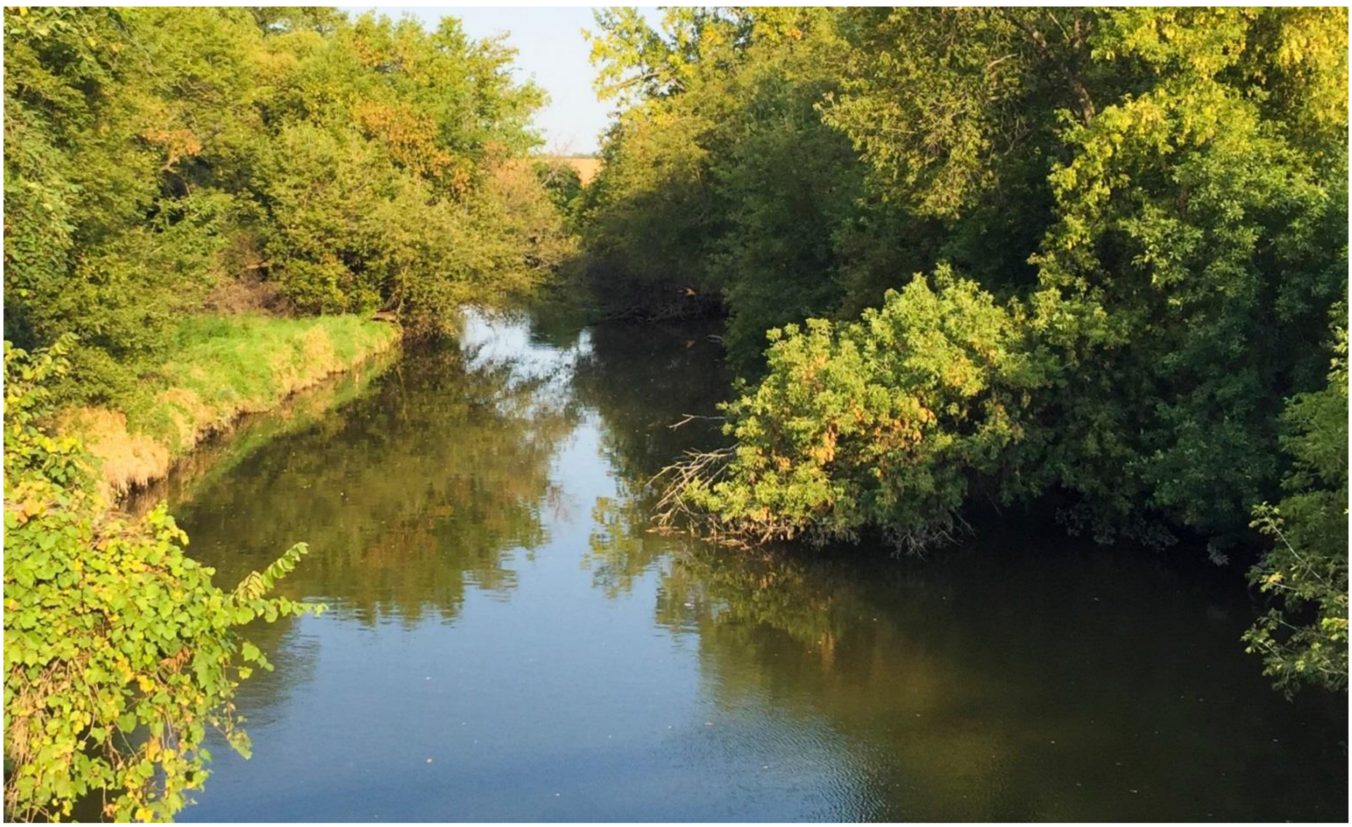
Watershed health

July 2018

Lac qui Parle River Watershed Monitoring and Assessment Report



MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT

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List of acronyms

CD County Ditch

CI Confidence Interval

CLMP Citizen Lake Monitoring Program

CSAH County State Aid Highway

CWA Clean Water Act

DNR Minnesota Department of Natural Resources

EQuIS Environmental Quality Information System

FWMC Flow Weighted Mean Concentration

HUC Hydrologic Unit Code

IBI Index of Biotic Integrity

IWM Intensive watershed monitoring

LQPYBWD Lac qui Parle - Yellow Bank Watershed District

LRVW Limited Resource Value Water

MDA Minnesota Department of Agriculture

MDH Minnesota Department of Health

MPCA Minnesota Pollution Control Agency

MSHA Minnesota Stream Habitat Assessment

MTS Meets the Standard

Nitrate-N Nitrate Plus Nitrite Nitrogen

NHD National Hydrologic Dataset

NH3 Ammonia

PCB Poly Chlorinated Biphenyls

SWAG Surface Water Assessment Grant

TALU Tiered Aquatic Life Uses

TKN Total Kjeldahl Nitrogen

TMDL Total Maximum Daily Load

TP Total Phosphorous

TSS Total Suspended Solids

USGS United States Geological Survey

WID Waterbody Identification Number

WPLMN Watershed Pollutant Load Monitoring Network

Executive summary

The Lac qui Parle River Watershed drains an area of approximately 1,100 square miles (704,000 acres) in eastern South Dakota and southwestern Minnesota. Approximately 70% of this area lies within portions of Minnesota's Lac qui Parle, Yellow Medicine, and Lincoln Counties, spanning an area from the South Dakota border on the western end of the basin to its confluence with the Minnesota River, just west of the city of Montevideo.

In 2015, the Minnesota Pollution Control Agency (MPCA) began a two-year, intensive watershed monitoring (IWM) project in Lac qui Parle River Watershed. This project was designed to assess the quality of the lakes and streams in the watershed through both biological and water chemistry monitoring. MPCA biomonitoring staff evaluated fish and macroinvertebrate communities at 52 unique monitoring stations across 35 assessment reaches of stream. MPCA surface water quality staff and the Lac qui Parle - Yellow Bank Watershed District (LQPYBWD) completed lake and stream chemistry sampling at 16 stream locations: 11 of which were at the outlets of each major subwatersheds and additional locations were sampled on tributaries entering the state from South Dakota. MPCA surface water quality staff and LQPYBWD also collected water chemistry samples from Del Clark Lake and Lake Hendricks to assess the aquatic life and aquatic recreation potential of each lake and stream where sufficient data was available. Overall, 2 lakes and 40 streams were assessed for aquatic life and/or aquatic recreation (where insufficient data existed, assessments were not made).

Results presented in this report indicate significantly degraded water quality and biological communities throughout the watershed. Overall, scores of biological communities in this watershed were resoundingly poor; not a single general use stream in the Lac qui Parle River Watershed fully supported aquatic life use. Only one stream (< 3% of assessed reaches) was determined to be fully supporting aquatic life for modified use waters (which have lower biological expectations than general use waters).

Fish communities throughout the Lac qui Parle Watershed were characterized by a near-total lack of species that are sensitive to declines in habitat and water quality. Further, these communities were frequently dominated by species that are capable of persisting in degraded and sub-marginal habitats. The most commonly collected species of fish were generalist species that are particularly tolerant of disturbed conditions: common shiner, fathead minnow, and brassy minnow. Fish communities were diverse and balanced in some stream reaches; aquatic life use standards were met at 24% of the streams that were assessed. Some sensitive, intolerant species were observed in the watershed. Pearl dace, a species that has not been verified in the Minnesota Basin since 1954, were sampled in Cobb Creek in a June 2015 visit.

A similar pattern was noted among stream macroinvertebrates in the Lac qui Parle River Watershed; 81% of assessed stream reaches had impaired communities. Preliminary evidence suggests that a combination of elevated nutrients, altered watershed hydrology, and a lack of adequate riparian vegetation is contributing to these impairments. Of the five assessment units that exhibited healthy macroinvertebrate communities for their use class, three were designated general aquatic life use streams. Four of these streams, however, are not fully supporting aquatic life due to other impairments, an indication that these streams are all experiencing significant levels of disturbance in their watersheds.

Stream water chemistry data collected during the IWM process indicate that surface water quality in the Lac qui Parle River Watershed is poor, with widespread bacterial contamination, elevated nutrients, and dissolved oxygen issues beyond the permissible thresholds. Of 16 stream reaches with sufficient chemistry data to make an assessment, not a single stream was determined to be supporting aquatic recreation. Water chemistry datasets for total suspended solids, chlorpyrifos (pesticide) and dissolved oxygen resulted in three new listings for aquatic life use impairment. Elevated total phosphorus concentrations were noted on numerous stream reaches, although limited response data was available. Existing aquatic life use impairments for turbidity (Lac qui Parle River, West Branch Lac qui Parle River, Lazarus Creek, Florida Creek) were confirmed by data collected during this assessment effort. Bacteria data collected during IWM confirmed nine existing recreational use impairments (Lac qui Parle River, West Branch Lac qui Parle River, Lazarus Creek, Florida Creek, Tenmile Creek).

Water chemistry was monitored on Lake Hendricks and Del Clark Lake in the Lac qui Parle River Watershed. In a prior assessment in 2009, Lake Hendricks was listed as impaired for aquatic recreation due to exceedances in total phosphorus (TP) and chlorophyll-a (chl-a). Data collected during the IWM process may be indicative of minor improvements. Data collected within the current 10-year assessment period show that the chlorophyll-a seasonal average is meeting the impairment threshold, although large algal blooms were observed during two months of 2015. Historical Secchi disk data suggest a slight increase in water clarity. Further monitoring will be necessary to determine if these improvements represent a long-term trend in improving water quality or are merely an artifact of natural variation. Monitoring of fish communities in Lake Hendricks (conducted by DNR) revealed a dominance of tolerant species; aquatic life use standards are not being met. In contrast, Del Clark Lake fully supports aquatic recreation, meeting standards for total phosphorus, chlorophyll-a, and water clarity (Secchi disk). Lake protection modeling identified Del Clark Lake as a priority lake for efforts to reduce phosphorus loading in the future. Riparian land management within and upstream of Stonehill Regional Park are likely contributors to the elevated water quality in this lake.

Chemical contaminants were examined in fish tissues from three lakes (Del Clark, Hendricks, Marietta Kids Fishing Pond) and five reaches of the Lac qui Parle River within this watershed. All of the sampled locations exhibited high levels of mercury and are listed as impaired for aquatic consumption.

Groundwater quality in the Lac qui Parle River Watershed is considered poor when compared to other regions with comparable aquifers. Exceedances of drinking water standards for manganese and boron were the primary concern for those from natural sources, and nitrate was the primary concern associated with anthropogenic sources.

The overall area covered by wetlands in this watershed has been reduced to approximately 19% of its pre-settlement acreage. Plant and macroinvertebrate community scores in these wetlands ranged from fair to poor. Wetland plant communities in this watershed have been dramatically impacted by invasive plant species such as narrow-leaf cattail (*Typha angustifolia*), hybrid cattail (*Typha* X *glauca*), and reed canary grass (*Phalaris arundinacea*).

The degraded water quality and biological communities in the Lac qui Parle River Watershed reflect the land use, hydrologic modification, and discharge of pollutants (point and non-point) within this watershed. Changes in land use beginning in the mid-19th century have resulted in a near wholesale conversion of the landscape from tall grass prairie, wetland and forest vegetation to row crop agriculture in this watershed. Such a dramatic shift in land cover, coupled with widespread modification of stream channels and wetland complexes has had severe consequences for surface water quality. The prevalence of stream channelization and artificial drainage tiling has created an engineered surficial hydrology that does not retain water from precipitation in the same manner as an unaltered landscape; rain events result in a rapid spike in discharge volumes, while intervening periods of low precipitation result in exceptionally low flows. High discharge events destabilize and erode stream banks, which generate high sediment loads and progressively wider, shallower channels. The loss of riparian tree cover and rooted, perennial vegetation can greatly exacerbate these issues by further destabilizing banks and increasing water temperatures from lack of shade and cover. Streams impacted by these processes are characterized by uniform depths, homogenous fine substrates and lack of well-developed riffle-pool-run sequences; they provide little habitat for diverse and healthy aquatic communities.

The adoption of best land management practices such as an implementation of perennial vegetation buffers along stream reaches, improved control of waste runoff at livestock operations, installation of exclusion fencing to limit animal access to streams, and novel manners to mitigate nutrient loading to surface waters from fertilizer application would have profound benefits to water quality and biological communities throughout the region.

Introduction

Water is one of Minnesota's most abundant and precious resources. The Minnesota Pollution Control Agency (MPCA) is charged under both federal and state law with the responsibility of protecting the water quality of Minnesota's water resources. MPCA's water management efforts are tied to the 1972 Federal Clean Water Act (CWA), which requires states to adopt water quality standards to protect their water resources and the designated uses of those waters, such as for drinking water, recreation, fish consumption and aquatic life. States are required to provide a summary of the status of their surface waters and develop a list of water bodies that do not meet established standards. Such waters are referred to as "impaired waters" and the state must make appropriate plans to restore these waters, including the development of total maximum daily loads (TMDLs). A TMDL is a comprehensive study determining the assimilative capacity of a waterbody, identifying all pollution sources causing or contributing to impairment, and an estimation of the reductions needed to restore a water body so that it can once again support its designated use.

The MPCA currently conducts a variety of surface water monitoring activities that support our overall mission of helping Minnesotans protect the environment. To successfully prevent and address problems, decision makers need good information regarding the status of the resources, potential and actual threats, options for addressing the threats and data on the effectiveness of management actions. The MPCA's monitoring efforts are focused on providing that critical information. Overall, the MPCA is striving to provide information to assess, and ultimately, to restore or protect the integrity of Minnesota's waters.

The passage of Minnesota's Clean Water Legacy Act in 2006 provided a policy framework and the initial resources for state and local governments to accelerate efforts to monitor, assess, restore and protect surface waters. This work is implemented on an on-going basis with funding from the Clean Water Fund created by the passage of the Clean Water Land, and Legacy Amendment to the state constitution. To facilitate the best use of agency and local resources, the MPCA has developed a watershed monitoring strategy, which uses an effective and efficient integration of agency and local water monitoring programs to assess the condition of Minnesota's surface waters, and to allow for coordinated development and implementation of water quality restoration and improvement projects.

The strategy behind the watershed monitoring approach is to intensively monitor streams and lakes within a major watershed to determine the overall health of water resources, identify impaired waters, and to identify waters in need of additional protection. The benefit of the approach is the opportunity to begin to address most, if not all, impairments through a coordinated TMDL process at the watershed scale, rather than the reach-by-reach and parameter-by-parameter approach often historically employed. The watershed approach will more effectively address multiple impairments resulting from the cumulative effects of point and non-point sources of pollution and further the CWA goal of protecting and restoring the quality of Minnesota's water resources.

This watershed-wide monitoring approach was implemented in the Lac Qui Parle River Watershed beginning in the summer of 2015. This report provides a summary of all water quality assessment results in the Lac Qui Parle River Watershed and incorporates all data available for the assessment process including watershed monitoring, volunteer monitoring and monitoring conducted by local government units.

The watershed monitoring approach

The watershed approach is a 10-year rotation for monitoring and assessing waters of the state on the level of Minnesota's 80 major watersheds. The major benefit of this approach is the integration of monitoring resources to provide a more complete and systematic assessment of water quality at a geographic scale useful for the development and implementation of effective TMDLs, project planning, effectiveness monitoring and protection strategies. The following paragraphs provide details on each of the four principal monitoring components of the watershed approach. For additional information see: Watershed Approach to Condition Monitoring and Assessment (MPCA 2008) (http://www.pca.state.mn.us/publications/wq-s1-27.pdf).

Watershed pollutant load monitoring

The Watershed Pollutant Load Monitoring Network (WPLMN) is a long-term statewide river monitoring network initiated in 2007 and designed to obtain pollutant load information from 199 river monitoring sites throughout Minnesota. Monitoring sites span three ranges of scale:

Basin – major river main stem sites along the Mississippi, Minnesota, Rainy, Red, Des Moines, Cedar and St. Croix rivers

Major Watershed – tributaries draining to major rivers with an average drainage area of 1,350 square miles (8-digit HUC scale)

Subwatershed – major branches or nodes within major watersheds with average drainage areas of approximately 300-500 square miles

The program utilizes state and federal agencies, universities, local partners, and MPCA staff to collect water quality and flow data to calculate nitrogen, phosphorus, and sediment pollutant loads.

Intensive watershed monitoring

The intensive watershed monitoring strategy utilizes a nested watershed design allowing the sampling of streams within watersheds from a coarse to a fine scale (Figure 1). Each watershed scale is defined by a hydrologic unit code (HUC). These HUCs define watershed boundaries for water bodies within a similar geographic and hydrologic extent. The foundation of this approach is the 80 major watersheds (8-HUC) within Minnesota. Using this approach, many of the smaller headwaters and tributaries to the main stem river are sampled in a systematic way so that a more holistic assessment of the watershed can be conducted and problem areas identified without monitoring every stream reach. Each major watershed is the focus of attention for at least one year within the 10-year cycle.

River/stream sites are selected near the outlet of each of three watershed scales, 8-HUC, aggregated 12-HUC and 14-HUC (Figure 1). Within each scale, different water uses are assessed based on the opportunity for that use (i.e., fishing, swimming, supporting aquatic life such as fish and insects). The major river watershed is represented by the 8-HUC scale. The outlet of the major 8-HUC watershed (purple dot in Figure 2) is sampled for biology (fish and macroinvertebrates), water chemistry and fish contaminants to allow for the assessment of aquatic life, aquatic recreation and aquatic consumption use support. The aggregated 12-HUC is the next smaller subwatershed scale, which generally consists of major tributary streams with drainage areas ranging from 75 to 150 mi2. Each aggregated 12-HUC outlet (green dots in Figure 2) is sampled for biology and water chemistry for the assessment of aquatic life and aquatic recreation use support. Within each aggregated 12-HUC, smaller watersheds (14 HUCs, typically 10-20 mi2), are sampled at each outlet that flows into the major aggregated 12-HUC tributaries. Each of these minor subwatershed outlets is sampled for biology to assess aquatic life use support (red dots in Figure 2).

Figure 1. The Intensive Watershed Monitoring Design.

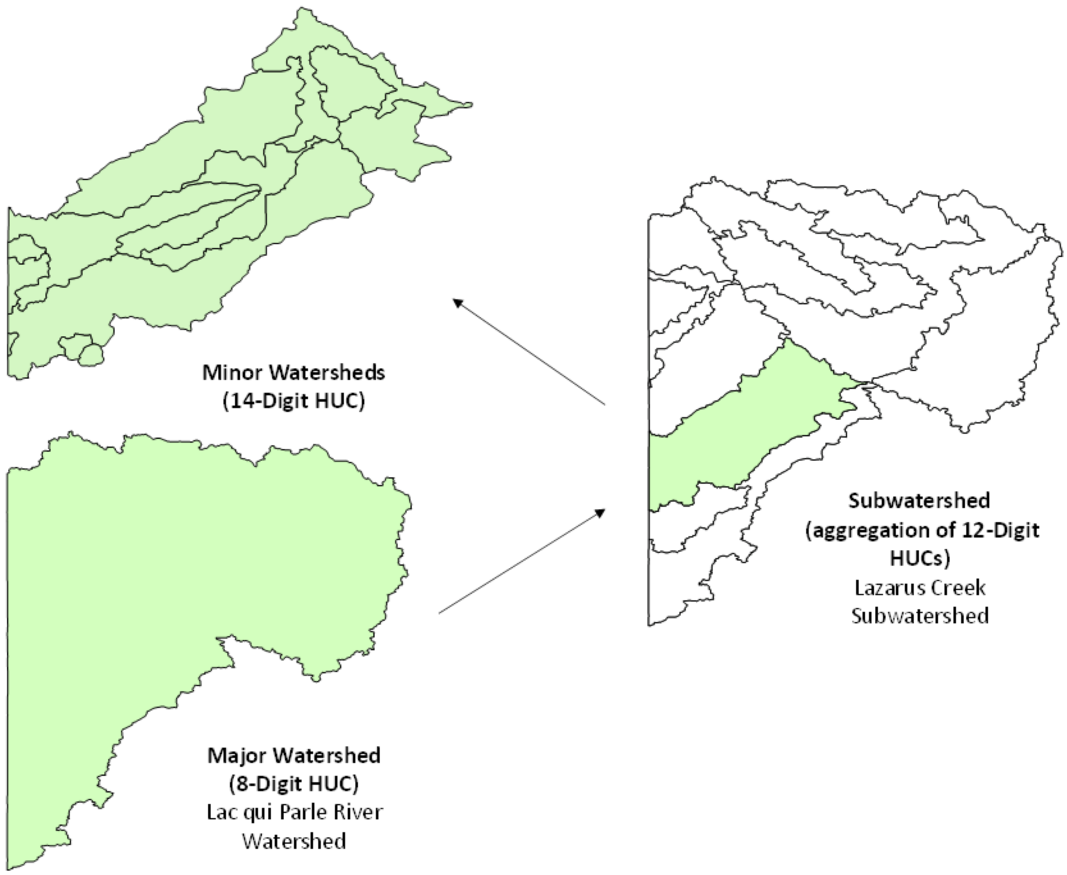
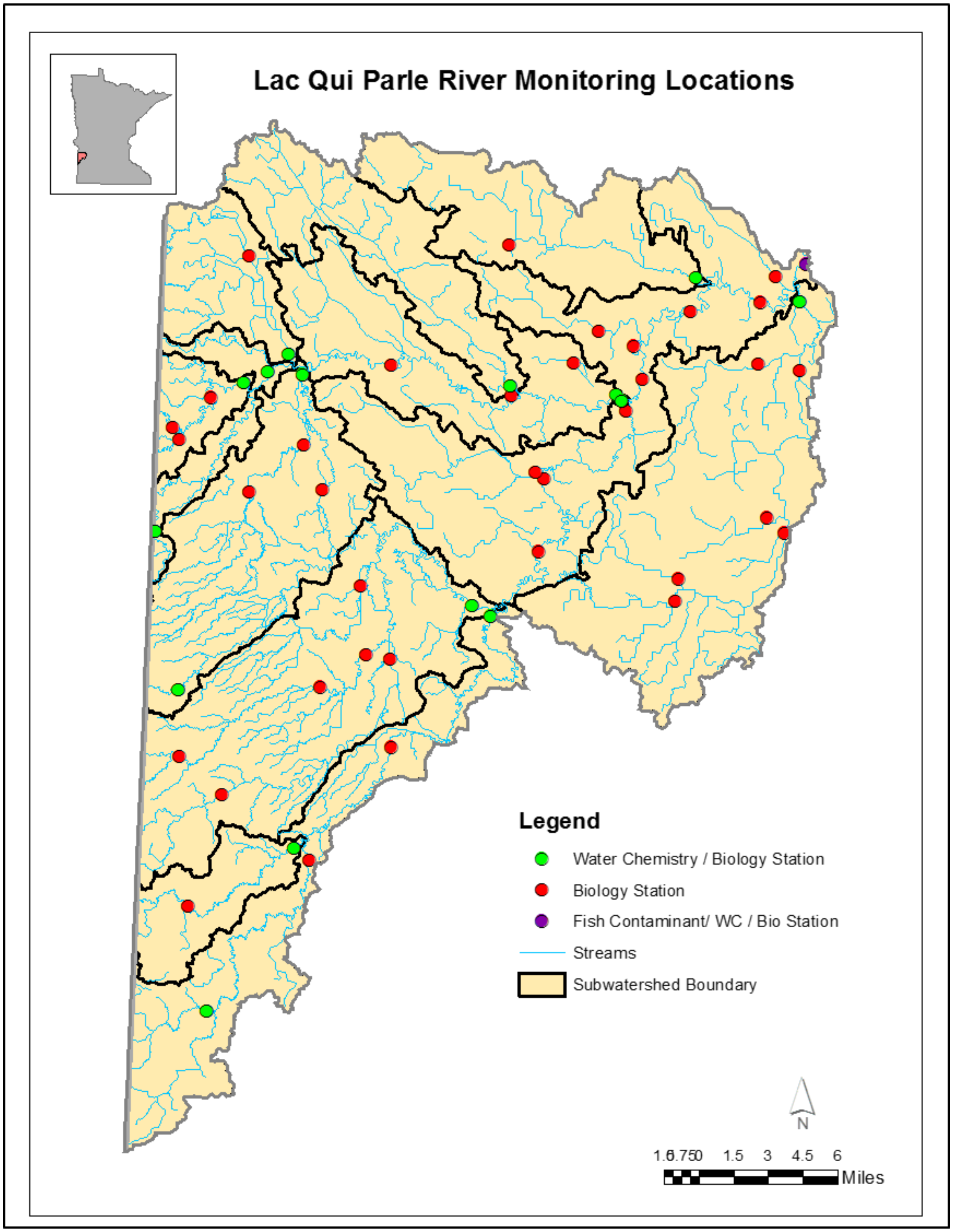


Figure 2. Intensive watershed monitoring sites for streams in the Lac qui Parle River Watershed.



Lake monitoring

Lakes most heavily used for recreation (all those greater than 500 acres and at least 25% of lakes 100-499 acres) are monitored for water chemistry to determine if recreational uses, such as swimming and wading, are being supported and where applicable, where fish community health can be determined. Lakes are prioritized by size, accessibility (can the public access the lakes), and presence of recreational use.

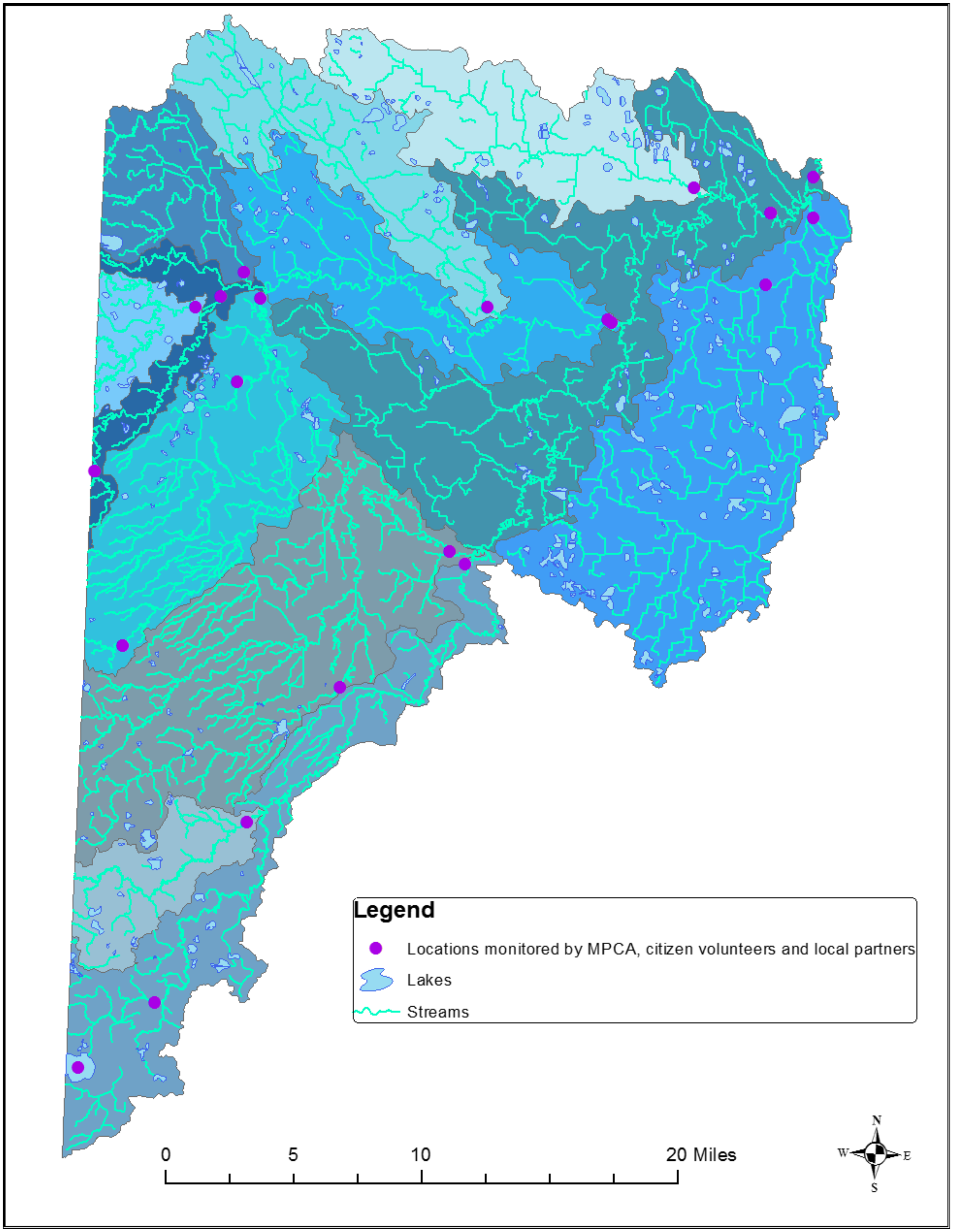
Specific locations for sites sampled as part of the intensive monitoring effort in the Lac Qui Parle River Watershed are shown in Figure 2 and are listed in Appendices 2.1 and 2.2.

Citizen and local monitoring

Citizen and local monitoring is an important component of the watershed approach. The MPCA and its local partners jointly select the stream sites and lakes to be included in the intensive watershed monitoring process. Funding passes from MPCA through Surface Water Assessment Grants (SWAGs) to local groups such as counties, soil and water conservation districts, watershed districts, nonprofits and educational institutions to support lake and stream water chemistry monitoring. Local partners use the same monitoring protocols as the MPCA, and all monitoring data from SWAG projects are combined with the MPCA's to assess the condition of Minnesota lakes and streams. Preplanning and coordination of sampling with local citizens and governments helps focus monitoring where it will be most effective for assessment and observing long-term trends. This allows citizens/governments the ability to see how their efforts are used to inform water quality decisions and track how management efforts affect change. Many SWAG grantees invite citizen participation in their monitoring projects and their combined participation greatly expand our overall capacity to conduct sampling.

The MPCA also coordinates two programs aimed at encouraging long term citizen surface water monitoring: the Citizen Lake Monitoring Program (CLMP) and the Citizen Stream Monitoring Program. Like the permanent load monitoring network, having citizen volunteers monitor a given lake or stream site monthly and from year to year can provide the long-term picture needed to help evaluate current status and trends. Citizen monitoring is especially effective at helping to track water quality changes that occur in the years between intensive monitoring years. Figure 3 provides an illustration of the locations where citizen-monitoring data were used for assessment in the Lac Qui Parle River Watershed.

Figure 3. Monitoring locations of local groups, citizens and the MPCA lake monitoring staff in the Lac qui Parle River Watershed.



Assessment methodology

The CWA requires states to report on the condition of the waters of the state every two years. This biennial report to Congress contains an updated list of surface waters that are determined to be supporting or non-supporting of their designated uses as evaluated by the comparison of monitoring data to criteria specified by Minnesota Water Quality Standards (Minn. R. ch. 7050 2008; https://www.revisor.leg.state.mn.us/rules/?id=7050). The assessment and listing process involves dozens of MPCA staff, other state agencies and local partners. The goal of this effort is to use the best data and best science available to assess the condition of Minnesota's water resources. For a thorough review of the assessment methodologies see: Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List (MPCA 2012). https://www.pca.state.mn.us/sites/default/files/wq-iw1-04.pdf.

Water quality standards

Water quality standards are the fundamental benchmarks by which the quality of surface waters are measured and used to determine impairment. These standards can be numeric or narrative in nature and define the concentrations or conditions of surface waters that allow them to meet their designated beneficial uses, such as for fishing (aquatic life), swimming (aquatic recreation) or human consumption (aquatic consumption). All surface waters in Minnesota, including lakes, rivers, streams and wetlands are protected for aquatic life and recreation where these uses are attainable. Numeric water quality standards represent concentrations of specific pollutants in water that protect a specific designated use. Narrative standards are statements of conditions in and on the water, such as biological condition, that protect their designated uses.

Protection of aquatic recreation means the maintenance of conditions safe and suitable for swimming and other forms of water recreation. In streams, aquatic recreation is assessed by measuring the concentration of *E. coli* bacteria in the water. To determine if a lake supports aquatic recreational activities its trophic status is evaluated, using total phosphorus, Secchi depth and chlorophyll-a as indicators. Lakes that are enriched with nutrients and have abundant algal growth are eutrophic and do not support aquatic recreation.

Protection of consumption means protecting citizens who eat fish from Minnesota waters or receive their drinking water from waterbodies protected for this beneficial use. The concentrations of mercury and polychlorinated biphenyls (PCBs) in fish tissue are used to evaluate whether or not fish are safe to eat in a lake or stream and to issue recommendations regarding the frequency that fish from a particular water body can be safely consumed. For lakes, rivers and streams that are protected as a source of drinking water the MPCA primarily measures the concentration of nitrate in the water column to assess this designated use.

Protection of aquatic life means the maintenance of a healthy aquatic community, including fish, invertebrates and plants. Biological monitoring, the sampling of aquatic organisms, is a direct means to assess aquatic life use support, as the aquatic community tends to integrate the effects of all pollutants and stressors over time. To effectively use biological indicators, the MPCA employs the Index of Biotic Integrity (IBI). This index is a scientifically validated combination of measurements of the biological community (called metrics). An IBI is comprised of multiple metrics that measure different aspects of aquatic communities (e.g., dominance by pollution tolerant species, loss of habitat specialists). Metric scores are summed together and the resulting index score characterizes the biological integrity or "health" of a site. The MPCA has developed stream IBIs for (fish and macroinvertebrates) since these communities can respond differently to various types of pollution. The MPCA also uses a lake fish IBI developed by the Minnesota Department of Natural Resources (DNR) to determine if lakes are meeting aquatic life use. Because the lakes, rivers, and streams in Minnesota are physically, chemically, and biologically diverse, IBI's are developed separately for different stream classes and lake class groups to account for this natural variation. Further interpretation of biological community data is provided by an assessment threshold or biocriteria against which an IBI score can be compared within a given stream class. In general, an IBI score above this threshold is indicative of aquatic life use support, while a score below this threshold is indicative of non-support. Additionally, chemical parameters are measured and assessed against numeric standards developed to be protective of aquatic life. For streams, these include pH, dissolved oxygen, un-ionized ammonia nitrogen, chloride, total suspended solids, pesticides, and river eutrophication. For lakes, pesticides and chlorides contribute to the overall aquatic life use assessment.

Protection for aquatic life uses in streams and rivers are divided into three tiers: Exceptional, General, and Modified. Exceptional Use waters support fish and macroinvertebrate communities that have minimal changes in structure and function from the natural condition. General Use waters harbor "good" assemblages of fish and macroinvertebrates that can be characterized as having an overall balanced distribution of the assemblages and with the ecosystem functions largely maintained through redundant attributes. Modified Use waters have been extensively altered through legacy physical modifications which limit the ability of the biological communities to attain the General Use. Currently the Modified Use is only applied to streams with channels that have been directly altered by humans (e.g., maintained for drainage, riprapped). These tiered uses are determined before assessment based on the attainment of the applicable biological criteria and/or an assessment of the habitat. For additional information, see: http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/tiered-aquatic-life-use-talu-framework.html).

Table 1. Proposed tiered aquatic life use standards.

Proposed tiered aquatic life use	Acronym	Proposed use class code	Description
Warm water General	WWg	2Bg	Warm water Stream protected for aquatic life and recreation, capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool water aquatic organisms that meet or exceed the General Use biological criteria.
Warm water Modified	WWm	2Bm	Warm water Stream protected for aquatic life and recreation, physically altered watercourses (e.g., channelized streams) capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool water aquatic organisms that meet or exceed the Modified Use biological criteria, but are incapable of meeting the General Use biological criteria as determined by a Use Attainability Analysis
Warm water Exceptional	WWe	2Be	Warm water Stream protected for aquatic life and recreation, capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of warm or cool water aquatic organisms that meet or exceed the Exceptional Use biological criteria.
Coldwater General	CWg	2Ag	Coldwater Stream protected for aquatic life and recreation, capable of supporting and maintaining a balanced, integrated, adaptive community of coldwater aquatic organisms that meet or exceed the General Use biological criteria.

Proposed tiered aquatic life use	Acronym	Proposed use class code	Description
Coldwater Exceptional	CWe	2Ae	Coldwater Stream protected for aquatic life and recreation, capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of coldwater aquatic organisms that meet or exceed the Exceptional Use biological criteria.

A small percentage of stream miles in the state (~1% of 92,000 miles) have been individually evaluated and re-classified as a Class 7 Limited Resource Value Water (LRVW). These streams have previously demonstrated that the existing and potential aquatic community is severely limited and cannot achieve aquatic life standards either by: a) natural conditions as exhibited by poor water quality characteristics, lack of habitat or lack of water; b) the quality of the resource has been significantly altered by human activity and the effect is essentially irreversible; or c) there are limited recreational opportunities (such as fishing, swimming, wading or boating) in and on the water resource. While not being protective of aquatic life, LRVWs are still protected for industrial, agricultural, navigation and other uses. Class 7 waters are also protected for aesthetic qualities (e.g., odor), secondary body contact, and groundwater for use as a potable water supply. To protect these uses, Class 7 waters have standards for bacteria, pH, dissolved oxygen and toxic pollutants.

Assessment units

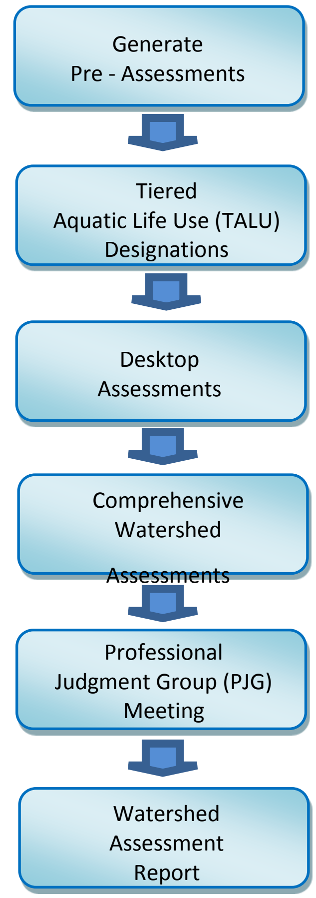
Assessments of use support in Minnesota are made for individual waterbodies. The waterbody unit used for river systems, lakes and wetlands is called the “assessment unit”. A stream or river assessment unit usually extends from one significant tributary stream to another or from the headwaters to the first tributary. A stream “reach” may be further divided into two or more assessment reaches when there is a change in use classification (as defined in Minn. R., ch. 7050) or when there is a significant morphological feature, such as a dam or lake, within the reach. Therefore, a stream or river is often segmented into multiple assessment units that are variable in length. The MPCA is using the 1:24,000 scale high resolution National Hydrologic Dataset (NHD) to define and index stream, lake and wetland assessment units. Each river or stream reach is identified by a unique waterbody identifier (known as its WID), comprised of the United States Geological Survey (USGS) eight-digit hydrologic unit code (8-HUC) plus a three-character code that is unique within each HUC. Lake and wetland identifiers are assigned by the DNR. The Protected Waters Inventory provides the identification numbers for lake, reservoirs and wetlands. These identification numbers serve as the WID and are composed of an eight-digit number indicating county, lake and bay for each basin.

It is for these specific stream reaches or lakes that the data are evaluated for potential use impairment. Therefore, any assessment of use support would be limited to the individual assessment unit. The major exception to this is the listing of rivers for contaminants in fish tissue (aquatic consumption). Over the course of time it takes fish, particularly game fish, to grow to “catchable” size and accumulate unacceptable levels of pollutants, there is a good chance they have traveled a considerable distance. The impaired reach is defined by the location of significant barriers to fish movement such as dams upstream and downstream of the sampled reach and thus often includes several assessment units.

Determining use attainment

For beneficial uses related to human health, such as drinking water or aquatic recreation, the relationship is well understood and thus the assessment process is a relatively simple comparison of monitoring data to numeric standards. In contrast, assessing whether a waterbody supports a healthy aquatic community is not as straightforward and often requires multiple lines of evidence to make use attainment decisions with a high degree of certainty. Incorporating a multiple lines of evidence approach into MPCA's assessment process has been evolving over the past few years. The current process used to assess the aquatic life use of rivers and streams is outlined below and in Figure 4.

Figure 4. Flowchart of aquatic life use assessment process.



The first step in the aquatic life assessment process is largely an automated process performed by logic programmed into a database application where all data from the 10 year assessment window is gathered; the results are referred to as 'Pre-Assessments'. Data filtered into the "Pre-Assessment" process is then reviewed to insure that data is valid and appropriate for assessment purposes. Tiered use designations are determined before data is assessed based on the attainment of the applicable biological criteria and/or an assessment of the habitat. Stream reaches are assigned the highest aquatic life use attained by both biological assemblages on or after November 28, 1975. Streams that do not attain the Exceptional or General Use for both assemblages undergo a Use Attainability Analysis (UAA) to determine if a lower use is appropriate. A Modified Use can be proposed if the UAA demonstrates that the General Use is not attainable as a result of legal human activities (e.g., drainage maintenance, channel stabilization) which are limiting the biological assemblages through altered habitat. Decisions to propose a new use are made through UAA workgroups, which include watershed project managers and biology leads. The final approval to change a designated use is through formal rulemaking.

The next step in the aquatic life assessment process is a comparison of the monitoring data to water quality standards. Pre-assessments are then reviewed by either a biologist or water quality professional, depending on whether the parameter is biological or chemical in nature. These reviews are conducted at the workstation of each reviewer (i.e., desktop) using computer applications to analyze the data for potential temporal or spatial trends as well as gain a better understanding of any extenuating circumstances that should be considered (e.g., flow, time/date of data collection, or habitat).

The next step in the process is a Comprehensive Watershed Assessment meeting where reviewers convene to discuss the results of their desktop assessments for each individual waterbody. Implementing a comprehensive approach to water quality assessment requires a means of organizing and evaluating information to formulate a conclusion utilizing multiple lines of evidence. Occasionally, the evidence stemming from individual parameters are not in agreement and would result in discrepant assessments if the parameters were evaluated independently. However, the overall assessment considers each piece of evidence to make a use attainment determination based on the preponderance of information available. See the *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment 305(b) Report and 303(d) List* (MPCA 2016) https://www.pca.state.mn.us/sites/default/files/wq-iw1-04j.pdf for guidelines and factors considered when making such determinations.

The last step in the assessment process is the Professional Judgment Group meeting. At this meeting, results are shared and discussed with entities outside of the MPCA that may have been involved in data collection or that might be responsible for local watershed reports and project planning. Information obtained during this meeting may be used to revise previous use attainment decisions (e.g., sampling events that may have been uncharacteristic due to annual climate or flow variation, local factors such as impoundments that do not represent the majority of conditions on the WID). Waterbodies that do not meet standards and therefore do not attain one or more of their designated uses are considered impaired waters and are placed on the draft 303(d) Impaired Waters List. Assessment results are also included in watershed monitoring and assessment reports.

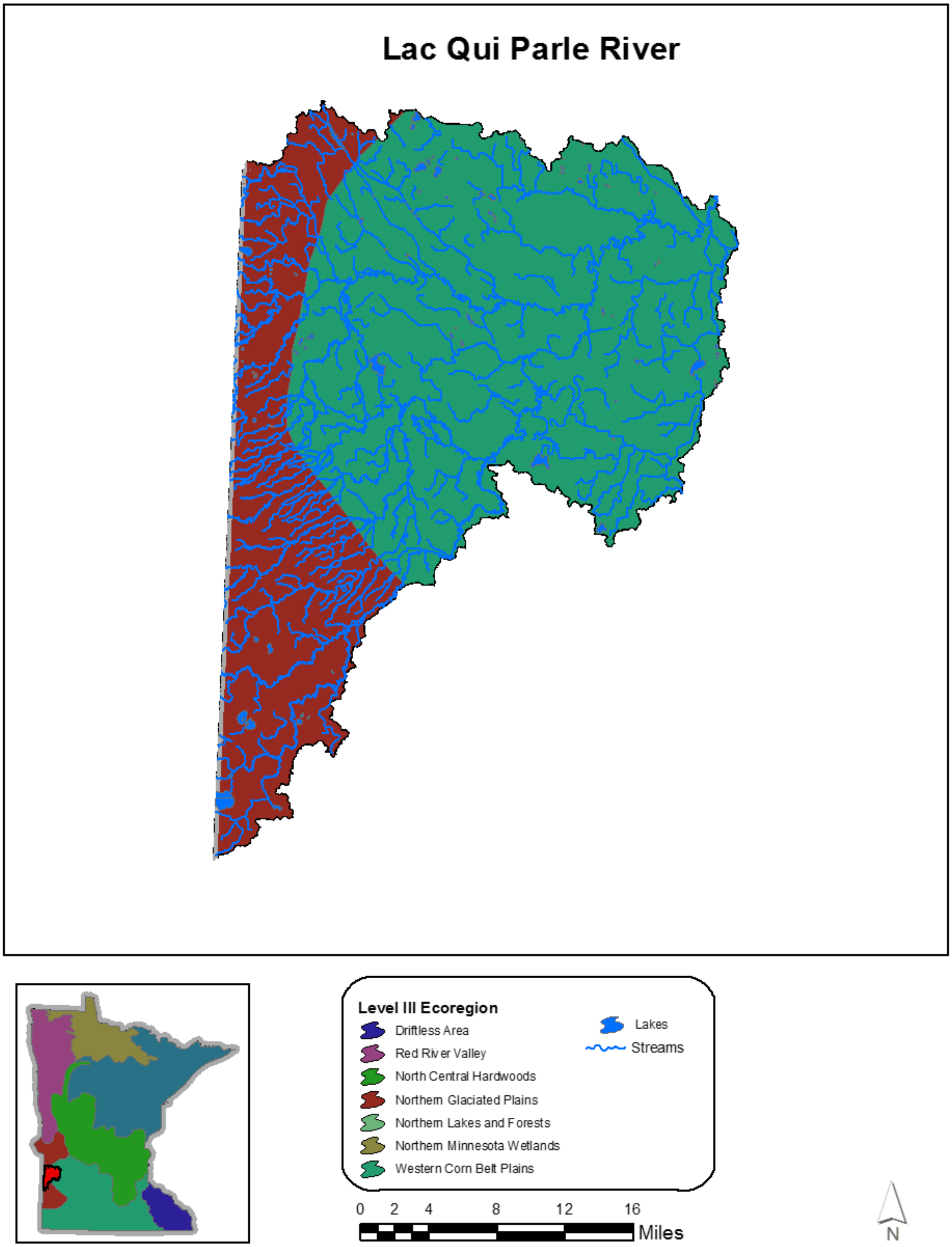
Watershed overview

The Lac qui Parle River Watershed (HUC 07020003) drains an area of approximately 1,100 square miles (704,000 acres) in eastern South Dakota and southwestern Minnesota. Approximately 70% of this area lies within portions of Minnesota's Lac qui Parle, Yellow Medicine, and Lincoln Counties, spanning an area from the South Dakota border on the western end of the basin to its confluence with the Minnesota River, just west of the city of Montevideo. This watershed spans the boundary between two Minnesota ecoregions; the western edge of the watershed along the South Dakota border is in the Northern Glaciated Plains ecoregion, and the larger, eastern portion is in the Western Corn Belt Plains ecoregion (Figure 5).

This watershed is divided into twelve subwatersheds (Figure 2). These subwatersheds are aggregations of individual 12 digit HUC drainages, containing anywhere from one to many 12 digit HUC units. For example, the Tributary to West Branch Lac qui Parle River and County Ditch Number 4 subwatersheds are relatively small and consist of one 12-digit HUC drainage, while the Lazarus Creek subwatershed is somewhat larger and consists of five aggregated 12-digit HUC units.

The far eastern and western portions of the watershed fall within the Rolling Till Prairie Major Land Resource Area (MLRA), while the central portion of the watershed is considered part of the Iowa and Minnesota Till Prairies MLRA. These areas are characterized by loamy, glacial till soils. Prior to development and land use changes beginning in the 1850s, the native vegetation was predominantly tall grass prairie.

Figure 5. The Lac qui Parle Watershed within the Northern Glaciated Plains and Western Corn Belt Plains ecoregions of southwest Minnesota.



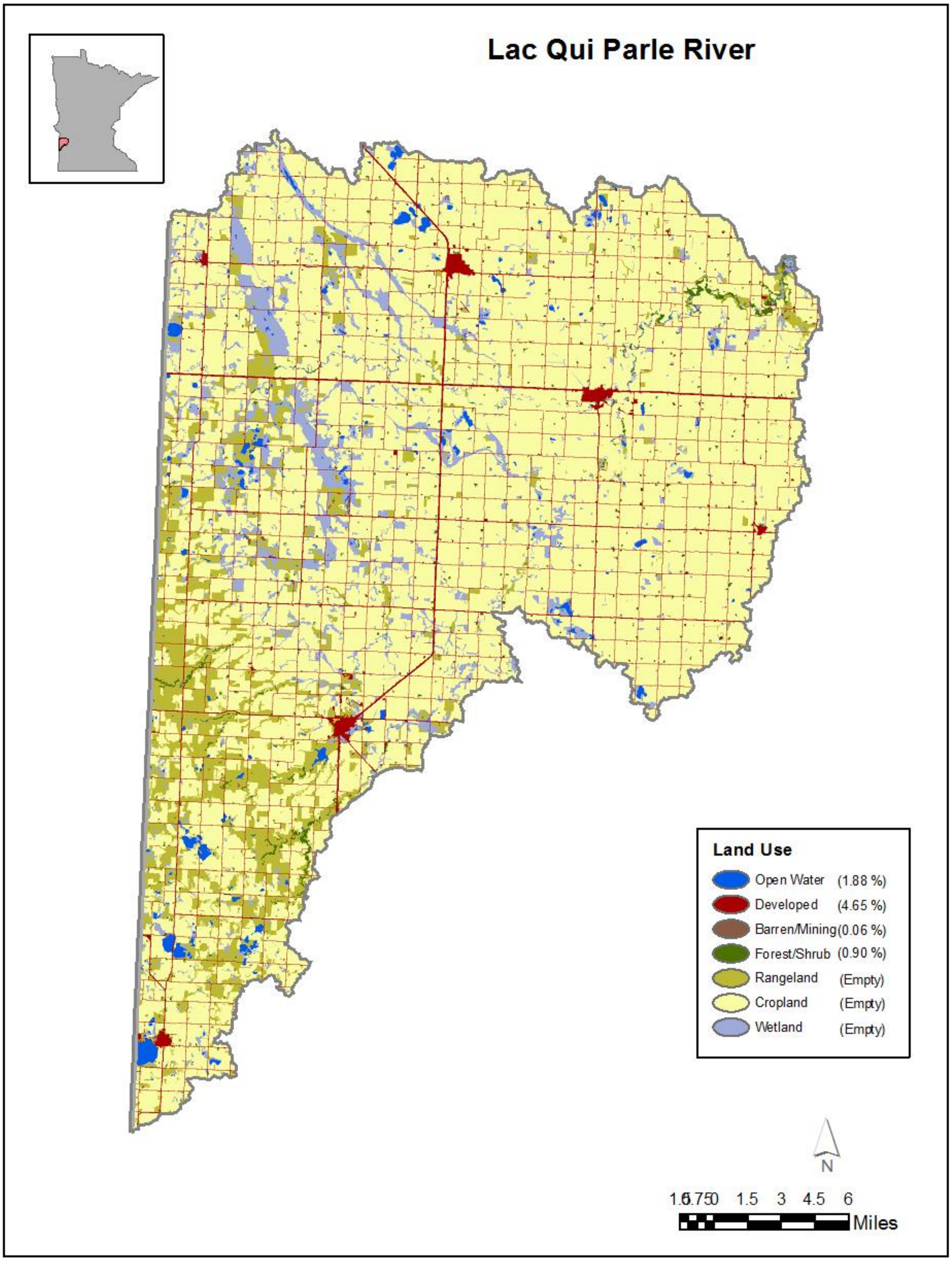
Land use summary

Lands within the Lac qui Parle River watershed were opened to non-indigenous settlement in the mid-19th century. Over the following century and a half, the landscape underwent a near wholesale conversion from native tall grass prairie vegetation to agricultural uses. To increase arable land surface, wetlands and free flowing streams were converted to networks of agricultural drainage ditches.

Today, the landscape in this watershed is dominated by agriculture, with over 65% of the land coverage dedicated to row crop farming. Corn and soybeans account for nearly 80% of cropped lands. Rangeland is the second most prevalent land use type at just over 20%. The remaining land use types are split amongst developed lands (4.7 %), forest/shrub (< 1%), open water (<2%) and wetlands (6.8%).

Nearly all the land (95%) in the Lac qui Parle watershed is privately owned, and the region is predominantly rural. The most sizable towns in this watershed are Canby (1,720), Madison (1,432), and Dawson (1,422). The remaining towns and communities throughout the watershed have less than 1,000 inhabitants.

Figure 6. Land use in the Lac qui Parle River Watershed.



Surface water hydrology

The Lac qui Parle River flows in a predominantly southwest to northeast direction, flowing approximately 120 miles from its source, Lake Hendricks on the South Dakota border, to its confluence with the Minnesota River just west of the city of Montevideo. For the first roughly 60 miles, the mainstem of this river is a small stream that flows along the southeastern boundary of the watershed. It is joined by Lazarus Creek northeast of Dawson. Its largest tributary, the West Branch Lac qui Parle River, drains much of the western and central portions of the watershed, receiving several other streams along its west to east course to its confluence with the mainstem just east of Dawson. The eastern portion of the watershed is drained by channelized networks of ditches that flow into Tenmile Creek. Tenmile Creek flows in a northerly direction until it meets the mainstem of the Lac qui Parle River shortly before the confluence with the Minnesota River.

A large low head dam on the West Branch Lac qui Parle River in was removed in 2009 and replaced with a set of rock and boulder riffles. This structure still impounds the river for a number of miles, but allows for the passage of fish and other aquatic organisms. Several species of fish have recolonized the areas upstream of the new structure that had not been collected upstream of the original dam since it was built in 1913.

Figure 7. Map of percent modified streams by major watershed (8-HUC).

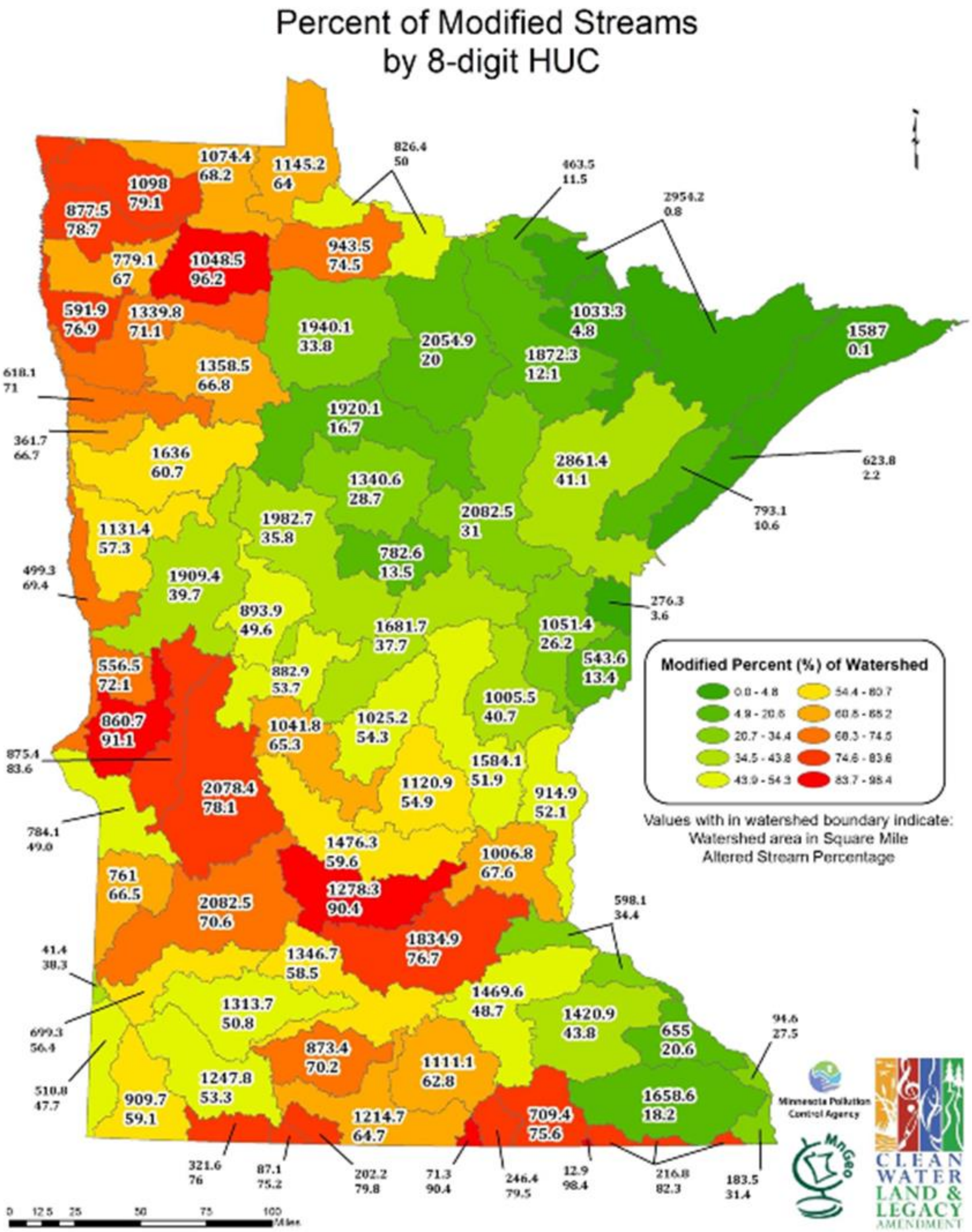
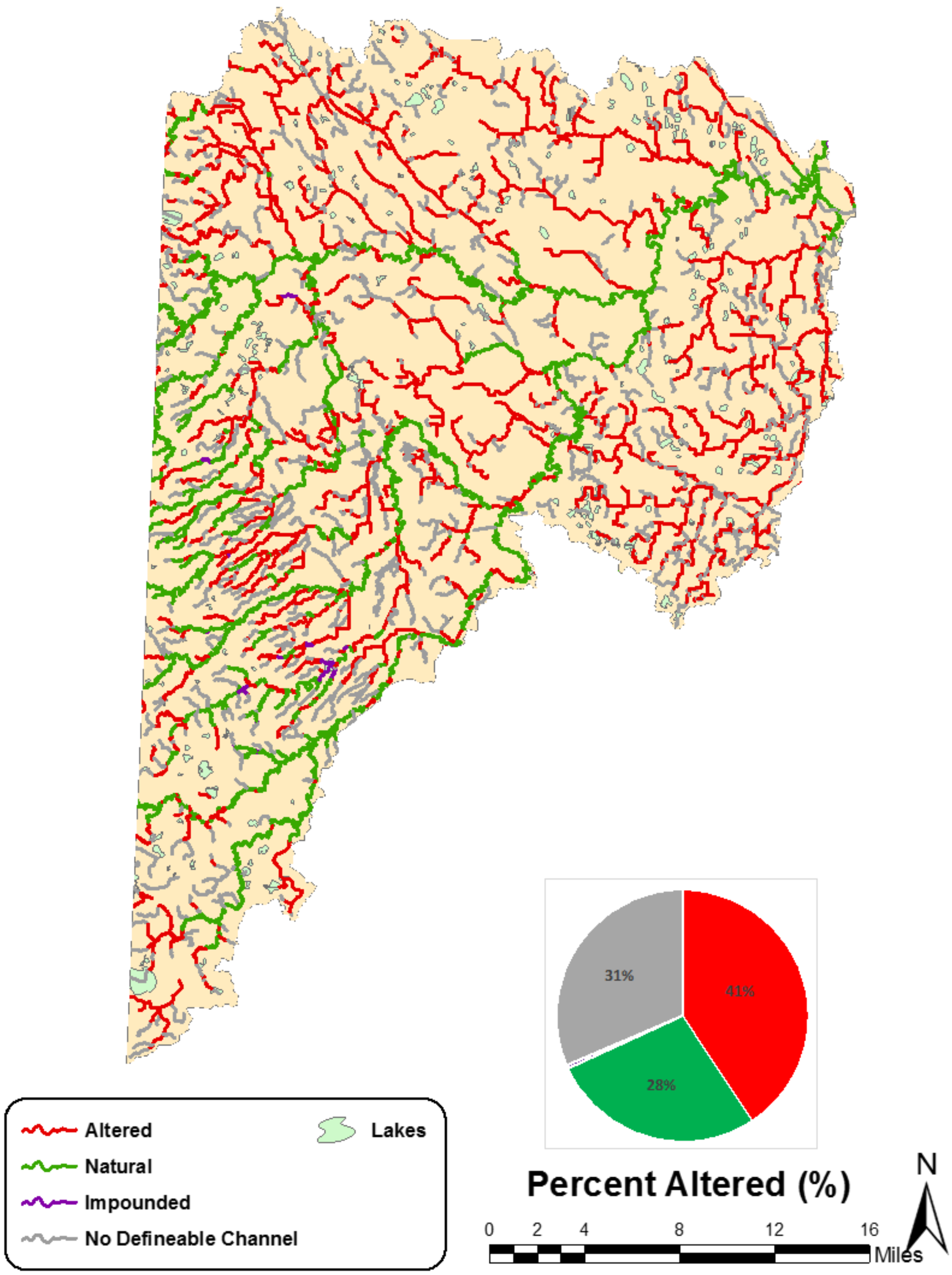


Figure 8. Comparison of natural to altered streams in the Lac qui Parle River Watershed (percentages derived from the Statewide Altered Water Course project).



Climate and precipitation

Minnesota has a continental climate, marked by warm summers and cold winters. The mean annual temperature for Minnesota is 4.6˚C (NOAA 2016); the mean (1981-2010) summer (June-August) temperature for the Lac Qui Parle River Watershed is 20.5˚C and the mean winter (December-February) temperature is -8.88˚ C (DNR 2017a).

Precipitation is an important source of water input to a watershed. Figure 9 displays two representations of precipitation for calendar year 2015. On the left is total precipitation, showing the typical pattern of increasing precipitation toward the eastern portion of the state. According to this figure, the Lac Qui Parle River Watershed area received 24 to 28 inches of precipitation in 2015. The display on the right shows the amount that precipitation levels departed from normal. The watershed area experienced precipitation that ranged from two inches below normal to two inches above normal in 2015.

Figure 9. Statewide precipitation levels during the 2015 water year.

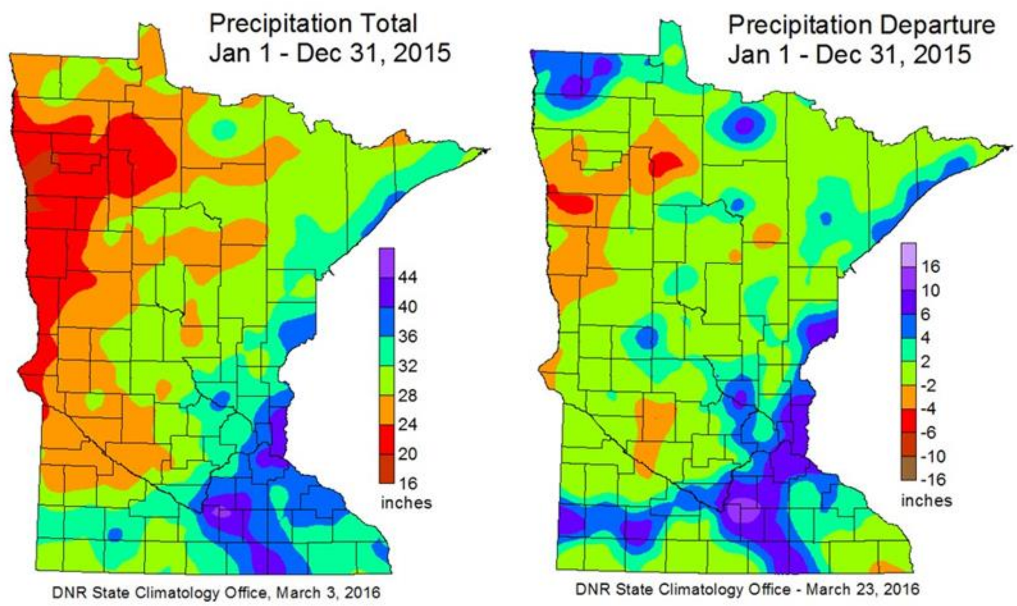


Figure 10. Precipitation trends in west central Minnesota (1995-2015) with five-year running average.

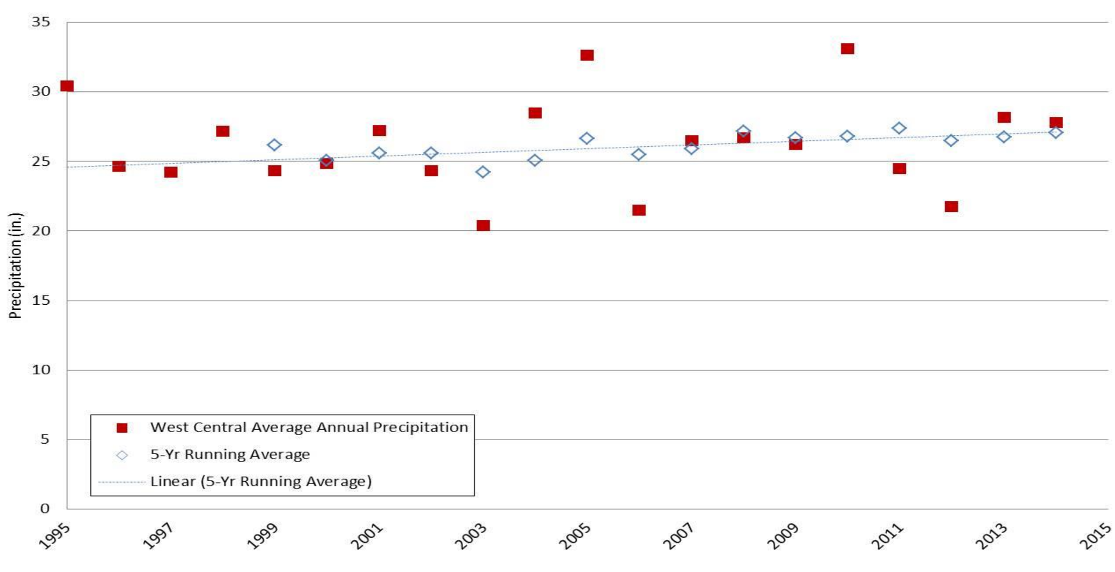
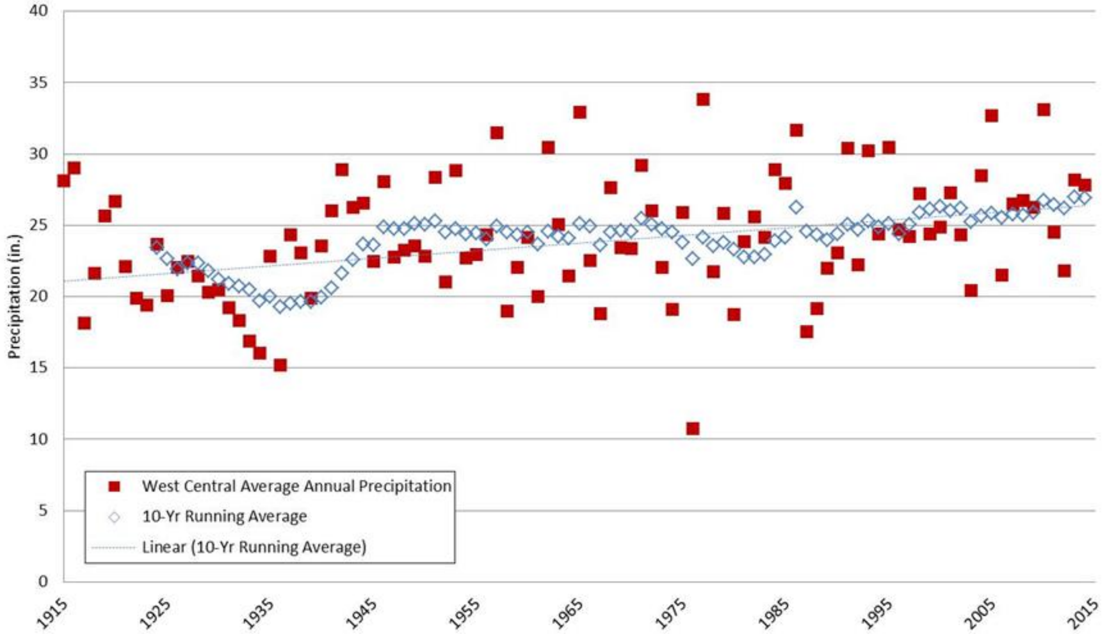


Figure 11. Precipitation trends in West-Central Minnesota (1916-2015) with ten-year running average (Source: WRCC, 2017).



Hydrogeology and groundwater quality

Hydrogeology is the study of the interaction, distribution and movement of groundwater through the rocks and soil of the earth. The geology of a region strongly influences the quantity of groundwater available, the quality of the water, the sensitivity of the water to pollution, and how quickly the water will be able to recharge and replenish the source aquifer. This branch of geology is important to understand as it indicates how to manage groundwater withdrawal and land use and can determine if mitigation is necessary.

The Lac qui Parle River Watershed contains features of two of Minnesota's Groundwater provinces: the Western and Central Provinces. Most of the watershed resembles the Western Province, with clayey drift over top bedrock with aquifers of limited extent. Features from the Central Province are present near the Minnesota River Valley in the eastern portion of the watershed. Here, there are sandy aquifers in sandy and clayey glacial drift (DNR 2017a).

Groundwater Potential Recharge

Groundwater recharge is one of the most important parameters in the calculation of water budgets, which are used in general hydrologic assessments, aquifer recharge studies, groundwater models, and water quality protection. Recharge is a highly variable parameter, both spatially and temporally, making accurate estimates at a regional scale difficult to produce. The MPCA contracted the US Geological Survey to develop a statewide estimate of recharge using the SWB – Soil-Water-Balance Code. The result is a gridded data structure of spatially distributed recharge estimates that can be easily integrated into regional groundwater studies. The full report of the project as well as the gridded data files are available at: https://gisdata.mn.gov/dataset/geos-gw-recharge-1996-2010-mean.

Recharge of these aquifers is important and limited to areas located at topographic highs, those with surficial sand and gravel deposits, and those along the bedrock-surficial deposit interface. Typically, recharge rates in unconfined aquifers are estimated at 20 to 25% of precipitation received, but can be less than 10% of precipitation where glacial clays or till are present (USGS 2007). For the Lac qui Parle River Watershed, the average annual potential recharge rate to surficial materials ranges from 0.6 to 6.0 inches per year, with a mean of 2.7 inches per year. The statewide average potential recharge is estimated to be four inches per year with 85% of all recharge ranging from three to eight inches per year (USGS 2015).

Groundwater Quality

Approximately 75% of Minnesota's population receives their drinking water from groundwater, undoubtedly indicating that clean groundwater is essential to the health of its residents. The Minnesota Pollution Control Agency's Ambient Groundwater Monitoring Program monitors trends in statewide groundwater quality by sampling for a comprehensive suite of chemicals including nutrients, metals, and volatile organic compounds. These Ambient Groundwater wells represent a mix of deeper domestic wells and shallow monitoring wells. The shallow wells interact with surface waters and exhibit impacts from human activities more rapidly. Available data from federal, state and local partners are used to supplement reviews of groundwater quality in the region.

There are currently no MPCA Ambient Groundwater Monitoring wells within the Lac Qui Parle River Watershed. However, a baseline study conducted by the MPCA (1998) found that the groundwater quality in this region is considered poor when compared to other areas with similar aquifers. Exceedances of drinking water standards for manganese and boron were the primary concern for those from natural sources, and nitrate as the primary concern associated with anthropogenic sources.

A more recent MPCA report on the statewide condition of Minnesota's groundwater found that groundwater in the Southwest region has fairly high nitrate concentrations; approximately 20% of the shallow sand and gravel aquifer wells exceed the maximum contaminant level (MCL) of 10 mg/L (Kroening and Ferrey 2013).

Another source of information on groundwater quality comes from the Minnesota Department of Health (MDH). Mandatory testing for arsenic, a naturally occurring but potentially harmful contaminant for humans, of all newly constructed wells has found that 10.7% of all wells installed from 2008 to 2015 have arsenic levels above the maximum contaminant level (MCL) for drinking water of 10 micrograms per liter (MDH 2016a). The Minnesota River Headwaters Watershed includes portions of Lac Qui Parle, Yellow Medicine and Lincoln Counties. Testing from Yellow Medicine and Lincoln counties showed 18.3% and 16.7% of new wells contained arsenic above the MCL. Results from Lac qui Parle County indicate 5.1% were above the MCL.

Groundwater Quantity

The Minnesota Department of Natural Resources (DNR) maintains a statewide network of water level wells to assess groundwater resources, evaluate trends and plan for the future. While there are a number of deep wells within the Lac qui Parle watershed, a shallower, water table well is more reactive to recharge and withdrawals. Groundwater elevations (below the monitoring point of 1047 feet) from well #225958 near Canby are displayed below. The water level shows marked, annual fluctuations that coincide with the seasons, but the changes do not reflect a statistically significant trend (DNR 2018).

High capacity withdrawals

The DNR permits all high capacity water withdrawals where the pumped volume exceeds 10,000 gallons/day or one million gallons/year (See Figure 12 for locations of permitted groundwater and surface water withdrawals). Permit holders are required to track water use and report back to the DNR yearly. Information on the program and the program database are found at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.

The changes in withdrawal volume detailed in this groundwater report are a representation of water use and demand in the watershed and are taken into consideration when the DNR issues permits for water withdrawals. Other factors not discussed in this report but considered when issuing permits include: interactions between individual withdrawal locations, cumulative effects of withdrawals from individual aquifers, and potential interactions between aquifers. This holistic approach to water allocations is necessary to ensure the sustainability of Minnesota's groundwater resources.

The three largest permitted consumers of water in the state for 2015 are (in order) power generation, public water supply (municipals), and irrigation (DNR 2017b). According to the most recent DNR Permitting and Reporting System (MPARS), in 2015 the withdrawals within the Lac qui Parle River Watershed are primarily used for agricultural irrigation and water supply.

Figure 12 displays total high capacity withdrawal locations within the watershed with active permit status in 2013. Permitted groundwater withdrawals are displayed below as blue triangles and surface water withdrawals as red squares. From 1996 to 2015, neither groundwater nor surface water withdrawals within the Lac Qui Parle River Watershed exhibit any statistically significant trend (Figure 13).

Figure 12. Locations of permitted groundwater withdrawals in the Lac qui Parle River Watershed.

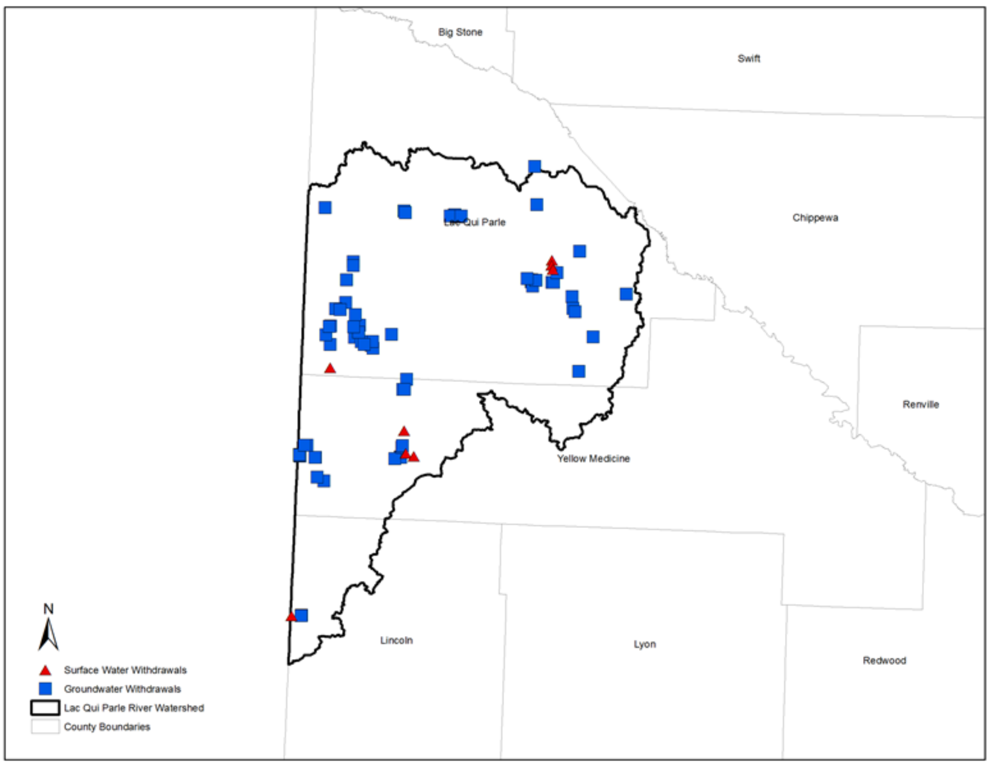
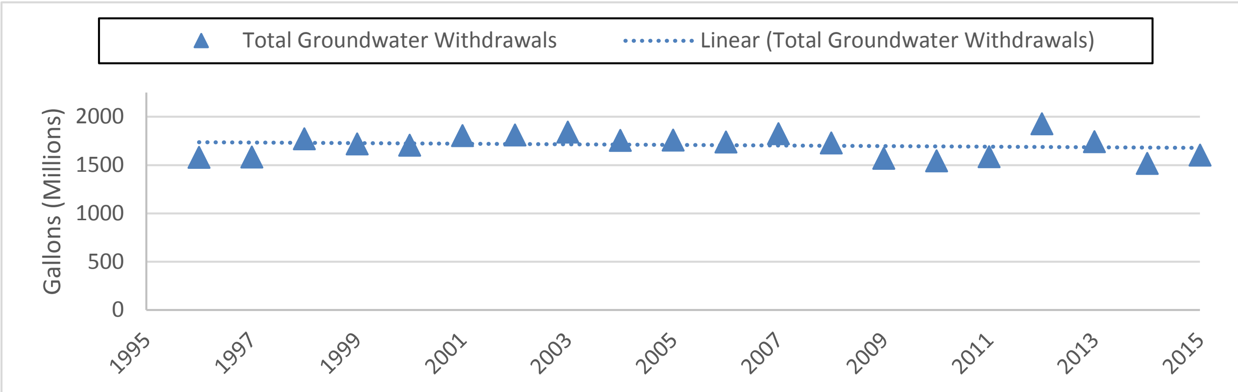
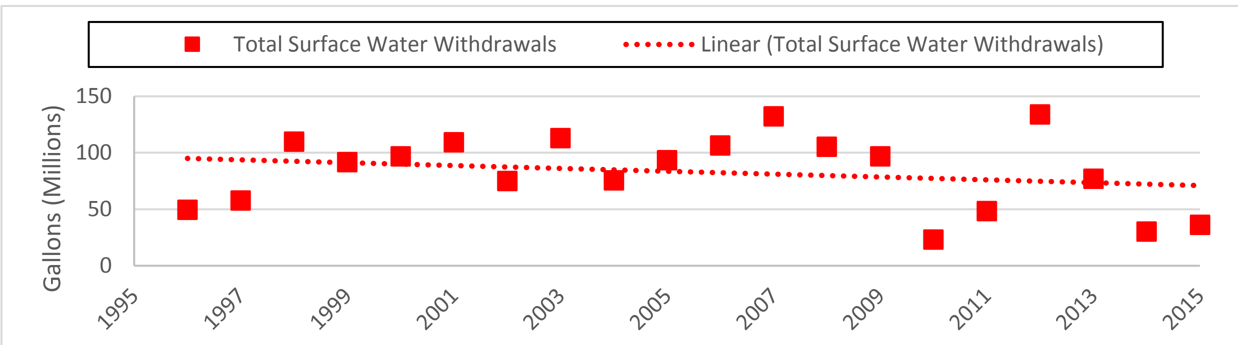


Figure 13. Total annual groundwater (above) and surface water (below) withdrawals in the Lac qui Parle River Watershed (1996-2015)





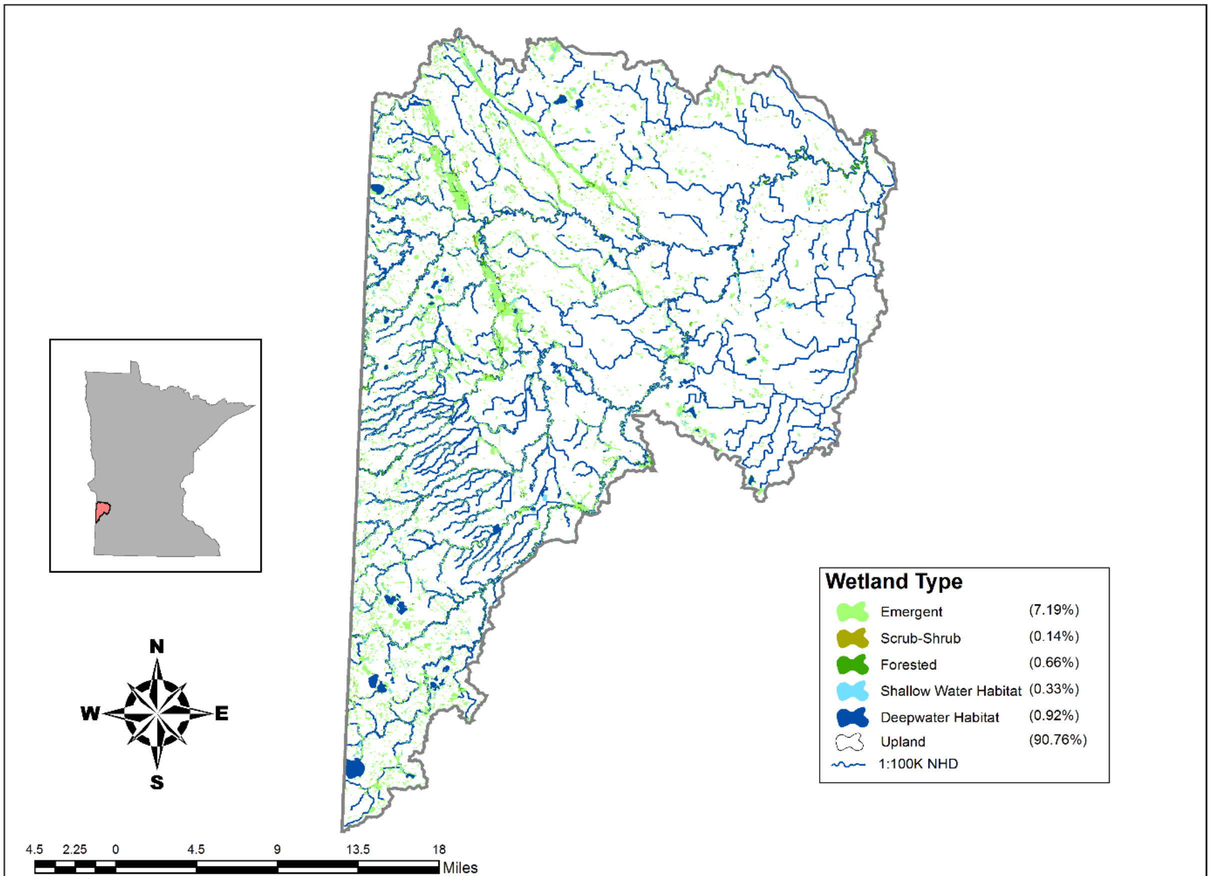
Wetlands

Currently there are approximately 40,000 wetland acres in the Lac qui Parle River watershed, roughly equivalent to 8.3% of its total area. Emergent vegetation wetlands comprise the majority of this wetland acreage and are well distributed across the watershed (Figure 1). Scrub-shrub wetlands and forested wetlands account for a minor component (< 1%) of the watershed's wetland profile. The topography and soil types – and thus the type and distribution of wetlands – has largely been determined by the region's glacial history. The Lac qui Parle River watershed lies within glacial till of the Des Moines lobe as it retreated to the northwest about 12,000 years ago (MNGS 1997). The southern region of the watershed is an area of stagnation moraine where the slow-melting, stagnant glacial ice – due to the insulation of accumulated sediment on top of the ice – resulted in a rugged topography after the ice had fully melted. This area of the watershed roughly corresponds to the escarpment of the Prairie Coteau, a plateau formed by the parting of two lobes (James and Des Moines) of the Laurentide glacier during the last Ice Age. The majority of the watershed is characterized, however, by ground moraine with a gentle, rolling topography and thus has relatively fewer lake and wetland basins. The highest concentration of wetlands in the watershed occurs along areas of glacial outwash that run in a slight northwest to southeast direction beginning at the northern edge of the watershed (Figure 1).

Prior to European settlement, wetlands were much more prevalent throughout the watershed. Considering that wetland soil features typically persist after artificial drainage, soil survey data can provide an estimate of historical wetland extent and serve as a baseline for comparisons with current wetland acreage. The Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database, based on a summation of map units classified as "poorly drained" or "very poorly drained", yields an estimate of approximately 211,000 acres of wetlands (~43% of watershed area) occurring in the Lac qui Parle River Watershed prior to European settlement (Soil Survey Staff, NRCS 2013). The current wetland area estimate for the watershed, based on the updated National Wetland Inventory, is about 40,000 acres. A comparison of these two periods (i.e., pre-settlement vs. 2011) shows an overall estimate of 81% wetland loss for the watershed. Wetland losses are not distributed evenly across the watershed, which can likely be attributed to the differences in topography mentioned in the previous paragraph and the resulting impacts on the suitability of the land for crop production and artificial drainage (Figure 15).

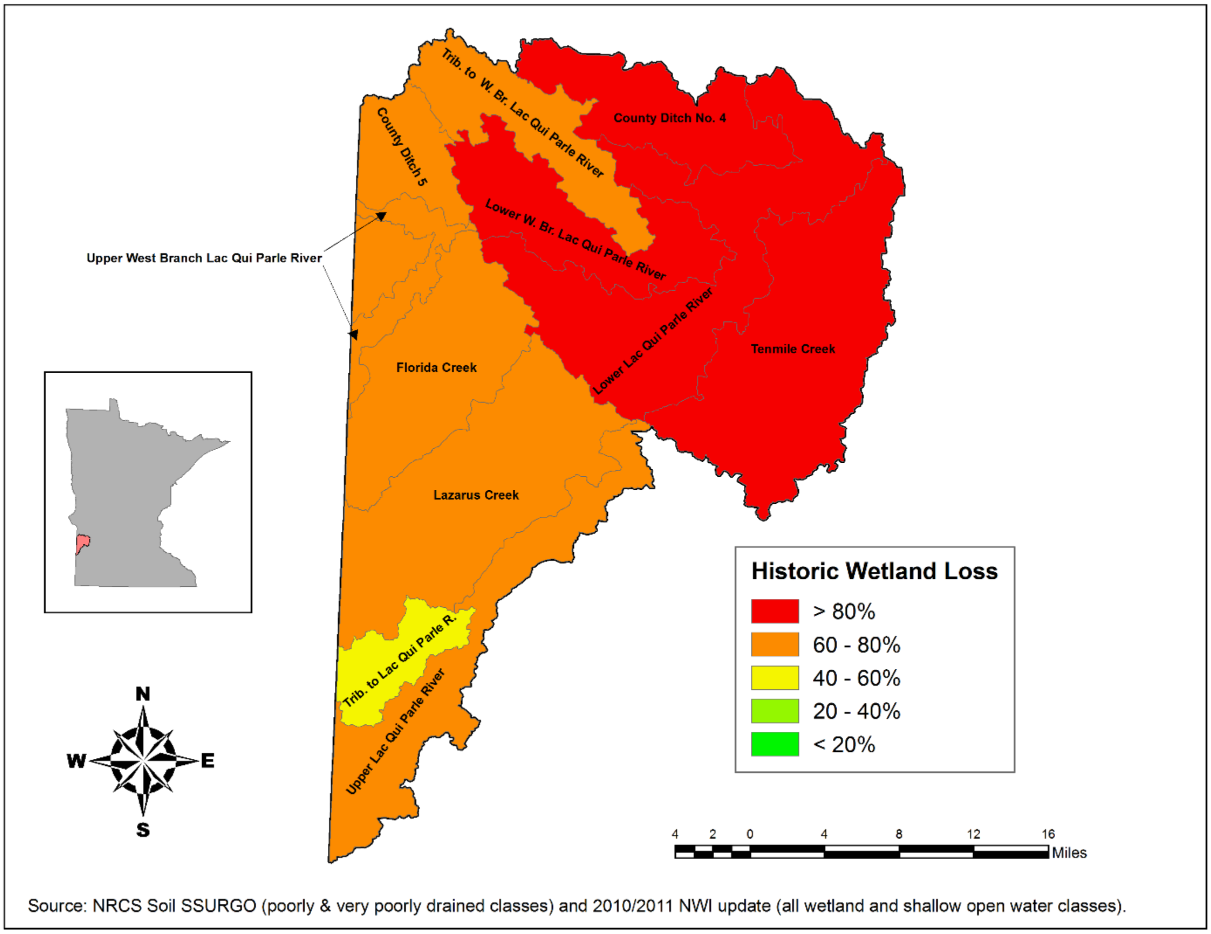
The Lac qui Parle River watershed supports some notable wetland features. Calcareous fens, which receive an upwelling of ground water rich in calcium carbonate, support a unique community of plant species (many are rare) and receive additional protections as state Outstanding Resource Value Waters (ORVW; Minn. R. ch. 7050; https://www.revisor.leg.state.mn.us/rules/?id=7050). The DNR has identified two calcareous fens in the watershed, both of which are designated ORVWs: Yellow Medicine Fen & Sioux Nation WMA.

Figure 14. Wetland types and their distribution across the Lac qui Parle River Watershed.



Source: Minnesota Department of Natural Resources Southern Minnesota National Wetlands Inventory update based on aerial photography acquired in 2010 and 2011.

Figure 15. Estimated historic wetland loss in each subwatershed based on a comparison of "poorly drained" and "very poorly drained" soil types (SSURGO database) to wetland extent in 2011 (NWI update).



Watershed-wide data collection methodology

Lake water sampling

MPCA sampled Lake Hendricks in 2015 to monitor recent changes in water quality since the previous assessment in 2010. A SWAG was awarded to the Lac qui Parle- Yellow Bank Watershed District to conduct water chemistry monitoring on Del Clark Lake. There is currently one volunteer enrolled in the MPCA's CLMP that are conducting lake monitoring within the watershed. Sampling methods are similar among monitoring groups and are described in the document entitled "*MPCA Standard Operating Procedure for Lake Water Quality*" found at http://www.pca.state.mn.us/publications/wq-s1-16.pdf. The lake recreation use assessment requires eight observations/samples within a 10-year period (June to September) for phosphorus, chlorophyll-a and Secchi depth.

Stream water sampling

Sixteen water chemistry stations were sampled from May thru September in 2015, and again June through August of 2016, to provide sufficient water chemistry data to assess all components of the aquatic life and recreation use standards. A SWAG was awarded to the Lac Qui Parle- Yellow Bank Watershed District to conduct water chemistry monitoring at these locations (See Appendix 2.1 for locations of stream water chemistry monitoring sites. See Appendix 1 for definitions of stream chemistry analytes monitored in this study). Following the IWM design, water chemistry stations were placed at the outlet of each aggregated 12 HUC subwatershed that was >40 square miles in area (purple circles and green circles/triangles in Figure 2. The Upper Lac qui Parle River, Upper West Branch Lac qui Parle River and Florida Creek subwatersheds had two water chemistry stations in an attempt to characterize water quality near the South Dakota border and outlet of the subwatershed. The Lower Lac Qui Parle River subwatershed had two water chemistry stations to isolate the inputs from Ten Mile Creek.

Lake biological sampling

One lake was monitored for fish community health in the Lac qui Parle River watershed. While data from the last 10 years contributed to the watershed assessments, the majority of data utilized for the 2017 assessment was collected between 2011 and 2016.

To measure the health of aquatic life at each lake, a fish IBI was calculated based on monitoring data collected in the lake. A fish classification framework was developed to account for natural variation in community structure, which is attributed to area, maximum depth, alkalinity, shoreline complexity, and geographic location. As a result, an IBI is available for four different groups of lake classes (Schupp Lake Classification, DNR). Each IBI class uses a unique suite of metrics, scoring functions, impairment thresholds, and confidence intervals (CIs). IBI scores higher than the impairment threshold and upper CI indicate that the lake supports aquatic life. Scores below the impairment threshold and lower CI indicate that the lake does not support aquatic life. When an IBI score falls within the upper and lower confidence limits additional information may be considered when making the impairment decision such as the consideration of potential local and watershed stressors and additional monitoring information (e.g., water chemistry, physical habitat, plant surveys, and observations of local land use activities).

Stream biological sampling

The biological monitoring component of the intensive watershed monitoring in the Lac qui Parle River Watershed was completed during the summer of 2015. A total of 47 sites were newly established across the watershed and sampled. These sites were located near the outlets of most minor HUC-14 watersheds. In addition, five existing biological monitoring stations within the watershed were revisited in 2015. These monitoring stations were initially established as part of a random Minnesota River Basin wide survey, or as part of a survey which investigated the quality of channelized streams with intact riparian zones. While data from the last 10 years contributed to the watershed assessments, the majority of data utilized for the 2017 assessment was collected in 2015. A total of 35 reaches were sampled for biology in the Lac qui Parle River Watershed. Waterbody assessments to determine aquatic life use support were conducted for 30 reaches. Biological information that was not used in the assessment process will be crucial to the stressor identification process and will also be used as a basis for long-term trend results in subsequent reporting cycles.

To measure the health of aquatic life at each biological monitoring station, indices of biological integrity (IBIs), specifically Fish and Invert IBIs, were calculated based on monitoring data collected for each of these communities. A fish and macroinvertebrate classification framework was developed to account for natural variation in community structure which is attributed to geographic region, watershed drainage area, water temperature and stream gradient. As a result, Minnesota's streams and rivers were divided into seven distinct warm water classes and two coldwater classes, with each class having its own unique Fish IBI and Invert IBI. Each IBI class uses a unique suite of metrics, scoring functions, impairment thresholds, and CIs (For IBI classes, thresholds and CIs, see Appendix 3.1). IBI scores higher than the impairment threshold and upper CI indicate that the stream reach supports aquatic life. Contrarily, scores below the impairment threshold and lower CI indicate that the stream reach does not support aquatic life. When an IBI score falls within the upper and lower confidence limits additional information may be considered when making the impairment decision such as the consideration of potential local and watershed stressors and additional monitoring information (e.g., water chemistry, physical habitat, observations of local land use activities). For IBI results for each individual biological monitoring station, see Appendices 4.1 and 4.2.

Fish contaminants

Minnesota Department of Natural Resource (DNR) fisheries staff collect most of the fish for the Fish Contaminant Monitoring Program. In addition, MPCA's biomonitoring staff collect up to five piscivorous (top predator) fish and five forage fish near the HUC8 pour point, as part of the Intensive Watershed Monitoring. All fish collected by the MPCA are analyzed for mercury and the two largest individual fish of each species are analyzed for polychlorinated biphenyls (PCBs).

Captured fish were wrapped in aluminum foil and frozen until they were thawed, scaled (or skinned), filleted, and ground to a homogenized tissue sample. Homogenized fillets were placed in 60 mL glass jars with Teflon™ lids and frozen until thawed for lab analysis. The Minnesota Department of Agriculture Laboratory analyzed the samples for mercury and PCBs. If fish were tested for perfluorochemicals (PFCs), whole fish were shipped to AXYS Analytical Laboratory, which analyzed the homogenized fish fillets for 13 PFCs. Of the measured PFCs, only perfluorooctane sulfonate (PFOS) is reported because it bioaccumulates in fish to levels that are potentially toxic and a reference dose has been developed.

From the fish contaminant analyses, MPCA determines which waters exceed impairment thresholds. The Impaired Waters List is prepared by the MPCA and submitted every even year to the U.S. EPA. MPCA has included waters impaired for contaminants in fish on the Impaired Waters List since 1998. Impairment assessment for PCBs (and PFOS when tested) in fish tissue is based on the fish consumption advisories prepared by the Minnesota Department of Health (MDH). If the consumption advice is to restrict consumption of a particular fish species to less than a meal per week the MPCA considers the lake or river impaired. The threshold concentration for impairment (consumption advice of one meal per month) is an average fillet concentration of 0.22 mg/kg for PCBs (and 0.200 mg/kg for PFOS).

Monitoring of fish contaminants in the 1970s and 1980s showed high concentrations of PCBs were primarily a concern downstream of large urban areas in large rivers, such as the Mississippi River, and in Lake Superior. Therefore, PCBs are now tested where high concentrations in fish were measured in the past and the major watersheds are screened for PCBs in the watershed monitoring collections.

Before 2006, mercury in fish tissue was assessed for water quality impairment based on MDH's fish consumption advisory, the same as PCBs. With the adoption of a water quality standard for mercury in edible fish tissue, a waterbody has been classified as impaired for mercury in fish tissue if 10% of the fish samples (measured as the 90^{th} percentile) exceed 0.2 mg/kg of mercury. At least five fish samples of the same species are required to make this assessment and only the last 10 years of data are used for the assessment. MPCA's Impaired Waters List includes waterways that were assessed as impaired prior to 2006 as well as more recent impairments.

Pollutant load monitoring

Intensive water quality sampling occurs at all WPLMN sites. Thirty-five samples per year are allocated for basin and major watershed sites and 25 samples per season (ice out through October 31) for subwatershed sites. Because concentrations typically rise with streamflow for many of the monitored pollutants, and because of the added influence elevated flows have on pollutant load estimates, sampling frequency is greatest during periods of moderate to high flow. All major snowmelt and rainfall events are sampled. Low flow periods are also sampled although sampling frequency is reduced as pollutant concentrations are generally more stable when compared to periods of elevated flow.

Water sample results and daily average flow data are coupled in the $FLUX_{32}$ pollutant load model to estimate the transport (load) of nutrients and other water quality constituents past a sampling station over a given period of time. Loads and flow weighted mean concentrations (FWMCs) are calculated for total suspended solids (TSS), total phosphorus (TP), dissolved orthophosphate, nitrate plus nitrite nitrogen (NO_3+NO_2-N), and total Kjeldahl nitrogen (TKN).

More information can be found at the WPLMN website: https://www.pca.state.mn.us/water/watershed-pollutant-load-monitoring-network

Groundwater monitoring

Groundwater Quality

The MPCA's Ambient Groundwater Monitoring Program monitors trends in statewide groundwater quality by sampling for a comprehensive suite of chemicals including nutrients, metals, and volatile organic compounds. These Ambient wells represent a mix of deeper domestic wells and shallow monitoring wells. The shallow wells interact with surface waters and exhibit impacts from human activities more rapidly. Available data from federal, state and local partners are used to supplement reviews of groundwater quality in the region.

Groundwater Quantity

Monitoring wells from the DNR Observation Well Network track the elevation of groundwater across the state. The elevation of groundwater is measured as depth to water in feet and reflects the fluctuation of the water table as it rises and falls with seasonal variations and anthropogenic influences. Data from these wells and others are available at: https://www.dnr.state.mn.us/waters/cgm/index.html

Groundwater/Surface Water Withdrawals

The Department of Natural Resources permits all high capacity water withdrawals where the pumped volume exceeds 10,000 gallons/day or 1 million gallons/year. Permit holders are required to track water use and report back to the DNR yearly. Information on the program and the program database are found at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html

Stream Flow

MPCA and the MDNR jointly monitor stream water quantity and quality at dozens of sites across the state on major rivers, at the mouths of most of the state's major watersheds, and at the mouths of some aggregated 12-HUC subwatersheds. Information and data on these sites are available at the DNR/PCA Cooperative Stream Gaging webpage at: http://www.dnr.state.mn.us/waters/csg/index.html.

Wetland monitoring

The MPCA is actively developing methods and building capacity to conduct wetland quality monitoring and assessment. Our primary approach is biological monitoring—where changes in biological communities may be indicating a response to human-caused impacts. The MPCA has developed IBIs to monitor the macroinvertebrate condition of depressional wetlands that have open water and the Floristic Quality Assessment (FQA) to assess vegetation condition in all of Minnesota's wetland types. For more information about the wetland monitoring (including technical background reports and sampling procedures), please visit the MPCA Wetland monitoring and assessment webpage.

The MPCA currently does not monitor wetlands systematically by watershed. Alternatively, the overall status and trends of wetland quality in the state and by major ecoregion is being tracked through probabilistic monitoring. Probabilistic monitoring refers to the process of randomly selecting sites to monitor; from which, an unbiased estimate of the resource can be made. Regional probabilistic survey results can provide a reasonable approximation of the current wetland quality in the watershed.

As few open water depressional wetlands exist in the watershed, the focus will be on vegetation quality results of all wetland types.

Individual Aggregated 12-HUC Subwatershed results

Aggregated 12-HUC subwatersheds

Assessment results for aquatic life and recreation use are presented for each Aggregated HUC-12 subwatershed within the Lac qui Parle River Watershed. The primary objective is to portray all the full support and impairment listings within an aggregated 12-HUC subwatershed resulting from the complex and multi-step assessment and listing process. This scale provides a robust assessment of water quality condition at a practical size for the development, management, and implementation of effective TMDLs and protection strategies. The graphics presented for each of the aggregated HUC-12 subwatersheds contain the assessment results from the 2017 Assessment Cycle as well as any impairment listings from previous assessment cycles. Discussion of assessment results focuses primarily on the 2015 intensive watershed monitoring effort, but also considers available data from the last ten years.

The proceeding pages provide an account of each aggregated HUC-12 subwatershed. Each account includes a brief description of the aggregated HUC-12 subwatershed, and summary tables of the results for each of the following: a) stream aquatic life and aquatic recreation assessments, and b) lake aquatic life and recreation assessments. Following the tables is a narrative summary of the assessment results and pertinent water quality projects completed or planned for the aggregated HUC-12 subwatershed. A brief description of each of the summary tables is provided below.

Stream assessments

A table is provided in each section summarizing aquatic life and aquatic recreation assessments of all assessable stream reaches within the aggregated HUC-12 subwatershed (i.e., where sufficient information was available to make an assessment). Primarily, these tables reflect the results of the 2017 assessment process (2014 U.S. Environmental Protection Agency [EPA] reporting cycle); however, impairments from previous assessment cycles are also included and are distinguished from new impairments via cell shading (see footnote section of each table). These tables also denote the results of comparing each individual aquatic life and aquatic recreation indicator to their respective criteria (i.e., standards); determinations made during the desktop phase of the assessment process (see Figure 4). Assessment of aquatic life is derived from the analysis of biological (fish and invert IBIs), dissolved oxygen, total suspended solids, chloride, pH, total phosphorus, chlorophyll-a, biochemical oxygen demand and un-ionized ammonia (NH_3) data, while the assessment of aquatic recreation in streams is based solely on bacteria (Escherichia coli) data. Included in each table is the specific aquatic life use classification for each stream reach: coldwater community (2A); cool or warm water community (2B); or indigenous aquatic community (2C). Where applicable and sufficient data exists, assessments of other designated uses (e.g., class 7, drinking water, aquatic consumption) are discussed in the summary section of each aggregated HUC-12 subwatershed as well as in the Watershed-wide results and discussion section.

Lake assessments

A summary of lake water quality is provided in the aggregated HUC-12 subwatershed sections where available data exists. This includes aquatic recreation (phosphorus, chlorophyll-a, and Secchi) and aquatic life, where available (chloride and fish IBI). Similar to streams, parameter level and over all use decisions are included in the table.

County Ditch 5 subwatershed

Group ID: 0702000303-02

The County Ditch 5 watershed drains an area of approximately 60 square miles in the northeast portion of the watershed, approximately half of which is in South Dakota. It principally consists of County Ditch 5, which flows in a southeasterly direction to its confluence with the West Branch of the Lac qui Parle River. Virtually the entirety of this watershed has been channelized or otherwise altered from its natural condition.

Table 2. Aquatic life and recreation assessments on stream reaches: County Ditch 5 subwatershed.

				Aquatic life indicators:											
WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-523, County Ditch 5, T118 R46W S23, north line to W Br Lac Qui Parle R	15MN085, 15MN096	6.87	LRVW	NA	NA	IF				MTS	MTS				IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 3. Lake assessments: County Ditch 5 subwatershed

Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi trend	Aquatic life indicators: Fish IBI	Aquatic life indicators: Chloride	Aquatic life indicators: Pesticides ***	Aquatic recreation indicators: Total phosphorus	Aquatic recreation indicators: Chlorophyll-a	Aquatic recreation indicators: Secchi	Aquatic life use	Aquatic recreation use
Salt	**37-0229-00**	**216**	**--**	**Shallow Lake**	**NGP**	**--**	**--**	**--**	**--**	**IF**	**IF**	**IF**	**--**	**IF**

Abbreviations for Ecoregion: **DA** = Driftless Area, **NCHF** = North Central Hardwood Forest, **NGP** = Northern Glaciated Plains, **NLF** = Northern Lakes and Forests, **NMW** = Northern Minnesota Wetlands, **RRV** = Red River Valley, **WCBP** = Western Corn Belt Plains

Abbreviations for Secchi Trend: **D** = decreasing/declining trend, **I** = increasing/improving trend, **NT** = no detectable trend, **--** = not enough data

Abbreviations for Indicator Evaluations: **--** = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)

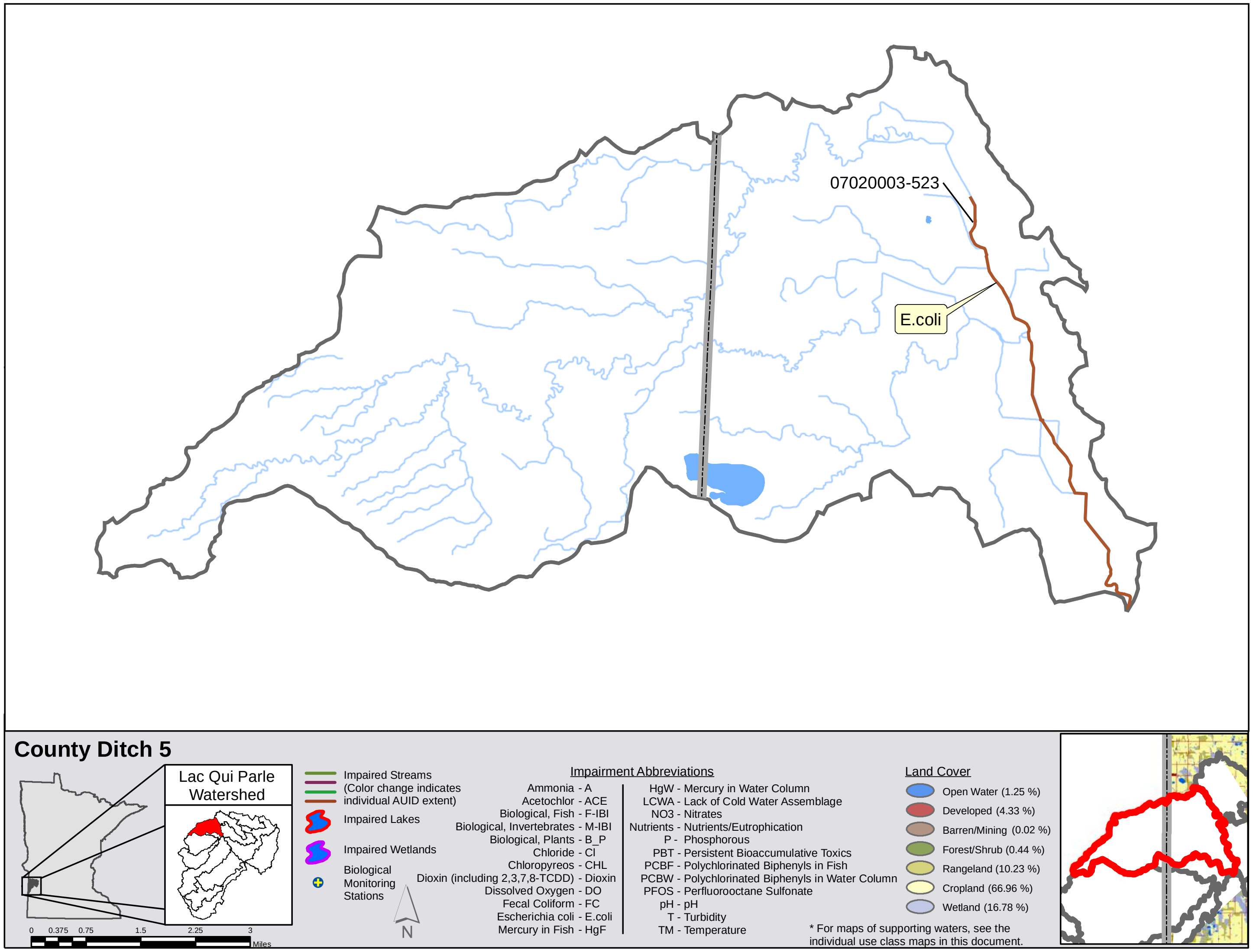
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

Data within this subwatershed were limited to a reach of County Ditch 5, which is designated as a limited resource value (LRV) water. Water quality standards are less stringent for this stream class and do not include biological criteria; fish and macroinvertebrate samples were collected but not assessed. Bacteria concentrations indicated that poor water quality exists and resulted in a new listing during this assessment effort. Other water quality data met their standards; dissolved oxygen data indicates large daily swings in concentrations that can be problematic for aquatic communities.

Lake data was limited to a single visit by the DNR shallow lake program in 2014 more robust lake eutrophication datasets would be needed for a complete aquatic recreation use assessment. The few lake basins within this subwatershed are shallow and small, recreational use is more than likely involves waterfowl observation and hunting. Traditional lake eutrophication goals may not be commonly associated with basins of this type, however maintaining good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species.

Figure 16. Currently listed impaired waters by parameter and land use characteristics in the County Ditch 5 subwatershed.



Lost Creek subwatershed

Group ID: 0702000303-03

Approximately 80% of this subwatershed's 77 square miles are in South Dakota, with only the downstream portion of the watershed in Minnesota. Lost Creek and its tributaries flow in an easterly direction until its confluence with the West Branch Lac qui Parle River southeast of Marietta.

Table 4. Aquatic life and recreation assessments on stream reaches: Lost Creek subwatershed.

WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Aquatic life indicators:** Fish IBI	Invert IBI	Dissolved oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-517, Lost Creek, Crow Timber Cr to W Br Lac Qui Parle R	15MN072	3.31	WWg	EXS	EXS	EXS	EXS	MTS	MTS	MTS	MTS		IF	IMP	IMP
07020003-520, Crow Timber Creek, MN/SD border to Lost Cr	15MN065, 15MN070	10.39	WWg	EXS	EXS	EXS	IF	IF	IF		IF		IF	IMP	
07020003-567, Unnamed creek, Unnamed cr to Unnamed cr	15MN066	3	WWg	MTS	EXS	EXS	IF	IF	IF				IF	IMP	

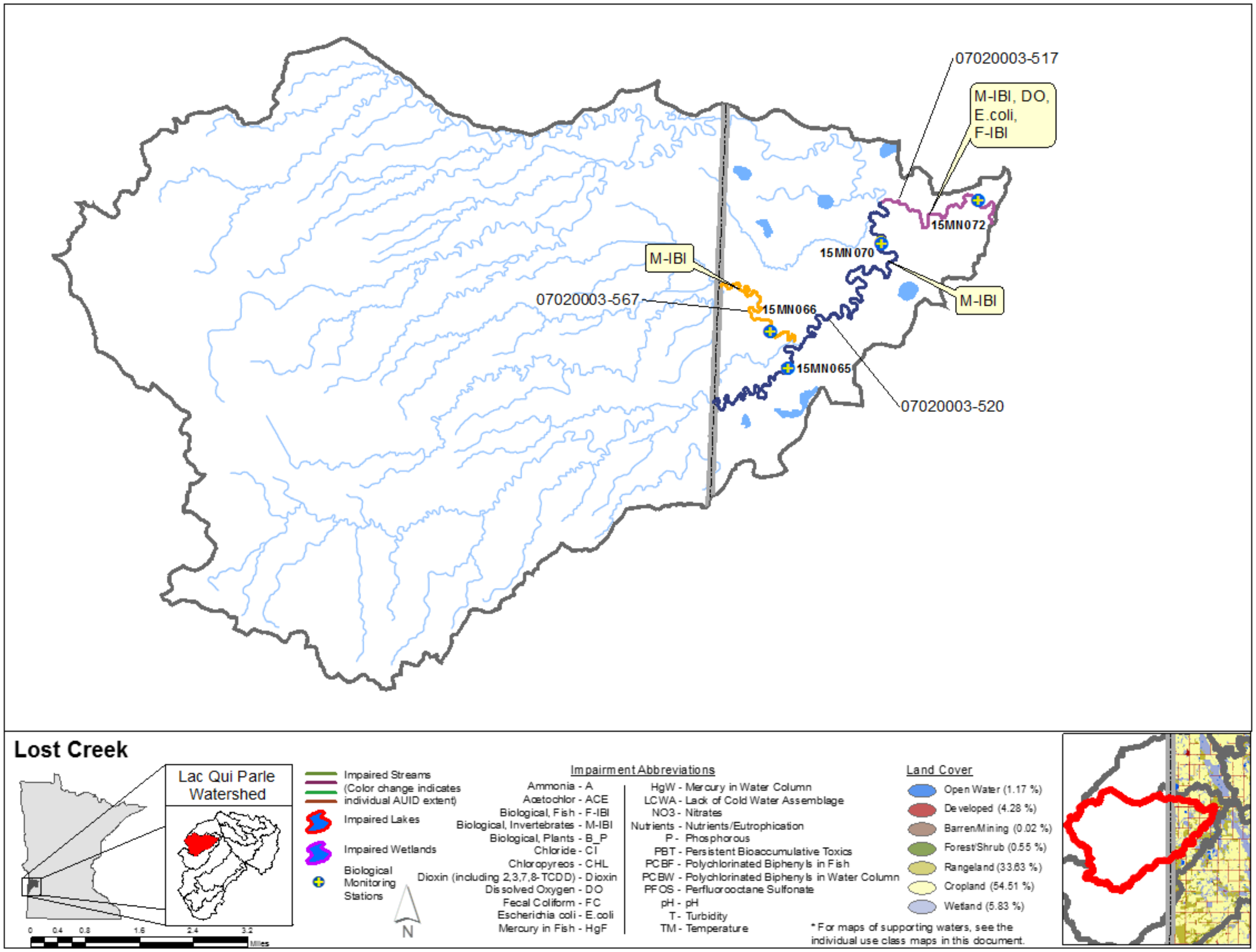
Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Summary

Fishes and macroinvertebrate communities were sampled at four biological stations within this subwatershed: one on a tributary to Crow Timber Creek, two on Crow Timber Creek, and one on Lost Creek. The fish sample on the unnamed tributary was indicative of a balanced community with good diversity (15 spp.) for a headwater stream in this basin and scored well above the impairment threshold and the upper CI. Conversely, the macroinvertebrate community at this station scored very poorly and was comprised of 90% tolerant taxa. Similarly, fish community samples from two stations on Crow Timber Creek met the standard or fell within the CI, while macroinvertebrate community scores fell well below the impairment threshold. The fish community at the station near the outlet of this subwatershed on Lost Creek (15MN072) scored poorly and fell well below the impairment threshold. Aquatic macroinvertebrates were impaired in all three streams assessed in this subwatershed and ancillary evidence observed and recorded by monitoring staff suggests that elevated nutrients and low dissolved oxygen have a significant role in these biological impairments. Extensive growth of algae was noted in all three streams, affecting both the dissolved oxygen regime as well as the trophic composition of these streams (e.g., increases in scrapers such as snails), both of which result in a less diverse macroinvertebrate community comprised of mostly tolerant species.

Water chemistry data was available on Lost Creek. Dissolved oxygen (DO) concentrations sag overnight, occasionally failing to recover to meet criteria throughout the daytime hours when concentrations typically recover, and likely stressing aquatic life. The available phosphorus dataset is small; while an assessment could not be completed, high concentrations are present. Bacteria concentrations summarized for each month in the two-year dataset are indicative of poor recreational water quality and will result in a new aquatic recreation use listing.

Figure 17. Currently listed impaired waters by parameter and land use characteristics in the Lost Creek subwatershed.



Upper West Branch Lac qui Parle River subwatershed Group ID: 0702000303-01

The Upper West Branch Lac qui Parle River subwatershed occupies an area of about 84 square miles on the western end of the watershed, 65 of which are in South Dakota. It is a flow through watershed that receives the outflow of the Lost Creek Subwatershed where Lost Creek meets the West Branch Lac qui Parle River southeast of Marietta. The West Branch flows out of this subwatershed and into the Lower West Branch Lac qui Parle River subwatershed southwest of Madison.

Table 5. Aquatic life and recreation assessments on stream reaches: Upper West Branch Lac qui Parle River subwatershed.

				Aquatic life indicators:											
WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-516, *Lac qui Parle River,* *West Branch, Lost Cr to Florida Cr*	15MN074	3.99	WWg	EXS	EXS	IF	IF	MTS	MTS	MTS	MTS		MTS	IMP	IMP
07020003-519, *Lac qui Parle River,* *West Branch, MN/SD border to Lost Cr*	15MN103, 90MN002	22	WWg	EXS	MTS	IF	MTS	MTS	MTS	MTS	MTS		IF	IMP	IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

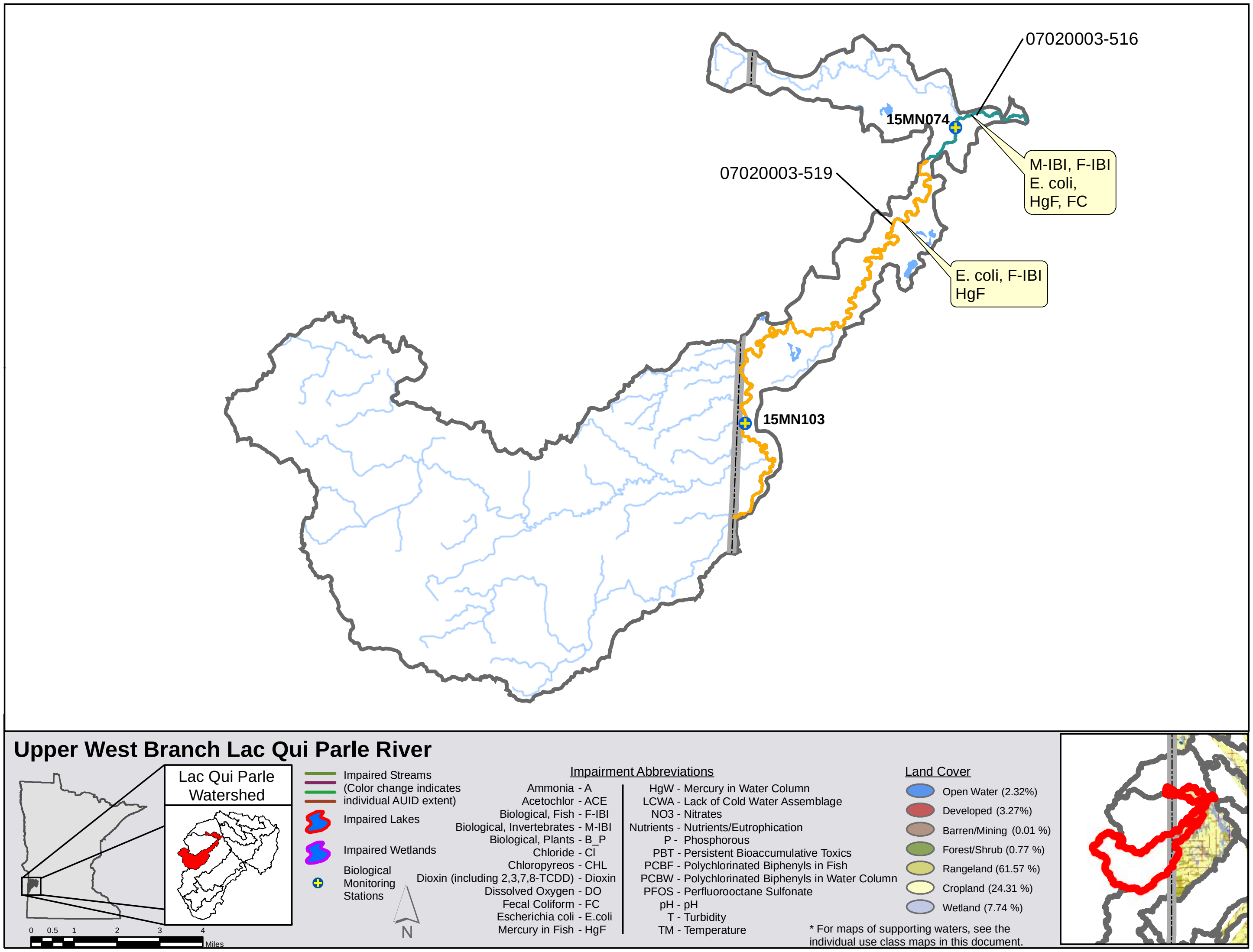
Summary

Fish communities were monitored at two stations (15MN103, 15MN074) on two reaches of the West Branch Lac qui Parle River. Although the habitat was much better on the upstream reach, both stations were composed of roughly 80% tolerant taxa and scored well below the General Use threshold. In this instance, the pastured riparian and trampled banks on the downstream reach seemed to have a greater impact on macroinvertebrate communities.

Two segments of the West Branch Lac qui Parle River were assessed in this subwatershed based on macroinvertebrate community data with opposite outcomes. Differences in habitat conditions at the monitoring stations on each segment may provide some insight on why one met general aquatic life expectations and one did not. Monitoring station 15MN074 was located in an active pasture and had an average Minnesota Stream Habitat Assessment (MSHA) score (across two visits) of 36, while 15MN103 had a forested riparian corridor and an average MSHA score of 65. Though based on a very limited data set, this comparison suggests that when the banks of the West Branch Lac qui Parle River are afforded some degree of protection (i.e., vegetated buffer) its water quality can support a healthy macroinvertebrate community. However, additional monitoring along this river in areas where riparian vegetation is undisturbed and in areas where it is disturbed should be conducted to evaluate these initial findings.

The downstream reach of the West Branch Lac qui Parle River was assessed as impaired for both aquatic life and aquatic recreation use during a previous effort based on turbidity and fecal coliform datasets. Restoration activities have been underway to address water quality issues since the initial listings. More recent total suspended solid (TSS) and Secchi tube (STUBE) datasets had a single violation in ten samples across 2015 and 2016. Additional sampling would be required to determine if the sediment impairment has been adequately addressed. More recent bacteria data clearly confirms the initial bacteria listing. Water quality issues in the headwater reaches of this watershed are feeding larger problems in downstream waterbodies.

Figure 18. Currently listed impaired waters by parameter and land use characteristics in the Upper West Branch Lac qui Parle River.



Tributary to West Branch Lac qui Parle River subwatershed Group ID: 0702000305-02

This subwatershed drains an area of approximately 50 square miles in central Lac qui Parle County. Virtually all of the stream reaches in this watershed have been channelized or otherwise altered from their natural condition. The final three miles of stream before it reaches its confluence with the West Branch Lac qui Parle River just west of Dawson represents the only remaining natural channel in this watershed.

Table 6. Aquatic life and recreation assessments on stream reaches: Tributary to West Branch Lac qui Parle Riversubwatershed.

WID *Reach name,* *Reach description*	Biological station ID	Reach length (miles)	Use class*	Aquatic life indicators: Fish IBI	Invert IBI	Dissolved oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic life	Aquatic rec. (Bacteria)
07020003-580, Unnamed creek, -96.1517, 44.9533 to W Br LqP River	15MN078	3.20	WWg	EXS	EXS	NA	MTS	MTS	MTS	MTS	IF		IF	IMP	IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 7. Lake assessments: Tributary to the West Branch Lac Qui Parle River subwatershed.

							Aquatic life indicators:			Aquatic recreation indicators:				
Lake name	**DNR ID**	**Area (acres)**	**Max depth (ft)**	**Assessment method**	**Ecoregion**	**Secchi Trend**	**Fish IBI**	**Chloride**	**Pesticides *** **	**Total phosphorus**	**Chlorophyll-a**	**Secchi**	**Aquatic life use**	**Aquatic recreation use**
Unnamed (Madison WMA)	37-0107-00	33	0	Shallow Lake	WCBP	--	--	--	--	IF	IF	IF	--	--
Unnamed (Arena)	37-0148-00	179	--	--	WCBP	--	--	--	--	IF	IF	IF	--	IF

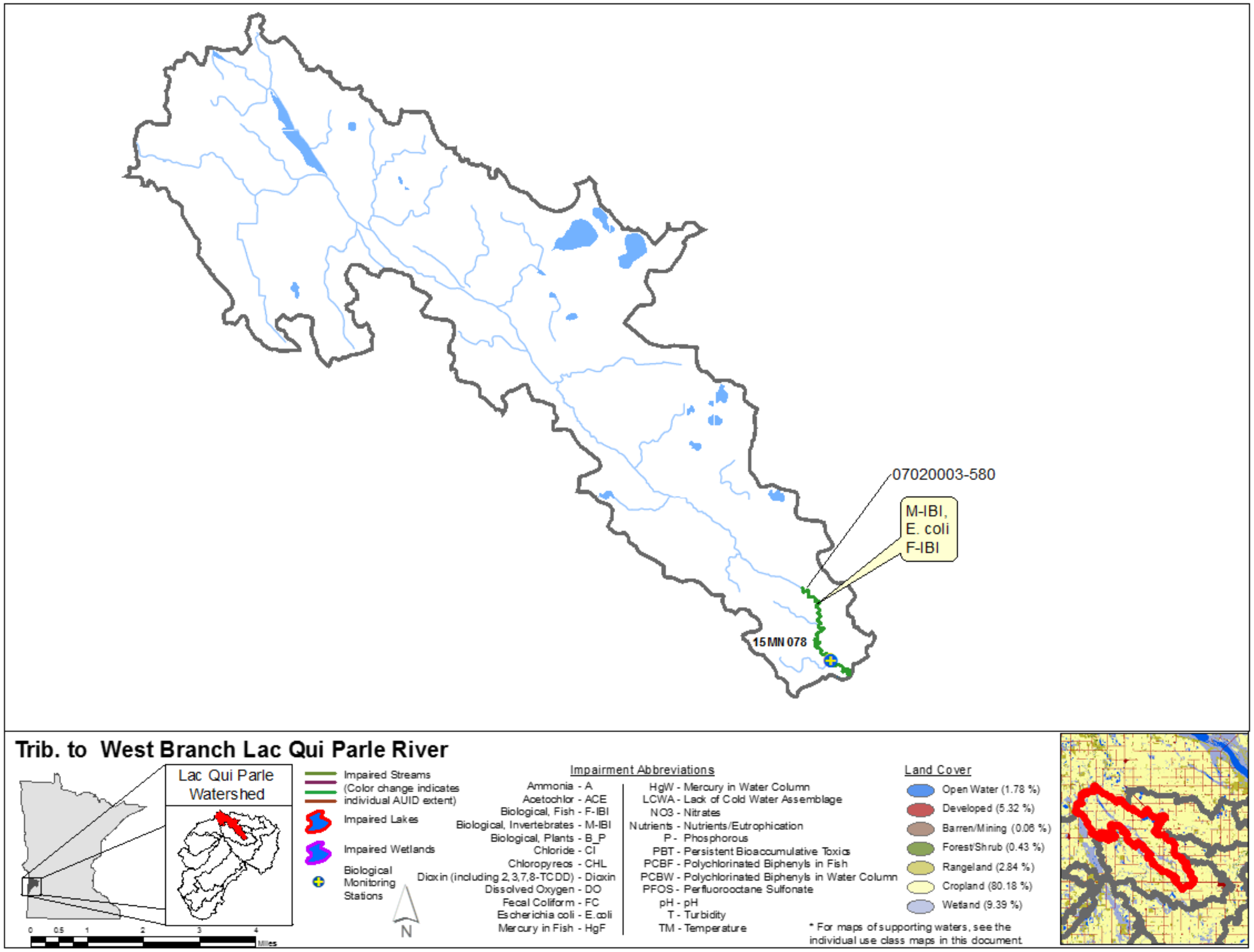
Abbreviations for Ecoregion: **DA** = Driftless Area, **NCHF** = North Central Hardwood Forest, **NGP** = Northern Glaciated Plains, **NLF** = Northern Lakes and Forests, **NMW** = Northern Minnesota Wetlands, **RRV** = Red River Valley, **WCBP** = Western Corn Belt Plains
Abbreviations for Secchi Trend: **D** = decreasing/declining trend, **I** = increasing/improving trend, **NT** = no detectable trend, **--** = not enough data
Abbreviations for Indicator Evaluations: **--** = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2016 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

Fishes and aquatic macroinvertebrates were monitored at one location on unnamed creek near the outlet of this subwatershed. The fish and aquatic macroinvertebrate communities in this stream are impaired. The fish community consisted of few species, many of which were tolerant, and the majority of the macroinvertebrates collected in this stream can withstand low dissolved oxygen concentrations and are often found in wetland habitats. Upstream wetland complexes are influencing dissolved oxygen (DO) concentrations resulting in an unrepresentative dataset for comparison to riverine criteria. The majority of total phosphorous data was collected in 2015 with a grossly elevated seasonal average. No response data (chlorophyll-a, biological oxygen demand, DO flux) was available to support a complete river eutrophication assessment. Remaining aquatic life use water chemistry parameters are supporting aquatic communities. Poor recreational water quality was apparent from the bacteria dataset at hand, resulting in a new listing during this assessment cycle.

The Madison Wildlife Management Area and Unnamed (Arena) Lake had a DNR shallow lake program surveys from July 2014, the single data point for each basin does not allow for a complete aquatic recreation assessment during this effort. The few lake basins within this subwatershed are similarly shallow and small, recreational use is more than likely involves waterfowl enthusiasts. Shallow basins are subject to wind mixing which drives internal loading of phosphorus that leads to poor water clarity and reduced vegetation. Maintaining good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species.

Figure 19. Currently listed impaired waters by parameter and land use characteristics in the Tributary to West Branch Lac qui Parle River.



Florida Creek subwatershed

Group ID: 0702000304-01

The Florida Creek subwatershed occupies an area of approximately 150 square miles on the western end of the watershed that is roughly bisected by Minnesota's border with South Dakota. Within the Minnesota (downstream) portion of the watershed, Florida Creek flows in a northeasterly direction for 37 miles from the state border to its confluence with the West Branch Lac qui Parle River, approximately 7 miles southwest of Madison.

Table 8. Aquatic life and recreation assessments on stream reaches: Florida Creek subwatershed.

WID *Reach name,* *Reach Description*	Biological station ID	Reach length (miles)	Use class*	Aquatic life indicators: Fish IBI	Invert IBI	Dissolved oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic life	Aquatic rec. (Bacteria)
07020003-521, Florida Creek, MN/SD border to W Br Lac Qui Parle R	03MN047, 15MN067, 15MN073	37.45	WWg	EXS	EXS	IF	EX	EX	MTS	MTS	MTS		MTS	IMP	IMP
07020003-583, Cobb Creek, Unnamed cr to -96.3457, 44.8724	15MN059	3.43	WWm	MTS	EXS	IF	IF	IF					IF	IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)

Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional,

LRVW = limited resource value water

*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

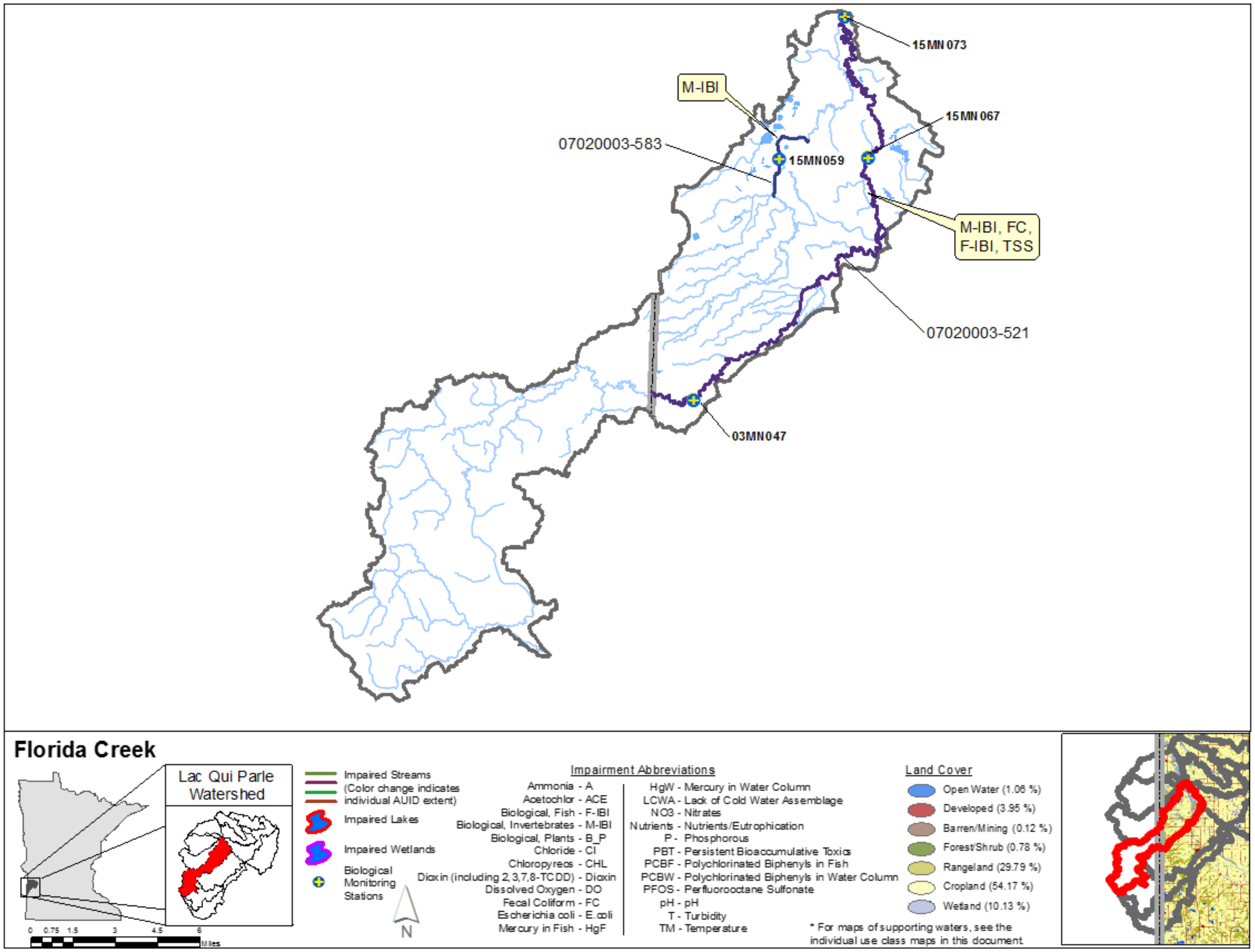
Summary

Fishes and aquatic macroinvertebrates were sampled at four biological stations: three on Florida Creek, and one on its tributary Cobb Creek. The fish community at the station on a channelized reach of Cobb Creek scored above the General Use threshold and its upper confidence limit. Eleven individuals of Pearl Dace, a species classified as sensitive and intolerant, were collected at this station. A verified collection of this species has not occurred in the Minnesota River Basin since 1954. Fish community samples from four visits to three stations on Florida Creek consistently scored below the impairment threshold and confirm the existing impairment on this reach.

Aquatic macroinvertebrates represent a new impairment on Florida Creek, augmenting the fish, turbidity, and fecal coliform impairments that have previously been identified on this stream. This assessment unit is 37 miles in length and has some significant inaccuracies comparing its spatial representation in GIS to current conditions as depicted by aerial imagery. At some point in the past, Florida Creek was re-routed out of its natural channel into ditches that stretch for long distances. Examination of the aerial imagery during the assessment process revealed that this re-routing occurred at points just upstream and downstream of Florida Creek Wildlife Management Area: North West Unit. These cut-off channels may represent opportunities to restore the hydrology of this creek as well as improve in-stream habitat conditions for aquatic life.

This long reach of Florida Creek has a history of poor water quality for both aquatic life and recreation uses. Previously listed for turbidity in 2006, restoration efforts underway to address sediment loading issues from upstream sources to this reach. More recent total suspended solids (TSS) data was collected in 2015, and extensive Secchi tube dataset confirms the initial listing. Minor violations in the dissolved oxygen and pH datasets reveal short-term departures into poor water quality from both parameters but likely not a long termlong-term problem considering remaining extensive datasets meet criteria. Fecal coliform data from 2001 and 2003 revealed numerous violations triggering a previous aquatic recreation use listing in 2006, more recent bacteria data is still clearly indicating poor recreation water quality, restoration activities are underway.

Figure 20. Currently listed impaired waters by parameter and land use characteristics in the Florida Creek subwatershed.



Lower West Branch Lac qui Parle River subwatershed

Group ID: 0702000305-01

The lower West Branch Lac qui Parle River Watershed occupies an area of approximately 60 square miles in central Lac qui Parle County. It is a flow through watershed that contains the lower reaches of the West Branch Lac qui Parle River and several small, first-order tributaries as it flows in a westerly direction to its confluence with the Lac qui Parle River, just east of Dawson. As several other subwatersheds flow into this one, it has a drainage area of nearly 500 square miles.

Table 9. Aquatic life and recreation assessments on stream reaches: Lower West Branch Lac qui Parle River subwatershed.

				Aquatic life indicators:											
WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-512, Lac qui Parle River, West Branch, Unnamed cr to Unnamed ditch	15MN209	7.18	WWg	NA	NA	IF	IF	MTS		MTS	MTS		EX	IF	IMP
07020003-513, Lac qui Parle River, West Branch, Unnamed ditch to Lac Qui Parle R	15MN097	1.28	WWg	MTS	EXS	IF	MTS	MTS	MTS	MTS	MTS		EX	IMP	IMP
07020003-515, Lac qui Parle River, West Branch, Florida Cr to Unnamed cr	15MN069, 15MN079	21.16	WWg	EXS	MTS	IF	IF	IF		IF	IF		IF	IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)

Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water

*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 10. Lake assessments: Lower West Branch Lac Qui Parle River Aggregated 12-HUC.

Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi Trend	Aquatic life indicators: Fish IBI	Aquatic life indicators: Chloride	Aquatic life indicators: Pesticides ***	Aquatic recreation indicators: Total Phosphorus	Aquatic recreation indicators: Chlorophyll-a	Aquatic recreation indicators: Secchi	Aquatic life use	Aquatic recreation Use
Cory	37-0103-00	66	5	Shallow Lake	WCBP	--	--	--	--	IF	IF	IF	--	IF
Unnamed	37-0154-00	--	--	--	WCBP	--	--	--	--	IF	--	IF	--	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains

Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data

Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: -- = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)

Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

The West Branch Lac qui Parle River flows through this watershed and is divided in to three reaches from upstream to downstream. Fish community scores were discrepant on the upstream reach; the fish community at the upstream station (15MN079) failed to meet the threshold and was dominated by tolerant and generalist taxa, while the community at the downstream station (15MN069) scored well above the threshold and upper CI. The upstream reach attained the macroinvertebrate criteria for general use streams. Fish were not sampled at 15MN209 due to an impoundment (see below). Fish community scores improve as one moves downstream through this watershed.

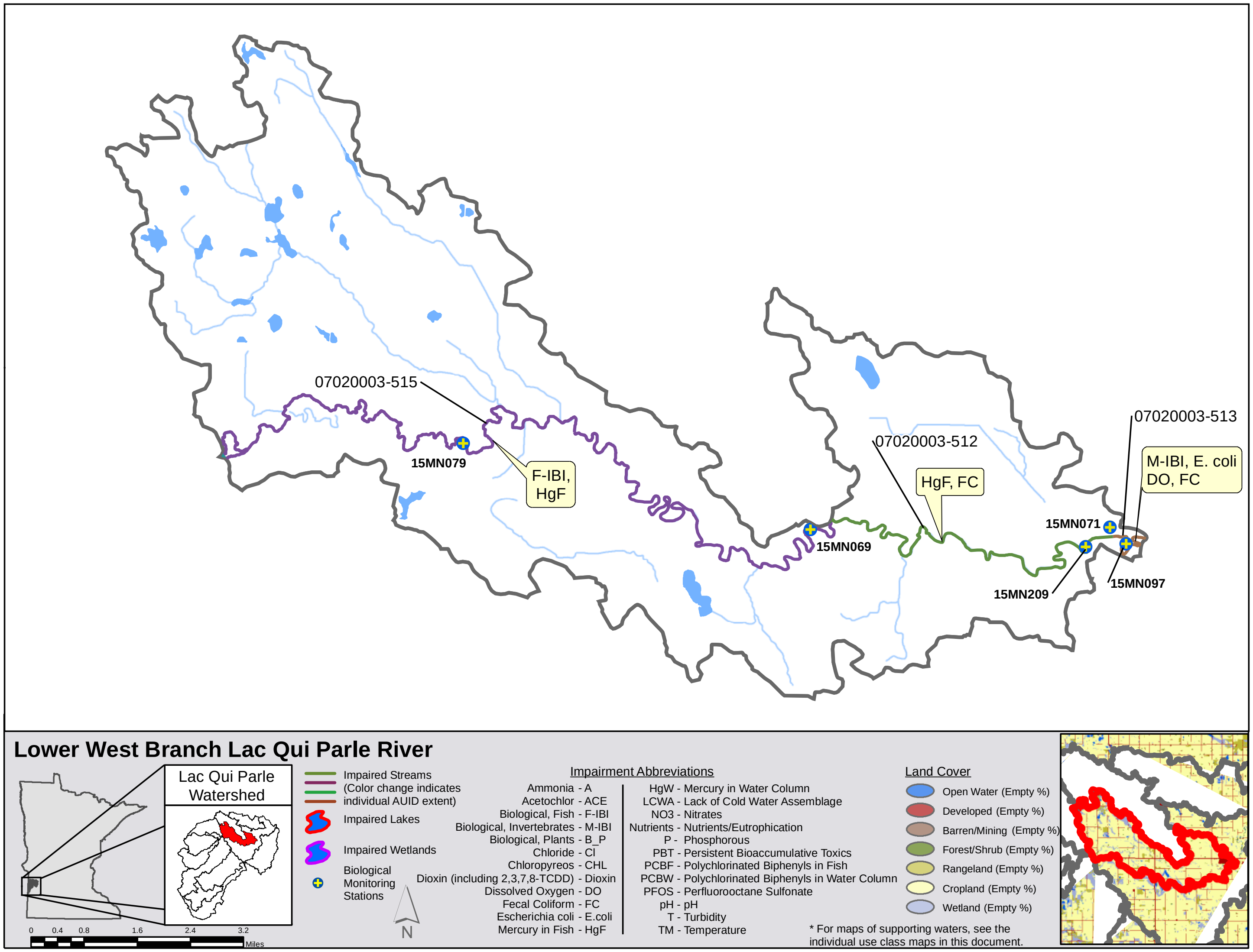
Station 15MN209 is located in Dawson, just upstream of the "rock ramp" that the Department of Natural Resources installed after removal of the dam. Even though the dam is gone, there is still an impounded section upstream of the rock ramp that includes the biological sampling reach, making it difficult (i.e., too deep) to sample macroinvertebrates effectively using the current qualitative multi-habitat protocol. Therefore, it was determined that without additional samples from a more representative location on the river there was insufficient information (IF) to make an assessment based on macroinvertebrate data.

The fish community at 15MN097 was diverse, balanced and scored well above the threshold. The macroinvertebrate community in the downstream reach did not attain the criteria for General Use streams.

A number of reaches within the subwatershed had small water chemistry datasets available; the two downstream reaches of the West Branch Lac Qui Parle River had the most notable data for assessment. The middle reach appears to be on the tipping point; available total suspended solid (TSS) indicated elevated concentrations on several dates. The downstream stream reaches are already impaired for TSS. This reach was previously listed as impaired for aquatic recreation use based on fecal coliform data in 2006. More recent *E. coli* data collected over a number of years in this current assessment window indicate that poor recreational water quality persists. A large total phosphorus (TP) dataset has a seasonal average that does not meet criteria. The chlorophyll-a dataset was small and does not clearly show a response to elevated TP concentrations. Dense in-stream vegetation and low water clarity could be playing a role in limiting algae growth. The downstream reach of the West Branch Lac Qui Parle River has less TSS or Secchi tube data available, especially during time periods with violations from the upstream reach discussed above. Additional Secchi tube data along these portions of the West Branch would help provide a more complete picture of conditions across the summer months. Poor recreational water quality was clear, triggering a new listing for aquatic recreation use based on bacteria.

Two lake basins had single data points available from Ducks Unlimited and DNR shallow lake program surveys, neither leading to a complete assessment for aquatic recreation use. Both are small, shallow basins that are probably most desirable to waterfowl enthusiasts. Maintaining good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species.

Figure 21. Currently listed impaired waters by parameter and land use characteristics in the Lower West Branch Lac qui Parle River.



Tributary to Lac qui Parle River subwatershed

Group ID: 0702000301-02

This subwatershed occupies an area of approximately 76 square miles spanning the Minnesota/South Dakota border. About two thirds of this subwatershed are on the South Dakota side of the border, with the remaining third in Minnesota's Yellow Medicine and Lincoln Counties. It principally consists of an unnamed stream and its tributaries that flow in a generally southwest to northeast direction until its confluence with the Lac qui Parle River about five miles south of the town of Canby.

Table 11. Aquatic life and recreation assessments on stream reaches: Tributary to Lac qui Parle River subwatershed.

WID ***Reach name,*** *Reach description*	Biological station ID	Reach length (miles)	Use class*	Aquatic life indicators: Fish IBI	Invert IBI	Dissolved oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	Aquatic life	Aquatic rec. (Bacteria)
07020003-530, Unnamed creek, Unnamed cr to Lac Qui Parle R	03MN044	3.05	WWg	EXS	EXS	IF	EX	EX	MTS	MTS	MTS		EX	IMP	IMP
07020003-569, Unnamed creek, Unnamed cr to Unnamed cr	15MN039	4.87	WWg	EXS	IF	IF	IF	IF		IF	IF		IF	IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 12. Lake assessments: Tributary to Lac Qui Parle River subwatershed.

							Aquatic life indicators:			Aquatic recreation indicators:				
Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi Trend	Fish IBI	Chloride	Pesticides ***	Total phosphorus	Chlorophyll-a	Secchi	Aquatic life use	Aquatic recreation use
West Twin	41-0102-00	7	1	--	NGP	--	--	--	--	IF	IF	IF	--	IF
East Twin	41-0108-00	7	--	--	NGP	--	--	--	--	IF	IF	IF	--	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

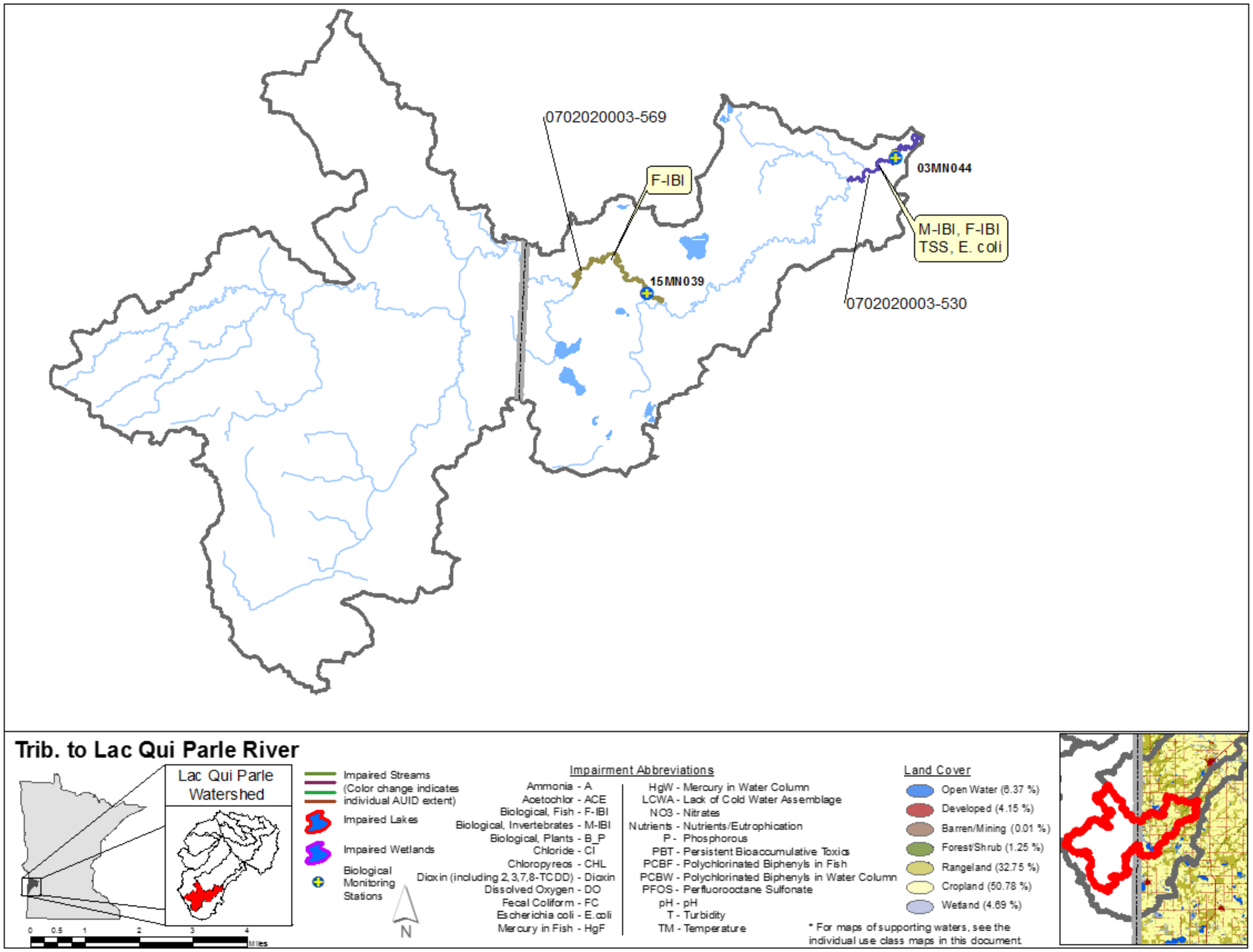
Summary

Two unnamed streams were monitored at two biological monitoring stations in this subwatershed. Both fish and macroinvertebrate communities scored below the impairment threshold at station 03MN044. Both communities exhibited high proportions of tolerant taxa and an absence of intolerant, sensitive species. Excessive nutrients appear to be impacting aquatic life in this system. The stream water was green in color and had a secchi tube visibility reading of 8 cm during the fish visit in July. Nutrient data point to a pattern of high concentrations while no response data were available to gauge response potential. The TSS dataset was collected in 2015, with 60% of samples failing to meet criteria, while Secchi tube was collected between 2015 and 2016 with a violation rate of 36%. Downstream waterbodies (e.g. Lac qui Parle River) are also impaired for turbidity; a new TSS listing was added to this reach. Bacteria data collected over two years were indicative of poor recreational water quality and triggered a listing during this assessment review.

As flows were high during the macroinvertebrate sample at station 15MN039, only fish data was considered for an aquatic life assessment. The fish community scored poorly at this station and was far below the impairment threshold; the sample was comprised of more than 99% tolerant individuals.

Two lake basins within this subwatershed had limited data from DNR shallow lake program surveys. Both basins may not be best characterized as traditional lake basins for comparison against lake eutrophication standards. Good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species, which may be the most applicable recreation use of basin within the subwatershed.

Figure 22. Currently listed impaired waters by parameter and land use characteristics in the Tributary to Lac qui Parle River subwatershed.



Upper Lac qui Parle River subwatershed

Group ID: 0702000301-01

This subwatershed occupies nearly 105 square miles on the southern end of the watershed and contains the uppermost reaches of the Lac qui Parle River mainstem. This reach of the Lac qui Parle River flows in a northeasterly direction from Lake Hendricks on the South Dakota border to the confluence with Lazarus Creek, a distance of approximately 60 river miles.

Table 13. Aquatic life and recreation assessments on stream reaches: Upper Lac qui Parle River subwatershed.

				Aquatic life indicators:											
WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-505, Lac qui Parle River, Headwaters (Lk Hendricks 41-0110-00) to Lazarus Cr (Canby Cr)	15MN036, 15MN040, 15MN041, 15MN047	61.56	WWg	EXS	EXS	MTS	EX	EX	MTS	MTS	MTS		EX	IMP	IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 14. Lake assessments: Upper Lac Qui Parle River subwatershed.

Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi Trend	Aquatic life indicators: Fish IBI	Aquatic life indicators: Chloride	Aquatic life indicators: Pesticides ***	Aquatic Recreation Indicators: Total phosphorus	Aquatic Recreation Indicators: Chlorophyll-a	Aquatic Recreation Indicators: Secchi	Aquatic life use	Aquatic recreation use
Hendricks	41-0110-00	1529	8	Shallow Lake	NGP	I	EX	MTS	--	EX	IF	MTS	NS	NS
Unnamed	41-0116-00	22	--	Shallow Lake	NGP	--	--	--	--	IF	IF	IF	--	IF
Kvernmo Marsh	41-0095-00	--	--	--	NGP	--	--	--	--	IF	--	IF	--	IF
Unnamed	41-0115-00	2	--	--	NGP	--	--	--	--	IF	IF	--	--	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains

Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data

Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information

Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)

Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

Fishes and macroinvertebrates were sampled at four biological stations along this reach of stream. Fish communities scored well below the impairment threshold and lower CI in five visits. The upstream most station (15MN036) exhibited the lowest score; the sample was dominated by the very tolerant fathead minnow. At station 15MN040, multiple minnow hybrids were collected that appeared to be the result of introgression between common shiners and hornyhead chubs. Macroinvertebrate communities demonstrated a similar trend as macroinvertebrate community scores increased towards the downstream end of the assessment unit – even meeting general aquatic life expectations in some locations – yet may be on the brink of impairment as well.

This reach of the Lac qui Parle River has a history of poor recreational and aquatic life related water quality. The reach was listed impaired for turbidity in 2006 based on numerous violations from multiple stations across the entire reach. More recent total suspended solid (TSS) and Secchi tube (Stube) data was available between 2007 and 2015, with many violations from midpoint and downstream end of this reach, confirming the initial listing for turbidity. Direct and indirect impacts from sediment loading are one of the leading stressors to aquatic communities within this reach and the Lac qui Parle River as a whole. Restoration work has been underway since the initial listing. Total phosphorus data collected over three years of the assessment exceeds the threshold; there was no data available to determine if excess productivity was occurring as a result. Other aquatic life use related parameters do not appear to be stressing aquatic communities. Fecal coliform data triggered an aquatic recreation use listing during an assessment effort in 2006, more recent *E. coli* data confirms the impairment still exists. Restoration work has been underway since the initial listing.

Lake Hendricks water quality has long been a hot topic regionally, the basin was assessed against lake eutrophication shallow water criteria in 2009 triggering an aquatic recreation use listing based on violating total phosphorus (TP) and chlorophyll-a (chl-a) datasets from 2007 and 2008. TMDL work was completed by South Dakota Department of Environment & Natural Resources; reviewing more recent data during this assessment suggests there may be small improvements beginning to occur. The chl-a seasonal average has rebounded to just meeting standard using data from the current assessment window, although there are two months in 2015 that dense algal blooms are apparent. A long term water clarity trend was calculated using a large historical Secchi disk dataset bolstered by citizen monitoring, with an improving trend in water clarity detected. Whether water quality fluctuations is a form of short term variability or long term improvement, further investigation and implementation work should continue to return this basin to a healthy recreational source for the local citizens and economy. Ongoing water quality issues will need to continue involving multiple jurisdictions as most of the contributing watershed is in South Dakota. Fish community data was available on this Lake Hendricks from DNR; surveys were conducted over three years between 2011 and 2016. All fish IBI scores fell below criteria, attributed to low number of insectivore fish species and high proportion of tolerant species biomass in trap nets. A stressor analysis identifies watershed disturbance as the most likely issue for aquatic life, shoreline analysis indicates slightly above average conditions to support aquatic life compared to statewide average.

County Ditch 4 subwatershed — Group ID: 0702000307-02

County Ditch 4 drains an area of approximately 54 square miles in central Lac qui Parle County, flowing in a generally easterly direction from the town of Madison to the Lac qui Parle River, approximately 12 miles upstream of its confluence with the Minnesota River. Excluding the downstream-most mile of County Ditch 4 before its confluence with the Lac qui Parle River, the entirety of this subwatershed consists of channelized streams.

Table 15. Aquatic life and recreation assessments on stream reaches: County Ditch 4 subwatershed.

WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Aquatic life indicators:** Fish IBI	Invert IBI	Dissolved oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides	Eutrophication	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-575, Unnamed ditch, Headwaters to Unnamed ditch	15MN093	4.07	WWm	EXS	EXS	IF	IF	IF		IF			IF	IMP	
07020003-581, Unnamed ditch (County Ditch 4), Unnamed ditch to CSAH 20		3.09	WWg	NA	NA	IF	MTS	MTS	MTS	MTS	MTS		MTS	IF	IMP
07020003-582, Unnamed ditch (County Ditch 4), CSAH 20 to Lac Qui Parle R	15MN091	1.43	WWg	EXS	EXS	IF		IF		IF				IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

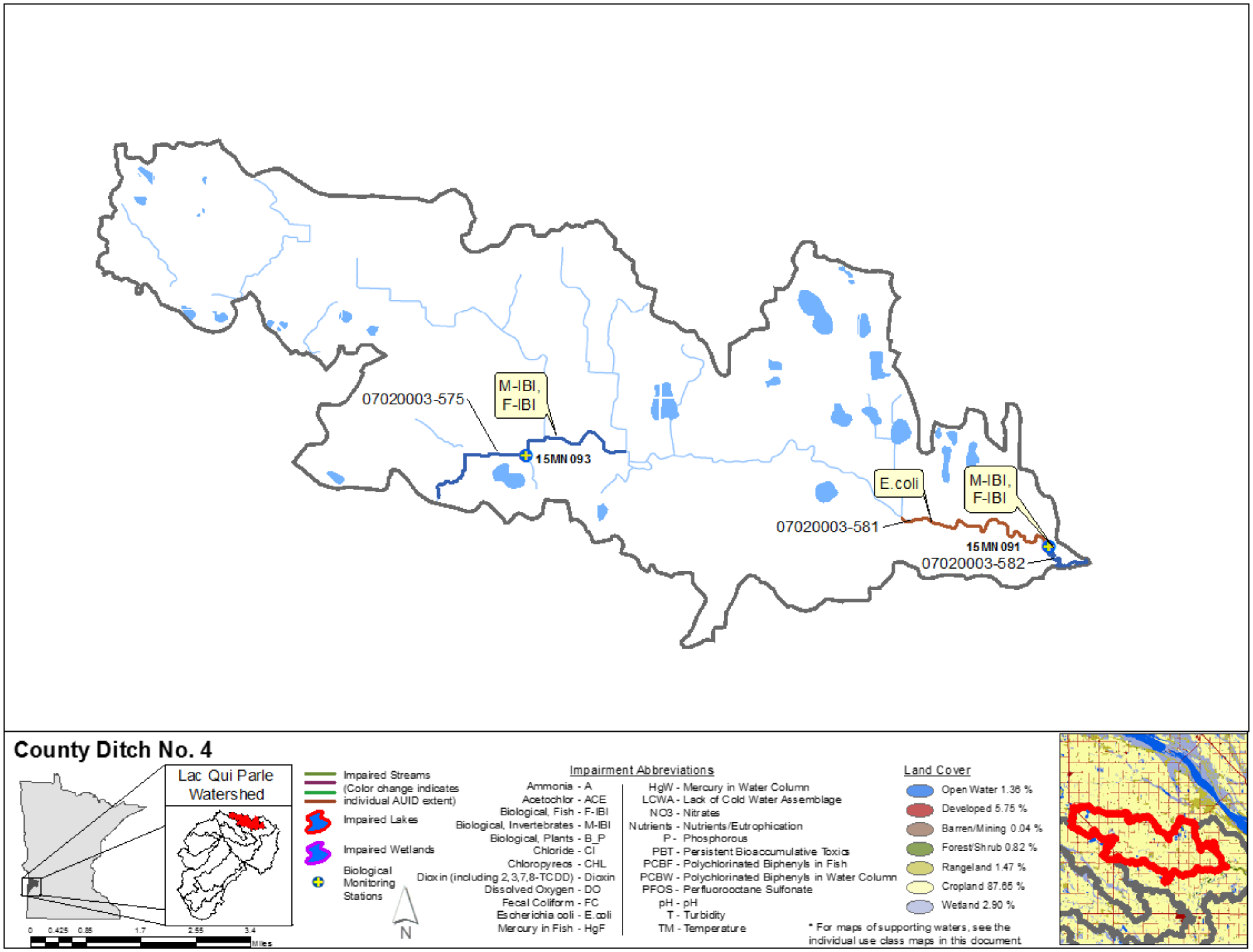
Summary

Both streams that were monitored for fish and macroinvertebrates in this subwatershed failed to meet their respective aquatic life use criteria. Fish and macroinvertebrate communities were sampled in separate visits at two biological monitoring stations in this subwatershed: one (15MN093) located on an unnamed ditch just east of Madison and another (15MN091) on County Ditch 4 approximately 1.5 miles upstream of the confluence with the Lac qui Parle River.

At the upstream station (15MN093), the habitat was poor (MSHA scores <25), and fish and macroinvertebrate communities were characterized by a lack of overall diversity, a dominance of tolerant taxa, and very low IBI scores. Although the downstream station (15MN091) was located on a natural stream segment with a forested riparian corridor, neither biological community met the aquatic life criteria for a general use. Both stations showed evidence of elevated nutrients with excessive growth of algae and/or duckweed. At the channelized station (15MN093), a lack of significant flow exacerbated the nutrient issue, resulting in low dissolved oxygen concentrations and a macroinvertebrate community typical of a wetland.

The outlet reach of County Ditch 4 had dissolved oxygen (DO) data with large swings in values; two early morning samples failed to meet the 5 mg/L criteria. Further investigation into daily DO fluctuations would be beneficial to determine if the variability is stressing aquatic communities. Bacteria data over two years of data collection reveals persistently elevated *E. coli* concentrations, resulting in poor recreational water quality.

Figure 23. Currently listed impaired waters by parameter and land use characteristics in the County Ditch 4 subwatershed.



Tenmile Creek subwatershed — Group ID: 0702000306-01

The Tenmile Creek subwatershed drains an area of approximately 120 square miles in the eastern portion of the Lac qui Parle Basin. It is nearly entirely drained by a network of channelized ditches that feed into Ten Mile Creek, which is itself nearly completely channelized; only the final four miles of this system are in a natural channel condition until it meets the Lac qui Parle River just west of Montevideo.

Table 16. Aquatic life and recreation assessments on stream reaches: Tenmile Creek subwatershed.

WID *Reach name,* *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Aquatic life indicators:**										**Aquatic life**	**Aquatic rec. (Bacteria)**
				Fish IBI	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**		
07020003-526, County Ditch 34, Unnamed ditch to Tenmile Cr	15MN077	5.07	WWm	MTS	EXS	IF	IF	MTS		IF			IF	IMP	
07020003-570, Unnamed ditch, Unnamed ditch to Tenmile Cr	15MN050	1.19	WWm	MTS	EXS	IF	IF	IF		IF			IF	IMP	
07020003-571, Unnamed ditch, Unnamed ditch to Tenmile Cr	15MN058	1.20	WWm	MTS	EXS	IF	IF	IF		IF			IF	IMP	
07020003-577, Tenmile Creek, Headwaters to CSAH 18	15MN054, 15MN056, 15MN075	24.96	WWm	EXS	EXS	MTS	MTS	MTS		IF	IF		MTS	IMP	IMP
07020003-578, Tenmile Creek, CSAH 18 to Lac Qui Parle R	15MN087, 90MN005	6.77	WWg	EXS	EXS	MTS	IF	MTS	MTS	MTS	MTS		IF	IMP	IMP

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
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Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule

Table 17. Lake assessments: Tenmile Creek subwatershed.

Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi Trend	Aquatic life indicators:			Aquatic recreation indicators:			Aquatic life use	Aquatic recreation use
							Fish IBI	Chloride	Pesticides ***	Total phosphorus	Chlorophyll-a	Secchi		
Miller	87-0102-00	49	--	Shallow Lake	WCBP	--	--	--	--	IF	--	IF	--	IF
Unnamed	37-0056-00	74	--	--	WCBP	--	--	--	--	IF	--	--	--	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: ☐ = existing impairment, listed prior to 2014 reporting cycle; ☐ = new impairment; ☐ = full support of designated use; ☐= insufficient information.

Summary

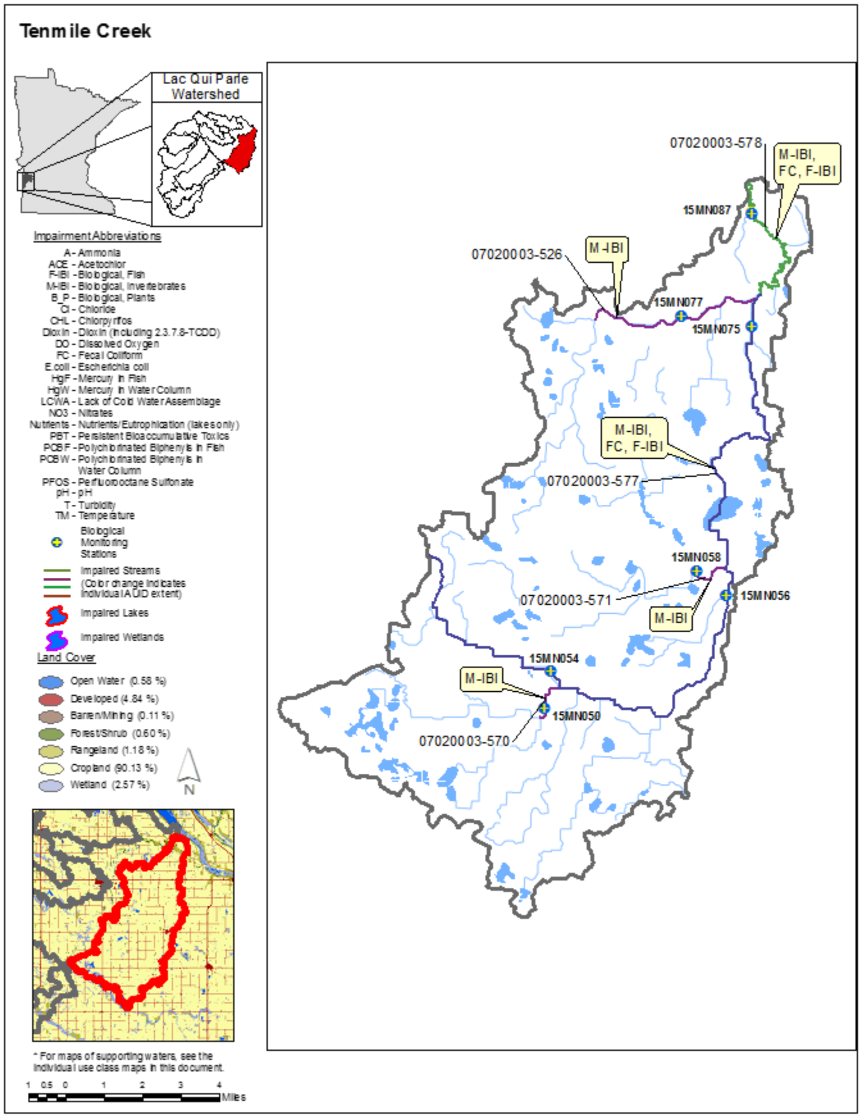
Fishes and aquatic macroinvertebrates were sampled at seven monitoring stations in this subwatershed, six of which were channelized streams that were assessed for Modified Use. Fish community scores on three tributaries to Tenmile Creek met the Modified Use threshold, while samples from three stations on the upstream, channelized portion of Tenmile Creek consistently did not meet the standard and the existing FIBI impairment was carried forward. The downstream reach of Tenmile Creek with a natural channel was assessed under General Use criteria. One visit from one station sampled in 2015 scores at the general use threshold. However, there are two expired and/or non-reportable visits from one station sampled in 1990 and 2010 as part of the MRAP project. The sampling length and effort on these visits are sufficient to justify their use as supporting information. Both visits score below threshold and below lower confidence interval.

A relatively robust data set from this subwatershed indicates that aquatic macroinvertebrate communities are severely degraded in both Modified and General Use streams. Three stations had MIBI scores below 10 and several more scored below 20, representing the worst collection of scores obtained in the Lac qui Parle River watershed. Macroinvertebrate monitoring at several stations yielded samples that were typified by very low taxa richness, zero intolerant taxa, and dominated by a handful of tolerant taxa. Based on the type of macroinvertebrates present and limited data suggesting highly fluctuating dissolved oxygen concentrations – detrimental to aquatic communities – it is likely that elevated nutrients are a key stressor for the observed impairments. However, given the severity of the impairments, the contribution of other stressors (e.g., pesticides) should not be ruled out.

Previous assessment of recreational water quality on Tenmile Creek in 2006 has resulted in two impaired listings based on fecal coliform data; more recent *E. coli* data available for both reaches revealed bacteria concentrations are still persistently elevated. Total suspended solid (TSS) dataset was relatively small, with two violations from May and June 2015, a more robust Secchi tube (STUBE) dataset had limited violations over six years.

Single data points exist on small basins associated with surveys conducted by the DNR shallow lakes program. Lake eutrophication standards may not be ideal for comparison; small, shallow basins in this subwatershed do not fit traditional lake criteria, but are potentially good waterfowl recreation areas that would benefit from improved water quality.

Figure 24. Currently listed impaired waters by parameter and land use characteristics in the Tenmile Creek subwatershed



Lower Lac qui Parle River subwatershed

Group ID: 0702000307-01

This subwatershed contains the lowermost reaches of the Lac qui Parle River and occupies an area of nearly 130 square miles in Lac qui Parle County. It is a flow through watershed that receives all of the outlets of the eleven other subwatersheds in the basin for a total drainage area of 1100 square miles. The bulk of the lower order tributaries are channelized, but the mainstem of this river maintains a natural channel throughout this subwatershed.

Table 18. Aquatic life and recreation assessments on stream reaches: Lower Lac qui Parle River subwatershed.

				Aquatic life indicators:											
WID ***Reach name,*** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-501, Lac qui Parle River, W Br Lac Qui Parle R to Tenmile Cr	10EM003, 15MN082, 15MN084, 15MN088, 90MN004	25.83	WWg	MTS	EXS	EX	EX	IF	MTS	MTS	MTS	EXS	EX	IMP	IMP
07020003-502, Lac qui Parle River, Tenmile Cr to Minnesota R	15MN092	2.71	WWg	NA	IF	IF	IF	IF	MTS	MTS	MTS		EX	IF	IMP
07020003-506, Lac qui Parle River, Lazarus Cr (Canby Cr) to W Br Lac Qui Parle R	03MN051, 15MN055, 15MN060, 15MN068	28.44	WWg	MTS	MTS	IF	EX	EX		MTS	MTS		EX	IMP	IMP
07020003-534, Unnamed creek, CD 29A to Lac Qui Parle R	15MN062	2.20	WWg	EXS	NA	IF	IF	IF		IF	IF		IF	IMP	
07020003-588, Unnamed creek, -95.9114, 45.012 to Lac qui Parle R	15MN090	1.15	WWg	EXS	EXS									IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 19. Lake assessments: Lower Lac Qui Parle River Aggregated 12-HUC.

Lake name	DNR ID	Area (acres)	Max depth (ft)	Assessment method	Ecoregion	Secchi Trend	Aquatic life indicators: Fish IBI	Aquatic life indicators: Chloride	Aquatic life indicators: Pesticides	Aquatic recreation indicators: Total phosphorus	Aquatic recreation indicators: Chlorophyll-a	Aquatic recreation indicators: Secchi	Aquatic life use	Aquatic recreation use
Unnamed	37-0100-00	25	--	Shallow Lake	WCBP	--	--	IF	--	IF	IF	IF	IF	IF
Andrew	37-0026-01	21	--	Shallow Lake	WCBP	--	--	IF	--	IF	IF	IF	IF	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

Fishes and macroinvertebrates were monitored at eleven stations in this subwatershed: nine on the three reaches of the river's mainstem, and on two separate channelized tributaries. In five fish sampling visits at the three stations along the upstream reach of the Lac qui Parle River, some scores fell below the threshold, but the system appears to be supporting a diverse and balanced community sufficient to meet the General Use standard. In general, fish community scores improve moving along this reach in a downstream direction. MIBI scores indicated support of the aquatic life designated use.

A sizable dataset was collected to assess fish communities on the middle reach of the Lac qui Parle River in this subwatershed; fishes were sampled six times at the four stations along this reach. Although some of the scores fell below the General Use threshold, it was determined that the fish communities are of suitable diversity and composition to indicate that aquatic life standards are being met. Along this middle reach of the Lac qui Parle River, the macroinvertebrate community is impaired but is very close to meeting aquatic life use goals at most of the stations along this reach. Even though there are other types of aquatic life impairments on this reach, the biological monitoring data suggests that it may be a high priority for restoration given the “barely” impaired macroinvertebrate community. Although both fish and macroinvertebrate communities met the standard, this reach does not meet full support for aquatic life use due to its existing impairments for turbidity.

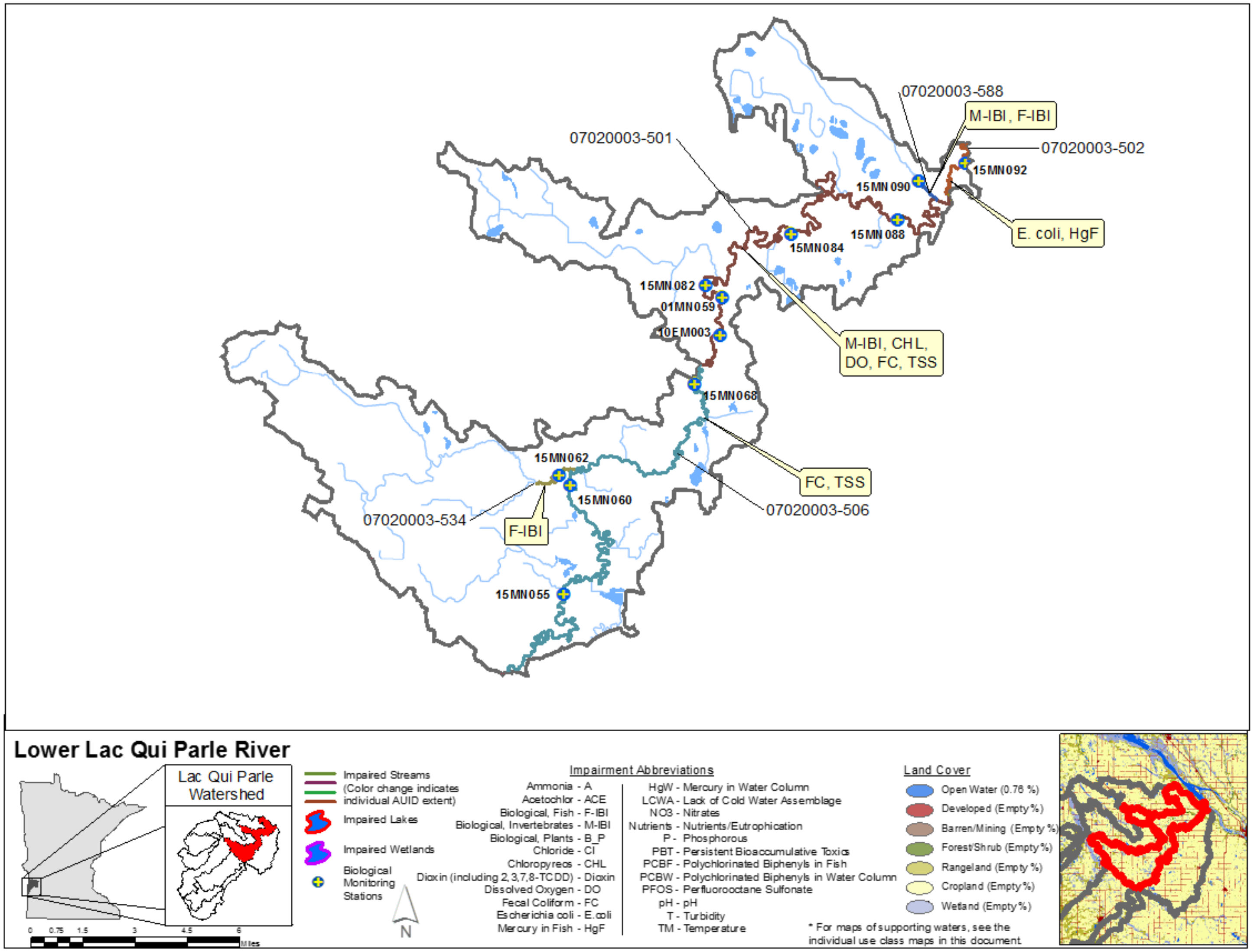
The downstream reach of the Lac qui Parle River was not assessed for F-IBI due to its naturally impounded condition where it meets the Minnesota River in Lac qui Parle State Park. Overall, the results from both Lac qui Parle River assessment units suggest that this river is hovering around aquatic life use criteria and may deserve a high priority when it comes to developing restoration and protection strategies.

Fish community scores failed to meet the standard on either of the channelized, unnamed tributaries. The poorly scoring fish community at station 15MN092 is likely an artifact of a perched culvert downstream of the site that almost certainly affects fish passage for much of the year.

The majority of Lac qui Parle River reaches within this subwatershed have undergone past assessment efforts from 2006 based on available water chemistry, resulting in previous listings on two of the downstream reaches. The upstream reach has exiting turbidity and bacteria impairments, and separate TMDLs have been underway since that time to address both issues. Recent data confirm that the impaired conditions remain. The next downstream Lac Qui Parle reach had similar turbidity and fecal coliform impairments; more recent TSS and STUBE data confirm the initial listing. Dissolved oxygen (DO) was assessed in 1994 resulting in an impairment based on two minor violations in a small dataset from one station (S001-112) on the upstream end of this reach. Extensive amounts of recent DO data does not have a single violation throughout the entire assessment window, but was collected predominately at the downstream end of the reach (S003-087), 20 miles downstream from the original listing dataset. Past dischargers may have been driving locally low DO concentrations where the violations occurred; local knowledge suggests that situation may no longer exist. To pursue a DO delisting in the future, at least two years of data from a station in close proximity to the original listing station (S001-112) would be needed. Pesticide (chlorpyrifos) data collected by the Minnesota Department of Agriculture in 2014, 2015, and 2016 revealed four samples in violation of toxicity based standard, which resulted in a new pesticide impairment added during this assessment effort.

Single visits to small, shallow lake basins within the subwatershed are associated with national lake assessment monitoring visits in 2012. Lake criteria for this project differs from lake eutrophication criteria typically used in monitoring efforts; this survey favors small basins in this area. Although traditional lake eutrophication goals may not be commonly associated with basins of this type, maintaining good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species.

Figure 25. Currently listed impaired waters by parameter and land use characteristics in the Lower Lac qui Parle River subwatershed.



Lazarus Creek subwatershed

Group ID: 0702000302-01

The Lazarus Creek subwatershed occupies about 133 square miles in the south central portion of the Lac qui Parle Basin, approximately 18 square miles of which are in South Dakota. Nearly all of the first order streams in this watershed are channelized, but portions of Canby Creek and Lazarus Creek remain in a natural channel condition. These two streams flow in a northeasterly direction until they meet northeast of Canby. Lazarus Creek flows into the Lac qui Parle River about 15 miles northeast of Canby. The portion of Canby Creek upstream of Del Clark Lake represents the only coldwater-designated stream in the Lac qui Parle Watershed.

Table 20. Aquatic life and recreation assessments on stream reaches: Lazarus Creek subwatershed.

				Aquatic life indicators:											
WID ***Reach name*,** *Reach description*	**Biological station ID**	**Reach length (miles)**	**Use class***	**Fish IBI**	**Invert IBI**	**Dissolved oxygen**	**TSS**	**Secchi Tube**	**Chloride**	**pH**	**Ammonia -NH_3**	**Pesticides**	**Eutrophication**	**Aquatic life**	**Aquatic rec. (Bacteria)**
07020003-508, Lazarus Creek (Canby Creek), Canby Cr to Lac Qui Parle R	15MN049	21.64	WWg	EXS	EXS	IF	EX	EX	MTS	MTS	MTS		MTS	IMP	IMP
07020003-509, Lazarus Creek, MN/SD border to Canby Cr	15MN043, 15MN045, 15MN102, 90MN003	25.20	WWg	EXS	EXS	IF	IF	MTS		IF	IF		IF	IMP	
07020003-557, Canby Creek, T114 R46W S21, south line to Del Clark Lk	09MN093	9.72	CWg	EXS	EXS	IF	IF	IF		IF	IF		IF	IMP	
07020003-560, Judicial Ditch 1, Unnamed ditch to CD 42	15MN053	2.12	WWm	MTS	MTS	IF	IF	IF		IF	IF		IF	SUP	
07020003-586, Canby Creek, CSAH 3 to Lazarus Cr	15MN044	4.48	WWm	EXS	MTS	IF	IF	IF		IF	IF		IF	IMP	

Abbreviations for Indicator Evaluations: **MTS** = Meets Standard; **EXS** = Fails Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **SUP** = Full Support (Meets Criteria); **IMP** = Impaired (Fails Standards)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.
Abbreviations for Use Class: **WWg** = warmwater general, **WWm** = Warmwater modified, **WWe** = Warmwater exceptional, **CWg** = Coldwater general, **CWe** = Coldwater exceptional, **LRVW** = limited resource value water
*Assessments were completed using proposed use classifications changes that have not yet been written into rule.

Table 21. Lake assessments: Lazarus Creek subwatershed.

Lake name	DNR ID	Area (acres)	Max Depth (ft)	Assessment method	Ecoregion	Secchi Trend	Aquatic life indicators: Fish IBI	Aquatic life indicators: Chloride	Aquatic life indicators: Pesticides ***	Aquatic recreation indicators: Total phosphorus	Aquatic recreation indicators: Chlorophyll-a	Aquatic recreation indicators: Secchi	Aquatic life use	Aquatic recreation use
Unnamed	41-0109-00	75	11	Shallow Lake	NGP	--	--	--	--	IF	--	--	--	IF
Del Clark	87-0180-00	149	30	Deep Lake	NGP	--	--	--	--	MTS	MTS	MTS	--	FS
Unnamed	41-0142-00	--	--	--	NGP	--	--	--	--	IF	--	--	--	IF

Abbreviations for Ecoregion: DA = Driftless Area, NCHF = North Central Hardwood Forest, NGP = Northern Glaciated Plains, NLF = Northern Lakes and Forests, NMW = Northern Minnesota Wetlands, RRV = Red River Valley, WCBP = Western Corn Belt Plains
Abbreviations for Secchi Trend: D = decreasing/declining trend, I = increasing/improving trend, NT = no detectable trend, -- = not enough data
Abbreviations for Indicator Evaluations: -- = No Data, **MTS** = Meets Standard; **EX** = Exceeds Standard; **IF** = Insufficient Information
Abbreviations for Use Support Determinations: -- = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **FS** = Full Support (Meets Criteria); **NS** = Not Support (Impaired, exceeds standard)
Key for Cell Shading: = existing impairment, listed prior to 2014 reporting cycle; = new impairment; = full support of designated use; = insufficient information.

Summary

Fishes and aquatic macroinvertebrates were monitored at seven locations in this subwatershed. Fish community scores did not meet General aquatic life use standards at any of the locations on Canby or Lazarus Creeks. The fish community on the channelized portion of Canby Creek downstream of Canby was dominated by the highly tolerant fathead minnow and scored far below the modified use standard. Fish community composition scored above the Modified Use standard on Judicial Ditch 1. This reach of stream represents the only reach in the entirety of the Lac qui Parle Basin that met aquatic life use standards for both fish and macroinvertebrates, albeit it for Modified Use.

Macroinvertebrates failed to attain general aquatic life use expectations in this subwatershed while meeting aquatic life expectations in streams that were determined to be habitat-limited due to channelization (i.e., Modified Use).

This subwatershed contains the only coldwater-designated stream in the Lac qui Parle Watershed, Canby Creek upstream of Del Clark Lake. This reach of Canby Creek is a Designated Trout Stream in MN rule 7050; however, data collected by MPCA in 2010 and 2015 suggest that the thermal regime in this reach may not be capable of supporting coldwater communities. Fish and macroinvertebrate surveys at this location noted an absence of coldwater obligate taxa in both communities. A continuous temperature logger placed on this reach (May to September 2015) suggested marginal suitability for coldwater fish. An overall average summer temperature of 18.75 degrees Celsius was observed between June 1 and August 31. Water temperatures fell within the "stress" range for brook trout for 34% of this summer interval.

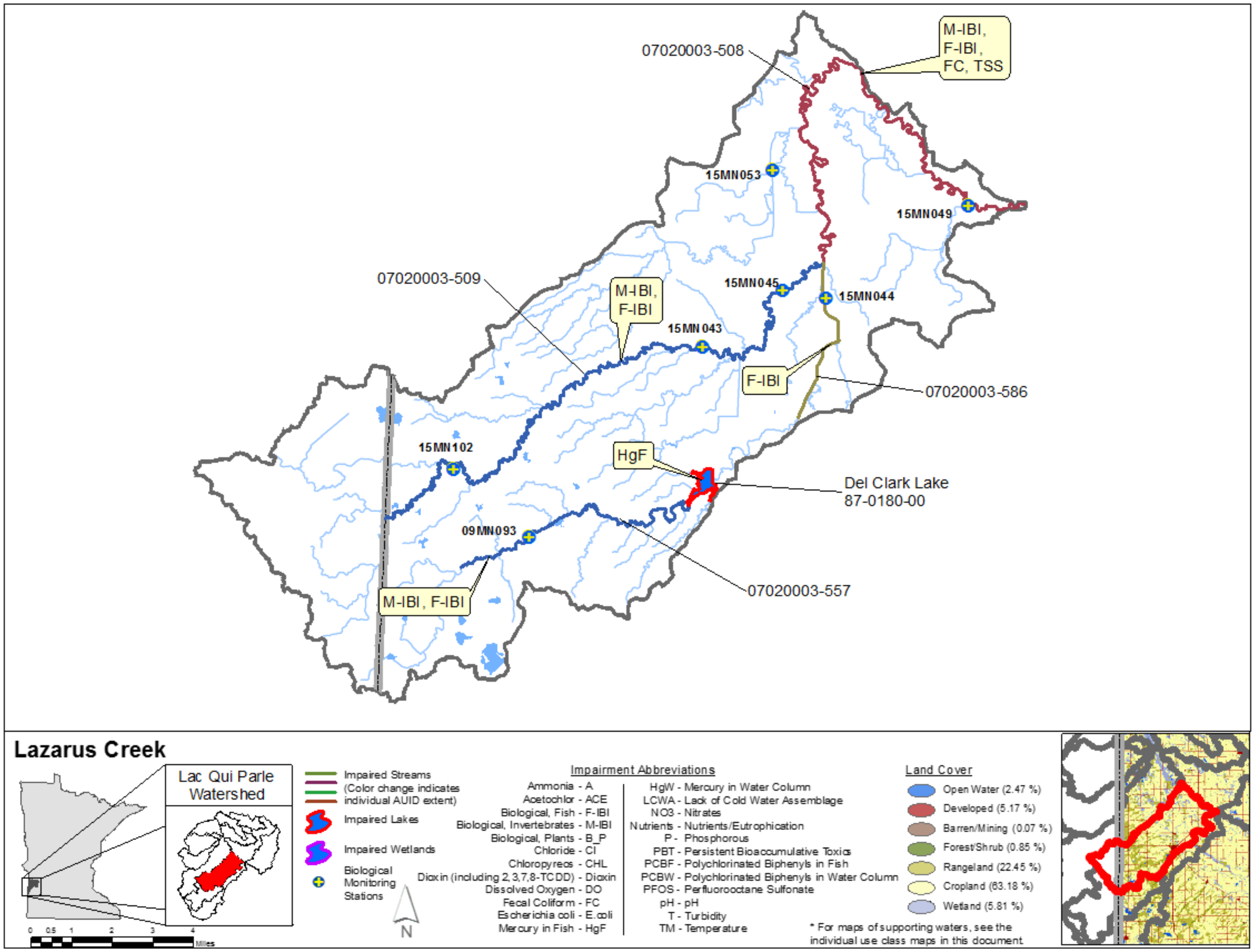
DNR population assessments in 1987, 1988, 1990 and 1993 found Canby Creek to provide marginal conditions for brown trout. In spring longitudinal surveys of this reach, brown trout were only sampled at or near stocking locations, and little to no over-winter survivorship was observed; no carry-over trout were sampled in any of these four assessments. Low summer flows and high water temperatures, due in part to loss of riparian habitat and cattle grazing/trampling, were cited as challenges to maintaining a put and take fishery in Canby Creek.

A use class change from coldwater to warmwater was considered for this reach given the aquatic community and temperature data. However, given that this stream represents a very unique resource in the region, the DNR has been pursuing riparian improvements, BMPs, removal of control structures that impound the stream, and increased angler access. In 2017, the DNR resumed stocking of brown trout and intends to manage a put and take fishery. The decision was made to maintain the coldwater designation and revisit the matter with more data in 2025.

The outlet reach of Lazarus (Canby) creek had the most notable water chemistry datasets available throughout the subwatershed. Past assessment in 2006 resulted in impairment listings for aquatic life and recreation use based on turbidity and fecal coliform datasets collected between 2001 and 2003. More recent data confirms both listings; restoration activities have been underway since 2006. Reviewing small datasets from upstream reaches appears to indicate water quality degrades downstream of the confluence of Lazarus and Canby creeks. Total phosphorus concentrations are relatively low in relation to other streams within the watershed and impoundments are potentially playing a role in nutrient concentrations in the downstream reach.

Del Clark Lake, located in Stonehill Regional Park, should be considered a water quality gem of the region, one of the few waterbodies that can support healthy swimming and fishing opportunities. All three lake eutrophication parameters easily meet water goals, local efforts should continue to be made to insure good water quality remains for future generations of recreational users. Technically an impoundment of Canby creek, the stream will undoubtedly playing a role in the future water quality of Del Clark Lake. Citizen monitoring would be ideal to track water quality changes between IWM cycles. Two small, shallow basins more representative of waterbody types in the subwatershed had survey information from the DNR Shallow Lakes Program. Although traditional lake eutrophication goals may not be commonly associated with basins of this type, maintaining good water quality and clarity will encourage native plant communities that are more attractive to a variety of waterfowl species.

Figure 26. Currently listed impaired waters by parameter and land use characteristics in the Lazarus Creek subwatershed.



Watershed-wide results and discussion

Assessment results and data summaries are included below for the entire 8-HUC watershed unit of the Lac qui Parle River Watershed, grouped by sample type. Summaries are provided for lakes, streams, and rivers in the watershed for the following: aquatic life and recreation uses, aquatic consumption results, load monitoring data results, and transparency trends. Waters identified as priorities for protection or restoration work were also identified. Additionally, groundwater and wetland monitoring results are included where applicable.

Following the results are a series of graphics that provide an overall summary of assessment results by designated use, impaired waters, and fully supporting waters within the entire Lac qui Parle River Watershed.

Stream water quality

40 of the 80 stream WIDs were assessed (Table 22) Of the assessed streams, only one stream was considered to be fully supporting of aquatic life and no streams were fully supporting of aquatic recreation. Seven WIDs were classified as limited resource waters and assessed accordingly.

Throughout the watersheds, 32 WIDs are non-supporting for aquatic life and/or recreation. Of those WIDs, 22 are non-supporting for aquatic life and 40 are non-supporting for aquatic recreation.

Table 22. Assessment summary for stream water quality in the River Watershed.

				Supporting		Non-supporting			
Watershed	**Area (acres)**	**# Total WIDs**	**# Assessed WIDs**	**# Aquatic life**	**# Aquatic recreation**	**# Aquatic life**	**# Aquatic recreation**	**Insufficient data**	**# Delistings**
Lac qui Parle River **HUC 8**	487022	80	40	1	**0**	22	40		
Co. Ditch Five	37875	4	1	NA	0	NA	1		
Lost Creek	49452	6	3	0	0	3	1		
Upper W. Br. LqP River	53536	2	2	0	0	2	2		
Trib. To W. Br. LqP River	31910	2	1	0	0	1	1		
Florida Creek	95987	8	2	0	0	2	1		
Lwr. W. Br. LqP River	38182	7	3	0	0	2	3		
Trib. To LqP River	48768	4	2	0	0	2	1		
Upper LqP River	67008	1	1	0	0	1	1		
Co. Ditch Four	34515	5	3	0	0	2	1		
Tenmile Creek	77798	6	5	0	0	4	1		
Lwr. LqP River	81728	10	5	0	0	4	3		
Lazarus Creek	85651	26	5	1	0	4	1		

Lake water quality

Lake Hendricks is the highest profile basin within the watershed, with considerable data available for this assessment effort resulting in a new aquatic life use impairment, and a confirmed recreation use impairment. Hendricks does show small signs that water quality may be improving, continued focused efforts by multiple jurisdictions will have positive impacts going forward. Despite heavy land use modification and altered hydrology within the contributing watershed, Del Clark Lake is highlighted by meeting recreation use criteria, prioritization efforts will be vital to ensure future water quality will maintain healthy swimming and boating opportunities. Numerous other small, shallow basins scattered throughout the watershed had limited datasets available that did not allow for complete recreation use assessment, most of this data was collected to support the Shallow Lake Wildlife Program or the National Lakes Assessment. Subwatersheds with no lake data involved in this assessment were removed from Table 23.

Table 23. Assessment summary for lake water chemistry in the Lac Qui Parle River Watershed.

			Supporting		Non-supporting			
Watershed	**Area (acres)**	**Lakes >10 acres**	**# Aquatic life**	**# Aquatic recreation**	**# Aquatic life**	**# Aquatic recreation**	**Insufficient data**	**# Delistings**
Lac Qui Parle River **HUC 8**	**487024**	**19**	**--**	**1**	**1**	**1**	**17**	**--**
County Ditch 5	18746	1	--	--	--	--	1	--
Trib. to West Branch Lac Qui Parle River	31910	2	--	--	--	--	2	--
Lower West Branch Lac Qui Parle River	38181	2	--	--	--	--	2	--
Trib. to Lac Qui Parle River	16100	2	--	--	--	--	2	--
Upper Lac Qui Parle River	39915	5	--	--	1	1	3	--
County Ditch 4	34515	1	--	--	--	--	1	--
Lazarus Creek	71025	2	--	1	--	--	2	--
Tenmile Creek	77796	2	--	--	--	--	2	--
Lower Lac Qui Parle River	81722	2	--	--	--	--	2	--

Fish contaminant results

Mercury and polychlorinated biphenyls (PCBs) were analyzed in fish tissue samples collected from the Lac Qui Parle River in 2015, by the MPCA biomonitoring staff. Samples had previously been collected by DNR fisheries staff in 1984 and 2007. Three lakes were sampled for fish contaminants in the watershed: Marietta Kids Fishing Pond (37-0355), Hendricks (41-0110), and Del Clark (87-0180). Samples from the lakes were collected between 1991 and 2013.

Lac Qui Parle River is on the 2018 Impaired Waters Inventory (IWI) for mercury in fish tissue; the four WIDs for the river were added to the IWI in 2010. In 2015, only two fish were collected from the river: one Northern pike and one Common carp. PCBs were tested in all species collected in 1984 and 2015 (Table 24). All, except a composite of three Common carp in 1984, were was less than the reporting limits.

The three lakes with fish contaminant results are on the IWI. PCB concentrations from the three lakes were less than the reporting limits.

Lac Qui Parle River, as well as Hendricks and Del Clark lakes, qualified for inclusion in the Minnesota Statewide Mercury TMDL.

Table 24. Fish contaminants: summary of fish length, mercury, and PCBs by waterway-species-year

							Length (in)			Mercury (mg/kg)			PCBs (mg/kg)			
WID / RIVER	Waterway / Location	Species	Year	Anatomy [1]	Total Fish	Number Samples	Mean	Min	Max	Mean	Min	Max	N	Mean	Max	< RL
LAC QUI PARLE R.*	RM 8.8, W BR AT HWY 75, 4 MI S OF MADISON	Common carp	1984	FILSK	2	1	18.5	18.5	19	0.720	0.720	0.720	1	0.05	0.05	Y
(07020003-515, 07020003-516, 07020003-519, 07020003-512)	RM 0.7, W BR BELOW DAM AT DAWSON	Common carp	1984	FILSK	3	1	18	18	18	0.080	0.080	0.080	1	0.23	0.23	
		Northern pike	1984	FILSK	3	1	19	19	19	0.290	0.290	0.290	1	0.05	0.05	Y
		Walleye	1984	FILSK	3	1	16	16	16	0.250	0.250	0.250	1	0.05	0.05	Y
	RM 18, MAIN BR AT HWY 56 S OF DAWSON	Northern pike	1984	FILSK	2	1	19	19	19	0.240	0.240	0.240	1	0.05	0.05	Y
	RM 1.5-3.0, WEST BRANCH, ABOVE DAWSON DAM	Northern pike	2007	FILSK	5	5	22.7	17.8	26	0.316	0.21	0.46				
	AT CR 33, 1 MI NE OF LAC QUI PARLE	Channel catfish	2015	FILET	1	1	24.3	24.3	24	0.224	0.234	0.234	1	0.025	0.025	Y
		Common carp	2015	FILSK	1	1	26.2	26.2	26	0.073	0.073	0.073	1	0.025	0.025	Y
37035500	MARIETTA KIDS FISHING POND**	Common Carp	2013	FILSK	3	1	28.8	28.8	28.8	0.145	0.145	0.145	1	0.025	0.025	Y
		Largemouth bass	2013	FILSK	3	3	14.1	11.4	16.8	0.536	0.426	0.722	1	0.025	0.025	Y
41011000	HENDRICKS*	Black bullhead	1991	FILET	8	1	9.6	9.6	9.6	0.058	0.058	0.058				
		Common Carp	1991	FILSK	12	3	19.4	14.4	27.1	0.069	0.051	0.099	1	0.01	0.01	Y
		Northern pike	1996	FILSK	5	5	20.3	16.7	24.2	0.117	0.057	0.241				
			2002	FILSK	24	24	19.4	15.7	33.7	0.107	0.074	0.269				
			2005	FILSK	4	4	25.5	22.9	29.8	0.243	0.191	0.287				
			2008	FILSK	20	20	22.3	13.8	27.4	0.109	0.051	0.308				
			2013	FILSK	10	10	26.4	18.4	34.1	0.168	0.109	0.259				
		Walleye	1991	FILSK	22	4	19.0	10.7	25.8	0.380	0.130	0.630	1	0.01	0.01	Y
			1996	FILSK	10	10	13.5	6.9	20.6	0.105	0.032	0.238				
			2008	FILSK	3	3	18.4	17.4	19.6	0.213	0.197	0.231				
		White bass	2008	FILSK	5	5	15.1	13.1	15.9	0.396	0.184	0.526				
		Yellow perch	1991	FILSK	10	1	9.8	9.8	9.8	0.130	0.130	0.130				
			2002	WHORG	10	2	5.5	5.2	5.7	0.026	0.024	0.028				
			2005	WHORG	11	3	7.9	6.3	9.1	0.059	0.038	0.081				
			2008	WHORG	10	2	6.0	5.4	6.5	0.034	0.031	0.036				
87018000	DEL CLARK*	Black crappie	2001	FILSK	10	1	8.8	8.8	8.8	0.131	0.131	0.131				
		Walleye	2001	FILSK	6	6	18.7	14.7	25.6	0.301	0.261	0.419				
		White sucker	2001	FILSK	10	1	16.5	16.5	16.5	0.291	0.291	0.291				

*** Impaired for mercury in fish tissue as of 2016 Draft Impaired Waters List; categorized as EPA Class 4a for waters covered by the Statewide Mercury TMDL.**

**** Impaired for mercury in fish tissue as of 2014 Draft Impaired Waters List; categorized as EPA Class 5 for waters needing a TMDL.**

1 Anatomy codes: FILSK – edible fillet, skin-on; FILET—edible fillet, skin-off; BIOPSY or PLUG—dorsal muscle piece, without skin; WHORG—whole organism; NOHV-organism without head or viscera; PLUSK-dorsal muscle with skin.

Pollutant load monitoring

The WPLMN has three sites within the Lac Qui Parle River watershed as shown in Table 25.

Table 25. WPLMN Stream Monitoring Sites for the Lac Qui Parle River watershed

Site Type	Stream Name	USGS ID	DNR/MPCA ID	EQuIS ID
Major Watershed	Lac qui Parle River nr Lac qui Parle, CSAH31	05300000	E24023001	S003-087
Subwatershed	Lac Qui Parle River nr Providence, CSAH23	NA	H24053001	S003-079
Subwatershed	West Branch Lac Qui Parle River at Dawson, Diagonal St	NA	H24059001	S003-089

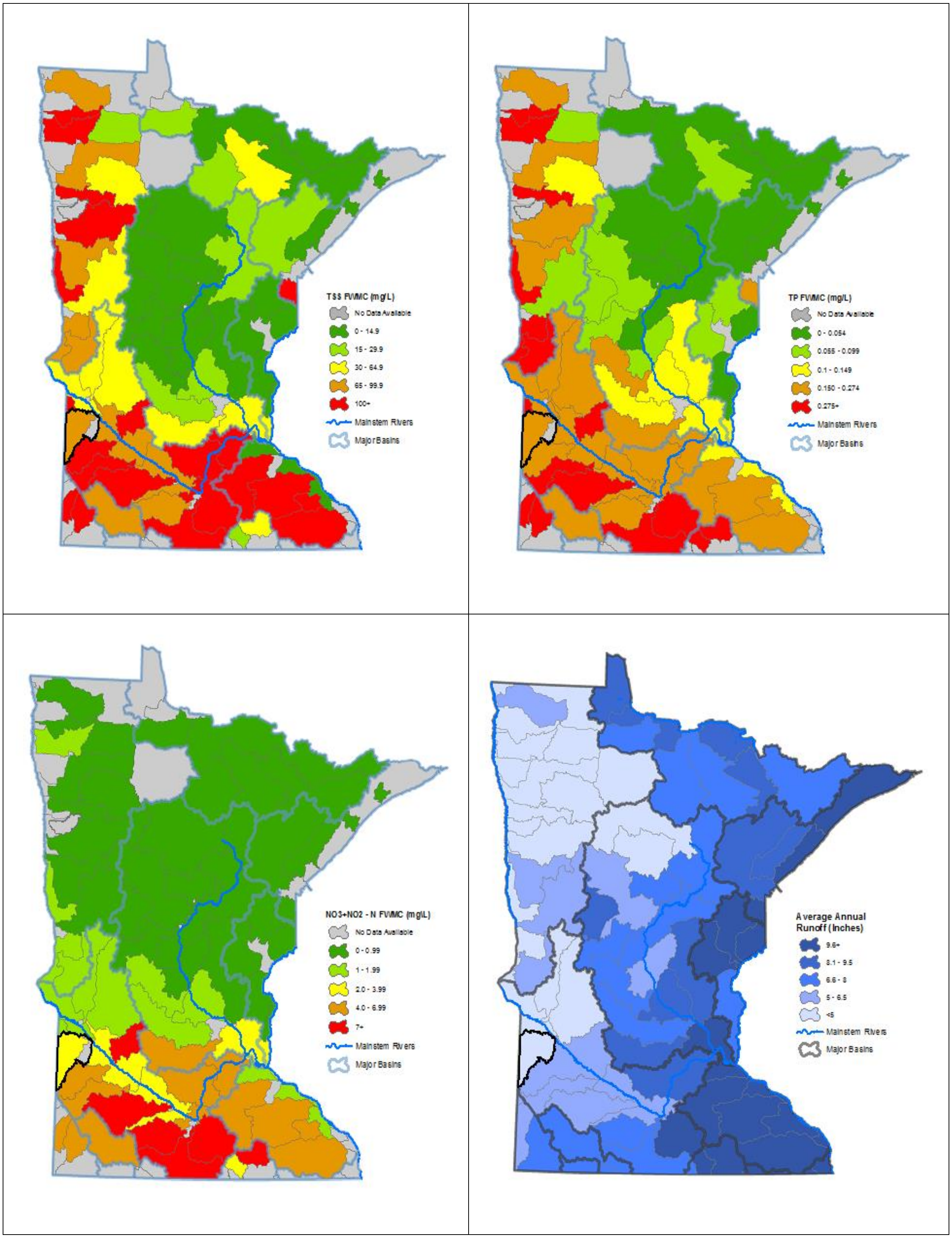
Average annual FWMCs of TSS, TP, and NO_3+NO_2-N for major watershed stations statewide are presented below (Figure 27), with the Lac Qui Parle River watershed highlighted. Water runoff, a significant factor in pollutant loading, is also shown. Water runoff is the portion of annual precipitation that makes it to a river or stream; thus it can be expressed in inches.

As a general rule, elevated levels of TSS and NO_3+NO_2-N are regarded as “non-point” source derived pollutants originating from many small diffuse sources such as urban or agricultural runoff. Excess TP can be attributed to both non-point as well as point sources such as industrial or wastewater treatment plants. Major “non-point” sources of phosphorus include dissolved phosphorus from fertilizers and phosphorus adsorbed to and transported with sediment during runoff.

Excessive TSS, TP, and NO_3+NO_2-N in surface waters impacts fish and other aquatic life, as well as fishing, swimming and other recreational uses. High levels of NO_3+NO_2-N is a concern for drinking water.

When compared with other major watersheds throughout the state, Figure 27 shows the average annual TSS, TP, and NO_3+NO_2-N FWMCs to be several times higher for the Lac Qui Parle River watershed than watersheds in north central and northeast Minnesota, but in line with the agriculturally rich watersheds found in the northwest and and southern regions of the state.

Figure 27. 2007-2015 Average annual TSS, TP, and NO3-NO2-N flow weighted mean concentrations, and runoff by major watershed.



More information, including results for subwatershed stations, can be found at the WPLMN website.

Substantial year-to-year variability in water quality occurs for most rivers and streams, including the Lac Qui Parle River. Results for individual years are shown in the charts (Figure 28) below.

In 2009-2011, there were intense storm runoff and snowmelt events where high TP and TSS concentrations were measured. On March 21, 2010, the highest flow over the nine-year period occurred. Several samples were collected during this snowmelt period; it is estimated that 62% of the annual TSS load and 47% of the annual TP load passed the monitoring site over a seven-day period during this event. During ice out in 2009 and 2010, high TP concentrations of 1.31 and 1.23 mg/L, respectively, were recorded.

Figure 28. TSS, TP, and NO3+NO2-N Flow Weighted Mean Concentrations and Loads for the Lac Qui Parle River.

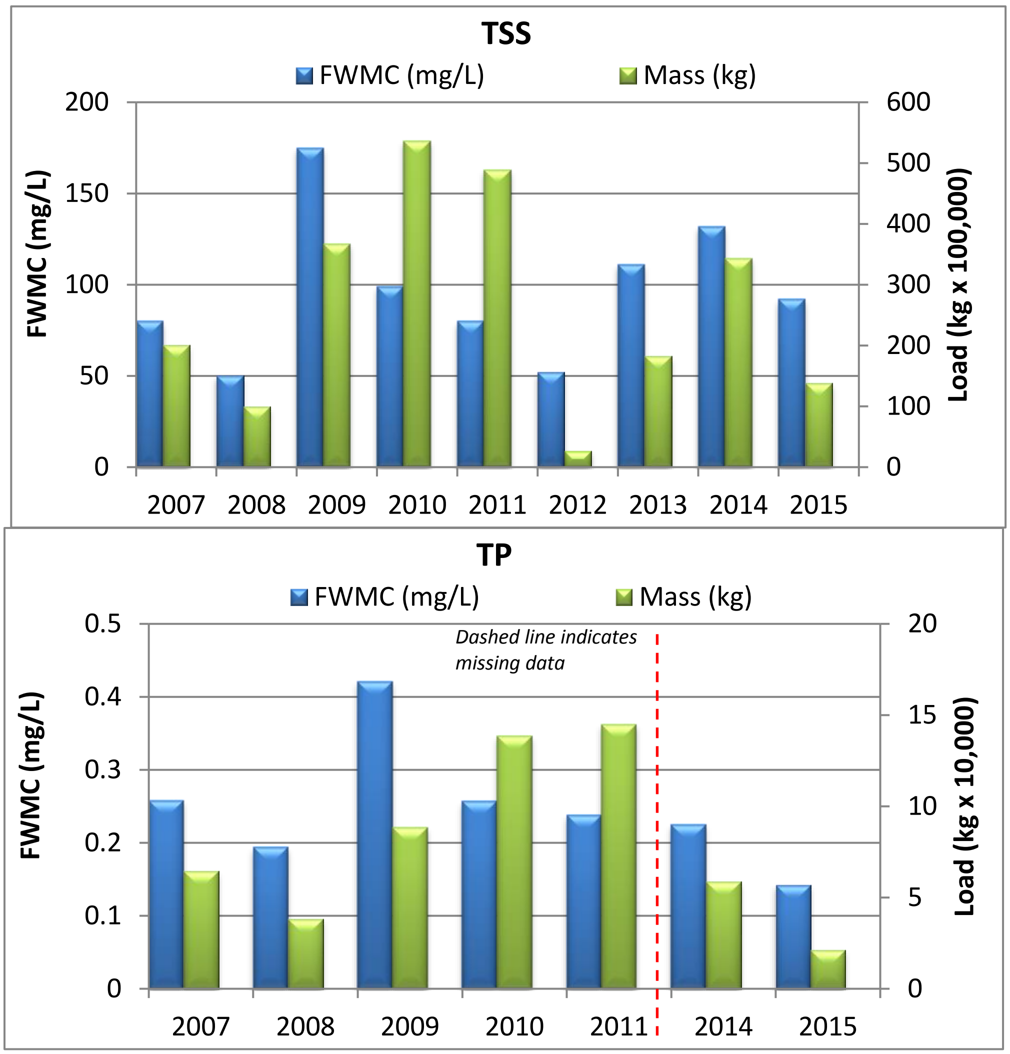
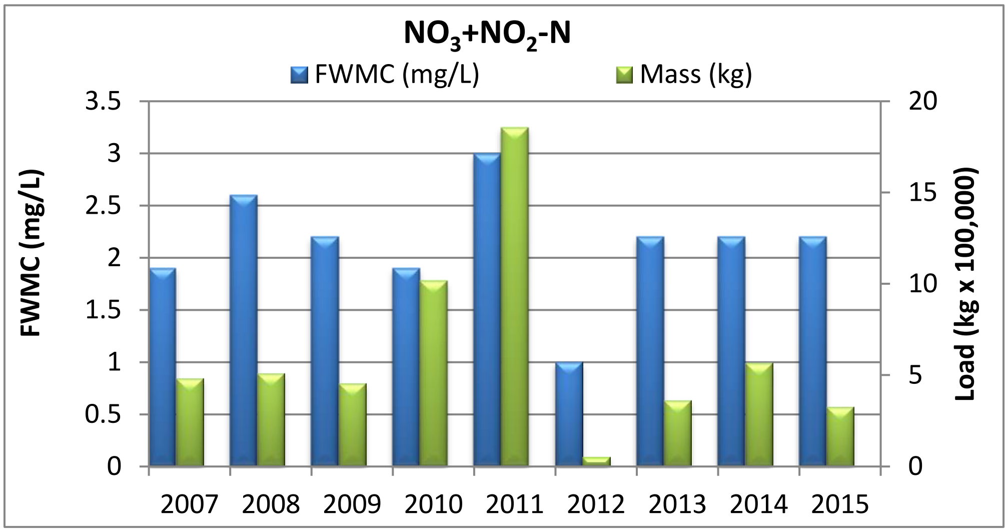
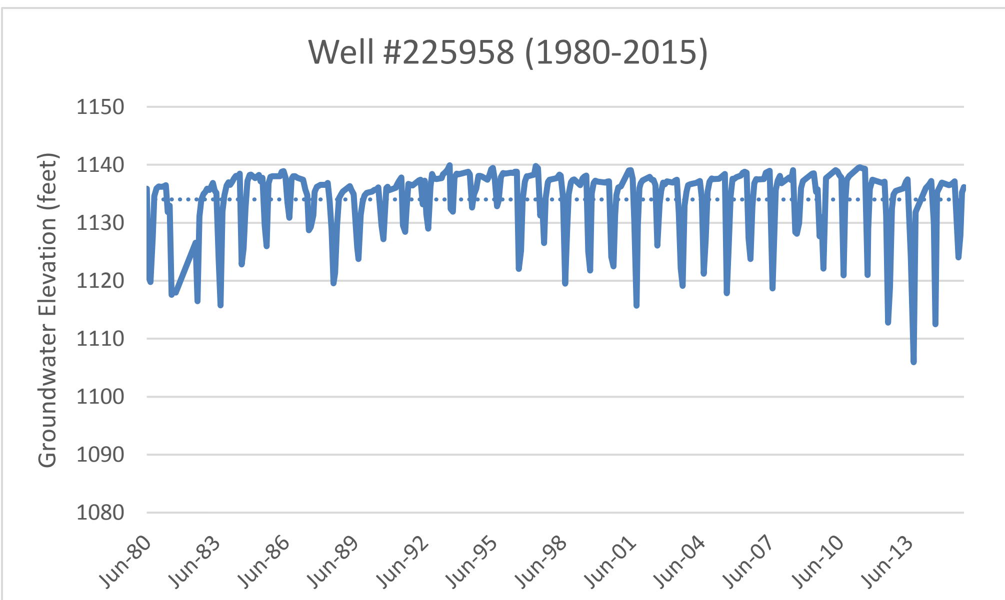


Figure 29. TSS, TP, and NO_3+NO_2-N Flow Weighted Mean Concentrations and Loads for the Lac Qui Parle River.



Groundwater monitoring

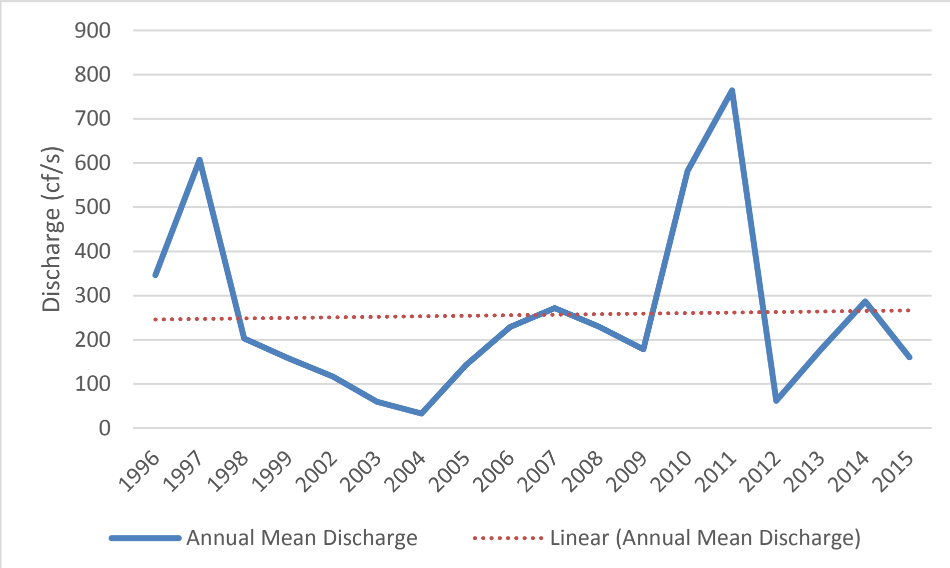
Figure 30. Water table elevations in Well #225958, 1980-2015

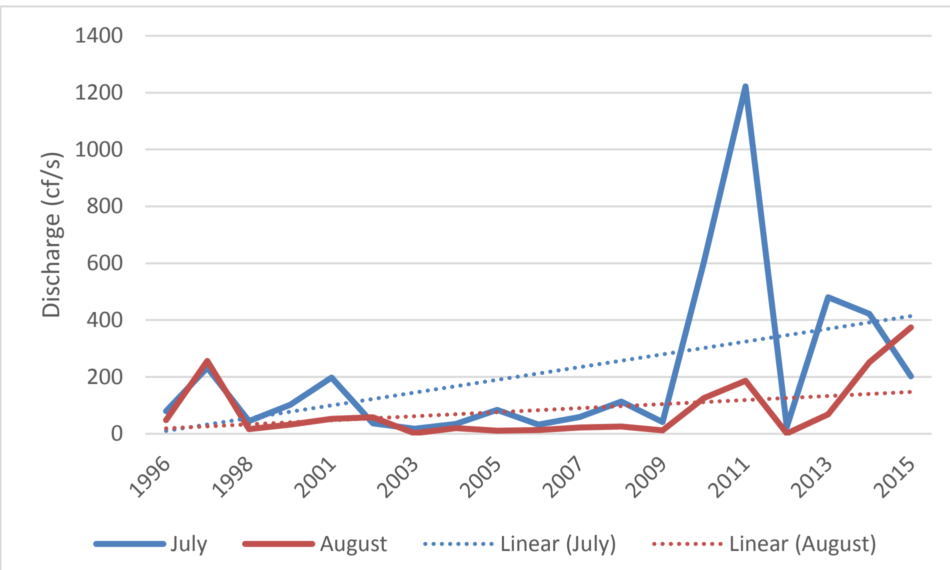


Stream flow

Stream flow data from the real-time streamflow gaging station on the Lac qui Parle River near Lac qui Parle were analyzed for annual mean annual discharge and summer (July and August) monthly mean discharge from 1996-2015 (Figure 31). Though fluctuations are visible, neither measure has increased or decreased significantly over that time period. By way of comparison at a state level, summer month flows have declined at a statistically significant rate at a majority of streams selected randomly for a study of statewide trends (Streitz 2011).

Figure 31. Annual (above) and summer (below) mean discharge for the Lac Qui Parle River near Lac Qui Parle, (1996-2015) (DNR, 2017c).





Wetland condition

Statewide wetland surveys have revealed that biological condition, based on floristic quality and aquatic macroinvertebrate indicators, in the Temperate Prairies ecoregion is relatively poor (Table 1). Since the Minnesota River – Headwaters watershed lies entirely within the Temperate Prairies ecoregion, it is expected that ~80% of wetlands (i.e., all wetland types) in this watershed have fair-poor vegetation condition. Depressional wetlands are a prominent feature in the watershed in areas of glacial moraine. Based on results from naturally formed basins in the Temperate Prairies ecoregion, it is likely that macroinvertebrate community condition is better, with an estimated 41% good (Table 1), in depressional wetlands that remain in the Lac qui Parle River Watershed. The predominance of invasive wetland plants such as narrow-leaf cattail (Typha angustifolia), hybrid cattail (Typha X glauca), and reed canary grass (Phalaris arundinacea) is believed to contribute to the difference between macroinvertebrate and vegetation condition results. Invasive plant species are likely to have a more direct impact on the composition and structure of the native plant community due to their tolerance of nutrient enrichment, hydrologic alterations and toxic pollutants (Galatowisch 2012). However, it should also be noted that comparison of the vegetation and macroinvertebrate results is somewhat of an apples-to-oranges comparison due to macroinvertebrate condition results being limited to depressional wetlands.

Table 26. Biological wetland condition statewide and by major ecoregions according to vegetation and macroinvertebrate indicators.

Vegetation Condition in All Wetlands

Condition Category	Mixed Wood Shield	Mixed Wood Plains	Temperate Prairies
Exceptional	64%	6%	7%
Good	20%	12%	11%
Fair	16%	42%	40%
Poor		40%	42%

Macroinvertebrate Condition in Depressional Wetlands

Condition Category	Mixed Wood Plains	Temperate Prairies
Good	46%	41%
Fair	34%	30%
Poor	20%	27%

Vegetation results are expressed by extent (i.e., percentage of wetland acres) and include virtually all wetland types (MPCA 2015). Macroinvertebrate results represent natural depressional wetlands (e.g., prairie potholes) that typically have open water and are expressed as the percentage of wetland basins (Genet 2015). Depressional wetland monitoring is focused in Mixed Wood Plains and Temperate Prairie ecoregions (as opposed to statewide) where it is a more prevalent type.

Figure 32. Stream Tiered Aquatic Life Use designations in the Lac qui Parle River Watershed.

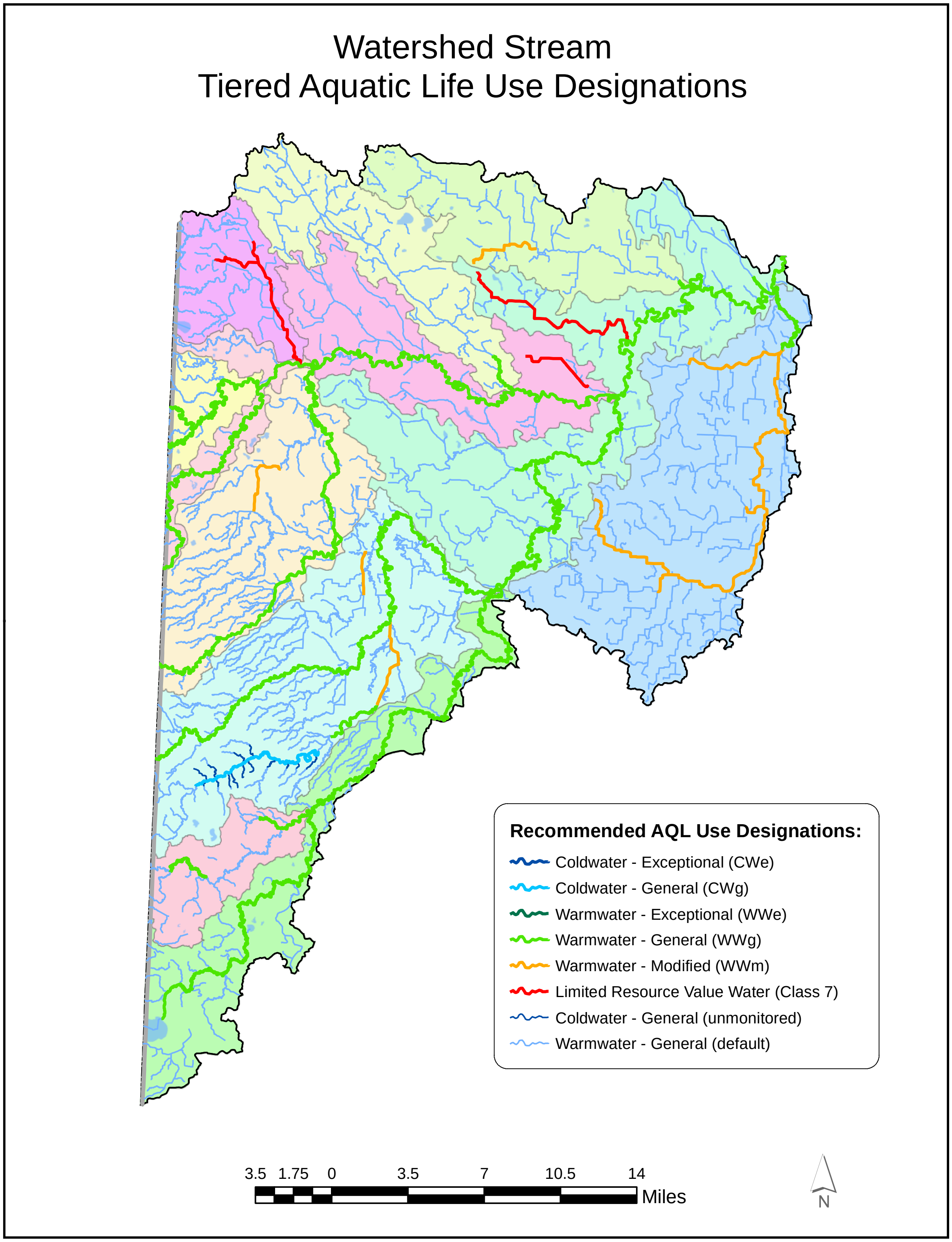
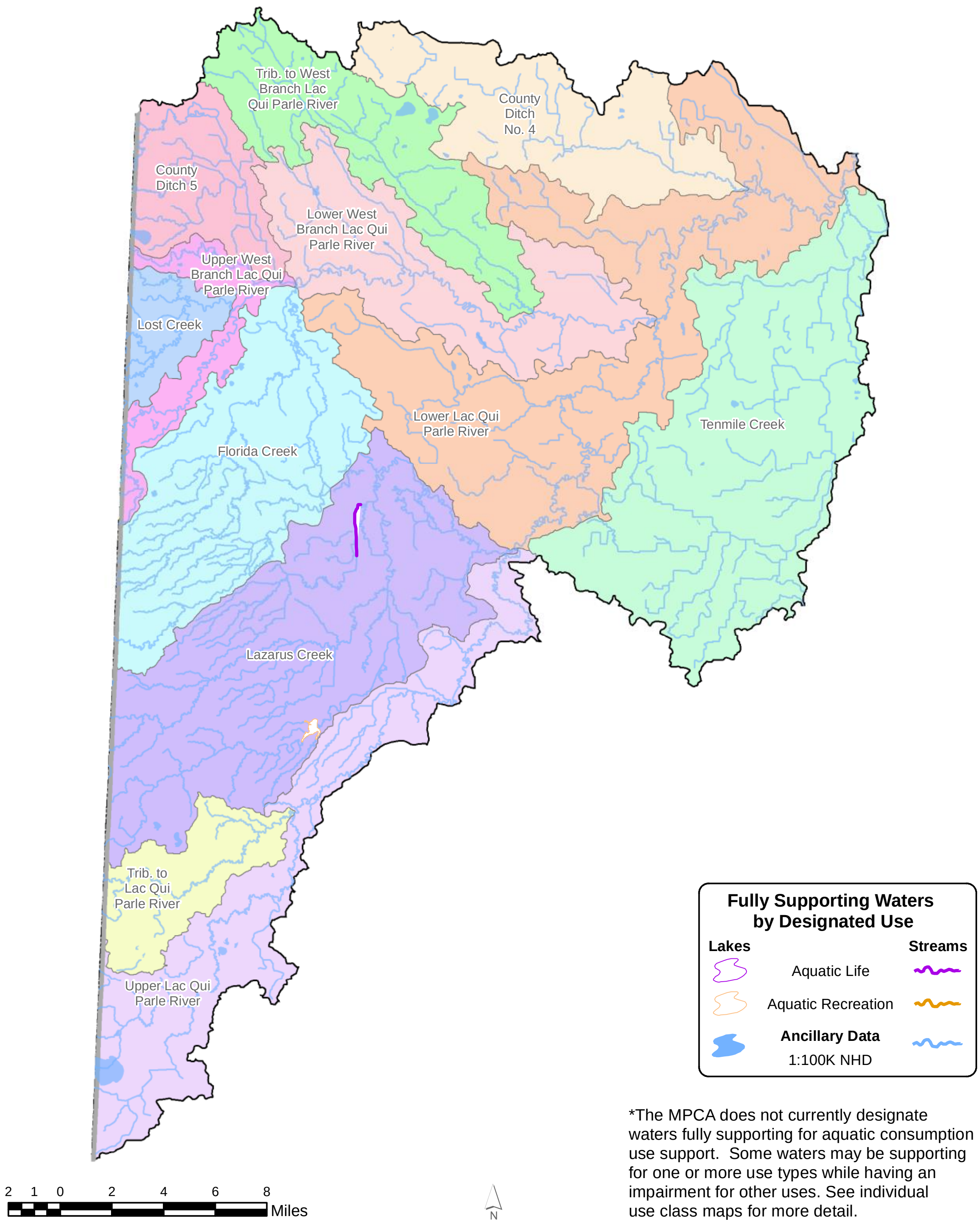


Figure 33. Fully supporting waters by designated use in the Lac qui Parle River Watershed.



*The MPCA does not currently designate waters fully supporting for aquatic consumption use support. Some waters may be supporting for one or more use types while having an impairment for other uses. See individual use class maps for more detail.

Figure 34. Impaired waters by designated use in the Lac qui Parle River Watershed.

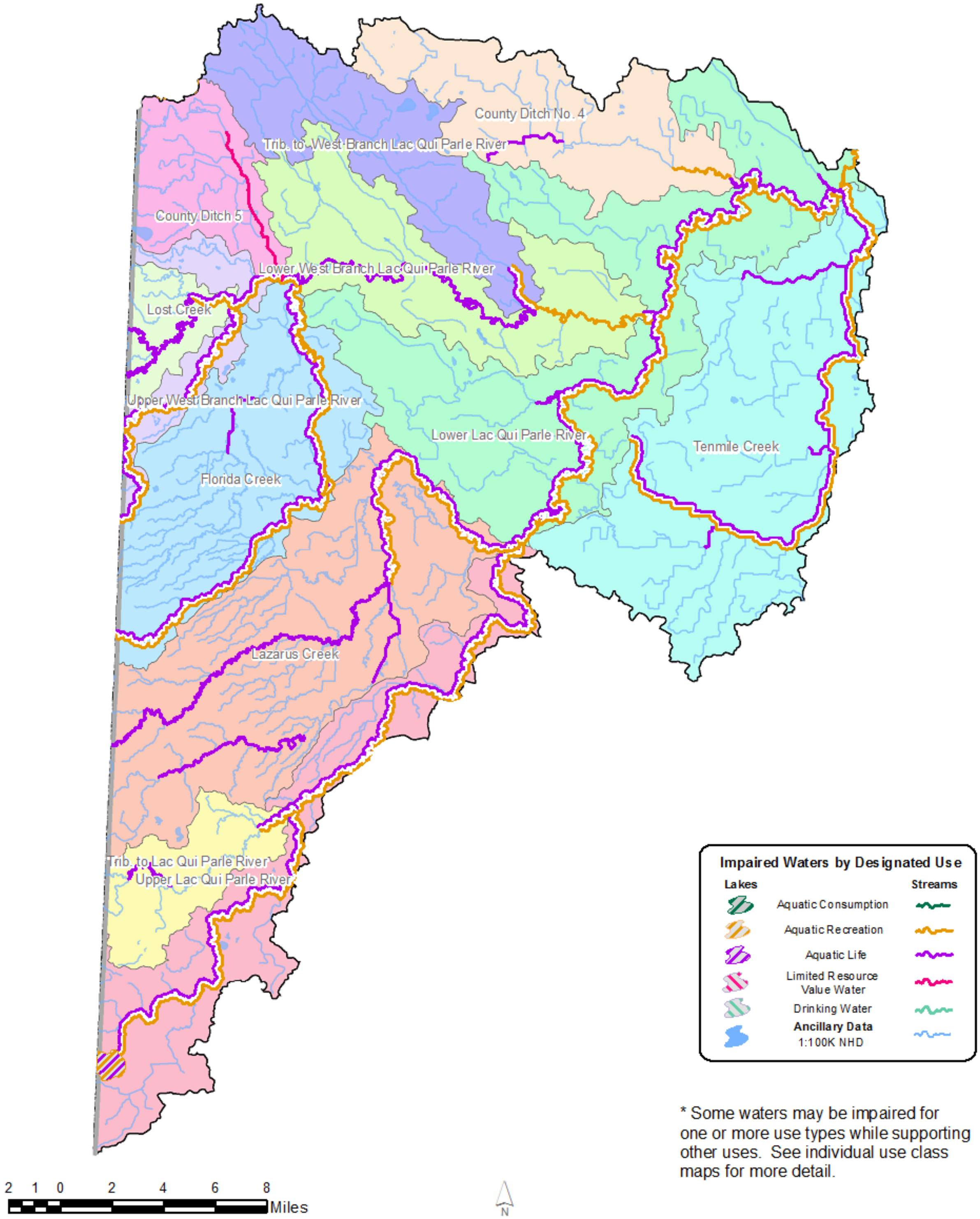


Figure 35. Aquatic consumption use support in the Lac qui Parle River Watershed.

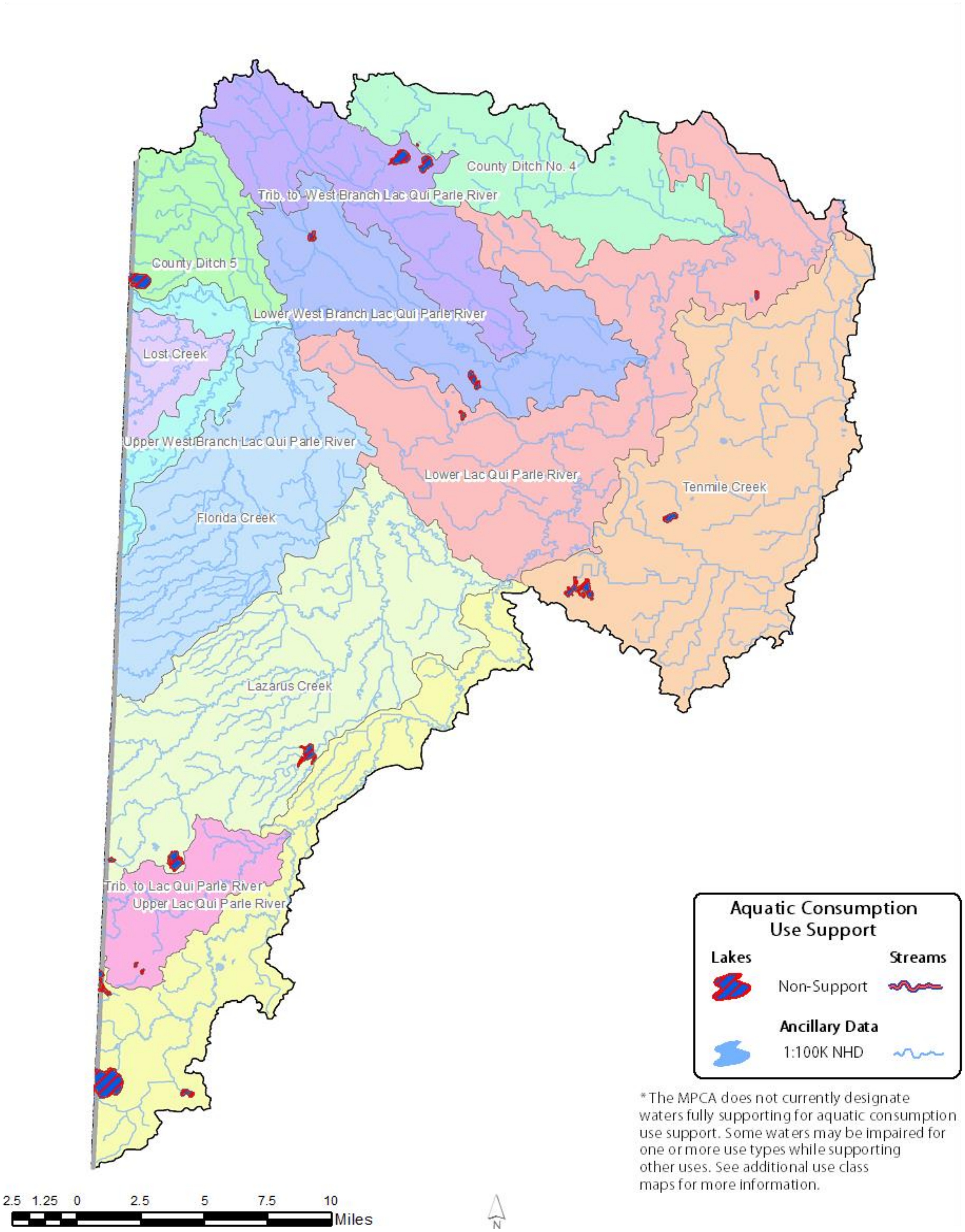
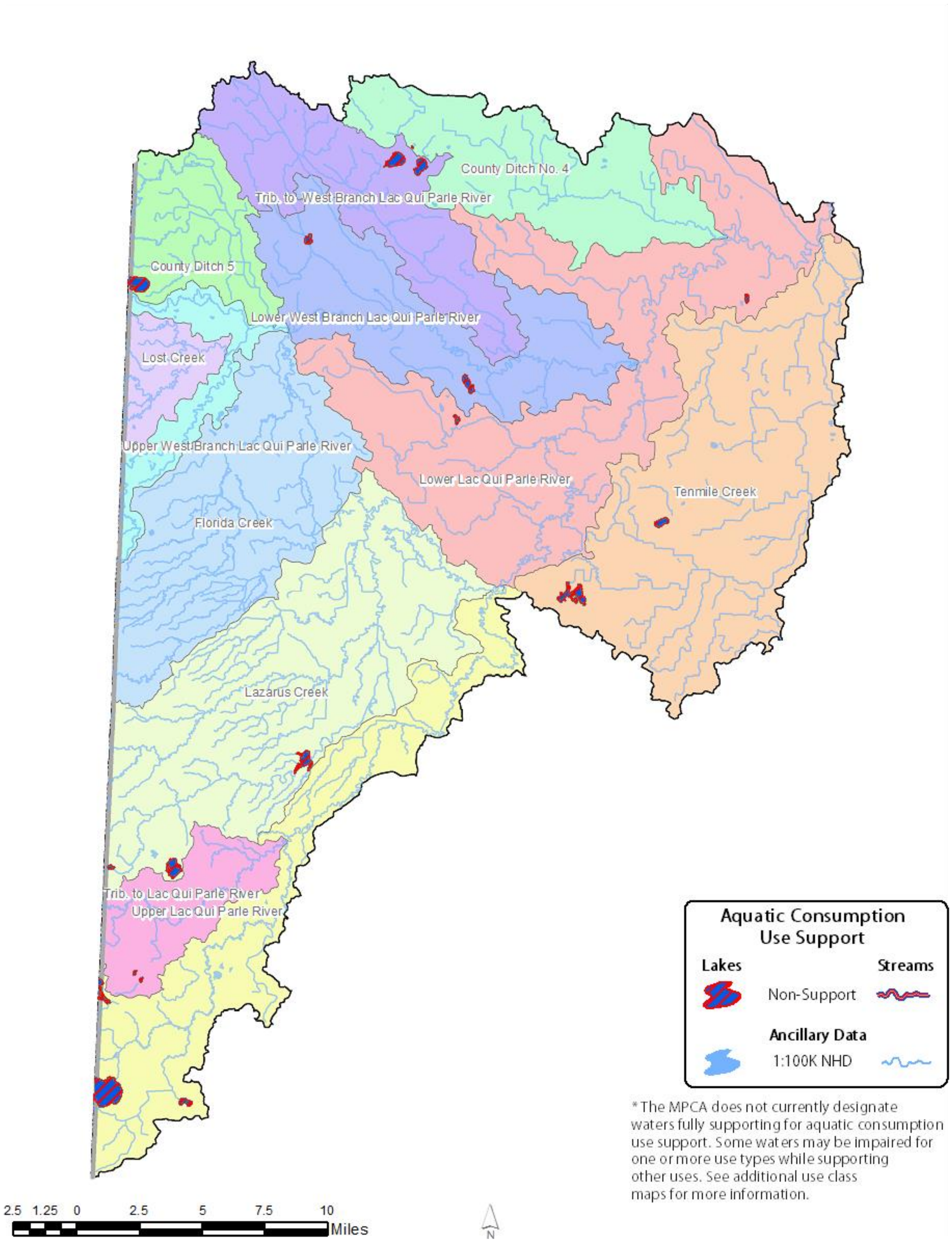


Figure 36. Aquatic recreation use support in the Lac qui Parle River Watershed.



Transparency trends for the Lac Qui Parle River Watershed

MPCA completes annual trend analysis on lakes and streams across the state based on long-term transparency measurements. The data collection for this work relies heavily on volunteers across the state and also incorporates any agency and partner data submitted to EQuIS.

The trends are calculated using a Seasonal Kendall statistical test for waters with a minimum of eight years of transparency data; Secchi disk measurements in lakes and Secchi tube measurements in streams.

Citizen volunteer monitoring occurs at three streams and one lake in the watershed. Water clarity data collected from Lake Hendricks has revealed a long-term trend in improving water clarity. No streams had sufficient sized dataset for long-term trend calculations.

Table 27. Water Clarity Trends.

Lac Qui Parle River HUC 07020003	Streams	Lakes
Number of sites w/increasing trend	--	1
Number of sites w/decreasing trend	--	--
Number of sites w/no trend	--	--

In June 2014, the MPCA published its final trend analysis of river monitoring data located statewide based on the historical Milestones Network. The network is a collection of 80 monitoring locations on rivers and streams across the state with good, long-term water quality data. The period of record is generally more than 30 years, through 2010, with monitoring at some sites going back to the 1950s. While the network of sites is not necessarily representative of Minnesota's rivers and streams as a whole, they do provide a valuable and widespread historical record for many of the state's waters. Starting in 2017, the MPCA will be switching to the Pollutant Load Monitoring Network for long-term trend analysis on rivers and streams. Data from this program has much more robust sampling and will cover over 100 sites across the state.

Priority Waters for Protection and Restoration in the Lac Qui Parle River Watershed

The MPCA and DNR have been developing methods to help identify waters that are high priority for protection and restoration activities. Protecting lakes and streams from degradation requires consideration of how human activities impact the lands draining to the water. In addition, helping to determine the risk for degradation allows prioritization to occur; so limited resources can be directed to waters that would benefit most from implementation efforts.

The results of the analysis are provided to watershed project teams for use during WRAPS and One Watershed One Plan or other local water plan development. The results of the analysis are considered a preliminary sorting of possible protection priorities and should be followed by a discussion and evaluation with other resource agencies, project partners and stakeholders. Other factors that are typically considered during the protection prioritization process include: whether a water has an active lake or river association, is publically accessible, presence of wild rice, presence of invasive, rare or endangered species, as well as land use information and/or threats from proposed development. Opportunities to gain or enhance multiple natural resource benefits ("benefit stacking") is another consideration during the final protection analysis. At present, the prioritization methodology has been developed for lakes based on recreation use and is summarized below (MPCA 2017). Stream Protection and Prioritization method development is nearing completion. Waterbodies identified during the assessment process as vulnerable to impairment are also included in the summary below.

The results for selected indicators and the risk priority ranking for each lake are shown in Appendix 6. Protection priority should be given to lakes that are particularly sensitive to an increase in phosphorus with a documented decline in water quality (measured by Secchi transparency), a comparatively high percentage of developed land use in the area, or monitored phosphorus concentrations close to the water quality standard. In the Lac Qui Parle River Watershed, highest protection priority is suggested for three lakes: Del Clark, Salt and Bohemian. Del Clark is the only basin with sufficient data to render a complete assessment, which was found to be supporting recreational use during this effort. Salt and Bohemian only have single data points available, future monitoring to develop a baseline for current quality would be beneficial to drive prioritization and protection projects in the future.

Summaries and recommendations

The condition of fish and macroinvertebrate stream communities in the Lac qui Parle River Watershed reflect the land use, hydrologic modification, and discharge of pollutants (point and non-point) upstream of each monitoring location. The habitats, surficial hydrology, and water quality of this watershed have been dramatically altered from their natural condition. These alterations have brought about a stark shift in the biological communities that these waters are capable of supporting.

The prevalence of stream channelization and drainage tiling results in an engineered surficial hydrology that does not retain water from precipitation in the same manner as an unaltered landscape; rain events result in a rapid spike in discharge volumes, while intervening periods of low precipitation result in exceptionally low flows. High discharge events destabilize and erode stream banks, which result in high sediment loads and ever wider, shallower channels. The loss of riparian tree cover and rooted, perennial vegetation can greatly exacerbate these issues by further destabilizing banks and increasing water temperatures from lack of shade and cover. Streams impacted by these processes are characterized by uniform depths, homogenous fine substrates and lack of well-developed riffle- pool-run sequences; they provide little habitat for diverse and healthy aquatic communities.

Overall, scores of biological communities in this watershed were poor: only one stream (< 3%) was determined to be supporting aquatic life for Modified Use (which holds communities to a lower threshold than General Use waters) for both fish and macroinvertebrate communities. Not a single General Use stream in the Lac qui Parle Watershed fully supported aquatic life use.

Fish assemblages were assessed in 29 reaches of streams and rivers throughout the Lac qui Parle River Watershed. An overwhelming majority of these reaches, 76% (n=22) exhibited fish communities that did not meet aquatic life standards and were listed as impaired. Only 24% (n=7) of these reaches sustained fish communities that met aquatic life use criteria. Of these seven streams that met the standards, only two were General Use streams: the lowest reach of the West Branch Lac qui Parle River, and an unnamed tributary to Crow Timber Creek.

A total of 46 fish species were collected in the Lac qui Parle River Watershed. The most commonly collected species of fish, both in number of sites where present and in number of individuals collected, were species that are tolerant of degradations to habitat and water quality. They were, however, all native species that require some amount of course substrate and flow to successfully spawn; the observed assemblages through most of this watershed do not represent the 'worst case scenario' or extremely degraded fish communities seen in some areas of the state. Some sensitive, intolerant species were observed in the watershed. Pearl dace, a species that has not been verified in the Minnesota Basin since 1954, were sampled in Cobb Creek in a June 2015 visit.

Of the 27 reaches of stream where macroinvertebrate communities were assessed, 81% (n=22) of assessed stream reaches were determined to harbor impaired macroinvertebrate communities. Similar to the fish community, stream macroinvertebrates in the Lac qui Parle River Watershed were predominantly tolerant of low dissolved oxygen, poor habitat, and excess sediments. For example, the most predominantly collected genera were the midge *Polypedilum* in terms of the number of sites and the snail *Physella* in terms of the number of individuals. Of the five reaches that exhibited healthy macroinvertebrate communities for their use class, three were designated general aquatic life use streams. Four of these streams, however, are not fully supporting aquatic life due to other impairments, an indication that these streams are all experiencing significant levels of disturbance in their watersheds.

Many of the tributaries to the Lac qui Parle River Watershed have symptoms of water quality problems that are directly contributing to poor water quality downstream waterbodies (e.g. Minnesota River, Lake Pepin). Past assessment efforts resulted in numerous turbidity listings and restoration work prior to this effort. Total suspended solid and Secchi tube data confirmed all previous listings for turbidity, those listings will remain as restoration work continues in an attempt troubleshoot problems all too common in western and southern Minnesota's rivers and streams. Elevated sediment concentrations carried by many of these tributaries on a consistent basis are not typical of good water quality, drastically impacting natural hydrology and aquatic communities. High phosphorus concentrations were found through the watershed. Phosphorus and sediment concentrations will require work to reduce overland runoff in the watershed. Preserving upland surface water storage areas can reduce severity of high flow events, bank instability, channel incision and surface water runoff that typically increases sediment and phosphorus concentrations in these tributaries. Stream buffers on many occasions provide a source for water and nutrients to infiltrate naturally. Dissolved oxygen concentrations indicate wide flux in maximum and minimum daily values, high fluxes in dissolved oxygen can be stressful to aquatic communities. These large swings may also be a sign of excess productivity in the watershed; phosphorus driven algal blooms can result in swings in oxygen concentrations. Water quality in the downstream reaches of this HUC8 watershed is reflective of many other tributaries to the Minnesota River, a factor of the current degraded state of the large river. Future investigation, implementation and restoration work is going to be at the forefront of fixing tributaries such as the Lac qui Parle River before any long-term water quality improvements can be expected in the Minnesota River.

Past fecal coliform datasets triggered eight aquatic recreation use listings throughout this watershed in 2006; more recent bacteria data confirmed the initial listings during this assessment cycle. Further investigation into patterns of elevated bacteria concentrations may be helpful to target specific sources. Concentrated animal activity within stream or immediately adjacent to the flood plain is typically associated with high bacteria levels. Limiting concentrated domesticated and wildlife access to these areas could potentially lower bacteria levels.

What is typically thought of as a traditional lake basin in Minnesota is not common within the Lac qui Parle River Watershed, but that does not discount the importance of water quality in small and shallow basins scattered throughout this watershed. Recreational use on these small basins does not necessarily mean direct body contact (swimming) in most cases, the majority of recreational use is related to secondary contact (i.e. canoeing/kayaking) associated with waterfowl enthusiasts. Datasets on these small basins are not robust enough to make a complete assessment and often are collected in monitoring efforts outside of the assessment based condition monitoring; lake eutrophication criteria may not be the best comparison tool for these waterbodies. Maintaining good water quality and clarity on these small basins is no less important than other more popular basins nearby, as good water clarity promotes healthy native plant communities that attract diverse populations of waterfowl and other wildlife. Internal loading is a persistent problem within many of these small waterbodies as well as overland runoff of phosphorus. Future work maintaining healthy riparian areas (e.g. buffer strips) to increase surface water infiltration and nutrient absorption is a simple but important step. Maintaining healthy aquatic plant communities may interrupt nutrient availability that fuels unwanted dense algae blooms.

A few higher profile basins like Lake Hendricks and Del Clark Lake offered the only traditional recreation use assessments against lake eutrophication standards. Del Clark is a recreational gem for the region; excellent water quality provides a unique opportunity for lake recreation. The basin should be a top priority for protection going forward to ensure future generations will continue to have this opportunity to recreate locally. Maintenance to nearby septic systems, healthy riparian areas and monitoring inputs from Canby Creek are all important aspects to consider going forward. The water quality of Lake

Hendricks triggered a past listing for recreation use, reviewing current datasets revealed rebounding response variables, which could be short-term variability and/or the result of local restoration work to address water quality issues. An improving trend in water clarity is further evidence of a basin that may be regaining some type of balance. Poor recreational water quality is likely playing an indirect role in struggling fish communities, which triggered an aquatic life use impairment. Watershed disturbance is the leading factor in both poor recreational and aquatic life related water quality. Available habitat metrics indicate relatively good habitat for fish communities to thrive. Much of the contributing watershed is in South Dakota; both jurisdictions will need to continue to collaborate to address water quality restoration and protection.

Groundwater protection should be considered both for quantity and quality. Concerns for quality are possible high levels of naturally occurring elements in drinking water and nitrate from human activities. The concerns for quantity are based on comparing the amount of water withdrawn versus the amount of water being recharged to the aquifer. Withdrawals from the watershed have not changed significantly. Groundwater levels in the monitoring well reviewed have not decreased significantly since 1980, but indicate a regular, annual drop in July and August with annual recovery. One location does not represent the entire watershed, but this does indicate there is a regular, predictable stress on the aquifer that relies on anticipated recovery. Continued mindfulness of this fact by water users and additional monitoring of groundwater quantity will provide the information needed to conserve the resource in the watershed.

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Appendix 1 – Water chemistry definitions

Dissolved oxygen (DO) - Oxygen dissolved in water required by aquatic life for metabolism. Dissolved oxygen enters into water from the atmosphere by diffusion and from algae and aquatic plants when they photosynthesize. Dissolved oxygen is removed from the water when organisms metabolize or breathe. Low DO often occurs when organic matter or nutrient inputs are high, and light inputs are low.

Escherichia coli (*E. coli*) - A type of fecal coliform bacteria that comes from human and animal waste. *E. coli* levels aid in the determination of whether or not fresh water is safe for recreation. Disease-causing bacteria, viruses and protozoans may be present in water that has elevated levels of *E. coli*.

Nitrate plus Nitrite – Nitrogen - Nitrate and nitrite-nitrogen are inorganic forms of nitrogen present within the environment that are formed through the oxidation of ammonia-nitrogen by nitrifying bacteria (nitrification). Ammonia-nitrogen is found in fertilizers, septic systems and animal waste. Once converted from ammonia-nitrogen to nitrate and nitrite-nitrogen, these species can stimulate excessive levels of algae in streams. Because nitrate and nitrite-nitrogen are water soluble, transport to surface waters is enhanced through agricultural drainage. The ability of nitrite-nitrogen to be readily converted to nitrate-nitrogen is the basis for the combined laboratory analysis of nitrate plus nitrite-nitrogen (nitrate-N), with nitrite-nitrogen typically making up a small proportion of the combined total concentration. These and other forms of nitrogen exist naturally in aquatic environments; however, concentrations can vary drastically depending on season, biological activity, and anthropogenic inputs.

Orthophosphate - Orthophosphate (OP) is a water-soluble form of phosphorus that is readily available to algae (bioavailable). While orthophosphates occur naturally in the environment, river and stream concentrations may become elevated with additional inputs from wastewater treatment plants, noncompliant septic systems and fertilizers in urban and agricultural runoff.

pH - A measure of the level of acidity in water. Rainfall is naturally acidic, but fossil fuel combustion has made rain more acid. The acidity of rainfall is often reduced by other elements in the soil. As such, water running into streams is often neutralized to a level acceptable for most aquatic life. Only when neutralizing elements in soils are depleted, or if rain enters streams directly, does stream acidity increase.

Total Kjeldahl nitrogen (TKN) - The combination of organically bound nitrogen and ammonia in wastewater. TKN is usually much higher in untreated waste samples then in effluent samples.

Total phosphorus (TP) - Nitrogen (N), phosphorus (P) and potassium (K) are essential macronutrients and are required for growth by all animals and plants. Increasing the amount of phosphorus entering the system therefore increases the growth of aquatic plants and other organisms. Excessive levels of Phosphorous over stimulate aquatic growth and resulting in the progressive deterioration of water quality from overstimulation of nutrients, called eutrophication. Elevated levels of phosphorus can result in: increased algae growth, reduced water clarity, reduced oxygen in the water, fish kills, altered fisheries and toxins from cyanobacteria (blue green algae) which can affect human and animal health.

Total suspended solids (TSS) – TSS and turbidity are highly correlated. Turbidity is a measure of the lack of transparency or "cloudiness" of water due to the presence of suspended and colloidal materials such as clay, silt, finely divided organic and inorganic matter and plankton or other microscopic organisms. The greater the level of TSS, the murkier the water appears and the higher the measured turbidity.

Higher turbidity results in less light penetration, which may harm beneficial aquatic species and may favor undesirable algae species. An overabundance of algae can lead to increases in turbidity, further compounding the problem.

Unionized ammonia (NH3) - Ammonia is present in aquatic systems mainly as the dissociated ion $NH4^+$, which is rapidly taken up by phytoplankton and other aquatic plants for growth. Ammonia is an excretory product of aquatic animals. As it comes in contact with water, ammonia dissociates into $NH4^+$ ions and ^-OH ions (ammonium hydroxide). If pH levels increase, the ammonium hydroxide becomes toxic to both plants and animals.

Appendix 2.1 – Intensive watershed monitoring water chemistry stations in the Lac Qui Parle River Watershed

EQuIS ID	Biological station ID	WID	Waterbody name	Location	Aggregated 12-digit HUC
07020003-530	03MN044	S008-461	Tributary to Lac Qui Parle River	Downstream of 170th St., 1.5 mi S of CR 36, 4 mi S of Canby	Tributary to Lac Qui Parle River
07020003-521	03MN047	S008-462	Florida Creek	Upstream of 120th St, 7.5 mi. W of Canby	Florida Creek
07020003-505	15MN036	S008-463	Lac Qui Parle River	CR 101, 2.5 mi. NE of Hendricks	Upper Lac Qui Parle River
07020003-505	15MN047	S003-085	Lac Qui Parle River	MN Hwy. 67, 7.5 mi NE of Canby	Upper Lac Qui Parle River
07020003-508	15MN049	S004-552	Lazarus Creek	245th Street, 8 MI NE OF CANBY	Lazarus Creek
07020003-563	15MN071	S003-381	Judicial Ditch 4	Downstream of 1st Street, in Dawson	Lower West Branch Lac Qui Parle River
07020003-517	15MN072	S008-464	Lost Creek	141st Avenue, 1.5 mi SE of Hwy 212, 1 mi. E of Mehurin	Lost Creek
07020003-521	15MN073	S003-088	Florida Creek	US Hwy 212, 11 MI SW of Madison	Florida Creek
07020003-516	15MN074	S003-086	Lac qui Parle River, West Branch	US Hwy 212, 12.5 mi SW of Madison	Upper West Branch Lac Qui Parle River
07020003-580	15MN078	S008-465	Tributary to Lac Qui Parle River	US Hwy 212, 4 mi. W of Dawson	Tributary to Lac Qui Parle River, West Branch
07020003-578	15MN087	S008-466	Tenmile Creek	CR 20, 1 mi E of Lac qui Parle	Tenmile Creek
07020003-581	15MN091	S001-841	County Ditch 4	Intersection of CR 27 / 73 (331st Ave) and CR 20, 4 mi. W of Lac Qui Parle	County Ditch 4
07020003-502	15MN092	S000-143	Lac Qui Parle River	CR 33, 1 mi. NE of Lac Qui Parle	Lower Lac Qui Parle
07020003-523	15MN096	S008-467	County Ditch 5	200th Street, 6 mi. SW of Marietta	County Ditch 5
07020003-513	15MN097	S004-554	Lac Qui Parle River, West Branch	Off Right Angle Turn in SE 3RD ST, in Dawson	Lower West Branch Lac Qui Parle River
07020003-519	15MN103	S008-468	Lac Qui Parle River, West Branch	CR 74, 3 mi. SW of Manfred	Upper West Branch Lac Qui Parle River

Appendix 2.2 – Intensive watershed monitoring biological monitoring stations in the Lac qui Parle River Watershed

WID 07020003	Biological station ID	Waterbody name	Biological station location	County	Subwatershed
-505	15MN036	Lac qui Parle River	Upstream of CR 101, 2.5 mi. NE of Hendricks	Lincoln	Upper Lac Qui Parle River
-505	15MN040	Lac Qui Parle River	Downstream of 160th Ave, 5 mi. S of Canby	Yellow Medicine	Upper Lac Qui Parle River
-505	15MN041	Lac Qui Parle River	Downstream of 210th Ave, 2 mi. E of Canby	Yellow Medicine	Upper Lac Qui Parle River
-505	15MN047	Lac qui Parle River	Downstream of Hwy 67, 3 mi. S of Providence	Yellow Medicine	Upper Lac Qui Parle River
-530	03MN044	Trib. to Lac Qui Parle River	Downstream of CR, 4 mi. SW of Canby	Yellow Medicine	Trib. to Lac Qui Parle River
-569	15MN039	Unnamed creek	Downstream of 380th St, 6.5 mi. N of Hendricks	Lincoln	Trib. to Lac Qui Parle River
-508	15MN049	Lazarus Creek	Upstream of 245th St, 0.5 mi N of Hwy 67, 6 mi NE of Canby	Yellow Medicine	Lazarus Creek
-509	15MN043	Lazarus Creek	Downstream of 180th St (CR E2), 1.5 mi. N of Canby	Yellow Medicine	Lazarus Creek
-509	15MN045	Lazarus Creek	Upstream of 200th St, 3 mi. N of Canby	Yellow Medicine	Lazarus Creek
-509	15MN102	Lazarus Creek	Downstream of CSAH 15, 8 mi. W of Canby	Yellow Medicine	Lazarus Creek
-557	09MN093	Canby Creek	Upstream of 140th St, 6 mi. SW of Canby	Yellow Medicine	Lazarus Creek
-560	15MN053	Trib. to Lazarus Creek	Downstream of 280th Ave, 0.5 mi E of CSAH 11/13, 6 mi. N of Canby	Lac Qui Parle	Lazarus Creek
-586	15MN044	Canby Creek	Upstream of CSAH 33 (250th St), 3 mi. NE of Canby	Yellow Medicine	Lazarus Creek
-516	15MN074	Lac qui Parle River, W Branch	Downstream of Hwy 212, 3 mi. E of Mehurin	Lac Qui Parle	Upper W Br LqP River
-519	15MN103	Lac Qui Parle River, W Branch	Downstream of CR 74 (120th St), 3 mi. N of Gary SD	Lac Qui Parle	Upper W Br LqP River
-523	15MN085	County Ditch 5	Upstream of Hwy 40, 2 mi. E of Marietta	Lac Qui Parle	County Ditch 5
-523	15MN096	County Ditch 5	Downstream of 200th St, 6 mi. SE of Marietta	Lac Qui Parle	County Ditch 5
-517	15MN072	Lost Creek	Upstream of 141st Ave (CR 53), 1.5 mi. S of Hwy 212, 6 mi. SE of Marietta	Lac Qui Parle	Lost Creek
-520	15MN065	Crow Timber Creek	Downstream of 160th St, 9 mi. S of Marietta	Lac Qui Parle	Lost Creek
-520	15MN070	Crow Timber Creek	Upstream of 180th St, 1 mi. S of Hwy 212, 7 mi. S of Marietta	Lac Qui Parle	Lost Creek

WID 07020003	Biological station ID	Waterbody name	Biological station location	County	Subwatershed
-567	15MN066	Trib. to Crow Timber Creek	Upstream of 111th Ave (CR K), 8 mi. S of Marietta	Lac Qui Parle	Lost Creek
-521	03MN047	Florida Creek	CR 15, 7 mi. NW of Canby	Yellow Medicine	Florida Creek
-521	15MN067	Florida Creek	Downstream of 140th St, 12 mi. SW of Madison	Lac Qui Parle	Florida Creek
-521	15MN073	Florida Creek	Downstream of Hwy 212, 6 mi. SE of Marietta	Lac Qui Parle	Florida Creek
-583	15MN059	Cobb Creek	Upstream of 140th St, 0.4 mi W of CSAH 9, 13 mi. SE of Marietta	Lac Qui Parle	Florida Creek
-513	15MN097	Lac Qui Parle River, W Branch	Downstream of SE 3rd St (at dead end), in Dawson	Lac Qui Parle	Lower W Br LqP River
-515	15MN069	Lac Qui Parle River, W Branch	Upstream of CSAH 21, 3.5 mi. W of Dawson	Lac Qui Parle	Lower W Br LqP River
-515	15MN079	Lac Qui Parle River, W Branch	Downstream of 201st Ave, 5 mi. SW of Madison	Lac Qui Parle	Lower W Br LqP River
-563	15MN071	Judicial Ditch 4	Downstream of 1st St, in Dawson	Lac Qui Parle	Lower W Br LqP River
-580	15MN078	Trib. to Lac qui Parle River	Downstream of Hwy 212, 4 mi. W of Dawson	Lac Qui Parle	Trib. to W Br LqP River
-526	15MN077	County Ditch 34	Upstream of CSAH 31 (371st Ave), 1.5 mi. N of Hwy 212, 6.5 mi NE of Dawson	Lac Qui Parle	Tenmile Creek
-570	15MN050	Trib. to Tenmile Creek	Upstream of 280th Ave, just E of CSAH 10/27, 5.5 mi SW of Boyd	Yellow Medicine	Tenmile Creek
-571	15MN058	Trib. to Tenmile Creek	Upstream of Hwy 275, 0.5 mi. NW of Boyd	Lac Qui Parle	Tenmile Creek
-577	15MN054	Tenmile Creek	Downstream of 110th St, just E of CSAH 27, 4 mi. SW of Boyd	Lac Qui Parle	Tenmile Creek
-577	15MN056	Judicial Ditch 1	Downstream of CSAH 2, 0.5 mi. E of Boyd	Lac Qui Parle	Tenmile Creek
-577	15MN075	Tenmile Creek	Downstream of 200th St, 1 mi. N of Hwy 212, 3 mi. S of Lac Qui Parle	Lac Qui Parle	Tenmile Creek
-578	15MN087	Ten Mile Creek	Downstream of CSAH 20, 1 mi E of Lac qui Parle	Lac Qui Parle	Tenmile Creek
-501	15MN082	Lac Qui Parle River	Upstream of 210th St, 2 mi. NE of Dawson	Lac Qui Parle	Lower LqP River
-501	15MN084	Lac Qui Parle River	Upstream of CSAH 27 (331st Ave), 3.5 mi. W of Lac Qui Parle	Lac Qui Parle	Lower LqP River
-501	15MN088	Lac Qui Parle River	Upstream of CSAH 31 (371st Ave), 0.5 mi. W of Lac Qui Parle	Lac Qui Parle	Lower LqP River
-502	15MN092	Lac qui Parle River	Downstream of CSAH 33, 1 mi. NE of Lac Qui Parle	Lac Qui Parle	Lower LqP River
-506	15MN055	Lac Qui Parle River	Upstream of 120th St, 10 mi. W of Boyd	Lac Qui Parle	Lower LqP River
-506	15MN060	Lac Qui Parle River	Downstream of CR 54 (150th St), 4 mi. SW of Dawson	Lac Qui Parle	Lower LqP River
-506	15MN068	Lac Qui Parle River	Upstream of E Diagonal Rd (CSAH 37), 1 mi. SE of Dawson	Lac Qui Parle	Lower LqP River
-534	15MN062	County Ditch 29 Branch A	Upstream of 265th Ave, 0.7 mi S of CSAH 10, 3.5 mi. SW of Dawson	Lac Qui Parle	Lower LqP River

WID 07020003	Biological station ID	Waterbody name	Biological station location	County	Subwatershed
-588	15MN090	Trib. to Lac Qui Parle River	Upstream of CSAH 48, 0.5 mi. N of Lac Qui Parle	Lac Qui Parle	Lower LqP River
-575	15MN093	Unnamed ditch	Adjacent to 250th St, 2 mi. E of Madison	Lac Qui Parle	County Ditch No. 4
-582	15MN091	County Ditch 4	Downstream of intersection of CSAH 27/ 73 (331st Ave) and CSAH 20, 4 mi. W of Lac qui Parle	Lac Qui Parle	County Ditch No. 4

Appendix 3.1 – Minnesota statewide IBI thresholds and confidence limits

Class #	Class name	Use class	Exceptional use threshold	General use threshold	Modified use threshold	Confidence limit
Fish						
1	Southern Rivers	2B, 2C	71	49	NA	±11
2	Southern Streams	2B, 2C	66	50	35	±9
3	Southern Headwaters	2B, 2C	74	55	33	±7
10	Southern Coldwater	2A	82	50	NA	±9
4	Northern Rivers	2B, 2C	67	38	NA	±9
5	Northern Streams	2B, 2C	61	47	35	±9
6	Northern Headwaters	2B, 2C	68	42	23	±16
7	Low Gradient	2B, 2C	70	42	15	±10
11	Northern Coldwater	2A	60	35	NA	±10
Invertebrates						
1	Northern Forest Rivers	2B, 2C	77	49	NA	±10.8
2	Prairie Forest Rivers	2B, 2C	63	31	NA	±10.8
3	Northern Forest Streams RR	2B, 2C	82	53	NA	±12.6
4	Northern Forest Streams GP	2B, 2C	76	51	37	±13.6
5	Southern Streams RR	2B, 2C	62	37	24	±12.6
6	Southern Forest Streams GP	2B, 2C	66	43	30	±13.6
7	Prairie Streams GP	2B, 2C	69	41	22	±13.6
8	Northern Coldwater	2A	52	32	NA	±12.4
9	Southern Coldwater	2A	72	43	NA	±13.8

Appendix 3.2 – Biological monitoring results – fish IBI (assessable reaches)

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Fish class	Threshold	FIBI	Visit date
Upper Lac qui Parle River							
07020003-505	15MN040	Lac Qui Parle River	77.27	Northern Streams	47	35.48	15-Jul-15
07020003-505	15MN047	Lac qui Parle River	180.22	Low Gradient	42	35.51	09-Sep-15
07020003-505	15MN041	Lac Qui Parle River	159.48	Low Gradient	42	31.00	10-Sep-15
07020003-505	15MN041	Lac Qui Parle River	159.48	Low Gradient	42	34.10	14-Jul-15
07020003-505	15MN036	Lac qui Parle River	51.80	Low Gradient	42	17.84	17-Jun-15
Trib to Lac qui Parle River							
07020003-530	03MN044	Trib. to Lac Qui Parle River	75.83	Northern Streams	47	35.15	14-Jul-15
07020003-569	15MN039	Unnamed creek	56.15	Low Gradient	42	31.65	04-Aug-15
Lazarus Creek							
07020003-586	15MN044	Canby Creek	34.43	Low Gradient	15	13.90	10-Sep-15
07020003-509	15MN045	Lazarus Creek	50.00	Low Gradient	42	23.67	10-Sep-15
07020003-509	15MN045	Lazarus Creek	50.00	Low Gradient	42	53.64	08-Jul-15
07020003-509	15MN102	Lazarus Creek	18.28	Northern Streams	47	42.07	08-Jul-15
07020003-508	15MN049	Lazarus Creek	124.83	Low Gradient	42	44.38	14-Jul-15
07020003-560	15MN053	Trib. to Lazarus Creek	19.79	Low Gradient	15	27.08	16-Jun-15
07020003-509	15MN043	Lazarus Creek	35.30	Low Gradient	42	32.22	08-Jul-15
07020003-586	15MN044	Canby Creek	34.43	Low Gradient	15	32.11	08-Jul-15
Upper West Branch Lac qui Parle River							
07020003-519	15MN103	Lac Qui Parle River, West Branch	59.13	Low Gradient	42	37.98	17-Jun-15
07020003-516	15MN074	Lac qui Parle River, West Branch	152.93	Low Gradient	42	34.91	10-Aug-15
Lost Creek							
07020003-567	15MN066	Trib. to Crow Timber Creek	15.16	Low Gradient	42	63.50	09-Jun-15
07020003-517	15MN072	Lost Creek	75.44	Low Gradient	42	40.20	29-Jul-15
07020003-517	15MN072	Lost Creek	75.44	Low Gradient	42	33.22	10-Sep-15

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Fish class	Threshold	FIBI	Visit date
Lost Creek cont.							
07020003-520	15MN070	Crow Timber Creek	38.48	Low Gradient	42	45.50	09-Jun-15
07020003-520	15MN065	Crow Timber Creek	19.06	Low Gradient	42	76.84	09-Jun-15
Florida Creek							
07020003-583	15MN059	Cobb Creek	15.38	Low Gradient	15	62.86	09-Jun-15
07020003-521	15MN067	Florida Creek	105.99	Low Gradient	42	29.79	15-Jul-15
07020003-521	03MN047	Florida Creek	74.91	Northern Streams	47	41.04	30-Aug-16
07020003-521	03MN047	Florida Creek	74.91	Northern Streams	47	43.48	04-Aug-15
07020003-521	15MN073	Florida Creek	149.62	Low Gradient	42	32.86	09-Sep-15
Lower West Br Lac qui Parle River							
07020003-513	15MN097	Lac Qui Parle River, West Branch	478.97	Northern Streams	47	66.75	15-Sep-15
07020003-515	15MN079	Lac Qui Parle River, West Branch	375.95	Low Gradient	42	36.95	13-Jul-15
07020003-515	15MN069	Lac qui Parle River, West Branch	412.48	Low Gradient	42	60.65	15-Sep-15
07020003-580	15MN078	Trib. to Lac qui Parle River	49.59	Low Gradient	42	38.81	05-Aug-15
Tenmile Creek							
07020003-526	15MN077	County Ditch 34	18.27	Low Gradient	15	57.18	10-Jun-15
07020003-570	15MN050	Trib. to Tenmile Creek	17.99	Low Gradient	15	39.76	11-Jun-15
07020003-577	15MN075	Tenmile Creek	90.67	Northern Streams	35	27.65	16-Jul-15
07020003-577	15MN054	Tenmile Creek	10.73	Low Gradient	15	22.50	11-Jun-15
07020003-571	15MN058	Trib. to Tenmile Creek	13.49	Low Gradient	15	23.93	10-Jun-15
07020003-578	15MN087	Ten Mile Creek	120.89	Northern Streams	47	50.07	11-Aug-15
07020003-577	15MN056	Judicial Ditch 1	55.03	Low Gradient	15	13.28	15-Jun-15
Lower Lac qui Parle River							
07020003-501	10EM003	Lac qui Parle River	867.98	Southern Streams	50	59.09	24-Aug-10

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Fish class	Threshold	FIBI	Visit date
07020003-501	10EM003	Lac qui Parle River	867.98	Southern Streams	50	66.52	14-Sep-15
07020003-501	10EM003	Lac qui Parle River	867.98	Southern Streams	50	38.18	04-Aug-15
07020003-506	15MN055	Lac Qui Parle River	318.73	Low Gradient	42	38.54	03-Aug-16
07020003-506	15MN055	Lac Qui Parle River	318.73	Low Gradient	42	26.05	15-Jul-15
Lower Lac qui Parle River cont.							
07020003-534	15MN062	County Ditch 29 Branch A	30.96	Low Gradient	42	15.42	17-Jun-15
07020003-506	15MN068	Lac Qui Parle River	385.66	Low Gradient	42	58.55	15-Sep-15
07020003-506	15MN068	Lac Qui Parle River	385.66	Low Gradient	42	62.25	03-Aug-16
07020003-501	15MN082	Lac Qui Parle River	870.25	Southern Streams	50	60.95	15-Sep-15
07020003-501	15MN084	Lac Qui Parle River	893.74	Southern Streams	50	50.38	16-Sep-15
07020003-501	15MN088	Lac Qui Parle River	958.94	Southern Streams	50	39.70	16-Sep-15
07020003-588	15MN090	Trib. to Lac Qui Parle River	12.06	Northern Streams	47	0.00	08-Jun-15
07020003-506	15MN060	Lac Qui Parle River	340.16	Northern Streams	47	53.98	09-Sep-15
County Ditch No. 4							
07020003-582	15MN091	County Ditch 4	53.64	Northern Streams	47	40.54	28-Jul-15
07020003-575	15MN093	Unnamed ditch	4.97	Low Gradient	15	15.78	10-Jun-15

Appendix 3.3 – Biological monitoring results-macroinvertebrate IBI (assessable reaches)

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Invert class	Threshold	MIBI	Visit date
Upper Lac qui Parle River							
07020003-505	15MN036	Lac qui Parle River	51.80	Prairie Streams GP	41	30.69	11-Aug-15
07020003-505	15MN040	Lac Qui Parle River	77.27	Southern Streams RR	37	23.67	11-Aug-15
07020003-505	15MN047	Lac qui Parle River	180.22	Prairie Streams GP	41	57.03	10-Aug-15
07020003-505	15MN041	Lac Qui Parle River	159.48	Prairie Streams GP	41	30.18	12-Aug-15
07020003-505	15MN041	Lac Qui Parle River	159.48	Prairie Streams GP	41	54.19	12-Aug-15
Trib. To Lac qui Parle River							
07020003-530	03MN044	Trib. to LqP River	75.83	Southern Streams RR	37	34.83	11-Aug-15
07020003-569	15MN039	Unnamed creek	56.15	Prairie Streams GP	41	28.27	11-Aug-15
Lazarus Creek							
07020003-509	15MN102	Lazarus Creek	18.28	Southern Streams RR	37	36.45	11-Aug-15
07020003-509	15MN043	Lazarus Creek	35.30	Prairie Streams GP	41	37.10	11-Aug-15
07020003-586	15MN044	Canby Creek	34.43	Prairie Streams GP	22	37.72	12-Aug-15
07020003-509	15MN045	Lazarus Creek	50.00	Prairie Streams GP	41	22.25	10-Aug-15
07020003-557	09MN093	Canby Creek	13.00	Southern Coldwater	43	31.08	11-Aug-15
07020003-508	15MN049	Lazarus Creek	124.83	Prairie Streams GP	41	35.81	10-Aug-15
07020003-557	09MN093	Canby Creek	13.00	Southern Coldwater	43	12.91	21-Sep-09
07020003-560	15MN053	Trib. to Lazarus Creek	19.79	Prairie Streams GP	22	36.81	12-Aug-15
Upper W Br. Lac qui Parle River							
07020003-516	15MN074	W Br LqP River	152.93	Prairie Streams GP	41	32.86	13-Aug-15
07020003-519	15MN103	W Br LqP River	59.13	Prairie Streams GP	41	55.64	12-Aug-15
Lost Creek							
07020003-567	15MN066	Trib. to Crow Timber Creek	15.16	Prairie Streams GP	41	8.47	12-Aug-15
07020003-520	15MN070	Crow Timber Creek	38.48	Prairie Streams GP	41	24.79	12-Aug-15
07020003-517	15MN072	Lost Creek	75.44	Prairie Streams GP	41	36.34	12-Aug-15
07020003-517	15MN072	Lost Creek	75.44	Prairie Streams GP	41	46.69	12-Aug-15
07020003-520	15MN065	Crow Timber Creek	19.06	Prairie Streams GP	41	15.69	12-Aug-15

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Invert class	Threshold	MIBI	Visit date
Florida Creek							
07020003-521	03MN047	Florida Creek	74.91	Southern Streams RR	37	48.14	11-Aug-15
07020003-583	15MN059	Cobb Creek	15.38	Prairie Streams GP	22	16.06	12-Aug-15
07020003-521	15MN073	Florida Creek	149.62	Prairie Streams GP	41	46.64	13-Aug-15
07020003-521	15MN067	Florida Creek	105.99	Prairie Streams GP	41	37.94	13-Aug-15
Lower W Br. Lac qui Parle River							
07020003-513	15MN097	W Br. LqP River	478.97	Southern Streams RR	37	28.51	11-Aug-15
07020003-512	15MN209	W Br. LqP River	471.12	Prairie Streams GP	41	34.56	18-Aug-15
07020003-515	15MN079	W Br. LqP River	375.95	Prairie Streams GP	41	46.73	13-Aug-15
07020003-515	15MN069	W Br. LqP River	412.48	Prairie Streams GP	41	42.11	10-Aug-15
Trib. To W Br. Lac qui Parle River							
07020003-580	15MN078	Trib. to LqP River	49.59	Prairie Streams GP	41	11.19	10-Aug-15
Tenmile Creek							
07020003-577	15MN075	Tenmile Creek	90.67	Southern Streams RR	24	20.00	11-Aug-15
07020003-578	15MN087	Ten Mile Creek	120.89	Southern Streams RR	37	22.77	11-Aug-15
07020003-570	15MN050	Trib. to Tenmile Creek	17.99	Prairie Streams GP	22	8.40	12-Aug-15
07020003-526	15MN077	County Ditch 34	18.27	Prairie Streams GP	22	4.39	11-Aug-15
07020003-577	15MN056	Judicial Ditch 1	55.03	Prairie Streams GP	22	10.03	11-Aug-15
07020003-577	15MN056	Judicial Ditch 1	55.03	Prairie Streams GP	22	14.87	11-Aug-15
07020003-571	15MN058	Trib. to Tenmile Creek	13.49	Prairie Streams GP	22	4.99	11-Aug-15
07020003-577	15MN054	Tenmile Creek	10.73	Prairie Streams GP	22	16.73	12-Aug-15
07020003-570	15MN050	Trib. to Tenmile Creek	17.99	Prairie Streams GP	22	3.81	12-Aug-15
Lower Lac qui Parle River							
07020003-501	15MN082	Lac Qui Parle River	870.25	Prairie Forest Rivers	31	27.36	13-Aug-15
07020003-501	15MN084	Lac Qui Parle River	893.74	Prairie Forest Rivers	31	31.02	13-Aug-15
07020003-501	15MN088	Lac Qui Parle River	958.94	Prairie Forest Rivers	31	31.73	11-Aug-15
07020003-502	15MN092	Lac qui Parle River	1096.28	Prairie Forest Rivers	31	17.10	11-Aug-15

National Hydrography Dataset (NHD) Assessment Segment WID	Biological station ID	Stream segment name	Drainage area Mi^2	Invert class	Threshold	MIBI	Visit date
Lower Lac qui Parle River cont.							
07020003-501	90MN004	Lac qui Parle River	897.13	Prairie Forest Rivers	31	37.72	24-Aug-10
07020003-501	10EM003	Lac qui Parle River	867.98	Prairie Forest Rivers	31	25.20	24-Aug-10
07020003-501	10EM003	Lac qui Parle River	867.98	Prairie Forest Rivers	31	9.97	18-Aug-15
07020003-501	10EM003	Lac qui Parle River	867.98	Prairie Forest Rivers	31	8.75	18-Aug-15
07020003-506	03MN051	Lac Qui Parle River	378.05	Southern Streams RR	37	43.48	01-Aug-16
07020003-501	15MN082	Lac Qui Parle River	870.25	Prairie Forest Rivers	31	33.34	13-Aug-15
07020003-588	15MN090	Trib. to LqP River	12.06	Southern Streams RR	37	24.41	11-Aug-15
07020003-506	15MN060	Lac Qui Parle River	340.16	Southern Streams RR	37	21.87	12-Aug-15
07020003-506	15MN055	Lac Qui Parle River	318.73	Prairie Streams GP	41	45.59	12-Aug-15
07020003-506	15MN068	Lac Qui Parle River	385.66	Prairie Streams GP	41	59.78	12-Aug-15
County Ditch No. 4							
07020003-582	15MN091	County Ditch 4	53.64	Southern Streams RR	37	21.82	13-Aug-15
07020003-575	15MN093	Unnamed ditch	4.97	Prairie Streams GP	22	9.85	10-Aug-15

Appendix 4.1 – Fish species found during biological monitoring surveys

Common name	Quantity of stations where present	Quantity of individuals collected
creek chub	43	2070
common shiner	41	4048
white sucker	41	1135
brassy minnow	39	2005
johnny darter	37	548
fathead minnow	36	3804
brook stickleback	35	757
blacknose dace	32	1174
central stoneroller	32	1083
green sunfish	30	593
hornyhead chub	29	1161
sand shiner	27	1382
bigmouth shiner	21	566
blackside darter	20	312
spotfin shiner	20	1059
bluntnose minnow	19	154
carmine shiner	19	240
common carp	18	57
Iowa darter	17	231
black bullhead	16	56
rock bass	13	86
stonecat	13	47
walleye	13	48
shorthead redhorse	12	108
tadpole madtom	12	29
bluegill	11	24
northern pike	11	34
slenderhead darter	11	99
channel catfish	10	58
golden redhorse	10	61
white bass	10	91
largemouth bass	9	22
yellow perch	8	14
emerald shiner	5	11
bigmouth buffalo	4	15
central mudminnow	3	30
freshwater drum	3	3
hybrid minnow	3	8
silver redhorse	3	9

Common name	Quantity of stations where present	Quantity of individuals collected
yellow bullhead	3	5
black crappie	2	3
greater redhorse	2	2
orangespotted sunfish	2	5
quillback	2	2
golden shiner	1	1
hybrid sunfish	1	1
pearl dace	1	11

Appendix 4.2 – Macroinvertebrate species found during biological monitoring surveys

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Polypedilum	47	1397
Thienemannimyia Gr.	44	441
Cricotopus	40	341
Physella	39	2335
Acari	38	337
Tubificinae	36	127
Cheumatopsyche	35	1262
Pisidiidae	35	202
Dubiraphia	34	458
Stenelmis	32	739
Caenis diminuta	31	827
Baetis	28	405
Dicrotendipes	28	118
Tricorythodes	26	713
Hydroptila	25	254
Nais	25	436
Orconectes	25	47
Coenagrionidae	24	251
Hyalella	24	1238
Rheotanytarsus	24	187
Ablabesmyia	23	54
Macronychus glabratus	23	292
Paratanytarsus	23	170
Hirudinea	22	71
Thienemanniella	22	129
Baetis intercalaris	21	349
Simulium	21	289
Tanytarsus	21	87
Chironomus	19	107
Brillia	18	35

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Hydropsychidae	18	99
Rheocricotopus	18	82
Atherix	17	166
Ceratopsyche morosa	17	224
Glyptotendipes	17	81
Isonychia	17	65
Cryptochironomus	16	32
Hydrobiidae	16	561
Hydropsyche	16	321
Labrundinia	16	59
Paratendipes	16	72
Stenochironomus	16	67
Procladius	15	38
Ephydridae	14	30
Hydroptilidae	14	44
Phaenopsectra	14	29
Stenacron	14	37
Zavrelimyia	14	30
Calopterygidae	13	33
Corixidae	13	108
Hemerodromia	13	37
Heptagenia	13	151
Stagnicola	13	77
Orthocladiinae	12	47
Orthocladius	12	31
Brachycentrus numerosus	11	35

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Maccaffertium	11	84
Lymnaeidae	10	33
Micropsectra	10	44
Nanocladius	10	12
Nectopsyche diarina	10	49
Nemata	10	27
Neoplea striola	10	14
Stictochironomus	10	22
Ceratopsyche	9	95
Conchapelopia	9	13
Ferrissia	9	118
Heptageniidae	9	37
Hydropsyche betteni	9	90
Tanypodinae	9	13
Caenis	8	117

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Chironomini	8	12
Optioservus	8	28
Tipula	8	10
Aeshna	7	7
Belostoma flumineum	7	8
Ceratopogoninae	7	15
Fallceon	7	44
Fridericia	7	11
Helichus	7	44
Parakiefferiella	7	49
Potamyia flava	7	10
Calopteryx	6	14
Cladotanytarsus	6	7
Hydropsyche simulans	6	36
Naididae	6	11
Pseudosuccinea columella	6	24
Corynoneura	5	9
Empididae	5	11
Enchytraeus	5	11
Gyraulus	5	34
Haliplus	5	18
Helicopsyche borealis	5	10
Physidae	5	64
Anax junius	4	4
Anthopotamus	4	11
Atrichopogon	4	10
Caenis hilaris	4	8
Ceraclea	4	6
Ceratopogonidae	4	4
Gomphidae	4	4
Hydrophilidae	4	5
Hydropsyche placoda	4	49
Leptoceridae	4	5
Leucrocuta	4	9
Limnophyes	4	6
Nectopsyche candida	4	5
Palmacorixa	4	24
Parachironomus	4	5
Paralauterborniella nigrohalterale	4	6
Rhagovelia	4	9
Argia	3	3
Calopteryx aequabilis	3	5

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Elmidae	3	9
Labiobaetis dardanus	3	26
Leptophlebiidae	3	4
Limnodrilus	3	3
Microtendipes	3	6
Nectopsyche	3	3
Nilotanypus	3	3
Oecetis avara	3	8
Parametriocnemus	3	5
Peltodytes	3	3
Planorbidae	3	19
Stylaria	3	38
Tanytarsini	3	3
Trichocorixa	3	3
Tvetenia	3	5
Acroneuria abnormis	2	2
Aeshna umbrosa	2	2
Amphipoda	2	5
Antocha	2	3
Baetis brunneicolor	2	7
Bezzia/Palpomyia	2	2
Callibaetis	2	2
Chaetogaster	2	2
Crangonyx	2	3
Endochironomus	2	4
Gammarus	2	22
Hexagenia	2	2
Maccaffertium mediopunctatum	2	9
Maccaffertium terminatum	2	5
Mayatrichia ayama	2	3
Neoplasta	2	4
Oecetis furva	2	2
Oligochaeta	2	21
Paracladopelma	2	2
Physa	2	38
Planorbella	2	6
Pycnopsyche	2	5
Rheumatobates	2	8
Saetheria	2	7
Stratiomyidae	2	2
Tabanidae	2	2
Thienemannimyia	2	8

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Tribelos	2	3
Acentrella parvula	1	1
Acerpenna	1	4
Acerpenna pygmaea	1	13
Acroneuria	1	2
Acroneuria lycorias	1	2
Aeshnidae	1	1
Anacaena	1	1
Anisoptera	1	1
Anthopotamus myops	1	2
Aulodrilus	1	1
Baetidae	1	1
Baetis flavistriga	1	1
Baetis tricaudatus	1	1
Baetisca	1	1
Belostoma	1	1
Boyeria	1	2
Branchiobdellida	1	7
Bratislavia	1	1
Caecidotea	1	1
Caloparyphus	1	3
Cambaridae	1	1
Ceratopsyche slossonae	1	1
Coleoptera	1	1
Cryptotendipes	1	1
Dero	1	1
Dicranota	1	7
Ephemeridae	1	1
Ephoron	1	1
Erioptera	1	1
Eukiefferiella	1	6
Forcipomyia	1	1
Fossaria	1	1
Gerridae	1	3
Gerris	1	1
Gomphus	1	1
Helicopsyche	1	9
Helisoma anceps	1	1
Hetaerina	1	1
Hexatoma	1	1
Hydrobaenus	1	1
Isopoda	1	1

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Kloosia/Harnischia	1	2
Labiobaetis frondalis	1	1
Labiobaetis propinquus	1	4
Laccophilus	1	3
Lethocerus	1	1
Limnephilidae	1	5
Liodessus	1	1
Macronychus	1	1
Merragata	1	1
Mesovelia	1	1
Metrobates	1	2
Microvelia	1	1
Naidinae	1	1
Nematomorpha	1	1
Neoplea	1	6
Neotrichia	1	6
Neureclipsis	1	1
Nyctiophylax	1	2
Ochrotrichia	1	1
Ochthebius	1	1
Oecetis	1	1
Paracloeodes minutus	1	1
Paracymus	1	1
Paraleptophlebia	1	10
Perlesta	1	1
Phryganeidae	1	1
Plauditus	1	2
Procloeon	1	10
Pseudosmittia	1	1
Psychoda	1	2
Pteronarcys	1	1
Ranatra	1	1
Robackia	1	3
Sciomyzidae	1	1
Scirtes	1	1
Scirtidae	1	2
Sialis	1	1
Sigara	1	6
Stenonema	1	9
Synorthocladius	1	1
Taeniopteryx	1	1
Trepaxonemata	1	2
Trichoptera	1	1

Taxonomic name	Quantity of stations where present	Quantity of individuals collected
Tropisternus	1	1
Valvata	1	1
Paracloeodes minutus	1	1
Paracymus	1	1
Paraleptophlebia	1	10
Perlesta	1	1
Phryganeidae	1	1
Plauditus	1	2
Procloeon	1	10
Pseudosmittia	1	1
Psychoda	1	2
Pteronarcys	1	1
Ranatra	1	1
Robackia	1	3
Sciomyzidae	1	1
Scirtes	1	1
Scirtidae	1	2
Sialis	1	1
Sigara	1	6
Stenonema	1	9
Synorthocladius	1	1
Taeniopteryx	1	1
Trepaxonemata	1	2
Trichoptera	1	1
Tropisternus	1	1
Valvata	1	1
Synorthocladius	1	1
Taeniopteryx	1	1
Trepaxonemata	1	2
Trichoptera	1	1
Tropisternus	1	1
Valvata	1	1
Synorthocladius	1	1
Taeniopteryx	1	1
Trepaxonemata	1	2
Trichoptera	1	1
Tropisternus	1	1
Valvata	1	1

Appendix 5 – Minnesota Stream Habitat Assessment results

Habitat information documented during each fish sampling visit is provided. This table conveys the results of the Minnesota Stream Habitat Assessment (MSHA) survey, which evaluates the section of stream sampled for biology and can provide an indication of potential stressors (e.g., siltation, eutrophication) impacting fish and macroinvertebrate communities. The MSHA score is comprised of five scoring categories including adjacent land use, riparian zone, substrate, fish cover and channel morphology, which are summed for a total possible score of 100 points. Scores for each category, a summation of the total MSHA score, and a narrative habitat condition rating are provided in the tables for each biological monitoring station. Where multiple visits occur at the same station, the scores from each visit have been averaged. The final row in each table displays average MSHA scores and a rating for the aggregated HUC-12 subwatershed.

# Visits	Biological station ID	Reach name	Land use	Ripa rian	Subst rate	Fish cover	Channel morph.	MSHA score	MSHA rating
2	15MN085	County Ditch 5	0.00	10.5	3.00	9.50	5.00	28.00	Poor
1	15MN096	County Ditch 5	0.00	3.00	2.00	2.00	0.00	7.00	Poor
Average Results: County Ditch 5			0.00	8.00	2.67	7.00	3.33	21.00	Poor
2	15MN091	County Ditch 4	0.00	9.00	18.90	11.00	25.50	64.40	Fair
2	15MN093	Unnamed Ditch	0.00	7.50	5.50	4.50	3.50	21.00	Poor
Average Habitat Results: Co. Ditch 4			0.00	8.25	12.20	7.75	14.50	42.70	Poor
3	03MN047	Florida Creek	1.67	11.0	15.67	12.33	23.67	64.33	Fair
2	15MN059	Cobb Creek	0.00	6.75	13.50	7.50	6.00	33.75	Poor
2	15MN067	Florida Creek	0.63	7.00	10.65	5.50	14.50	38.27	Poor
2	15MN073	Florida Creek	0.00	7.25	12.90	11.50	15.00	46.65	Fair
Average Habitat Results: Florida Creek			0.69	8.33	13.46	9.56	15.78	47.82	Fair
4	09MN093	Canby Creek	1.25	12.0	20.75	12.00	25.75	71.75	Good
2	15MN043	Lazarus Creek	0.00	10.0	13.15	11.00	21.00	55.15	Fair
3	15MN044	Canby Creek	0.00	7.17	10.67	6.67	6.67	31.17	Poor
3	15MN045	Lazarus Creek	0.00	6.50	15.42	6.67	11.67	40.25	Poor
2	15MN049	Lazarus Creek	0.00	9.25	9.20	11.00	14.00	43.45	Poor
2	15MN053	Judicial Ditch 1	0.00	4.00	6.50	10.00	4.00	24.50	Poor
2	15MN102	Lazarus Creek	0.50	7.75	16.97	10.50	23.00	58.72	Fair
Average Habitat Results: Lazarus Creek			0.33	8.39	14.05	9.61	15.67	48.05	Fair
2	15MN065	Crow Timber	0.00	10.5	15.13	13.50	20.00	59.13	Fair
2	15MN066	Unnamed Creek	0.00	4.50	14.82	10.50	14.50	44.33	Poor
2	15MN070	Crow Timber	0.00	6.75	17.75	7.00	10.00	41.50	Poor
4	15MN072	Lost Creek	0.00	8.13	15.92	14.50	19.25	57.80	Fair
Average Habitat Results: Lost Creek			0.00	7.60	15.91	12.00	16.60	52.11	Fair

Qualitative habitat ratings

= Good: MSHA score above the median of the least-disturbed sites (MSHA>66)

= Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45 < MSHA < 66)

= Poor: MSHA score below the median of the most-disturbed sites (MSHA<45)

# Visits	Biological station ID	Reach name	Land use	Ripa rian	Subst rate	Fish cover	Channel morph.	MSHA score	MSHA rating
1	03MN051	Lac qui Parle	0.00	7.50	16.10	11.00	19.00	53.60	Fair
2	03MN055	Lac qui Parle	0.00	8.00	4.50	8.00	5.50	26.00	Poor
4	10EM003	Lac qui Parle	0.63	7.25	17.16	9.25	20.00	54.29	Fair
3	15MN055	Lac qui Parle	0.00	4.83	6.73	8.00	13.33	32.90	Poor
2	15MN060	Lac qui Parle	0.63	6.25	17.68	10.50	21.00	56.05	Fair
2	15MN062	Unnamed Creek	0.00	8.00	11.00	12.00	13.00	44.00	Poor
3	15MN068	Lac qui Parle	0.00	6.00	12.25	9.33	16.33	43.92	Poor
3	15MN082	Lac qui Parle	0.00	9.50	17.70	11.00	22.00	60.20	Fair
2	15MN084	Lac qui Parle	0.63	5.75	17.05	12.50	21.00	56.93	Fair
2	15MN088	Lac qui Parle	2.50	7.50	19.15	10.50	23.50	63.15	Fair
2	15MN090	Unnamed Creek	0.00	10.7	19.65	15.50	26.00	71.90	Good
2	15MN092	Lac qui Parle	2.50	9.25	6.00	6.50	11.50	35.75	Poor
Average Results: Lower Lac qui Parle River			0.56	7.37	13.60	10.11	17.59	49.23	Fair
2	15MN069	W Br LqP River	0.63	8.75	15.20	11.50	13.50	49.58	Fair
2	15MN071	W Br LqP River	1.00	5.50	5.00	1.50	1.50	14.50	Poor
2	15MN079	W Br LqP River	0.00	7.25	8.60	12.50	15.50	43.85	Poor
2	15MN097	W Br LqP River	0.00	8.25	15.38	12.00	18.50	54.13	Fair
2	15MN106	W Br LqP River	0.00	9.50	3.00	5.00	4.00	21.50	Poor
1	15MN209	W Br LqP River	2.00	6.50	13.00	12.00	13.00	46.50	Fair
Average Habitat Results: Lower W Br LqP			0.48	7.73	9.76	8.82	10.82	37.60	Poor
2	15MN050	Unnamed Ditch	0.00	7.00	5.50	7.00	7.00	26.50	Poor
2	15MN054	Tenmile Creek	0.63	7.25	5.00	7.50	5.00	25.38	Poor
2	15MN056	Tenmile Creek	0.00	7.00	10.35	10.00	8.00	35.35	Poor
2	15MN058	Unnamed Ditch	0.00	8.00	6.50	9.50	6.50	30.50	Poor
2	15MN075	Tenmile Creek	0.00	6.25	16.70	7.00	12.00	41.95	Poor
2	15MN077	Unnamed Ditch	0.00	6.75	5.50	6.50	8.00	26.75	Poor
2	15MN087	Unnamed Ditch	3.13	9.50	18.00	11.50	22.50	64.63	Fair
Average Habitat Results: Tenmile Creek			0.54	7.39	9.65	8.43	9.86	35.86	Poor
2	15MN078	Unnamed Creek	0.00	9.00	5.00	6.00	8.00	28.00	Poor
Average Habitat Results: Trib to W Br Lqp			0.00	9.00	5.00	6.00	8.00	28.00	Poor
2	03MN044	Unnamed Creek	0.00	9.25	19.20	10.00	26.00	64.45	Fair
2	15MN039	Unnamed Creek	0.63	7.25	16.40	7.00	15.50	46.77	Fair
Average Habitat Results: Trib to Lqp River			0.31	8.25	17.80	8.50	20.75	55.61	Fair
2	15MN036	Lac qui Parle	0.00	8.00	10.45	11.50	19.00	48.95	Fair
2	15MN040	Lac qui Parle	0.00	10.0	20.75	9.00	23.50	63.25	Fair
3	15MN041	Lac qui Parle	0.00	9.17	13.27	13.00	23.67	59.10	Fair
2	15MN047	Lac qui Parle	0.00	5.75	11.70	7.00	16.00	40.45	Poor
Average Habitat Results: Upper LqP River			0.00	8.33	13.96	10.44	20.89	53.62	Fair
2	15MN074	W Br LqP River	0.00	0.75	14.00	5.00	16.50	36.25	Poor
2	15MN103	W Br LqP River	0.00	10.0	18.48	11.00	25.00	64.48	Fair
Average Habitat Results: Upper W Br LqP			0.00	5.38	16.24	8.00	20.75	50.36	Fair

Appendix 6 – Lake protection and prioritization results

Lake ID	Lake Name	Mean TP	Trend	% Disturbed Land Use	5% load reduction goal	Priority
87018000	Del Clark	38.0	Insufficient Data	55%	29	B
41010900	Unnamed (Bohemian)	101.0		48%	0	A
37022900	Salt	175.0	Insufficient Data	25%	0	A
37010300	Cory	232.5	Insufficient Data	85%	111	C
37014800	Unnamed (Arena)	404.0	Insufficient Data	73%	122	C