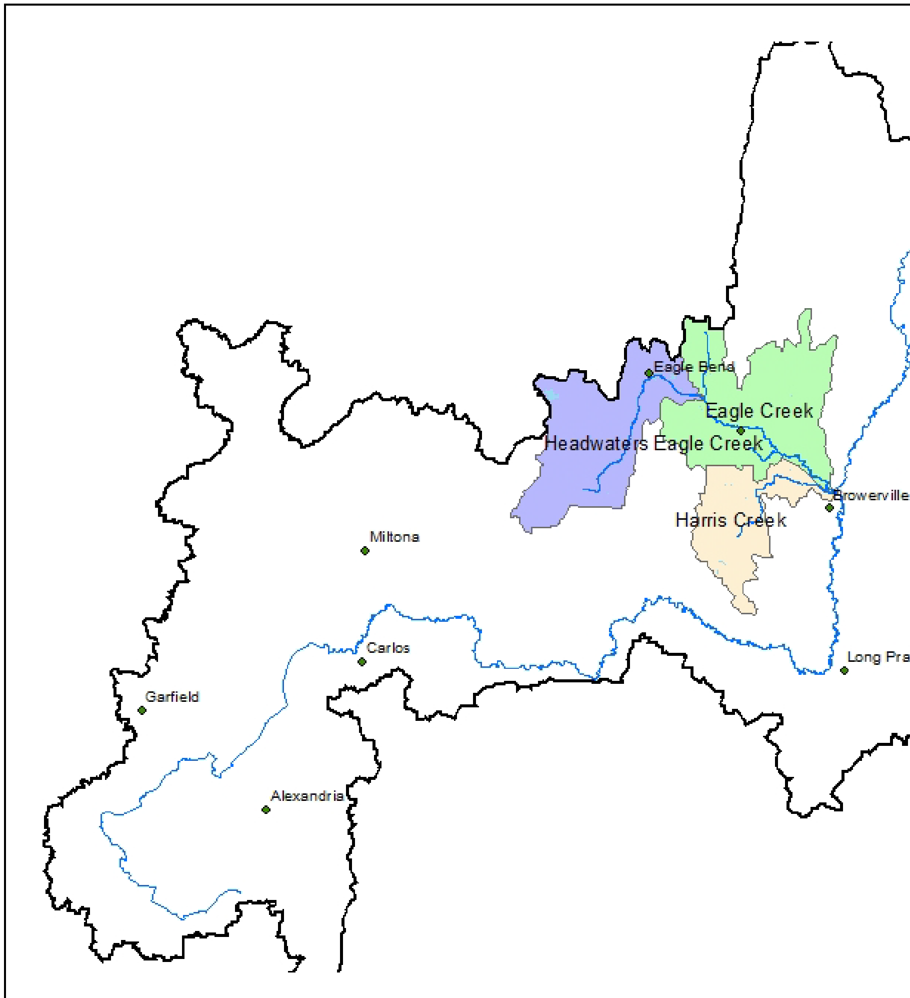


Figure 44: HUC 12 Subwatersheds of Eagle Creek-Long Prairie River HUC 10

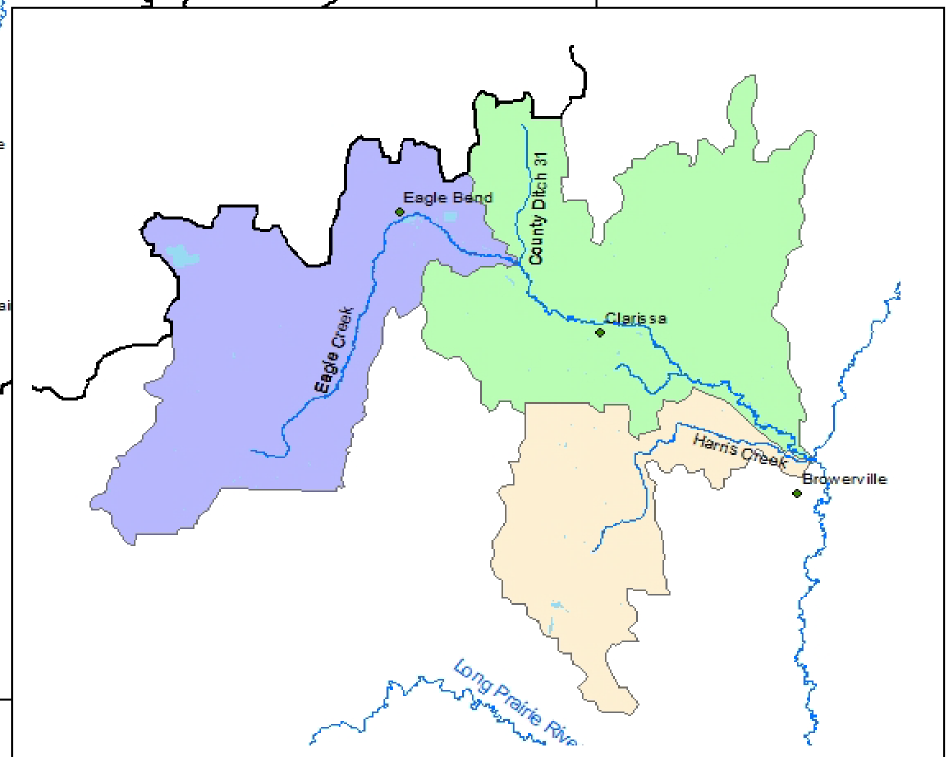


Figure 45: Priority water bodies in strategy tables

Table 28: Strategies for Second ranked HUC 12 Subwatersheds in Eagle Creek-Long Prairie River Watershed HUC 10 (0701010803)

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Strategies (see key below)	Strategy types and estimated scale of adoption needed to meet final water quality target	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water body (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Cur-rent Condit-ions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Headwaters Eagle Creek 701010803 01	Eagle Creek 07010108-507	2	Douglas, Todd	E Coli		Monthly geo-metric average *E. coli* < 126 org/ 100mL	Cropland Nutrient Reduc-tions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP in the Harris Creek Watershed to serve as a demonstration site.		•	D T						•	10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization	Implement at least one shoreline restoration or stream buffer project by 2025 in the Eagle Creek Watershed. Enforce shoreland development ordinances and setbacks to protect nearshore or near-stream vegetation.	•		D T		D T		•			10 yrs
Harris Creek 701010803 02	Harris Creek 07010108-592	2	Todd	Invert IBI	NS Invert	FS for Invert	Access Control	Livestock have direct access to the creek, contributing to increased nutrient levels and bank failure due to trampling. Restrict direct access to the stream through the use of fences or other barrier.	Identify areas where livestock have direct access to stream. Prioritize areas where fencing is critical to prevent future bank failure.		•	•						•	10 yrs
							Stream resto-ration	Bedded sediment identified as a stressor. Areas of bank failure and over widened channels have been identified. Lack of woody habitat is also a stressor.	Restore degraded sections of stream with goal of improving channel substrate and incorporating woody habitat along stream bank.	•		T	•	T	•	•		•	10 yrs
							Cropland Nutrient	Elevated TP concentrations identified as a stressor.	Implement at least one agricultural BMP (cover crops) in the Harris Creek		•	T						•	10 yrs

HUC-12 Sub-watershed	Waterbody (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties	Parameter (incl. non-pollutant stressors)	Current Conditions	Goals / Targets	Strategies (see key below)	Strategy types and estimated scale of adoption needed to meet final water quality target	Interim 10-yr Milestones	MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	Time-line
							Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Watershed to serve as a demonstration site.										
							Feedlot Runoff Reductions	Manure management and rotational grazing,	Implement at least one feedlot BMP (manure management) in the Harris Creek Watershed to serve as a demonstration site.		•	T						•	10 yrs
Eagle Creek 7010108030 3	Eagle Creek 07010108-507	2	Todd	E Coli		Monthly geometric average *E. coli* < 126 org/100mL	Pasture Management	Riparian pastures managed.	Reach 10% of pasture landowners in the watershed annually to discuss riparian pasture management strategies.		•	T		T				•	10 yrs
							Eagle perches removed	Steady reduction in perch trees.	Steady reduction in perch trees.	•				T		•			On-going
							Pasture and feedlot management	Manure management and rotational grazing.	Encourage and Develop Manure Management & Grazing Plans		•								5 yrs
							Riparian Buffers	Riparian buffer installation	Develop and support strategies to identify, target, and ensure plans are in place for full compliance throughout the Eagle Creek Watershed.	•		T		T	•	•	•	•	2 yrs
							Stream Channel Restoration	Restore natural stream meander to areas impacted by ditching, damming and culverts.	Restore degraded sections of stream with goal of improving natural channel flow. Culvert sizing and placement to encourage natural flow.	•		T		T	•				10 yrs
							Septic Systems	Discourage nutrient loss through upgraded systems	Work with city governments to seek additional funding opportunities			T	•	T	•	•			10 yrs
							Groundwater Protection	Nitrate Testing	Ward & Hartford Townships involvement in MDA Township Testing Program		•				•				2 yrs

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-polluta nt stresso rs)	Water Quality		Strategies (see key below)	Strategy types and estimated scale of adoption needed to meet final water quality target	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water body (ID)	Lake/ Stream Rank	Location and Upstream Influence Counties		Cur-rent Condit-ions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
							Cropland Nutrient Reduc-tions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP in the Eagle Creek Watershed to serve as a demonstration site.		•	T						•	10 yrs

Turtle Creek (0701010804) HUC 10 Watershed

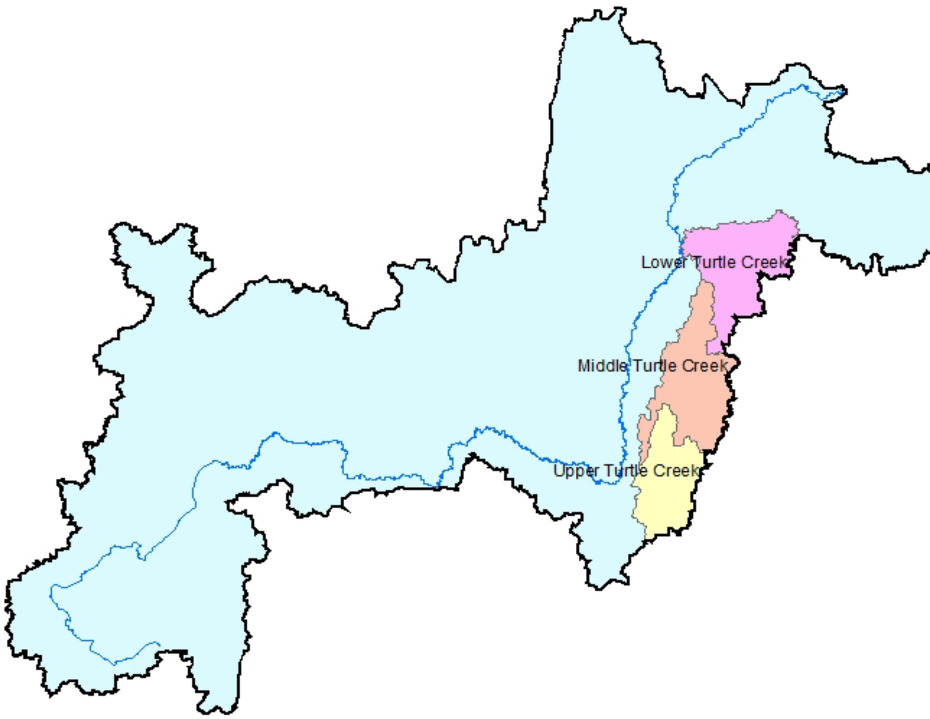


Figure 46: HUC 12 subwatersheds of Turtle Creek HUC 10 watershed

Figure 47: Priority waterbodies in strategy table

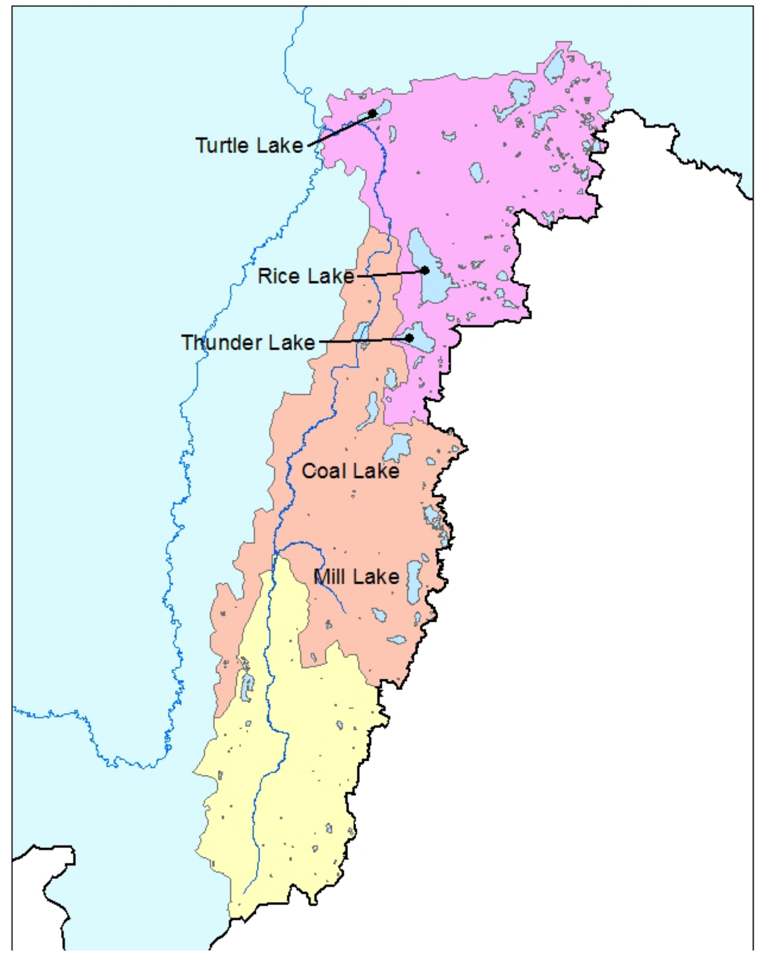


Table 29: Turtle Creek-Long Prairie River Watershed (0701010804): Second Ranked Subwatersheds Strategies

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Lower Turtle Creek 70101080403	Thunder Lake (77-0066)	3	Todd	TP	29 ug/L	Maintain	Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP in the Lower Turtle Creek Watershed to serve as a demonstration site.		●	T						●	10 yrs
							Riparian Buffers	Riparian buffer installation	Develop and support strategies to identify, target, and ensure plans are in place for full compliance throughout the Lower Turtle Creek Watershed.	●		T		T	●	●	●	●	9 yrs
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas	●				T	●				7 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				●					●	On-going
							Shoreland protection	Natural plantings, buffers, bank stabilization	Implement at least one shoreline restoration or stream buffer project by 2025 in the Lower Turtle Creek Watershed. Enforce shoreland development ordinances and setbacks to protect nearshore or near-stream vegetation.	●	●	T	●	T		●	●	●	9 yrs

HUC-12 Sub-watershed	Waterbody and Location: Water-body (ID)	Lake Rank	Location and Up-stream Influence Counties	Para-meter (incl. non-pollutant stressors)	Water Quality: Current Condit-ions	Goals / Targets	Manage-ment goals	Strategies	Interim 10-yr Milestones	MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	Time-line
							Shoreland Develop-ment Ordinances	Update ordinance to include added protections for pristine lakes	Protective shoreline ordinances are in place for pristine lakes.	•				T	•	•			5 yrs
							Forestry Manage-ment	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•				T	•				10 yrs
	Rice Lake (77-0061)	3	Todd	TP	50 ug/L	Main-tain	Shoreland Develop-ment Ordinances	Update ordinance to include added protections for pristine lakes	Protective shoreline ordinances are in place for pristine lakes.	•				T	•	•			5 yrs
							Maintain In-Lake Aquatic Biology	Rice Lake is recognized by the DNR as a statewide lake of biological significance.	Maintain status as lake of biological significance through implementation of protection measures (ordinances, voluntary BMPs, fisheries and wildlife management).	•			•					•	Ongoi ng
							Monitor In-Lake TP Concentrati ons	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	Ongoi ng
							Forestry Manage-ment	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•				T	•				10 yrs
	Turtle Lake (77-0088)	2	Todd	TP	18 ug/L	Maintain	Shoreland Develop-ment Ordinances	Update ordinance to include added protections for pristine lakes	Protective shoreline ordinances are in place for pristine lakes.	•				T	•	•			5 yrs

Table 30: Turtle Creek-Long Prairie River Watershed (0701010804): Third Ranked Subwatersheds Strategies

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. 2nd ranked priority HUC in yellow, 3rd ranked in green. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Timeline
	Waterbody (ID)	Lake Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	Non Govt Org	Citizens	
Middle Turtle Creek 70101080402	Mill Lake (77-0050)	3	Todd	Phosphorus	19 ug/L	Maintain	Septic Systems	SSTS Inspections for Mill Lake	Upgrade all failing shoreline septic systems			T	•	T	•	•			8 yrs
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•	•	T	•			•	•	•	9 yrs
	Coal Lake (77-0046)	3	Todd	Phosphorus	18 ug/L	Maintain	Septic Systems	SSTS Inspections for Coal Lake	Upgrade all failing shoreline septic systems			T	•	T	•	•			10 yrs
							Maintain In-Lake Aquatic Biology	Protection measures including shoreland development ordinances, voluntary adoption of BMPs, and fisheries management.	Maintain status as lake of high biological significance through implementation of protection measures.	•			•	T				•	On-going
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the second highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	On-going
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed	•				T	•				10 yrs

Moran Creek-Long Prairie River (0701010805) Watershed: Second Ranked County Ditch 25 HUC 12 Proposed strategies and actions

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Subwatershed	Waterbody and Location			Parameter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Waterbody (ID)	Lake / Stream Rank	Location and Upstream Influence Counties		Current Conditions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
County Ditch 25 070101080501	Unnamed Creek 07010108-603	2	Todd			Maintain	Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Moran Creek Watershed to serve as a demonstration site.		●	T						●	10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization, ordinance enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Moran Creek Watershed.	●	●	T	●	T		●	●	●	10 yrs

Long Prairie River HUC 10 Watershed (0701010807): Second Ranked subwatersheds

Figure 48: HUC 12 Subwatersheds for Long Prairie River HUC 10 Subwatershed

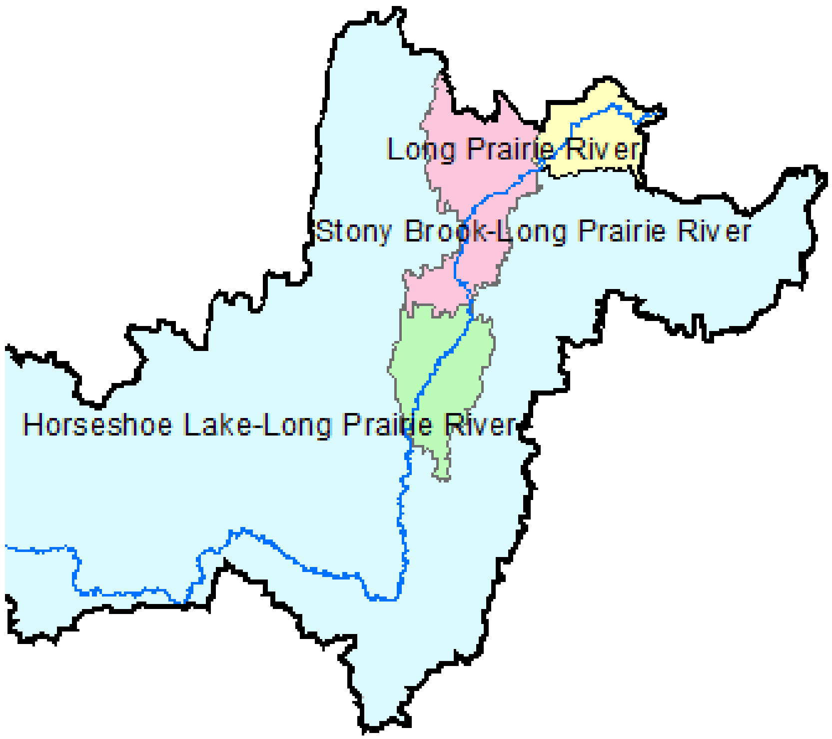


Figure 49: Waterbodies referred to in strategy table

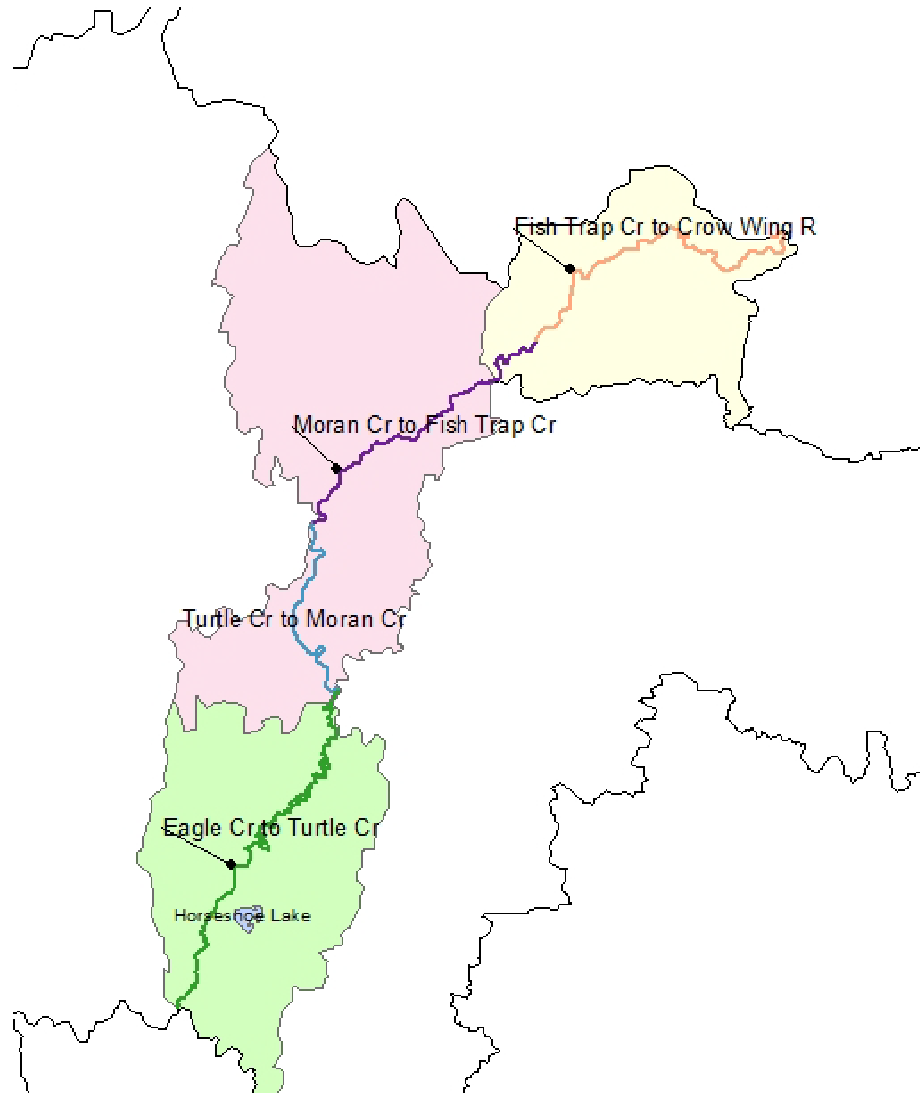


Table 31: Long Prairie River Watershed (701010807): Second ranked subwatersheds proposed strategies and actions

Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. Letters in governmental units with primary responsibility indicate the responsible County; A = All, D = Douglas, T = Todd, O = Ottertail, W = Wadena.

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Rank	Location and Up-stream Influence Counties		Current Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
Horse shoe Lake-Long Prairie River 0701010807 01	Long Prairie River - Eagle Creek to Turtle Creek 07010108-504	2	Douglas, Todd	Dissolved Oxygen	Impaired for DO	Daily Mini-mum DO >5 mg/L	Investigate Natural DO Loads	Deploy YSI Datalogger at additional sites.	Collect 2 years of data during the open water season. Combine with continuous flow/stage monitoring equipment to determine when low DO conditions are occurring. Combine monitoring with SWAT/HSPF outputs to prioritize areas for implementation of BMPs.			D T		D T			•	•	5 yrs
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed	•				D T	•				10 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Eagle Creek to Turtle Creek Watershed to serve as a demonstration site.		•	D T						•	10 yrs
							Zoning and Shoreland Development Ordinances	Update ordinance to include added protections along Long Prairie River for residential development	Ordinances are in place that provided added protection along the Long Prairie River for residential development.	•				D T	•	•			2 yrs
	Horse-shoe Lake (77-0128)	2	Todd	Phospho-rous	15 ug/L	Main-tain	Groundwater Protection	Nitrate Testing	Ward & Hartford Townships involvement in MDA Township Testing Program		•				•				2 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Horseshoe Lake Watershed to serve as a demonstration site.		•	T						•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Rank	Location and Up-stream Influence Counties		Current Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
							Water Management	Examine watershed contributions to high water levels in Horseshoe Lake	Monitor contributing watershed flow and peak flow.	•		T	•						5 yrs
							Monitor In-Lake TP Concentrations	Collect bi-monthly TP, Chl-a, and Secchi depth measurements	No increase in mean in-lake TP concentrations. Ranked by the DNR/MPCA as being in the highest priority category of lakes in terms of lake sensitivity to increases in TP loading.				•					•	Ongoing
				Secchi	3 m	Maintain	Zoning and Shoreland Development Ordinances	Zoning assistance	Assist Sylvan Shores in developing sensitive area/shoreland protections.	•				T	•	•			10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization, ordinance and setback enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Horseshoe Lake Watershed.	•	•	T	•			•	•	•	10 yrs
Long Prairie River – Stony Brook 701010807002	Long Prairie River Turtle Creek to Moran Creek 07010108-503	2	Todd	Dissolved Oxygen	Impaired for DO	Daily Minimum DO >5 mg/L	Investigate Natural DO Loads	Deploy YSI Datalogger at additional sites.	Collect 2 years of data during the open water season. Combine with continuous flow/stage monitoring equipment to determine when low DO conditions are occurring. Combine monitoring with SWAT/HSPF outputs to prioritize areas for implementation of BMPs.			T		T			•	•	5 yrs
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•				T	•				10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Rank	Location and Up-stream Influence Counties		Current Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Turtle Creek to Moran Creek Watershed to serve as a demonstration site.		•	T						•	10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization, ordinance and setback enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Turtle Creek to Moran Creek Watershed.	•	•	T	•			•	•	•	10 yrs
	Long Prairie River Moran Creek to Fish Trap Creek 07010108-502	2	Todd	Dissolved Oxygen	Impaired for DO	Daily Minimum DO >5 mg/L	Investigate Natural DO Loads	Deploy YSI Datalogger at additional sites.	Collect 2 years of data during the open water season. Combine with continuous flow/stage monitoring equipment to determine when low DO conditions are occurring. Combine monitoring with SWAT/HSPF outputs to prioritize areas for implementation of BMPs.			T		T			•	•	5 yrs
							Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•				T	•				10 yrs
							Cropland Nutrient Reductions	Conservation tillage, nutrient management planning, cover crops, and other agricultural BMPs	Implement at least one agricultural BMP (cover crops) in the Moran Creek to Fish Trap Creek Watershed to serve as a demonstration site.		•	T						•	10 yrs
							Shoreland protection	Natural plantings, buffers, bank stabilization, ordinance and setback enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Moran Creek to Fish Trap Creek Watershed.	•	•	T	•			•	•	•	10 yrs

HUC-12 Sub-watershed	Waterbody and Location			Param-eter (incl. non-pollutant stressors)	Water Quality		Management Goals	Strategies	Interim 10-yr Milestones	Governmental Units with Primary Responsibility									Time-line
	Water-body (ID)	Lake/ Stream Rank	Location and Up-stream Influence Counties		Current Condi-tions	Goals / Targets				MN DNR	MDA	SWCD	MPCA	Counties	Townships	Cities	NGOs	Citizens	
Long Prairie River 7010108070 3	Long Pr. River Fish Trap Creek to Crow Wing River	2	Douglas, Todd	Dissolved Oxygen	Impaired for DO	Daily Minimum DO >5 mg/L	Forestry Management	Riparian area establishment	Promote and encourage tree plantings, WMA Areas. Protect existing forestland from being developed.	•				D T	•				10 yrs
	Long Pr. River Fish Trap Creek to Crow Wing River 07010108-501	2	Douglas, Todd	Dissolved Oxygen	Impaired for DO	Daily Minimum DO >5 mg/L	Zoning and Shoreland Development Ordinances	Update ordinance to include added protections along Long Prairie River for residential development	Ordinances are in place that provided added protection along the Long Prairie River for residential development.	•				D T	•	•			2 yrs
							Shoreland Protection	Natural plantings, buffers, bank stabilization, ordinance and setback enforcement	Implement at least one shoreline restoration or stream buffer project by 2025 in the Fish Trap Creek Watershed.	•		D T				•			10 yrs