Watonwan Watershed Monitoring and Assessment Report

Minnesota Pollution Control Agency

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List of acronyms

AUID Assessment Unit Identification Determination

CCSI Channel Condition and Stability Index

CD County Ditch

CI Confidence Interval

CLMP Citizen Lake Monitoring Program

CR County Road

CREP Conservation Reserve Enhancement Program

CRP Conservation Reserve Program

CSAH County State Aid Highway

CSMP Citizen Stream Monitoring Program

CWA Clean Water Act

CWLA Clean Water Legacy Act

DOP Dissolved Orthophosphate

E Eutrophic

EQuIS Environmental Quality Information System

EX Exceeds Criteria (Bacteria)

EXP Exceeds Criteria, Potential Impairment

EXS Exceeds Criteria, Potential Severe Impairment

FS Full Support

FWMC Flow Weighted Mean Concentration

GBERB Greater Blue Earth River Basin

H Hypereutrophic

HUC Hydrologic Unit Code

IBI Index of Biotic Integrity

IF Insufficient Information

IWM Intensive watershed monitoring

K Potassium

LRVW Limited Resource Value Water

M Mesotrophic

MCES Metropolitan Council Environmental Services

MDA Minnesota Department of Agriculture

MDH Minnesota Department of Health

MINLEAP Minnesota Lake Eutrophication Analysis Procedure

MNDNR Minnesota Department of Natural Resources

MPCA Minnesota Pollution Control Agency

MSHA Minnesota Stream Habitat Assessment

MTS Meets the Standard

N Nitrogen

Nitrate-N Nitrate Plus Nitrite Nitrogen

NA Not Assessed

NHD National Hydrologic Dataset

NH3 Ammonia

NS Not Supporting

NT No Trend

OP Orthophosphate

P Phosphorous

PCB Poly Chlorinated Biphenyls

PWI Protected Waters Inventory

RNR River Nutrient Region

SWAG Surface Water Assessment Grant

SWCD Soil and Water Conservation District

SWUD State Water Use Database

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

WPLMN Water Pollutant Load Monitoring Network

WRP Wetland Restoration Program

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Executive summary

The results of the two year monitoring effort demonstrated there is degraded water quality and impaired biological communities throughout the Watonwan River watershed. Streams are, by default, required to meet general use standards. All natural streams must meet general use standards or higher. Streams that have modified by humans are evaluated. If they are found to be substantially modified or changed and cannot meet those standards they will be required to meet a lower set of standards called modified use standards. In the Watonwan River Watershed only 22% of streams are natural. Of the sites with assessable biological data 33% were determined to meet modified use requirements and were assessed using those lower standards. These standards only apply to fish and macroinvertebrate communities; streams are required to meet the same water chemistry standards.

Prior to this assessment of the Watonwan River Watershed turbidity impairments were common throughout. Reevaluation of these impairments resulted in 100% continuing to be listed as impaired; turbidity is an indicator for aquatic life in streams. Turbidity has long been a problem in the watershed, highlighting the persisting sediment problems. It is a measure of particles suspended in the water and can be an indicator of sediment levels. High turbidity readings can be the result of bank erosion, field runoff, urban runoff, or other sources. High turbidity levels can negatively impact fish and macroinvertebrates by limiting visibility for carnivorous species and altering habitat by depositing particles as sediment on the stream bottom. Sediment built up from turbid water and other sources can cover riffles and fill in pools eventually causing the stream to loose habitat variability and have reduced diversity in biological communities. Widespread exceedances of bacterial standards were seen at water chemistry stations throughout the watershed. Across the watershed 94% of streams assessed for aquatic recreation, using bacteria as an indicator, are impaired. All of the streams impaired for bacteria before this assessment will continue to be listed. Streams are impaired for aquatic recreation when levels of *E. coli* are high enough to pose a threat to human health. Previous listings could have resulted from elevated fecal coliform levels. Total Phosphorus (TP) was found to be elevated in several streams throughout the watershed, but chlorophyll-a (chl-a) amounts did not indicate an impairment.

Lake water quality performed as expected based on results from similar Minnesota River watersheds with widespread agricultural practices. Assessment of the lakes for aquatic recreation concluded 40% exceed the standard for nutrients, which means these lakes produce algae in levels that diminish the enjoyment of water recreation. This study also found 40% of sampled lakes did not have sufficient data for an assessment.

The MPCA collects fish to determine if they contain contaminants in levels that can harm human health. Fish in the Watonwan River Watershed were tested for mercury and polychlorinated biphenyls (PCBs). PCBs were not found to be a concern in any of the lakes or streams tested; however, mercury was found in fish samples from Mountain Lake with levels exceeding the standards for fish consumption. The Department of Health translates findings like these into safe eating guidelines that can be found in their annual Fish Consumption Advisory.

Tolerant fish and macroinvertebrates species dominated samples taken in the Watonwan River Watershed. Of the sites assessed for aquatic life 77% did not meet standards. Samples meeting standards were taken from streams determined to be modified use, meaning they do not have to meet as rigorous of standards. Tolerant fish account for 74% of the total number of fish collected. Tolerant species persist in degraded systems and can begin to dominate the fish community, ultimately leaving little resources for other species. These species are known to exist in streams that are habitat limited, sediment laden and/or chemically impaired. Similar to fish the macroinvertebrate samples were dominated by tolerant species and few species were found to indicate healthy water quality. Lakes were assessed using fish samples taken by the Minnesota Department of Natural Resources (MNDNR). Of the lakes assessed for aquatic life 83% did not meet standards. Poor water quality is likely influencing the biological communities.

Substantial wetland loss is seen in all of the subwatersheds within the Watonwan River Watershed. Currently only 3.65% of land within the Watonwan River Watershed is defined as wetland. Historic records indicate the entire watershed has lost 92.94% of wetlands that used to exist. Two wetlands had data within the 10-year window that could be used for this report. Macroinvertebrate and plant communities for both wetlands were evaluated and found to be in poor condition.

Annual pollutant loads have been calculated for TSS, NO3+NO2-N, TP, DOP, and TKN. Between 2007 and 2013, 40% of the 300 TSS samples collected exceeded the Southern River Nutrient Regions (SRNR) standard for total suspended solids (TSS). The majority (78%) of exceedances occurred between March and June when vegetative canopy is lacking or poorly defined. The majority of annual TSS loads are often delivered from two to four runoff events during this same period. While the Watonwan River's TSS loading rate is not as significant as those from neighboring watersheds, the Blue Earth and Le Sueur, on a statewide level it is still substantial and is the equivalent of the average TSS load coming out of the entire St. Croix River Basin. Water quality sample total phosphorus (TP) concentrations were at or above the standard. A disproportionate 32% of the average annual TP load passes through the watershed during the month of March alone, a month largely dominated by snowmelt runoff. The average TP Flow Weighted Mean Concentration (FWMC) was above the Southern RNR standard every year except 2008: this is in line with the other agriculturally rich watersheds in Minnesota. Of the 343 samples taken between 2007 and 2013, 27% were above the nitrate drinking water standard and occurred primarily under high to very high flow conditions. Similar to TSS and TP, the heaviest loading months for NO2+NO3-N were during the March through June time period.

Groundwater in the region was tested for nitrogen and arsenic. Nitrate-nitrogen was detected in 67% of samples and 25% were found to have levels above the standard for drinking water. Arsenic was found in 68% of wells in Watonwan County in levels above 2ug/L. Of those samples 13% were above the maximum contaminant level.

The streams and lakes of the Watonwan River Watershed are in poor condition. The waters widely violate the standards for swimming and other recreation, for aquatic life and for fish consumption. The impairments are seen in the form of turbid water, poor fish and macroinvertebrate communities, high bacteria levels and high nutrient levels. These results are similar to other Minnesota River watersheds with widespread agricultural practices. Bank erosion, poor stream buffers, large amounts of row crop cover, altered hydrology and direct tile lines to stream were seen at many of the streams in the Watonwan River Watershed and can be contributing factors to the identified impairments. Increasing flow in streams through modified hydrology and tile lines can result in amplified high water damage and higher levels of bank erosion. State waters are evaluated against the standards described in this report in an effort to protect them for the communities that rely on them. Minnesota and its citizens not only enjoy the streams and lakes fish fishing, swimming and boating, but rely on them for economic purposes. The next step in working on the Watonwan River Watershed will be done by the Stressor Identification Biologists who will identify the causes of the impairments. From there a unique plan will be created to restore the impaired waters and protect healthy streams and lakes. The results of restoration projects can take years to see dramatic results; however, every effort made to protect these lakes and streams will have an effect. With the cooperative work of property owners, local watershed partners and state agencies the Watonwan River Watershed can be restored to provide swimmable, fishable and drinkable water for the generations to come.

Introduction

Water is one of Minnesota's most abundant and precious resources. The 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 (CWLA) 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 Watonwan River Watershed beginning in the summer of 2013. This report provides a summary of all water quality assessment results in the Watonwan 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 (Figure 1). 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 Network

Funded with appropriations from Minnesota's Clean Water Legacy Fund, the Watershed Pollutant Load Monitoring Network (WPLMN) is a long-term program designed to measure and compare regional differences and long-term trends in water quality among Minnesota's major rivers including the Red, Rainy, St. Croix, Mississippi, and Minnesota, and the outlets of the major tributaries (8 digit HUC scale) draining to these rivers. Since the program's inception in 2007, the WPLMN has adopted a multi-agency monitoring design that combines site specific stream flow data from United States Geological Survey (USGS) and MNDNR flow gaging stations with water quality data collected by the Metropolitan Council Environmental Services (MCES), local monitoring organizations, and MPCA to compute pollutant loads from 201 streams and rivers across Minnesota. Monitoring sites span three ranges of scale with annual loads calculated for basin and major watershed sites and seasonal loads for subwatershed sites:

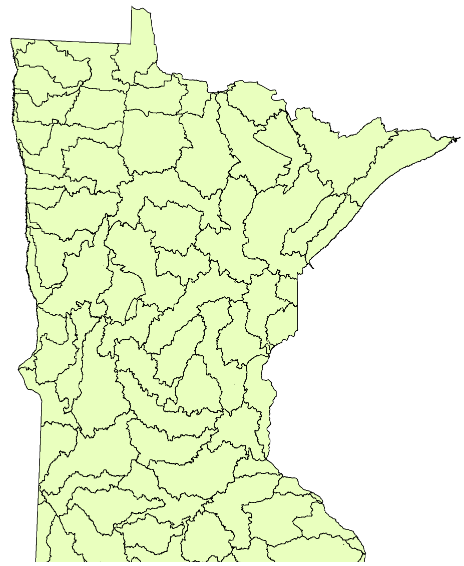


Figure 1. Major watersheds within Minnesota (8-Digit HUC).

- ***Basin*** – major river mainstem sites along the Mississippi, Minnesota, Rainy, Red, Des Moines, and St. Croix rivers
- ***Major Watershed*** – tributaries draining to basin 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

Data will also be used to assist with: TMDL studies and implementation plans; watershed modeling efforts; watershed research projects and watershed restoration and protection strategies.

More information can be found at the WPLMN website including a map of the sites.

The Watonwan River near Garden City site on CSAH 13 (MNDNR/MPCA ID 31051001, USGS ID 05319500, EQuIS ID S000-163) is the furthest downstream WPLMN monitoring site in the Watonwan River Watershed and drains an area of approximately 851 square miles (Figure 2). The gage is operated by the United States Geological Survey and is located approximately 7.7 river miles above the confluence of the Watonwan with the Blue Earth River near Rapidan, Minnesota. An average of 47 mid-stream grab samples were collected from this site per year between 2007 and 2014. Two subwatershed sites were also established in the watershed during 2013, the South Fork Watonwan River near Madelia, CSAH13 (DNR/MPCA ID 31021001, EQuIS ID S002-251), and the Watonwan River near La Salle, CSAH3 (DNR/MPCA ID 31028001, EQuIS ID S002-254).

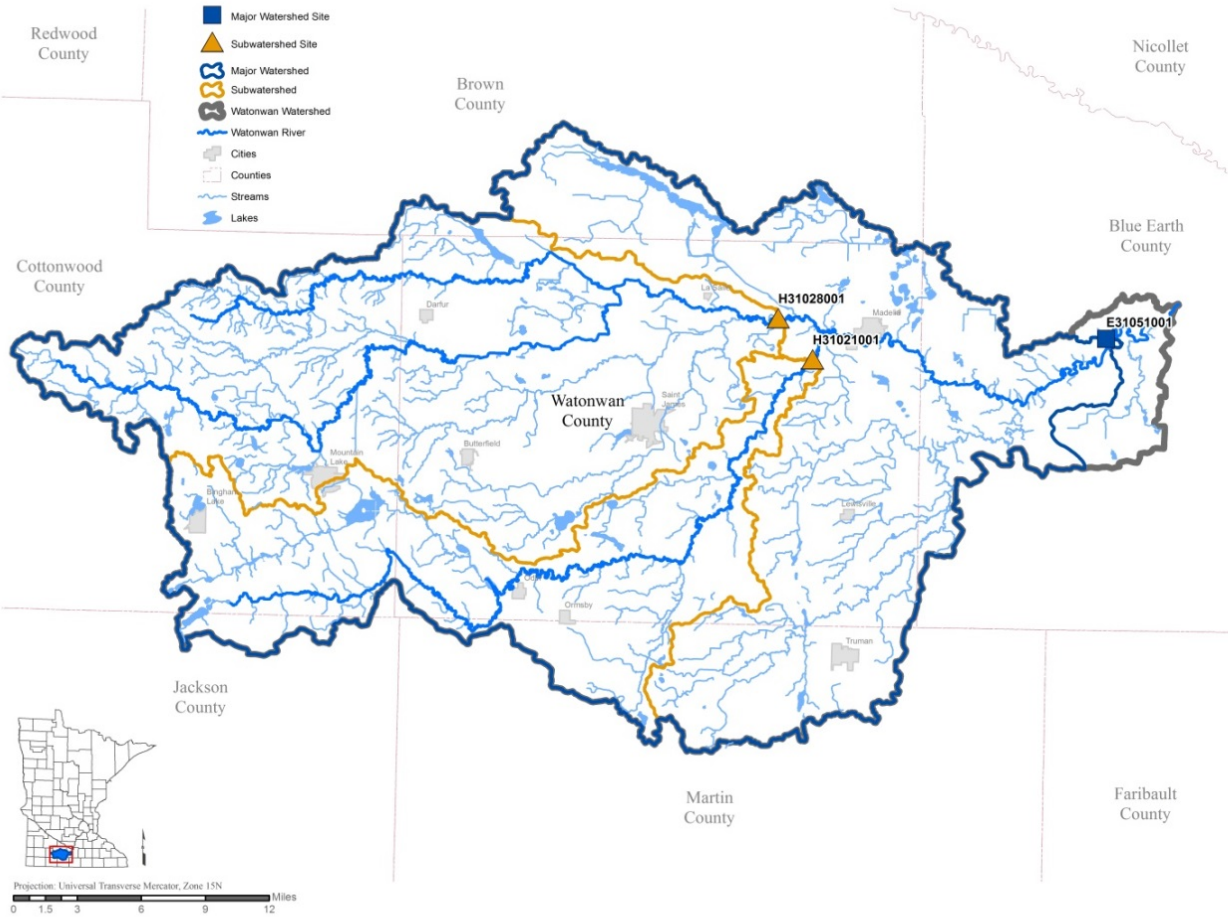


Figure 2. WPLMN monitoring sites in the Watonwan River Watershed.

Intensive watershed monitoring

The (IWM) strategy utilizes a nested watershed design allowing the sampling of streams within watersheds from a coarse to a fine scale (Figure 3). 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 3). 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 4) 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 mi^2. Each aggregated 12-HUC outlet (green dots in Figure 4) 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 mi^2), 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 4).

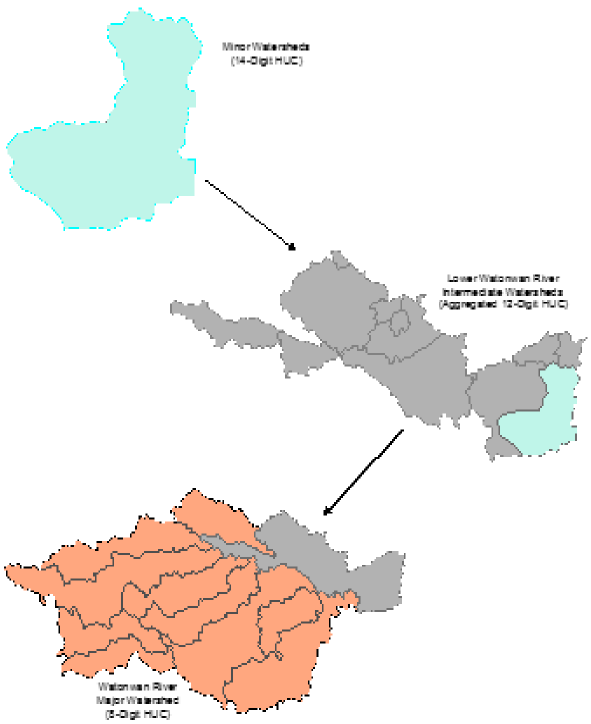


Figure 3. The Intensive Watershed Monitoring Design.

Within the IWM strategy, lakes are selected to represent the range of conditions and lake type (size and depth) found within the watershed. 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. Lakes are sampled monthly from May-September for a two-year period. The MNDNR has developed a fish based aquatic life index to assess lakes.

Specific locations for sites sampled as part of the intensive monitoring effort in the Watonwan River Watershed are shown in Figure 4 and are listed in Appendix 2.1, Appendix 4.2, and Appendix 4.3.

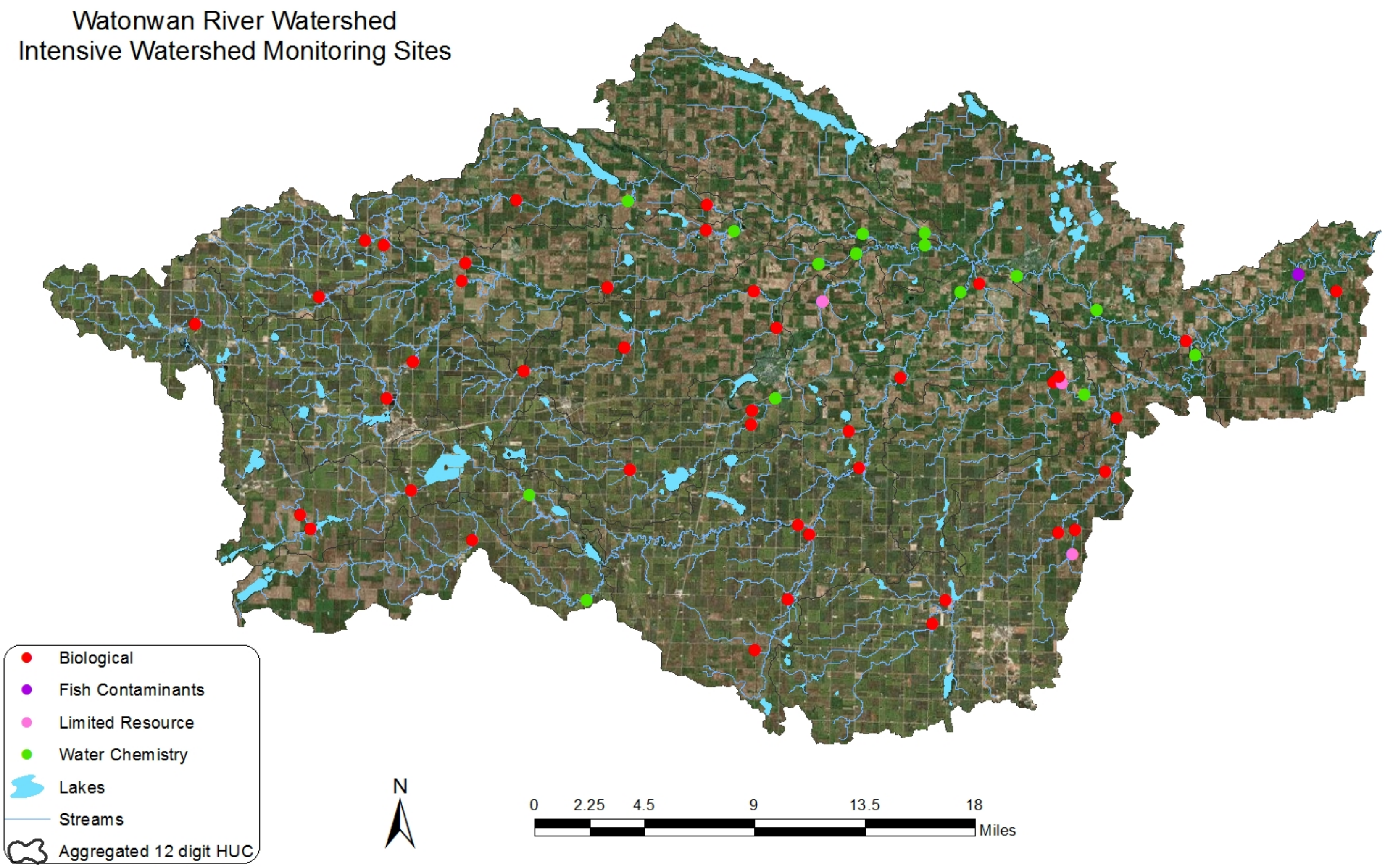


Figure 4. Intensive watershed monitoring sites for streams in the Watonwan River Watershed.

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 IWM process. Funding passes from MPCA through Surface Water Assessment Grants (SWAGs) to local groups such as counties, soil and water conservation districts (SWCDs), 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 (CSMP). 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 6 provides an illustration of the locations where citizen monitoring data were used for assessment in the Watonwan River Watershed.

Citizen volunteers enrolled in the Citizen Stream Monitoring Program (CSMP) observed physical water characteristics (*i.e.* Secchi-tube transparency) at two stream stations in 2014, just east of the city of Madelia, and submitted those data to the MPCA to aid in the assessment process (Figure 5).

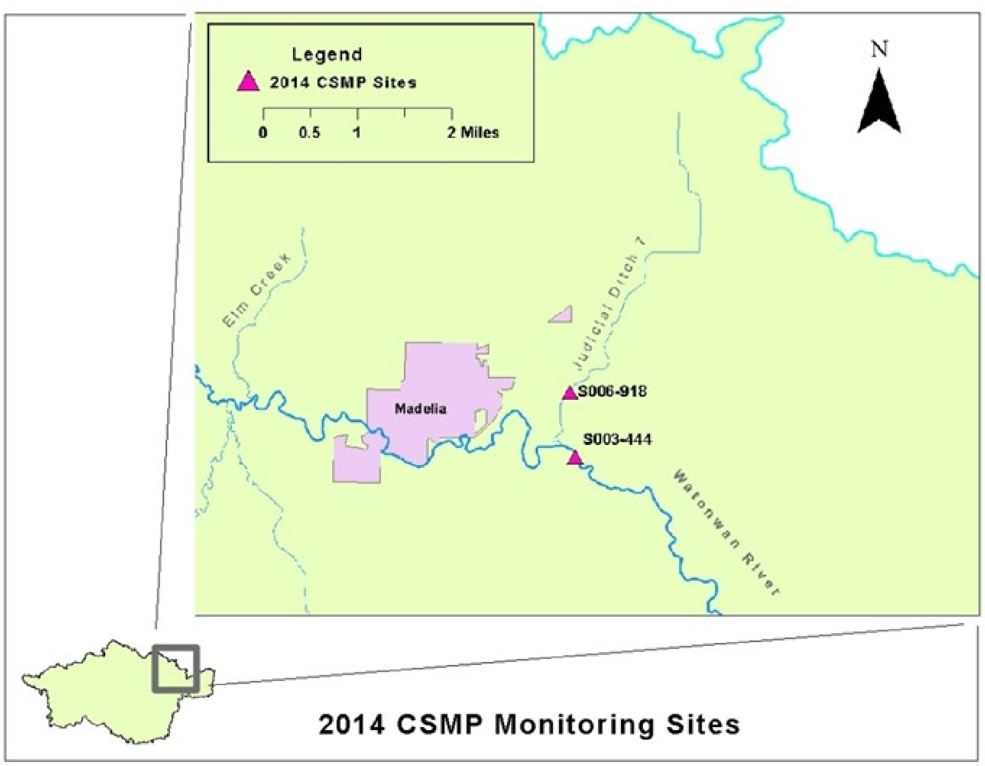


Figure 5. Citizen Monitoring Watonwan Watershed.

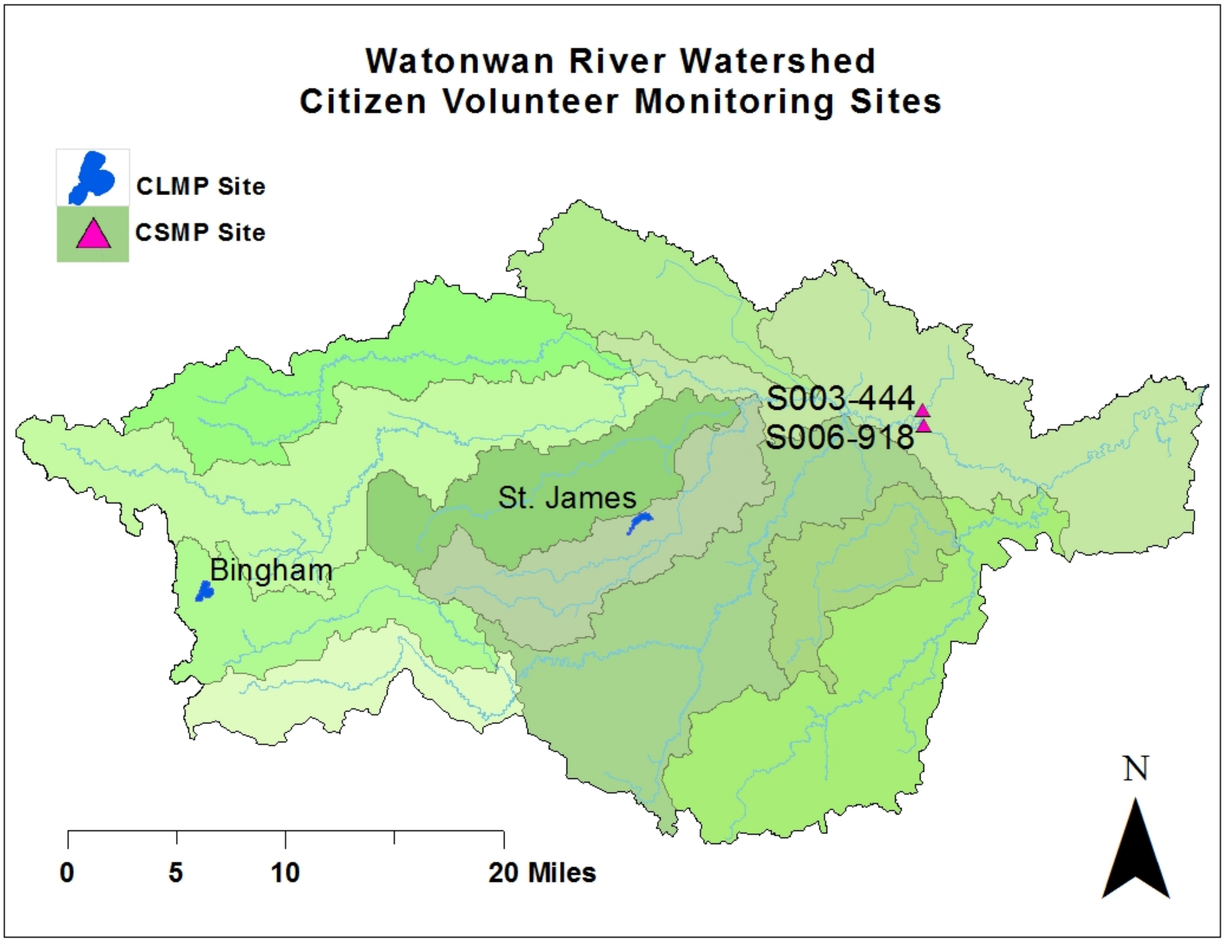


Figure 6. Monitoring locations of local groups, citizens and the MPCA lake monitoring staff in the Watonwan River Watershed.

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). http://www.pca.state.mn.us/index.php/view-document.html?gid=8601.

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 life means the maintenance of a healthy aquatic community, including fish, invertebrates and plants. The sampling of aquatic organisms for assessment is called biological monitoring. Biological monitoring 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 IBI's for (fish and macroinvertebrates) since these communities can respond differently to various types of pollution. Because the rivers and streams in Minnesota are physically, chemically, and biologically diverse IBI's are developed separately for different stream classes to account for this natural variation. Further interpretation of biological community data is provided by an assessment threshold or bio criteria 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, including pH, dissolved oxygen, un-ionized ammonia nitrogen, chloride and turbidity.

Protection for aquatic life uses 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 waters 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. Table of Proposed Tiered Aquatic Life Use Standards.

Proposed Tiered Aquatic Life Use	Acronym	Proposed Use Class Code	Description
Warmwater General	WWg	2Bg	Warmwater 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 .
Warmwater Modified	WWm	2Bm	Warmwater 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
Warmwater Exceptional	WWe	2Be	Warmwater 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 cold water aquatic organisms that meet or exceed the General Use biological criteria .
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 cold water aquatic organisms that meet or exceed the Exceptional Use biological criteria

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.

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 AUID), comprised of the 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 MNDNR. The Protected Waters Inventory (PWI) provides the identification numbers for lake, reservoirs and wetlands. These identification numbers serve as the AUID 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 7.

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).

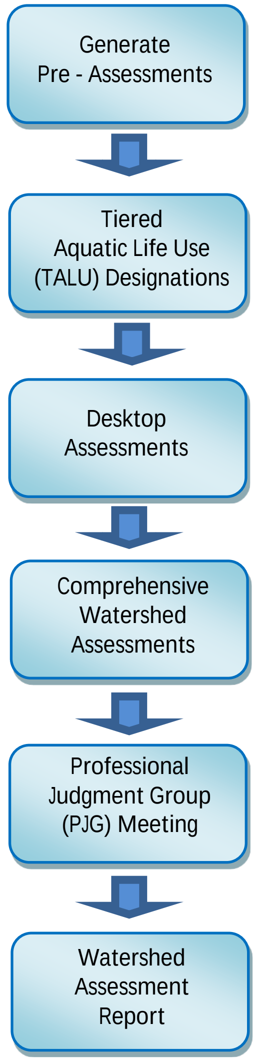


Figure 7. Flowchart of aquatic life use assessment process.

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 2012) http://www.pca.state.mn.us/index.php/view-document.html?gid=8601 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 AUID). 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.

Data management

It is MPCA policy to use all credible and relevant monitoring data to assess surface waters. The MPCA relies on data it collects along with data from other sources, such as sister agencies, local governments and volunteers. The data must meet rigorous quality assurance protocols before being used. All monitoring data required or paid for by MPCA are entered into Environmental Quality Information System (EQuIS), MPCA's data system and are also uploaded to the U.S. Environmental Protection Agency's (EPA) data warehouse. Data for monitoring projects with federal or state funding are required to be stored in EQuIS (e.g., Clean Water Partnership, CWLA Surface Water Assessment Grants and TMDL program). Many local projects not funded by MPCA also choose to submit their data to the MPCA in an EQuIS-ready format so that the monitoring data may be utilized in the assessment process. Prior to each assessment cycle, the MPCA sends out a request for monitoring data to local entities and partner organizations.

Period of record

The MPCA uses data collected over the most recent 10-year period for all water quality assessments. This time-frame provides a reasonable assurance that data will have been collected over a range of weather and flow conditions and that all seasons will be adequately represented; however, data for the entire period is not required to make an assessment. The goal is to use data that best represents current water quality conditions. Therefore, recent data for pollutant categories such as toxics, lake eutrophication and fish contaminants may be given more weight during assessment.

Watershed overview

The Watonwan River Watershed is the western most watershed in the Greater Blue Earth River Basin (GBERB). The Watonwan River, Blue Earth River and Le Sueur River make up the GBERB, which is a part of the greater Minnesota River Basin. The GBERB drains 2.3 million acres of land between Minnesota and Iowa (MPCA River Profile). The Watonwan River Watershed drains roughly 878 square miles of land (MNDNR, 2014). The watershed is heavily influenced by row crop agriculture, specifically corn and soy beans. Agriculture shaped the history of the watershed and now makes up 86% of its land use. Agriculture is a major contributor to 76% of waterways being altered or non-definable and 92.94% of wetlands being lost.

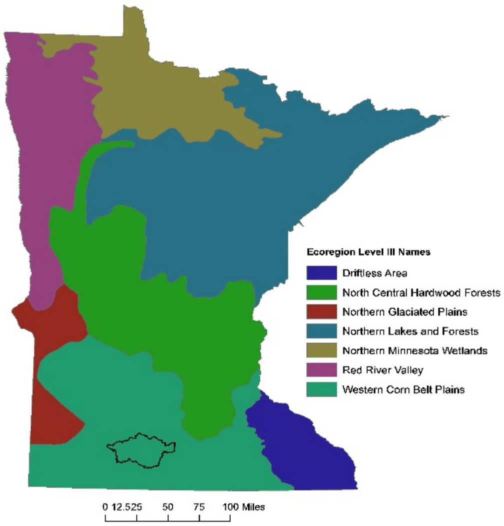


Figure 8. Minnesota Ecroregions

The Watonwan River Watershed begins in Cottonwood County and flow east for 113 miles before joining with the Blue Earth River near the Rapidan Dam outside of Garden City. After leaving Cottonwood County the River flows through Watonwan County and Blue Earth County. Tributaries to the river flow through parts of Jackson County, Martin County and Brown County. The Watonwan River consists of three branches: Watonwan River, South Fork Watonwan River, and North Fork Watonwan River. Major tributaries contributing to the Watonwan River are Butterfield Creek, St. James Creek, Perch Creek, and Willow Creek.

Creating the western boundary of the watershed is the Algona Moraine (a deposition of glacial debris), dividing the Watonwan River watershed from the Des Moines River Watershed (MNDNR, 2014). Glacial till plains dominate the watershed with a mixture of clay, silt, sand and gravel. The now dry Lake Minnesota deposited a layer of clay on top of the glacial till (NRCS, 2007). In the eastern side of the watershed the geology shows a combination of till plains, glacial lake plains and moraines, resulting in poorly drained soil and ultimately more tiling activity (NRCS, 2007).

Fishing is a popular recreational activity in the watershed, with walleye often caught on the mainstem Watonwan River. The MNDNR lists part of the Watonwan River as a State Water Trail encouraging canoers and kayakers to enjoy the nearly 30 miles of gentle currents of the Watonwan River from Madelia to Garden City.

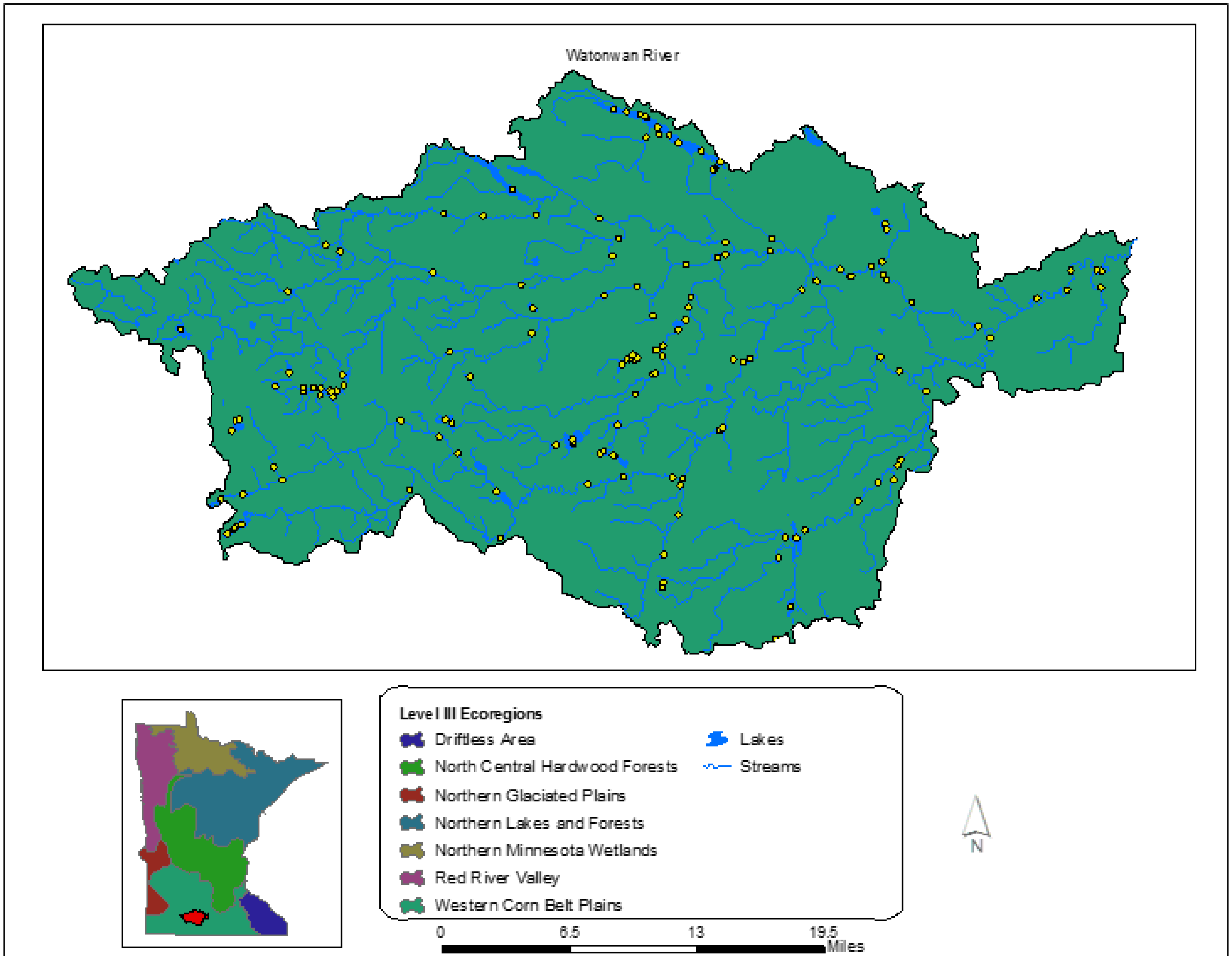


Figure 9. The Watonwan River Watershed within the Western Corn Belt Plains ecoregion of southern Minnesota.

Land use summary

The Watonwan River Watershed is within the western corn belt plains ecoregion. Most of the greater Minnesota River watershed is also within the same ecoregion and the Watonwan therefore shares many similarities to other major watersheds contributing to the Minnesota River.

The western boundary of the watershed is defined by the Algona Moraine. The regional history of glaciation resulted in glacial till plains soil as the dominant soil type within the watershed. This glacial till is a mixture of sand, silt, gravel and clay (NRCS, 2007). The western and eastern halves of the Watonwan River Watershed differ slightly in soil composition but both are considered poorly drained soils that require extensive drainage systems to effectively remove water (NRCS, 2007). Soil in the watershed is described as highly erodible (MPCA, 2000), especially around waterways in the southern and eastern regions of the Watonwan River watershed (NRCS, 2007).

The Watonwan River Watershed covers 561,610 acres of land (NRCS, 2007). Private land ownership accounts for 98% of the watershed, followed by the state owning 2% of the land. Total population within the watershed is relatively low with only 27,400 people, 67% are over the age of 18 (NRCS, 2007). There are 1,206 farms in the watershed. While much of the farmland is dedicated to row crop agriculture there are nearly 100,000 animal's units (cattle, swine and poultry and other) with over 650 permitted feedlots. St. James, Madelia and Mountain Lake are the largest cities within the watershed with a combined population of over 9,000 people (MNDNR, 2015).

Predominant landuse in the Watonwan River Watershed is row crop agriculture using 85% of the land. The second most common landuse is developed land at 6%. Row crop agriculture uses 482,265 acres of land (NRCS 2007). While the exact numbers are not known much the farmland land has artificial drainage systems which has resulted in over 50% of the streams being altered. The public drainage systems were under construction during 1912-1920 (MNDNR, 2014), however this work continues to the present. Historically, when the watershed was first settled, the land was speckled with pothole wetlands among the prairie (MPCA, 2000). The loss of these wetlands and meandering streams has decreased the amount of water storage on the land and has the potential to increase flood impacts (MNDNR, 2014).

In recent year's efforts have been made to increase conservation and restoration work throughout the Watonwan River watershed. The most recent survey shows nearly 6,000 acres enrolled in the Conservation Reserve Program (CRP), 298 acres in the Wetland Restoration Program (WRP) and 5,500 acres in the Conservation Reserve Enhancement Program (CREP) (NRCS, 2007). Another large focus for conservation is in farming practices both in row crop and pastureland. Practices such as Conservation Tillage, Conservation Crop Rotation, Prescribed Grazing, and Nutrient Management are being adopted by farmers and combined make up nearly 20,000 acres/year (NRCS, 2007).

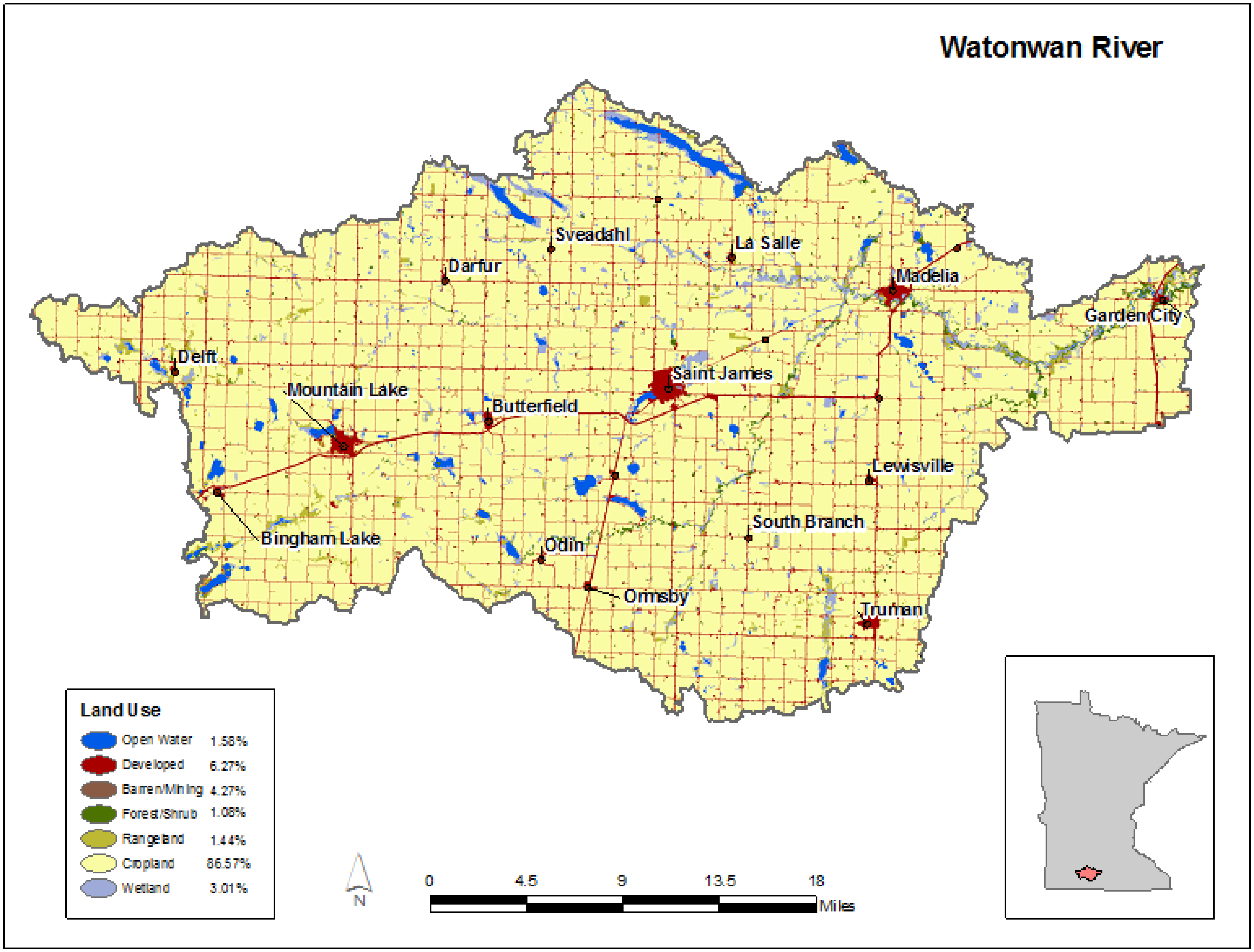


Figure 10. Land use in the Watonwan River Watershed.

Surface water hydrology

Altered hydrology defines the hydrology of the Watonwan River Watershed with only 22% of streams considered natural. Wetlands in the watershed have been decreased by roughly 92%. The loss of meandering streams and wetlands results in less natural water storage in the watershed. Hydrology is also altered through tiling, mainly for agricultural practices. The exact amount of tiling that has been done is not known since permits are not always required to alter hydrology in this way. Altering hydrology creates a faster path for water to the stream and out of both small and large basins can result in exaggerated effects from flooding (MNDNR, 2014). According to the MNDNR the Watonwan River Watershed rates poorly for stream connectivity to riparian land, which in most cases would be the stream's flood plain (MNDNR, 2015). Eliminating natural water storage and steam connectivity to flood plain can lead to increased bank erosion and more sediment entering the stream. Sediment levels have been a concern in the Watonwan River and its tributaries for many years. Several reaches of the river are currently impaired for turbidity.

Identified as the most western watershed of the GBERB, the Watonwan River begins in Cottonwood County in south central Minnesota. The river then flows in a general easterly direction. In Watonwan County the river flows through Madelia before continuing on into Blue Earth County and Garden City. The Watonwan River joins the Blue Earth River roughly eight miles southwest of Mankato. Two additional branches of the Watonwan River, the South Fork Watonwan River and North Fork Watonwan River are large tributaries. The South Fork Watonwan River begins in Northern Martin County and flows northeast to join the mainstem west of Madelia. The North Fork Watonwan River begins in northern Cottonwood County and flows west before joining the mainstem southeast of LaSalle. Major tributaries contributing to the Watonwan River are Butterfield Creek, St. James Creek, Perch Creek, and Willow Creek.

There are a number of lakes that dot the landscape. Lake Hanska is located in the farthest northern region of the Watonwan River and flows out of Brown County into the Watonwan River. Lake Hanska is the largest lake in the watershed.

Dams and road crossings can impact the connectivity of streams and could even limit the movement of fish throughout the watershed. There are 11 dams in the watershed; of those two are considered potential barriers to fish passage (MNDNR, 2014). Dams not only limit the movement of fish, they have also been shown to reduce species richness and increase abundance of tolerant species (MNDNR, 2014). Seven of the dams are at lake outlets. Fish barriers exist on both the North Fork and South Fork of the Watonwan River. Beaver dams were found at some sites in the Watonwan River Watershed during sampling; however, these are considered part of the natural condition. If large enough they can have similar impacts to man-made dams. Such impacts from beaver dams were not seen at sampling locations in the Watonwan River Watershed. Culvert and bridge crossings of streams have the potential to cause high water flow confinement (MNDNR, 2014). The Watonwan River Watershed has a total of 331 stream crossings, either a bridge or a culvert (MNDNR, 2014).

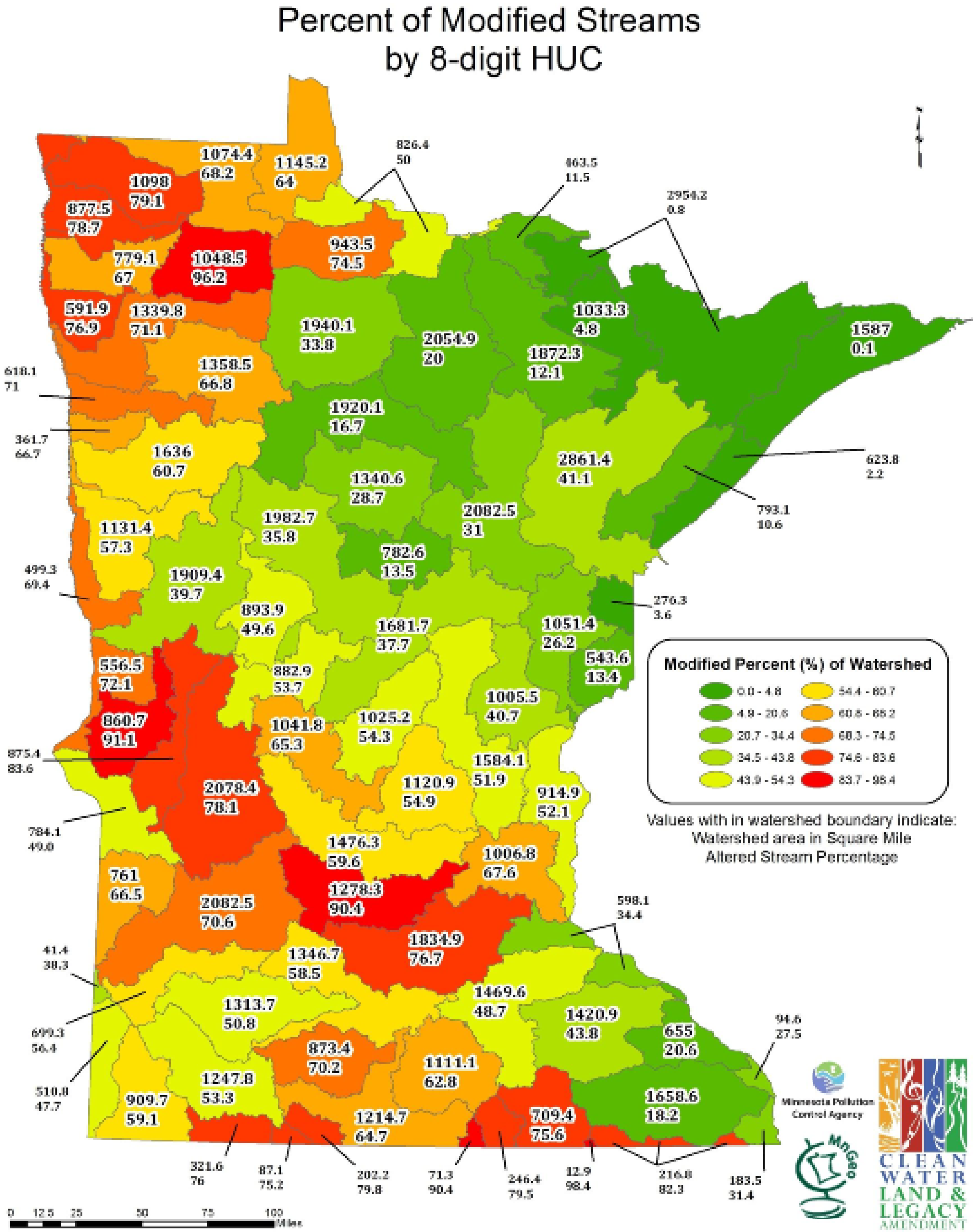


Figure 11. Map of percent modified streams by major watershed (8-HUC).

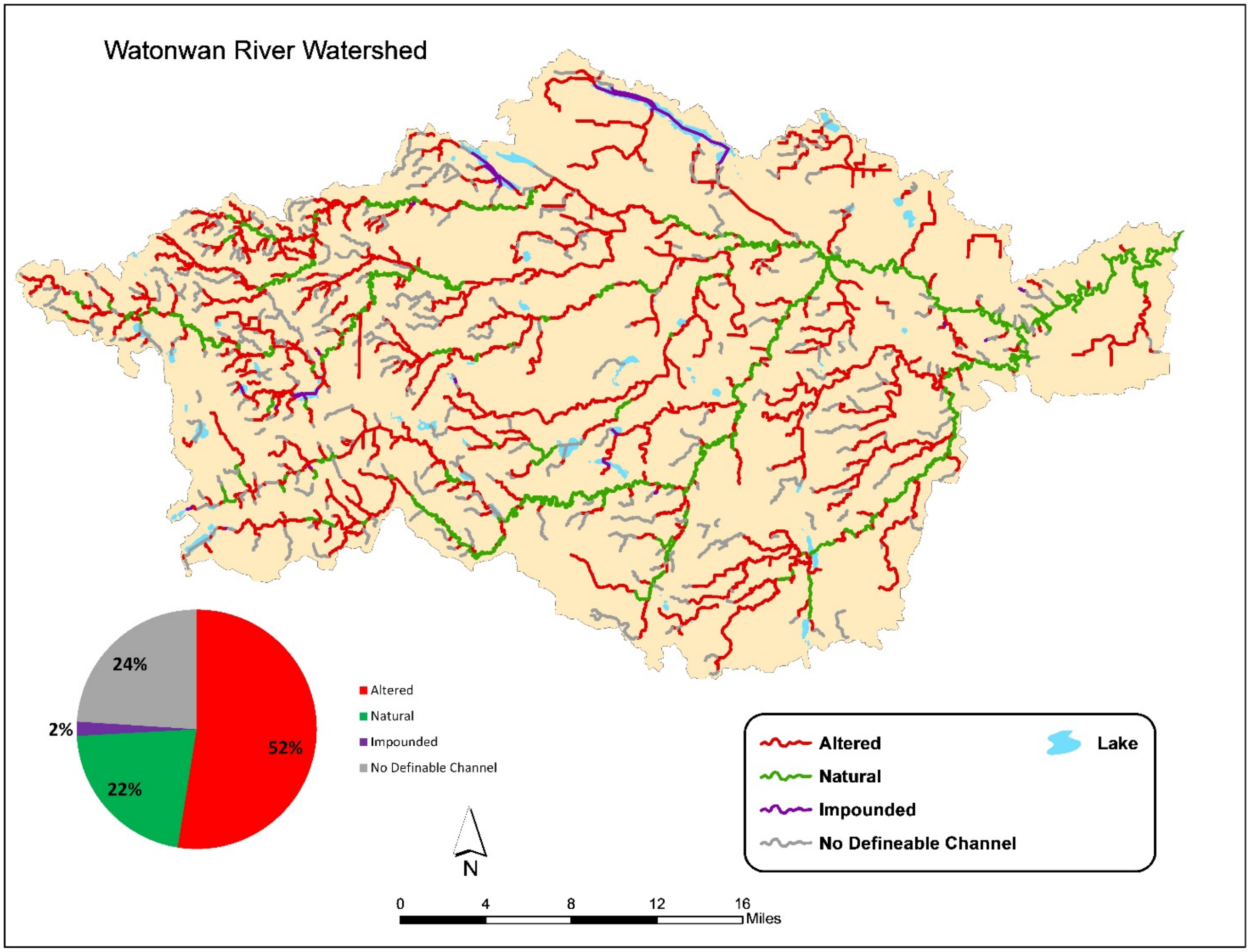


Figure 12. Comparison of natural to altered streams in the Watonwan River Watershed (percentages derived from the State-wide Altered Water Course project).

Climate and precipitation

Precipitation is an important source of water input to a watershed. Figure 13 shows two representations of precipitation for calendar year 2013. 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 Watonwan River Watershed area primarily received 24-28 inches of precipitation in 2013. The display on the right shows the amount those precipitation levels departed from normal. For the Watonwan River Watershed, the map shows that precipitation ranged from two to four inches below normal. (MNDNR, 2015)

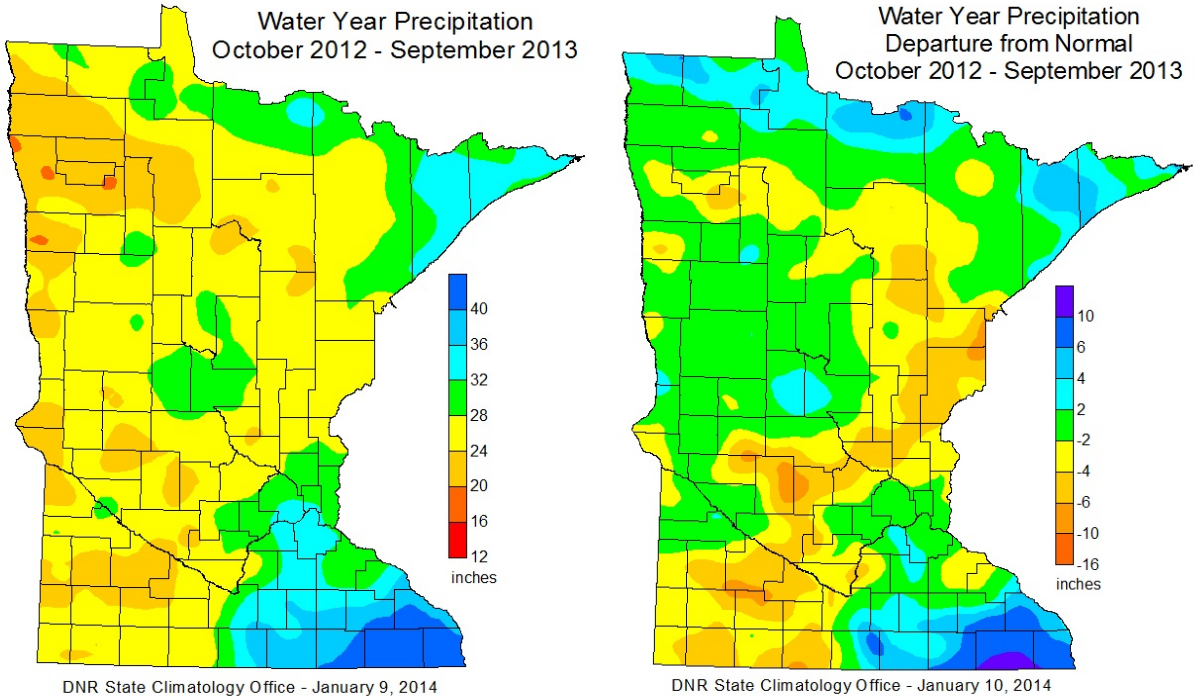


Figure 13. State-wide precipitation levels during the 2013 water year.

Figure 14 and Figure 15 display the areal average representation of precipitation in South Central Minnesota over the past 20 years and the past 100 years. An areal average is a spatial average of all the precipitation data collected within a certain area presented as a single dataset.

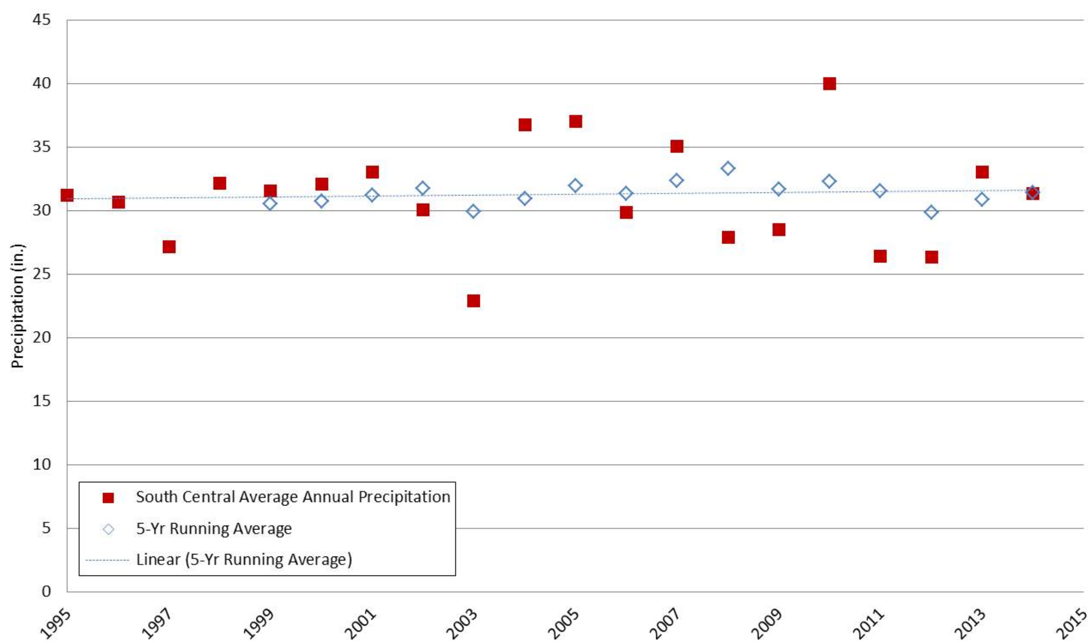


Figure 14. Precipitation trends in south central Minnesota (1995-2014) with five-year running average.

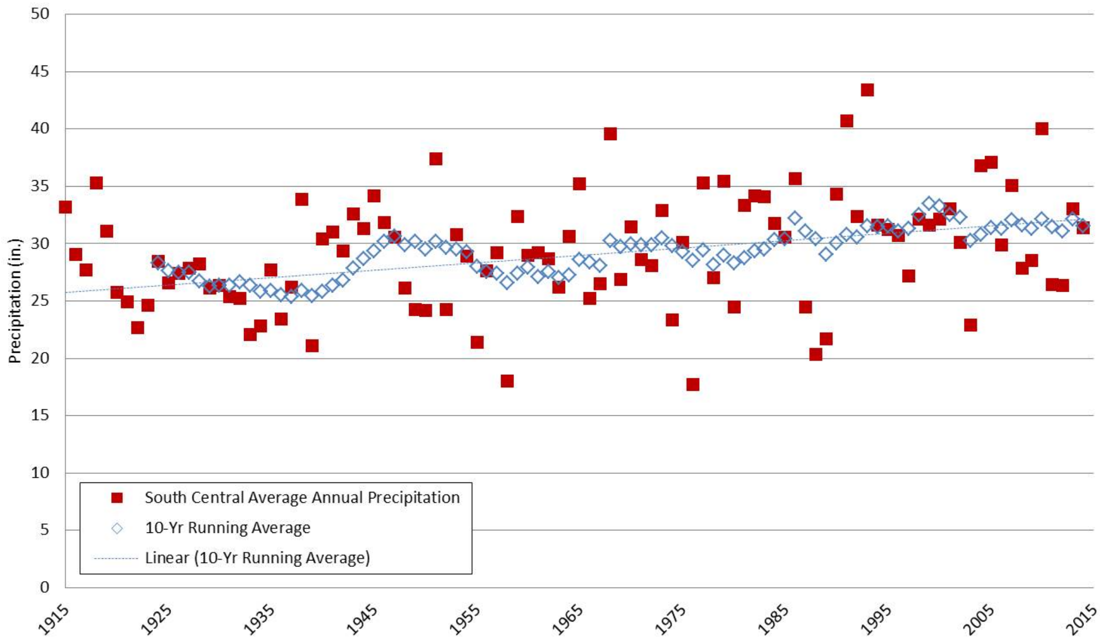


Figure 15. Precipitation trends in south central Minnesota (1915-2014) with 10-year running average.

Rainfall in the central region has not risen at a statistically significant rate over the last 20 years. This contrasts with a state-wide spatial average showing a statistically significant rising trend for the same time period. Though rainfall can vary in intensity and time of year, it would appear that south central Minnesota precipitation has not changed dramatically over this time period. The past 100 years of precipitation, though have shown a significant rising trend (p=0.001) that matches similar trends throughout Minnesota for the same period.

Hydrogeology and groundwater quality

The Watonwan River Watershed lies within the MNDNR's defined Western and South-Central Groundwater Provinces (Figure 16). The bulk of the watershed is within the Western Province; characterized by clayey glacial drift overtop Cretaceous and Precambrian bedrock. Aquifers are typically sand in glacial drift or sandstone and are of limited extent. (MNDNR, 2001)

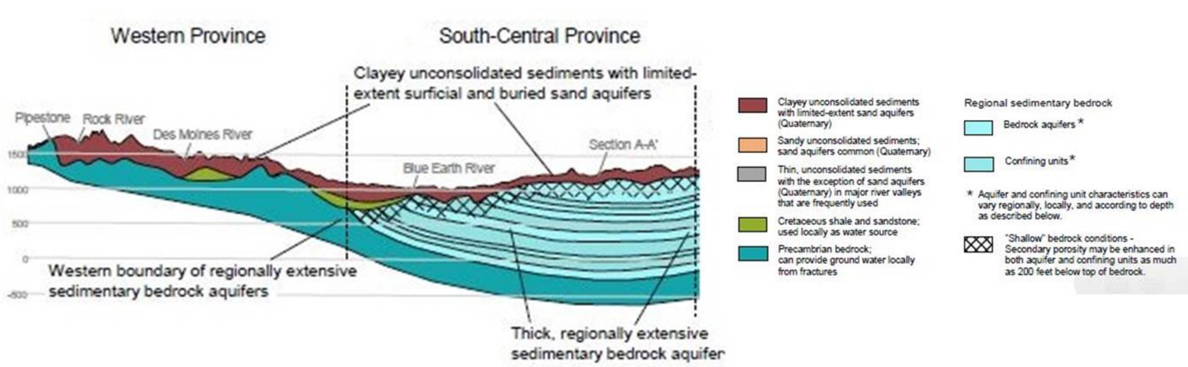


Figure 16. West/east cross section of MNDNR's Groundwater Provinces – western and south-central.

High capacity withdrawals

The MNDNR permits all high-capacity water withdrawals where the pumped volume exceeds 10,000 gallons/day or one million gallons/year (See Figure 17) for locations of permitted groundwater and surface water withdrawals). Permit holders are required to track water use and report back to the

MNDNR yearly. Information on the program and the program database are found at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html.

There are currently 110 active permitted groundwater withdrawals and 14 active permitted surface water withdrawals within the Watonwan River Watershed (Figure 17).

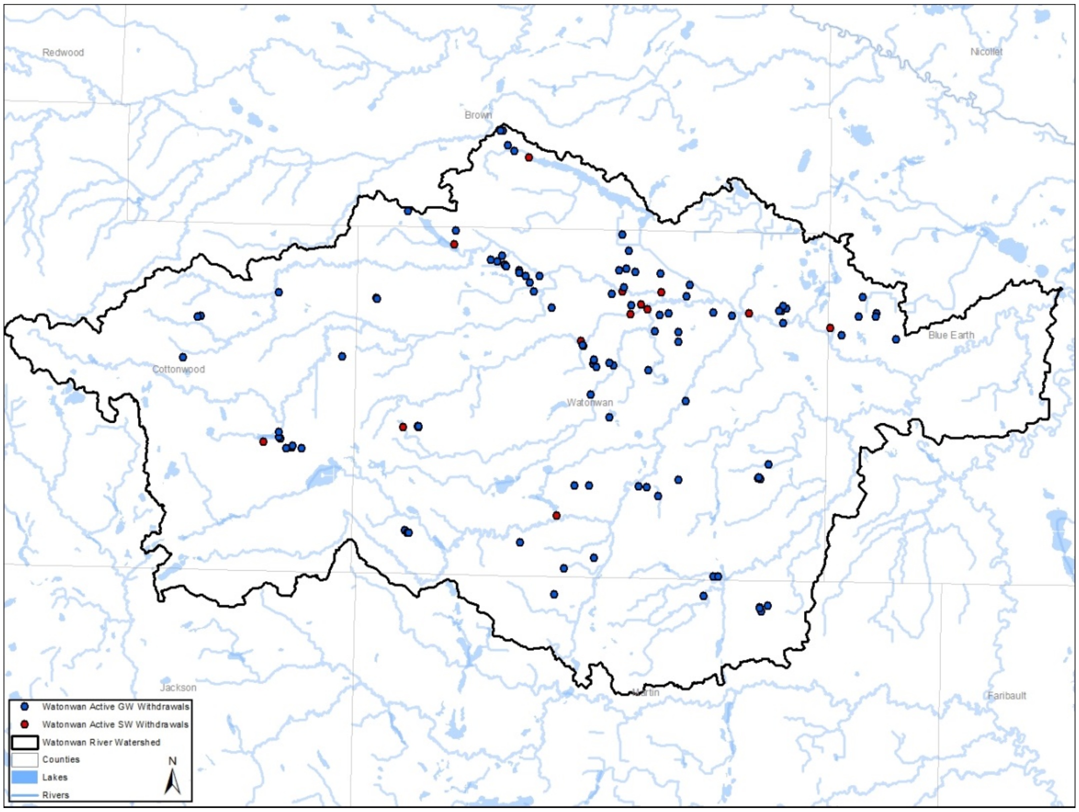


Figure 17. Active permitted groundwater and surface water withdrawals in the Watonwan River Watershed.

From 1994 to 2013, groundwater withdrawals within the Watonwan River Watershed exhibit a very significant increasing trend (p=0.001) (Figure 18), while surface water withdrawals exhibit a statistically significant trend (p=0.01) (Figure 19).

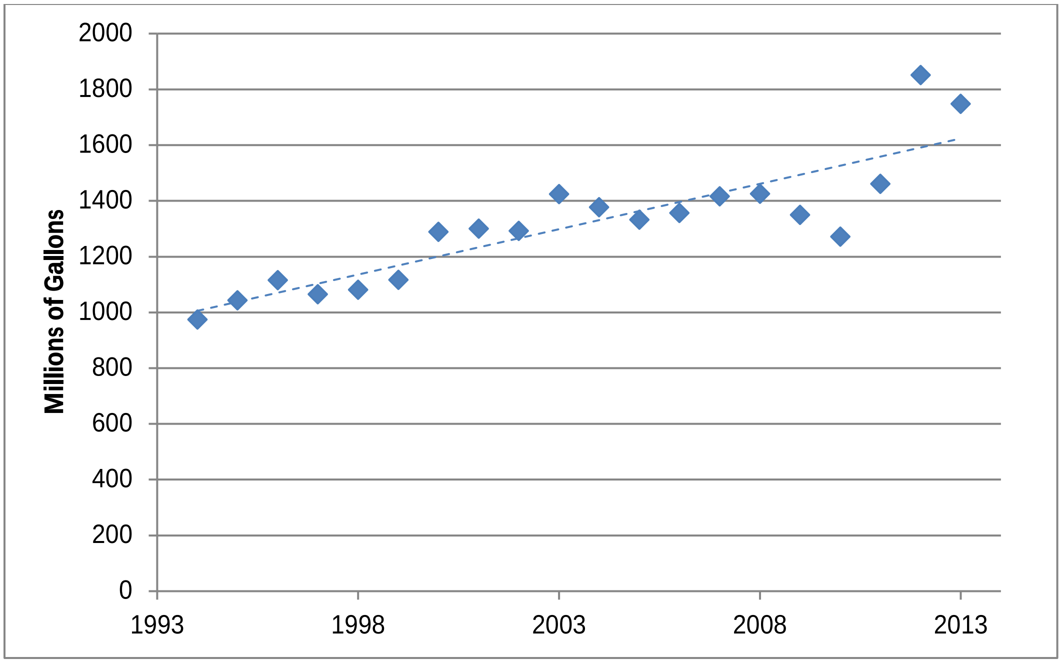


Figure 18. Total annual groundwater withdrawals in the Watonwan River Watershed (1994-2013).

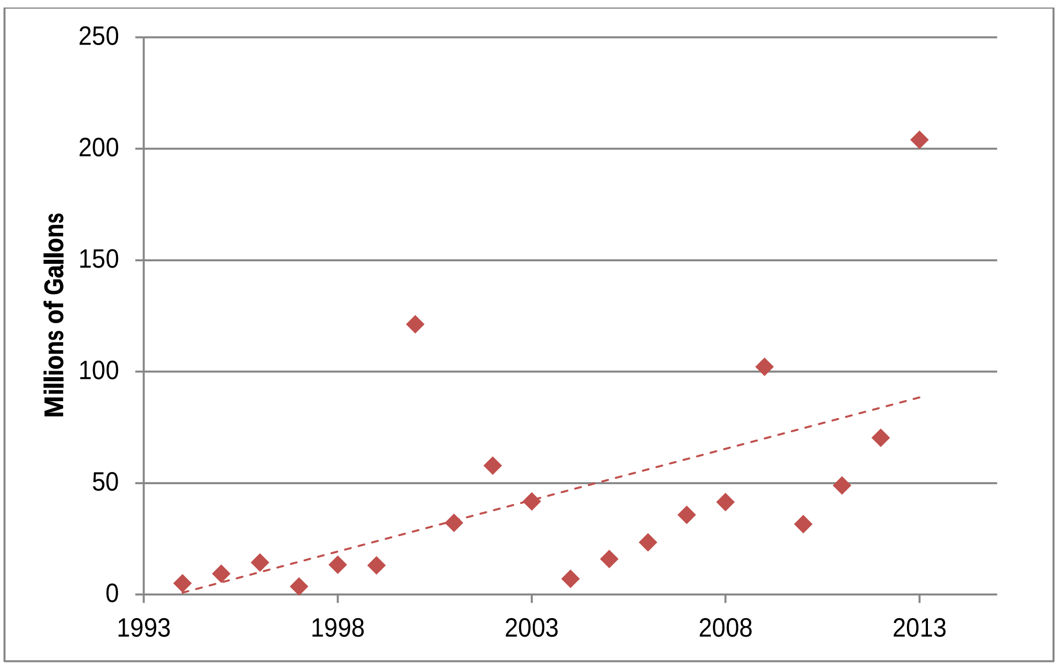


Figure 19. Total annual surface water withdrawals in the Watonwan River Watershed (1994-2013).

Wetlands

Excluding the open water portions of lakes, ponds, and rivers, the Watonwan River Watershed has approximately 20,430 acres of wetlands, equivalent to ~3.65% of the watershed area. Wetlands with herbaceous emergent vegetation are the most common wetland type in this watershed (Figure 20). Wetlands are fairly well distributed throughout the watershed, much of which is characterized as ground moraine originating from the most recent glaciation which led to the quaternary surface geology. The eastern third of the watershed is derived from sand, fine sand or silt originating from ancient lake beds. This type of course to fine grained well drained soils were historically fairly conducive to supporting wetlands of various types. Wetlands occur at a somewhat higher percentage in the lower Watonwan River along the NE end of the watershed. These estimates and distribution observations represent a snapshot of the location, type, and extent of wetlands from the recently updated state wetland inventory (NWI) based primarily on 2011 spring imagery.

Soils data can be used to estimate historical wetland extent prior to European settlement which initiated significant drainage of wetlands. Analysis of Natural Resources Conservation Service digital soil survey (SSURGO) soil map units with drainage classes of either Poorly Drained or Very Poorly Drained suggest approximately 290,000 acres of wetland or 51% of the Watonwan watershed existed prior to settlement. Figure 21 presents percent wetland loss estimates in the Watonwan HUC 12 subwatersheds derived by subtracting estimated contemporary (primarily 2011 spring imagery) wetland area from estimated historical wetland area based on SSURGO analysis divided by 12-HUC watershed area.

The North Fork, Upper and Lower South Fork of the Watonwan 12-HUC watersheds have each lost roughly 1/3 of the wetlands that were historically present which is the least amount of wetland loss among the 12 subwatersheds in the Watonwan River Watershed. The greatest amount of wetland loss is estimated to have occurred in the Spring Branch Creek and Perch Creek Subwatersheds which both have lost at least 51% of their wetlands present prior to pre-settlement. The Judicial Ditch 1, Upper South Fork and Lower Watonwan River as well as the tributary to the Watonwan River Subwatersheds each have lost between 45 and 50% of their historical wetlands.

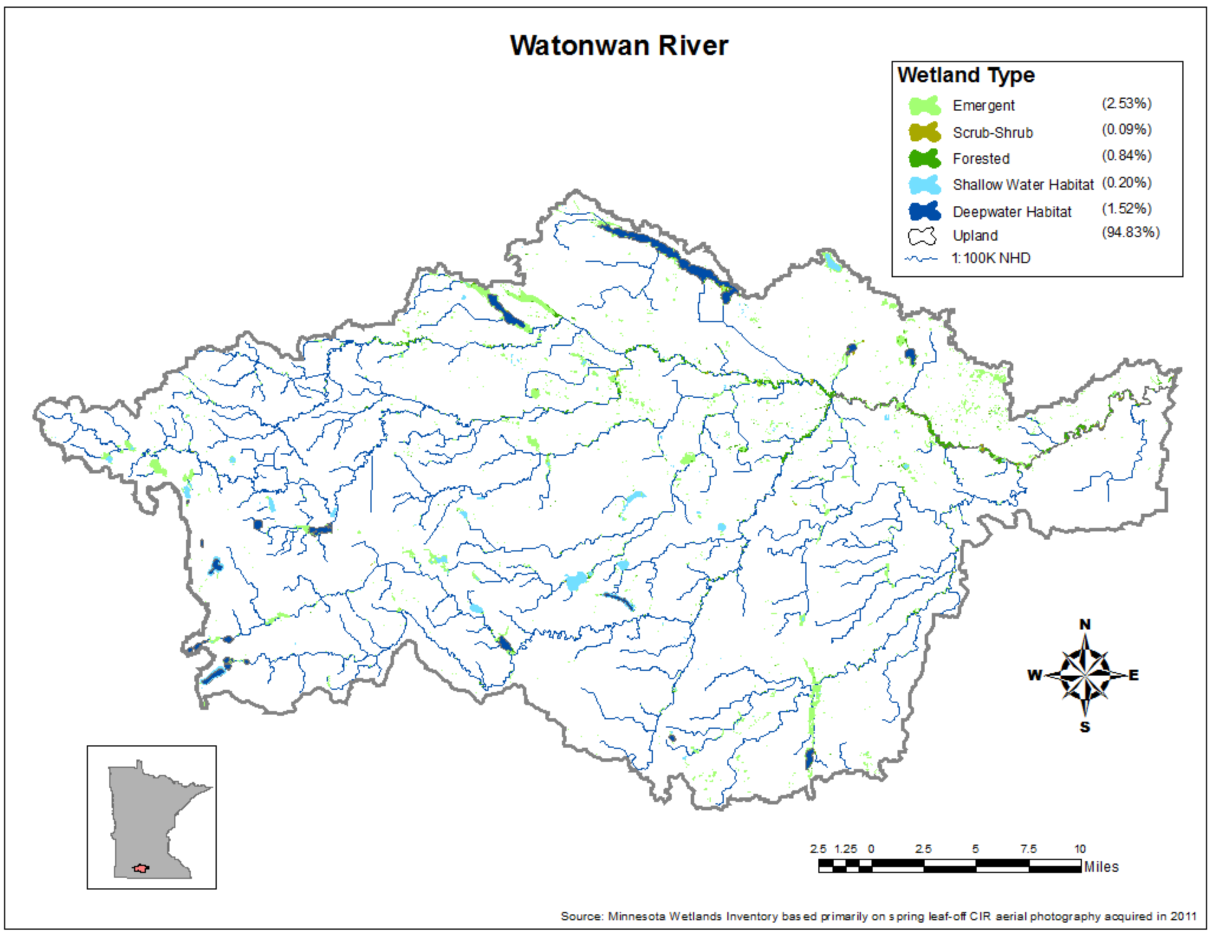


Figure 20. Distribution of wetlands by National Wetland Inventory type within the Watonwan Watershed.

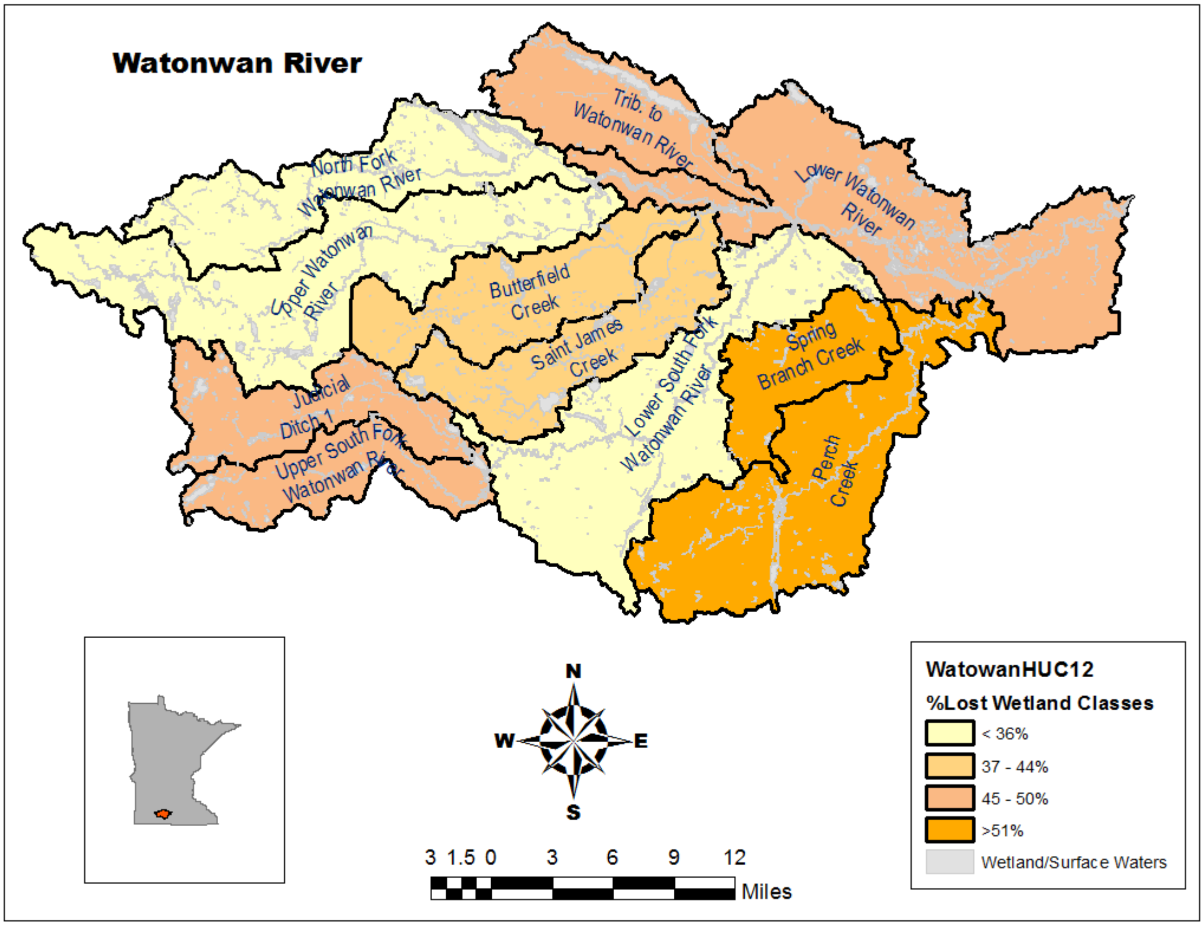


Figure 21. Estimated historic wetland loss in each HUC12 subwatershed, based on analysis of SSURGO drainage class data selected on "Very Poorly" and "Poorly" drained soil map units.

Watershed-wide data collection methodology

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 correlations between concentration and flow exist for many of the monitored analytes, sampling frequency is typically greatest during periods of moderate to high flow (Figure 22). Because these relationships can also shift between storms or with season, computation of accurate load estimates requires frequent sampling of all major runoff events. Low flow periods are also sampled and are well represented but sampling frequency tends to be less as concentrations are generally more stable when compared to periods of elevated flow. Despite discharge related differences in sample collection frequency, this staggered approach to sampling generally results in samples being well distributed over the entire range of flows.

Annual water quality and daily average flow data are coupled in the "FLUX32," pollutant load model, originally developed by Dr. Bill Walker and recently upgraded by the U.S. Army Corp of Engineers and the MPCA to compute pollutant loads for all WPLMN monitoring sites. FLUX32 allows the user to create seasonal or discharge constrained concentration/flow regression equations to estimate pollutant concentrations and loads on days when samples were not collected. Primary output includes annual and daily pollutant loads and flow weighted mean concentrations. Loads and flow weighted mean concentrations are calculated for total suspended solids (TSS), total phosphorus (TP), dissolved orthophosphate (DOP), nitrate plus nitrite nitrogen (NO_3+NO_2-N), and total Kjeldahl nitrogen (TKN).

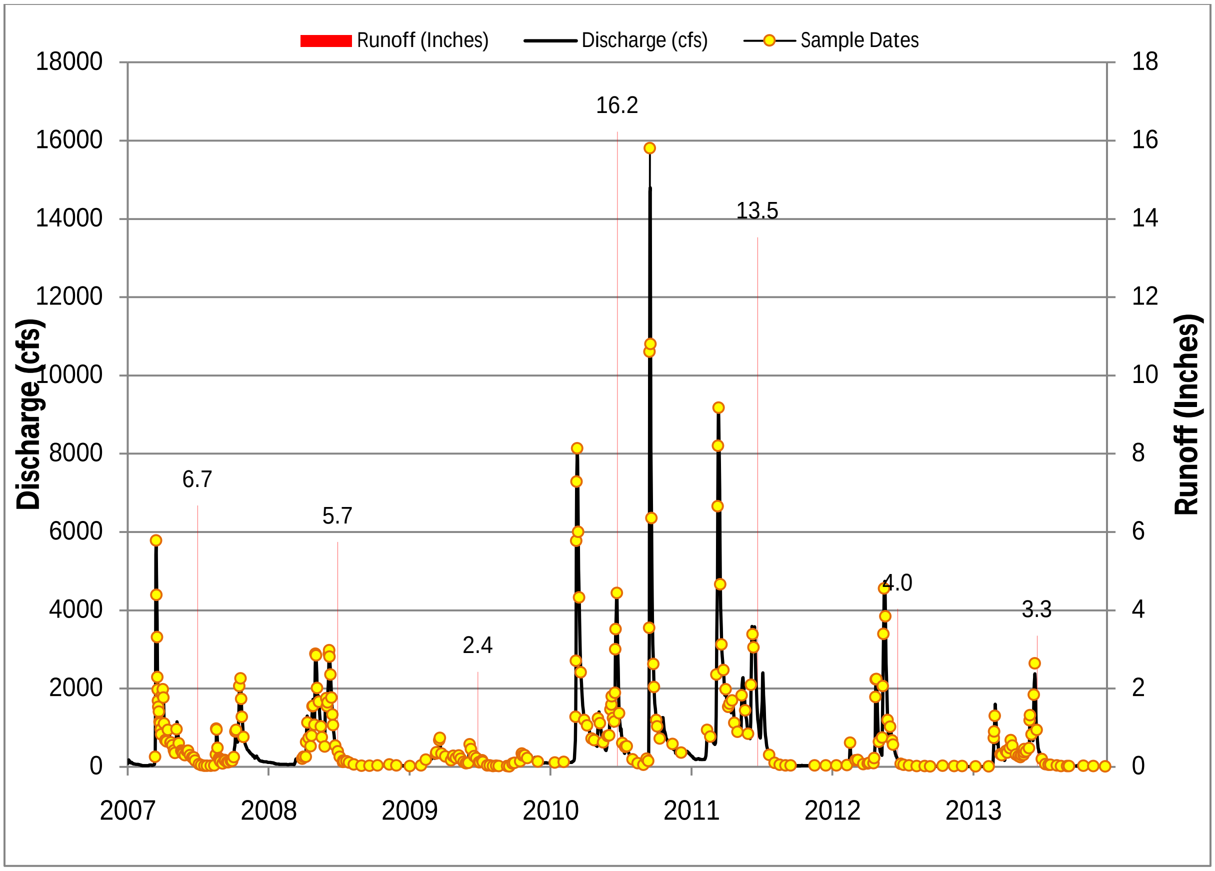


Figure 22. 2007-2013 Hydrograph, Sampling Regime and Annual Runoff for the Watonwan River near Garden City, Minnesota.

Stream water sampling

Forty-five stream reaches in the Watonwan River Watershed were assessed against current water quality standards for water chemistry, biological indicators or both. Chemistry data submitted by municipal or industrial wastewater treatment plants as part of permitted discharges (if any) were also reviewed during the assessment process. Data gathered from a stream reach are pared down to the most recent 10 years before it is used for assessment purposes, in an effort to characterize current water quality conditions. Based on these assessments, a supporting status for AQL and/or AQR use(s) was assigned as 'fully supporting' (FS), 'not supporting' (NS) or 'insufficient information' (IF). Stream reaches that lacked the minimum required data were assigned a 'not assessed' (NA) status. Stream sampling methods were consistent among monitoring groups and are described in the document titled: "Standard Operating Procedures (SOP): Intensive Watershed Monitoring – Stream Water Quality Component" found at: http://www.pca.state.mn.us/index.php/view-document.html?gid=16141.

There are 17 stream chemistry stations in the Watonwan River Watershed. Following the IWM design, stream chemistry stations were placed at, or near, the outlet of each major subwatershed that was >40 square miles in area (Figure 23). Based on this approach, 11 subwatershed outlet chemistry stations were established and monitored for two consecutive summers. Chemistry stations were also added farther upstream in the aggregated HUC-12 subwatersheds in an attempt to bracket point sources of effluent, or contributions from limited resource value waters (*i.e.* Class 7 streams; or LRVW). This bracketing technique occurs in three areas of the Watonwan River Watershed: around the St. James and Madelia wastewater treatment facilities; and around the St. James Creek (LRVW) confluence with the Watonwan River (~6 miles northeast of the city of St. James). Using stream sites to bracket in this manner is a common practice by the MPCA to identify conditions present both upstream and downstream of a discharge point source, or confluence with a LRVW tributary.

A surface water assessment grant (SWAG) was awarded to Minnesota State University-Mankato to collect water quality data at the 17 abovementioned stream chemistry stations from May-Sept of 2013, and again from June-Sept of 2014. The purpose of the SWAG monitoring at these 17 sites was to provide sufficient chemistry data to assess all chemistry related components of the AQL and AQR use standards during that two-year timeframe, and to provide a cumulative glimpse of water quality found upstream of the subwatershed outlets.

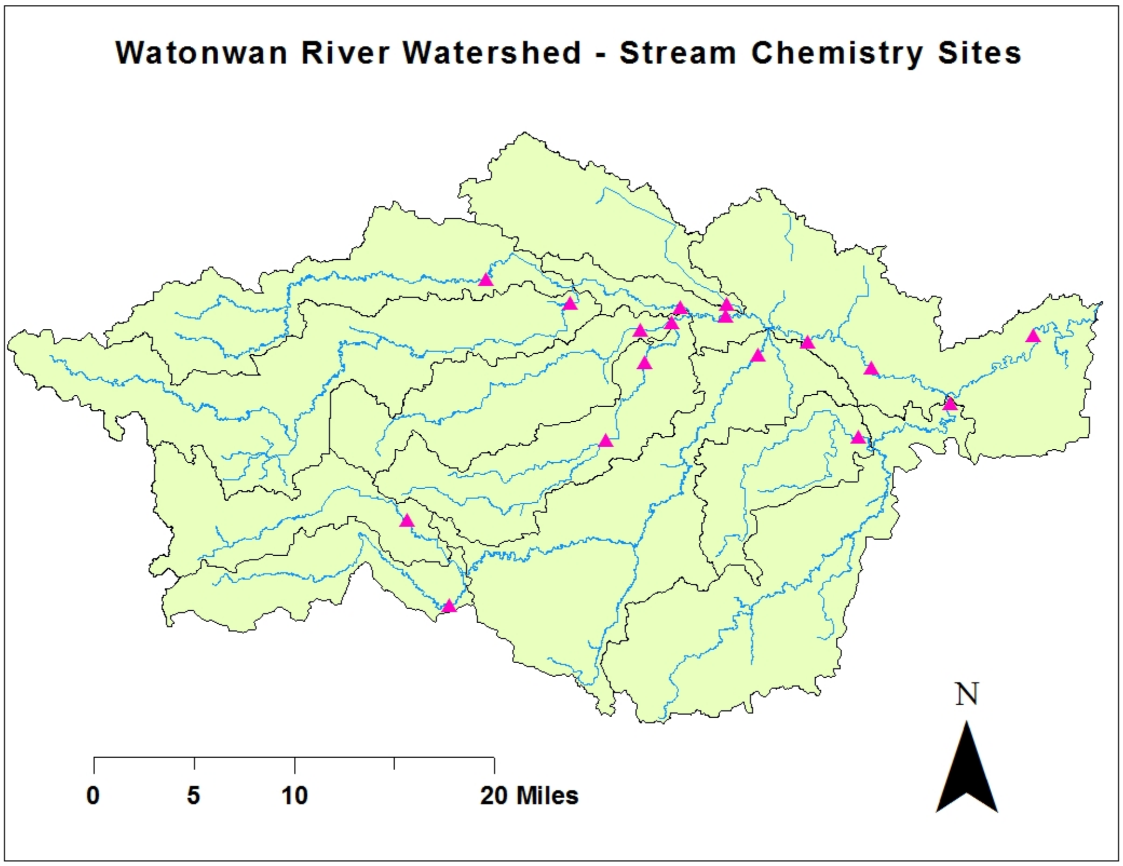


Figure 23. Stream chemistry sites (2013 & 2014).

Stream flow methodology

MPCA and the MNDNR joint stream water quantity and quality monitoring data for 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 are available at the MNDNR/MPCA Cooperative Stream Gaging webpage at: http://www.dnr.state.mn.us/waters/csg/index.html.

Stream biological sampling

The biological monitoring component of the IWM in the Watonwan River Watershed was completed during the summer of 2013. A total of 54 sites were newly established across the watershed and sampled. These sites were located near the outlets of most minor HUC-14 Watersheds. In addition, six existing biological monitoring stations within the watershed were revisited in 2013. The six existing stations came from a number of different projects done throughout the state or the Minnesota River watershed during the last 10 years. While data from the last ten years contributed to the watershed assessments, the majority of data utilized for the 2015 assessment was collected in 2013. A total of 42 AUIDs were sampled for biology in the Watonwan River Watershed. Waterbody assessments to determine aquatic life use support were conducted for 53 AUIDs. 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 cold water 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 confidence intervals (CIs) (For IBI classes, thresholds and CIs, see Appendix 4.1). 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 Appendix 4.1.

Fish contaminants

MNDNR fisheries staff collected fish for the Fish Contaminant Monitoring Program. When fish are collected as part of the MPCA's IWM, the MPCA biomonitoring staff attempt to collect up to five piscivorous (top predator) fish and five forage fish. All fish collected by the MPCA are analyzed for mercury and the two largest individual fish are analyzed for polychlorinated biphenyls (PCBs). 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.

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 125 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 bio accumulates in fish to levels that are potentially toxic and a reference dose has been developed. MPCA assesses the results of the fish contaminant analyses for waters that exceed impairment thresholds. The Impaired Waters List is prepared by the MPCA and submitted every even year to the U. S. Environmental Protection Agency (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).

Before 2006, mercury in fish tissue was assessed for water quality impairment based on MDH's fish consumption advisory. An advisory more restrictive than a meal per week was classified as impaired for mercury in fish tissue. Since 2006, 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, which is one of Minnesota's water quality standards for mercury. At least five fish samples per species are required to make this assessment and only the last 10 years of data are used for statistical analysis. MPCA's Impaired Waters List includes waterways that were assessed as impaired prior to 2006, as well as more recent impairments.

Lake water sampling

The Watonwan River Watershed contains 42 lakes that are at least 10 acres in size, which is the minimum size required for an AQR assessment according to MPCA guidance. The statewide water quality assessment standards for AQR use in lakes require a minimum of eight observations/samples within a 10-year period for each of the following: total phosphorus (TP), Secchi transparency depth (Secchi) and chlorophyll-*a* (chl-*a*). For an AQR support status of 'fully supporting' (FS) to be determined, the observed mean of the causative parameter (*i.e.* TP) and the means of either response parameter's (*i.e.* Secchi or chl-*a*) must all be meeting their respective ecoregion eutrophication standards. For a 'not supporting' (NS) status to be determined, the TP mean must exceed the ecoregion standard and the mean of either Secchi or chl-*a* must also exceed their respective standards. If TP meets the standard and both of the response parameters exceed the standard, the data are determined to be inconclusive and an 'insufficient information' (IF) status is assigned. When an IF status is assigned to a lake, additional data collection is needed before a FS or NS status can be assigned.

Ten lakes in the Watonwan River Watershed met the minimum data requirements (Figure 24) to be assessed against the established Western Corn Belt Plains (WCBP) ecoregion lake eutrophication standards (*i.e.* AQR use). Five other lakes had some AQR use data, but not enough to complete a full assessment. Data gathered on any lake are pared down to the most recent 10 years before they are used for assessment purposes, in an effort to characterize current water quality conditions in the lake and to ensure data are collected over a wide range of ambient conditions. The results of individual lake assessments are discussed in the 'Individual Subwatershed Results' sections. Lake sampling methods are similar among monitoring groups and are described in the document titled: "MPCA Standard Operating Procedure for Lake Water Quality" found at: http://www.pca.state.mn.us/publications/wq-s1-16.pdf.

Two lakes (St. James and Bingham) were monitored for Secchi transparency by citizen volunteers enrolled in the citizen lake monitoring program (CLMP) in partnership with the MPCA during 2014 (Figure 25). Those transparency data were used during the AQR use assessments, and to inform transparency trend analysis. Historical transparency data were reviewed for these two lakes to determine if long-term trends exist. Bingham Lake showed no identifiable trend or had insufficient historical data; however, strong evidence of an increasing transparency trend was identified on St. James Lake.

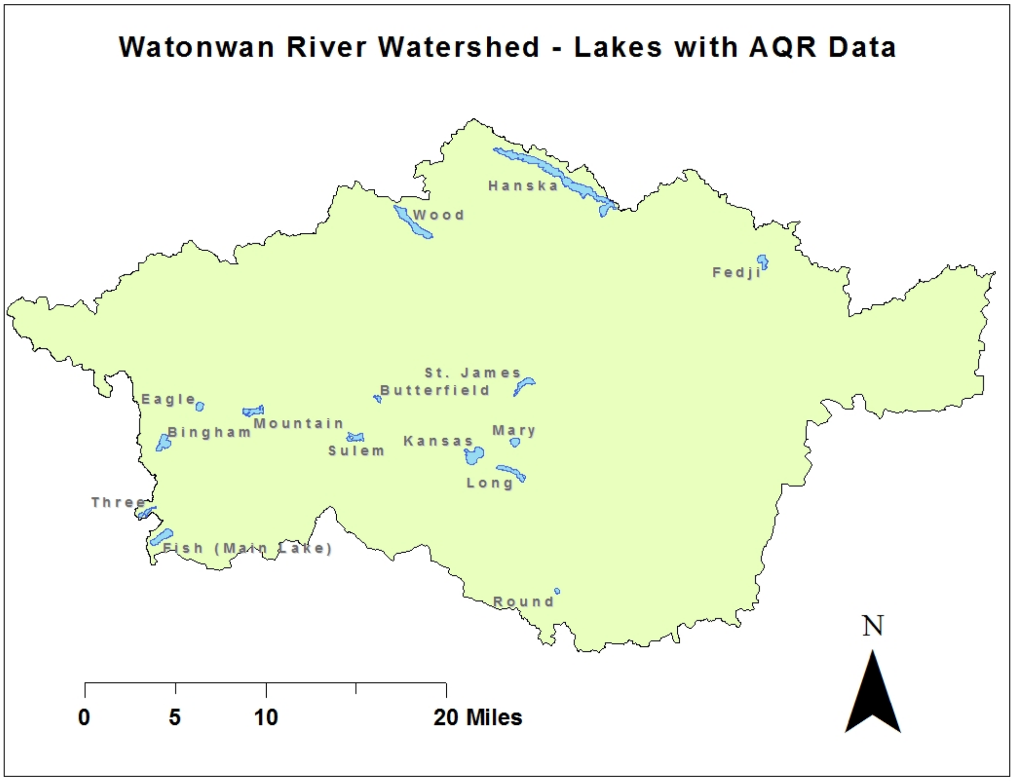


Figure 24. Lakes with AQR use data in the Watonwan River Watershed.

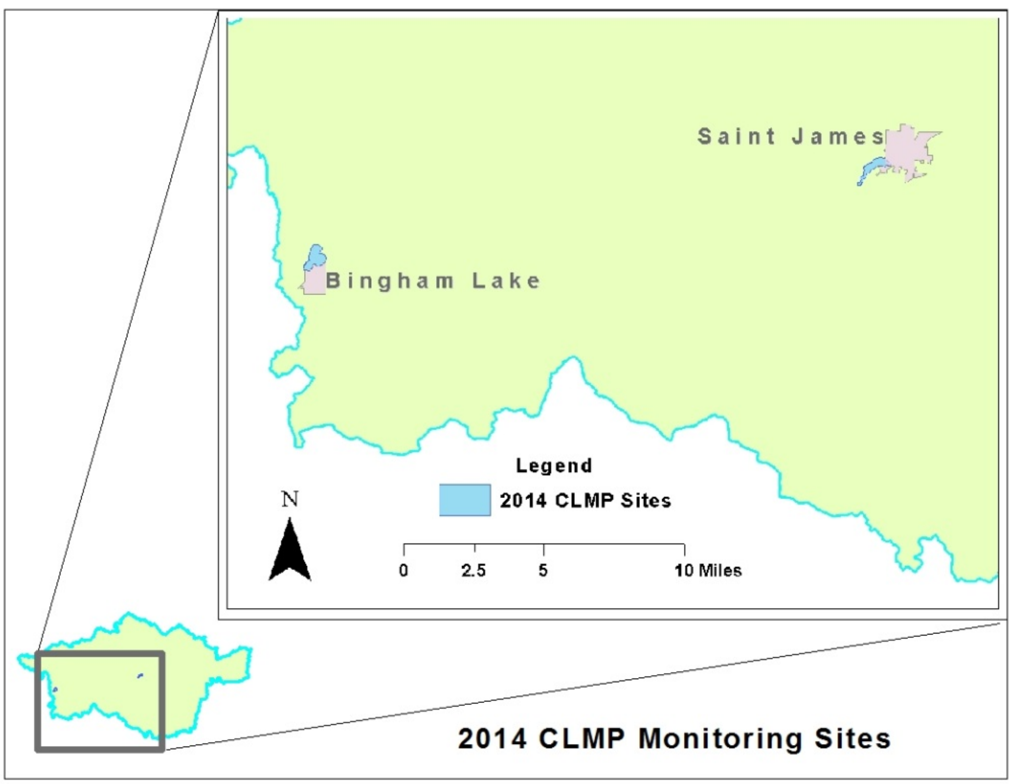


Figure 25. Lakes monitored by CLMP volunteers in 2014.

The MNDNR conducted fish and plant bio-assessment surveys and deemed the data adequate for assessment on six lakes. Those data were analyzed against a number of IBI metrics developed by the MNDNR to determine if aquatic life communities are supported or under stress. Results of these surveys are included in the 'Individual Subwatershed Results' sections.

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/surface water withdrawals

MNDNR's 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 MNDNR 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 report are a representation of water use and demand in the watershed and are taken into consideration when the MNDNR 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.

Groundwater quantity

Monitoring wells from the MNDNR 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:
http://www.dnr.state.mn.us/waters/groundwater_section/obwell/waterleveldata.html.

Stream flow

The USGS maintains real-time streamflow gaging stations across the United States. Measurements can be viewed at: http://waterdata.usgs.gov/nwis/rt.

Wetland monitoring

The MPCA began developing biological monitoring methods for wetlands in the early 1990s, focusing on wetlands with emergent vegetation (i.e., marshes) in a depressional geomorphic setting. This work has resulted in the development of plant and macroinvertebrate (aquatic bugs, snails, leeches, and crustaceans) IBIs for the Temperate Prairies (TP), Mixed Wood Plains (MWP) and the Mixed Wood Shield (MWS) level II ecoregions in Minnesota. These IBIs are suitable for evaluating the ecological condition or health of depressional wetland habitats. All of the wetland IBIs are scored on a 0 to 100 scale with higher scores indicating better condition. Wetland sampling protocols can be viewed at:

http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/wetlands/wetland-monitoring-and-assessment.html. Today, these indicators are used in a statewide survey of wetland condition where results can be summarized statewide and for each of Minnesota's three level II ecoregions (Genet 2012).

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 Watonwan River. 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. (A summary table of assessment results for the entire 8-HUC watershed including aquatic consumption, and drinking water assessments (where applicable) is included in Appendix 3.1). 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 2015 Assessment Cycle as well as any impairment listings from previous assessment cycles. Discussion of assessment results focuses primarily on the 2013 IWM 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, b) stream habitat quality c) channel stability, and where applicable d) water chemistry for the aggregated HUC-12 outlet, and e) lake aquatic 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 2012 assessment process (2014 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 7). Assessment of aquatic life is derived from the analysis of biological (fish and invert IBIs), dissolved oxygen, turbidity, chloride, pH and un-ionized ammonia (NH3) data, while the assessment of aquatic recreation in streams is based solely on bacteria (Escherichia coli or fecal coliform) data. Included in each table is the specific aquatic life use classification for each stream reach: cold water 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.

Stream habitat results

Habitat information documented during each fish sampling visit is provided in each aggregated HUC-12 subwatershed section. These tables convey 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.

Stream stability results

Stream channel stability information evaluated during each invert sampling visit is provided in each aggregated HUC-12 subwatershed section. These tables display the results of the Channel Condition and Stability Index (CCSI) which rates the geomorphic stability of the stream reach sampled for biology. The CCSI rates three regions of the stream channel (upper banks, lower banks, and bottom) which may provide an indication of stream channel geomorphic changes and loss of habitat quality which may be related to changes in watershed hydrology, stream gradient, sediment supply, or sediment transport capacity. The CCSI was recently implemented in 2008, and is collected once at each biological station. Consequently, the CCSI ratings are only available for biological visits sampled in 2010 or later. The final row in each table displays the average CCSI scores and a rating for the aggregated HUC-12 subwatershed.

Aggregated HUC-12 subwatershed outlet water chemistry results

These summary tables display the water chemistry results for the monitoring station representing the outlet of the aggregated HUC-12 subwatershed. This data along with other data collected within the 10 year assessment window can provide valuable insight on water quality characteristics and potential parameters of concern within the watershed. Parameters included in these tables are those most closely related to the standards or expectations used for assessing aquatic life and recreation. While not all of the water chemistry parameters of interest have established water quality standards, McCollor and Heiskary (1993) developed ecoregion expectations for a number of parameters that provide a basis for evaluating stream water quality data and estimating attainable conditions for an ecoregion. For comparative purposes, water chemistry results for the Watonwan River Watershed are compared to expectations developed by McCollor and Heiskary (1993) that were based on the 75th percentile of a long-term dataset of least impacted streams within each ecoregion.

Lake assessments

A summary of lake water quality is provided in the aggregated HUC-12 subwatershed sections where available data exists. For lakes with sufficient data, basic modeling was completed. Assessment results for all lakes in the watershed are available in Appendix 3.2. Lake models and corresponding morphometric inputs can be found in Appendix 5.2.

Watonwan River, North Fork Aggregated 12-HUC — HUC 070200102-01

Located in the northwestern end of the Watonwan River Watershed, this subwatershed is divided by three counties: Cottonwood County, Watonwan County and Brown County. The Watonwan River, North Branch is the main river found within this subwatershed and flows west to east. An Unnamed Tributary flows eastward from the southwest corner of the subwatershed to meet the Watonwan River, North Branch. Wood Lake is located in the northeast corner of the subwatershed and flows southeast into the Watonwan River, North Fork. The Watonwan River, North Fork empties into the Watonwan River after flowing 39 miles. The town of Sveadahl is located within this subwatershed near the eastern border and the town of Jeffers is located four miles to the west. Landuse is dominated by cropland at 87%.

Table 2. Aquatic life and recreation assessments on stream reaches: Watonwan River, North Fork Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID ***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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
07020010-583, Unnamed creek, T106 R35W S1, west line to Unnamed cr	10EM071	0.79	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-549, Unnamed creek, Unnamed cr to N Fk Watonwan R	13MN123	6.93	WWg	EXS	EXP	NA	NA	NA		NA	NA		NA		IMP	
07020010-564, Watonwan River, North Fork, Headwaters to T107 R32W S6, east line	13MN107, 13MN136, 13MN165	34.89	WWg	EXS	EXS	MTS	MTS	MTS	MTS	MTS	MTS		NA		IMP	IMP
07020010-565, Watonwan River, North Fork, T107 R32W S5, west line to Watonwan R	13MN133*	4.34	WWm	EXS	MTS	NA	NA	NA		NA	NA		NA		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 3. Minnesota Stream Habitat Assessment (MSHA): Watonwan River, North Fork Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use	Riparian	Substrate	Fish Cover	Channel Morph.	MSHA Score	MSHA Rating
3	10EM071	Trib. to Watonwan River, North	0	9.5	15.55	9.66	26.33	61.05	Fair
1	13MN123	Trib. to Watonwan River, North	0	12	17.55	8	17	54.55	Fair
1	13MN107	Watonwan River, North Fork	0	9.5	8	14	19	50.5	Fair
1	13MN136	Watonwan River, North Fork	0	7.5	18.2	15	21	61.7	Fair
1	13MN165	Watonwan River, North Fork	0	10.5	18.8	13	27	69.3	Good
2	13MN133	Watonwan River, North Fork	0	5	9	6.5	10.5	31	Poor
Average Habitat Results: *Watonwan River, North Fork Aggregated 12*			**0**	**9**	**14.52**	**11.03**	**20.14**	**54.68**	**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)

Table 4. Channel Condition and Stability Assessment (CCSI): Watonwan River, North Fork Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
2	10EM071	Trib. to Watonwan River, North Fork	MHL	27.5	31	26.5	7	92	severely unstable
1	13MN123	Trib. to Watonwan River, North Fork	MHL	25	24	22	5	76	moderately unstable
1	13MN107	Watonwan River, North Fork	MHL	27	34	34	7	102	severely unstable
1	13MN136	Watonwan River, North Fork	MHL	23	9	13	5	50	moderately unstable
1	13MN165	Watonwan River, North Fork	MHL	30	15	26	5	76	moderately unstable
1	13MN133	Watonwan River, North Fork	TC	31	9	17	5	62	moderately unstable
Average Stream Stability Results: *Watonwan River, North Fork Agg. 12 HUC*				**27.25**	**20.33**	**20.08**	**5.67**	**76.33**	moderately unstable

Qualitative channel stability ratings
= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Table 5. Outlet water chemistry results: Watonwan River, North Fork Aggregated 12-HUC.

Station location:	North Fork, Watonwan River - At CSAH 1; 5-miles east of Darfur						
STORET/EQuIS ID:	S007-565						
Station #:	0702001002-01						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	10	3.7	20.3	9.4	<40	0
Chloride	mg/L	10	17.3	32.8	23.9	<230	0
Dissolved Oxygen (DO)	mg/L	19	6.3	10.7	8.4	>5	0
pH	None	19	7.8	9.5	8.1	6.5 - 9	1
Phosphorus	µg/L	10	45	215	89	<150	1
Secchi Tube	Cm	19	7	100	46	> 10	1
Total Suspended Solids	mg/L	10	7	74	24	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	370	817	- - -	<126	3
Escherichia coli	MPN/100ml	15	146	2,723	745	<1,260	2

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the North Fork Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 6. Lake assessments: Watonwan River, North Fork Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-a (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Wood	83-0060-00	559	N/A	100	4.3	1.0*	N/A	174	18.7	0.4	NA	NA

Key for Cell Shading: = new impairment (2015 assessment cycle)
* Mean depth estimated by MPCA staff

Abbreviations:
E – Eutrophic
H – Hypereutrophic
Inc. – Increasing Trend
NT – No trend identifiable
IF – Insufficient Information
FS – Fully Supporting
NS – Not Supporting

Summary

The North Fork Watonwan River has four assessable AUIDs with biological stations. The furthest downstream AUID is designated as warm water modified use and the others are general use. One station was sampled for outlet water chemistry (13MN107).

The first AUID is an unnamed tributary to the North Fork Watonwan River. There is one biological station (10EM071) that was sampled for fish and macroinvertebrates in 2010 and 2013. The fish scored close to the threshold in both samples. The 2010 fish sample scored above the general use threshold but within the confidence interval. The2013 fish sample scored below the general use threshold which resulted in the listing of the AUID for fish. Both fish samples had a high percentage of creek chubs captured and were dominated by tolerant species. Macroinvertebrate samples in 2010 and 2013 both scored below the general use threshold. Water levels were low during the 2013 sample but there was adequate flow to suggest the low score was reflective of natural conditions, thus the decision was non-support for macroinvertebrates. The stream stability rating at this biological sample location indicates a severally unstable stream. The habitat is only considered to be in fair condition, which is similar to most of the other biological sample locations in this subwatershed.

Downstream from the first AUID is a second biological sampling location (13MN123) on the Unnamed Tributary. This AUID is also suggested to be listed for aquatic life. The site was sampled once for fish and once for macroinvertebrates in 2013. The fish and macroinvertebrate samples were dominated by tolerant species. Fish scored 13 points below threshold and macroinvertebrates scored five points below threshold.

The headwater AUID of the North Fork Watonwan River has three biological sample sites (13MN136, 13MN165, 13MN107). All three fish samples were below the general use threshold due to fish samples dominated by tolerant and generalist species. No sensitive species/taxa were found in any of the three fish samples. Elevated nitrogen levels were seen at each of the three samples (27mg/L, 15mg/L, 14mg/L). The macroinvertebrate samples taken at 13MN165 and 13MN107 both scored above the general use threshold but within the upper confidence interval. The sample taken at 13MN136 scored 32 points below the general use threshold, indicative of a very degraded population. The sample was dominated by low DO and nitrogen tolerant species and had much lower diversity than the other samples.

The last and furthest downstream AUID in the North Fork Watonwan is designated as modified use, meaning the thresholds are lower than those of a general use AUID. Macroinvertebrates scored above the modified use threshold and could have been considered for passing general use even with a sample dominated by tolerant species. The fish sample was dominated by tolerant species, the two most common species being sand shiners and common carp. The fish score did not pass for modified use and had a high level of nitrogen in the grab sample taken during the electrofishing survey.

Habitat and channel stability are rated as moderately unstable. Only one site (13MN165) was scored above fair for habitat condition. All sites scored zero for landuse with row crop listed as the primary use of land surrounding the sites. Overall the sites are listed as moderately unstable with two sites being called severely unstable. The site 13MN107 is the only stream with a natural sample reach.

Lakes summary

There is one shallow lake in this subwatershed that is at least 10 acres in size (Wood Lake, 83-0060-00). Presently, there are not enough data to determine a support status for AQR or AQL use. The decision to discontinue monitoring Wood Lake was made after the July, 2013 trip due to low water levels making the lake inaccessible. The table above (Table 6) shows the means of TP, Secchi and chl-*a* based on two observations of chl-*a*, and three observation each of TP and Secchi. Means for both TP and Secchi exceed the WCBP ecoregion standards (under limited observation) and suggest that excess nutrients may contribute to nuisance algal blooms. However, the datasets are insufficiently sized to apply the full assessment methodology and determine impairment or lack thereof; Wood Lake was not assessed for AQR use. Water levels in Wood Lake are maintained by a small dam at the outlet of the lake.

There were no aquatic plant or fish surveys conducted by MNDNR on Wood Lake.

Stream chemistry at large

The North Fork of the Watonwan River (07020010-564) has a newly identified AQR use impairment for *E. coli* bacteria. There is also an existing turbidity listing from the 2006 reporting cycle for this AUID (-564). New data for (-564) were collected at the subwatershed outlet chemistry station. All other AUIDs in this subwatershed had insufficient data for chemistry related AQL and AQR assessments.

Data collected at the outlet chemistry station (07020010-564; station S007-565) in the table above (Table 5) are from the 2013 and 2014, monitoring seasons. These data are reflective of stream conditions and impairments (if any) found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process.

Secchi tube transparency and TSS datasets both meet their respective standards; however, the data are not strong enough to pursue a delisting for turbidity. All new TSS data were collected in 2013 and provide insufficient insight into stream conditions over a range of flows and seasons. Review of newly collected data indicate that TSS could potentially still exceed the WCBP ecoregion standard based on a number of values falling close to, or above, the standard value of 65 mg/L. Based on this review it was determined that TSS has the potential to adversely affect the aquatic life communities found in the stream. Additional TSS and Secchi transparency data are needed to build confidence in the existing datasets. Phosphorous data currently meets the 150 µg/L standard for the 'south' river nutrient region (RNR). This indicates that eutrophication is not likely stressing the aquatic community. Other chemistry parameters that could potentially affect aquatic life communities are meeting their respective standards.

Parameters that were monitored and applied to the AQR use assessment are limited to *E. coli* bacteria. Bacteria data analyzed meet neither the statewide individual standard of 1,260 MPN/100mL, nor the statewide monthly geometric mean standard of 126 MPN/100mL. Two exceedances of the individual standard (as were observed at station S007-565) can be enough to assess a stream as not supporting AQR use. Monthly geometric mean exceedances are indicative of chronically elevated bacteria levels which may pose a risk to human health through bodily contact.

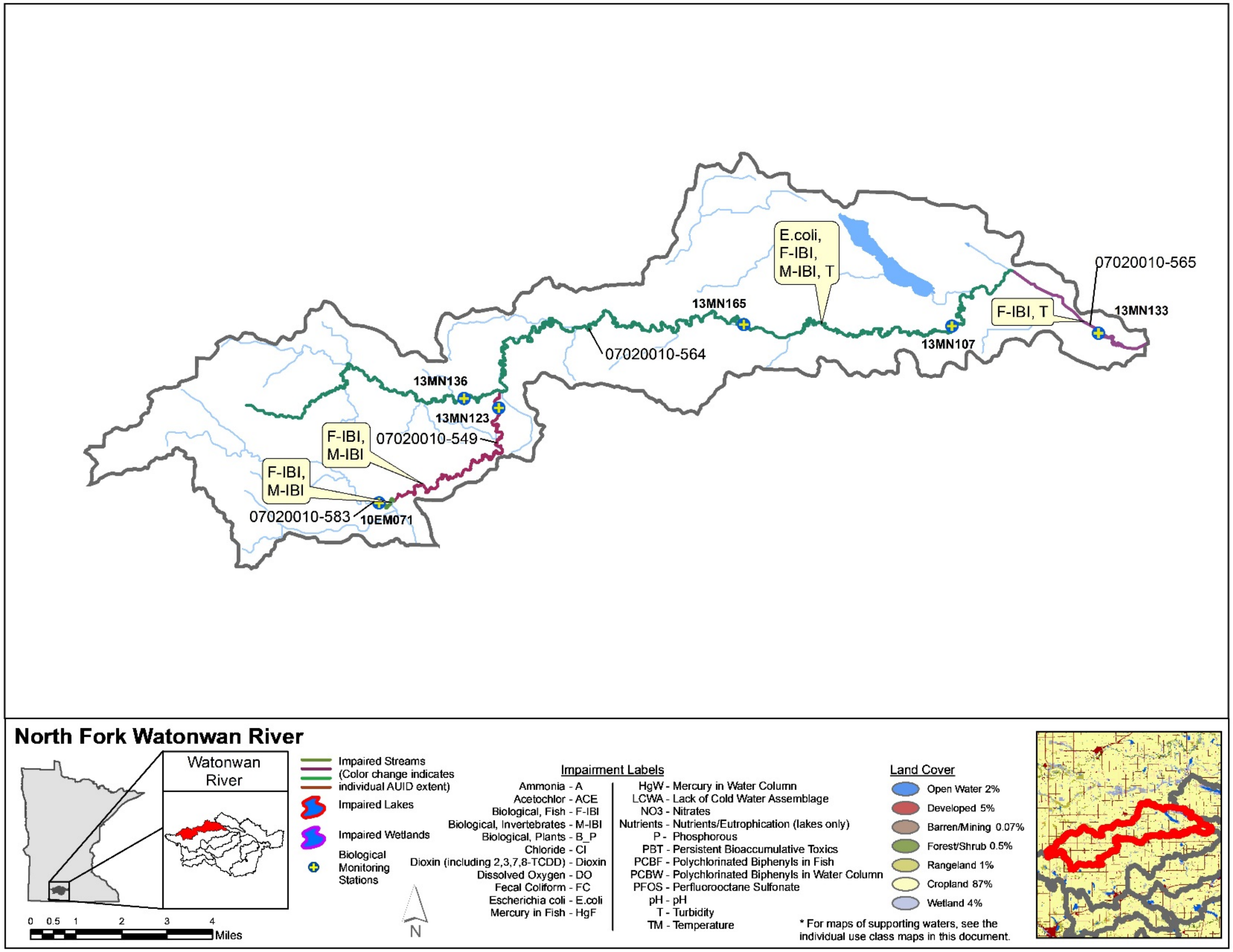


Figure 26. Currently listed impaired waters by parameter and land use characteristics in the Watonwan River, North Fork Aggregated 12-HUC.

Butterfield Creek Aggregated 12-HUC HUC 070200103-02

Butterfield Creek Subwatershed is centrally located within the Watonwan River Watershed, beginning in Cottonwood County and continuing into Watonwan County. Butterfield Creek is the main stream within this subwatershed with several small tributaries in the headwaters. Butterfield Creek flows northeast for 25 miles before flowing into St. James Creek. The town of Butterfield is located within the subwatershed, in the southwest. LaSalle is located one-mile north of the subwatershed outside the northeastern border. Butterfield Creek Subwatershed landuse is 89% cropland.

Table 7. Aquatic life and recreation assessments on stream reaches: Butterfield Creek Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name***, *Reach Description*	**Biological Station ID**	**Reach Length (miles)**	**Use Class**	**Aquatic Life Indicators:**									**Eutrophication**		**Aquatic Life**	**Aquatic Rec. (Bacteria)**
				Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides ***	Phosphorous	Response Indicator		
HUC 12 Agg: 0702001003-02 Butterfield Creek																
07020010-552, Unnamed creek, CD 4 to Butterfield Cr	13MN153*	1.49	WWm	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-516, Butterfield Creek, Headwaters to St James Cr	13MN156, 13MN125, 13MN128, 13MN105	25.18	WWg	EXS	EXS	MTS	MTS	IF	MTS	MTS	MTS		MTS		IMP	IMP

Abbreviations for Indicator Evaluations: **--** = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria; **EXP** = Exceeds criteria, potential impairment; **EXS** = Exceeds criteria, potential severe impairment; **EX** = Exceeds criteria (Bacteria).
Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **NS** = Non-Support, **FS** = Full Support
Key for Cell Shading: = existing impairment, listed prior to 2012 reporting cycle; = new impairment; = full support of designated use.

Table 8. Minnesota Stream Habitat Assessment (MSHA): Butterfield Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use	Riparian	Substrate	Fish Cover	Channel Morph.	MSHA Score	MSHA Rating
1	13MN153	Trib. to Butterfield Creek	0	9	18	12	7	46	Fair
7	13MN156	Butterfield Creek	0.12	7.43	14.88	11	14.57	47.99	Fair
7	13MN125	Butterfield Creek	0	8.79	15.89	10	20.14	54.8	Fair
7	13MN128	Butterfield Creek	1.07	8.29	11.14	7.57	10	38.07	Poor
9	13MN105	Butterfield Creek	0	8.11	14.33	9.22	12.22	43.88	Fair
Average Habitat Results: Butterfield Creek *Aggregated 12-HUC*			**.24**	**8.32**	**14.85**	**9.96**	**12.79**	**46.15**	**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)

Table 9. Channel Condition and Stability Assessment (CCSI): Butterfield Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN153	Trib. to Butterfield Creek	TC	33	15	13	5	66	moderately unstable
1	13MN156	Butterfield Creek	MHL	14	15	6	3	38	fairly stable
1	13MN128	Butterfield Creek	MHL	40	21	17	7	85	severely unstable
1	13MN105	Butterfield Creek	TC	35	23	17	7	82	severely unstable
Average Stream Stability Results: *Butterfield Creek Aggregated 12-HUC*				**30.5**	**18.5**	**13.25**	**5.5**	**67.75**	**moderately unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Table 10. Outlet water chemistry results: Butterfield Creek Aggregated 12-HUC.

Station location:	**Butterfield Creek - At CSAH 27 (740th Ave), 2 mi SW of La Salle**						
STORET/EQuIS ID:	**S007-562**						
Station #:	**0702001003-02**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	1.0	10.0	5.7	<40	0
Chloride	mg/L	10	21.2	42.4	31.1	<230	0
Dissolved Oxygen (DO)	mg/L	19	6.8	11.9	8.9	>5	0
pH	None	19	7.2	8.1	7.9	6.5 - 9	0
Phosphorus	µg/L	10	28	200	102	<150	3
Secchi Tube	cm	18	13	100	61	> 10	0
Total Suspended Solids	mg/L	10	7	70	25	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	335	691	- - -	<126	3
Escherichia coli	MPN/100ml	15	106	2,419	745	<1,260	2

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Butterfield Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Summary

Butterfield Creek Subwatershed has two AUIDs with assessable Biological data. Unnamed tributary to Butterfield Creek has one Biological sampling site (13MN153). Fish and macroinvertebrates were each sampled once in 2013. The AUID is being scored against the modified use thresholds. The macroinvertebrate sample was dominated by nitrogen and phosphorus tolerant species/taxa. The macroinvertebrate score was 17 points below the modified use threshold, resulting in a recommendation for impairment based on macroinvertebrates. Additionally, the fish sample conducted at 13MN153 scored zero. Blacknose dace, a generalist species, was the only fish found during the sample. The site is being listed for fish bioassessment. Nitrogen was high (8.4mgl/L) during the fish sample.

Butterfield Creek has one assessable AUID with four biological sampling sites (13MN156, 13MN125, 13MN128, 13MN105). The AUID is being assessed against general use thresholds. There were 18 visits between 2013 and 2014 for fish and eight visits for macroinvertebrates between the same time period. Of the 18 fish samples, 15 of them had failing scores (83% failure rate), resulting in the AUID being listed for fish bioassessment. Fish surveys were dominated by tolerant species and species did not vary highly from sample to sample. The macroinvertebrate samples found an abundance of nitrogen tolerant taxa. Six of the eight samples taken failed to score above general use threshold, causing the AUID to be listed for macroinvertebrates. Nitrogen levels were frequently high during both years of sampling at multiple sites and samples.

The only site with a sample occurring on a natural section of stream is 13MN156. This site is the furthest upstream sample location on Butterfield Creek. While the habitat was only rated as fair, it was the only site in the subwatershed to be rated fairly stable. All other sites were moderately to severely unstable. Agriculture is the dominant landuse in the Butterfield Creek Subwatershed. Habitat landuse scores indicate row crop as a dominant landuse type adjacent to and surrounding all sample locations. On average habitat fish cover and channel morphology scores were low, which indicated the streams were not well developed, a characteristic common in altered streams.

Stream chemistry at large

Butterfield Creek (07020010-516; station S007-562) has a newly identified AQR use impairment for *E. coli* bacteria. The dataset (from S007-562) shows two exceedances of the AQR use individual bacteria standard of 1260 MPN/100mL, as well as three months exceeding the geometric mean standard of 126 MPN/100mL. These data indicate that *E. coli* bacteria levels are chronically elevated (severely elevated at times); this AUID does not support AQR use and may pose a risk to human health through bodily contact.

There is also an existing turbidity listing from the 2008 reporting cycle for this AUID (-516). A review of TSS and Secchi transparency data going back to 2005 were inconclusive to determine if turbidity is still problematic or affecting AQL use. The TSS data showed only 1 exceedance of the 65 mg/L standard, and the Secchi dataset showed only four. However, there were two other TSS values that fell very near the standard, and eight other Secchi values that were very near the standard. In an effort to minimize the risk of assessing data that show possible 'false-positive' values, the overall assessment conclusion was 'IF'. Stressor identification work will take place on this AUID to investigate sources of the newly listed impairments to the fish and macroinvertebrate communities, and should bring resolution to the datasets to determine if turbidity and/or TSS are impairing AQL use.

Data collected at the outlet chemistry station (07020010-564; station S007-565) and shown in the table above (Table 10) are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments found higher up in the subwatershed. The data found in the table above do not necessarily reflect all data available at that station, but only those collected during the IWM program.

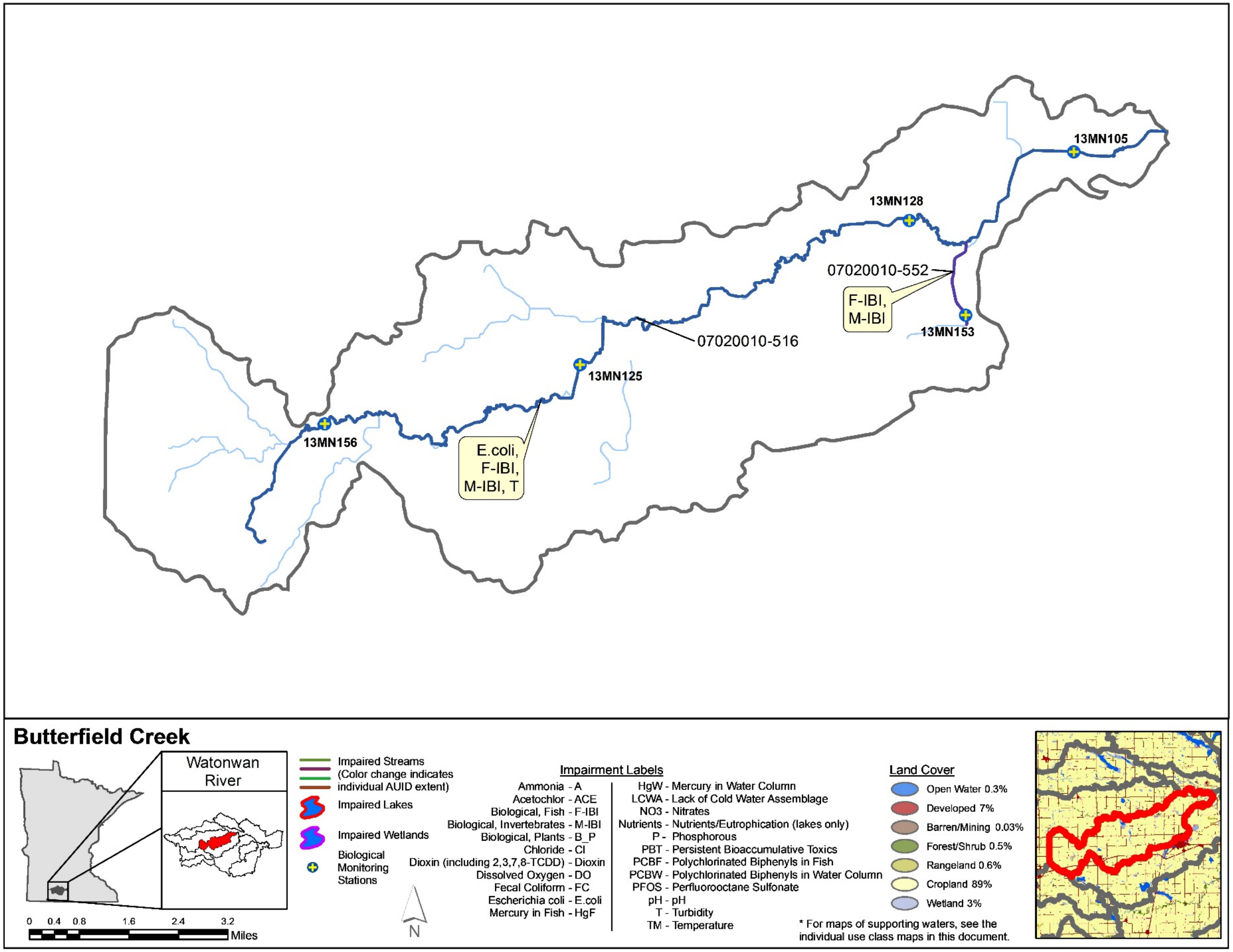


Figure 27. Currently listed impaired waters by parameter and land use characteristics in the Butterfield Creek Aggregated 12-HUC.

St. James Creek Aggregated 12-HUC

HUC 0702001003-01

Located entirely within Watonwan County, St. James Creek Subwatershed is located centrally within the Watonwan River Watershed. St. James Creek is the main stream within the subwatershed. The stream flows west out of Salem Lake before turning northeast after flowing through Kansas Lake. An Unnamed Creek flows into St. James Creek about one mile south west of St. James. Several smaller ditches contribute to St. James Creek throughout the subwatershed. The town of St. James is located in the north east region of the subwatershed. The St. James Creek Subwatershed landuse is 84% cropland.

Table 11. Aquatic life and recreation assessments on stream reaches: St. James Creek Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID *Reach Name*, Reach Description	Biological Station ID	Reach Length (miles)	Use Class	Aquatic Life Indicators:									Eutrophication		Aquatic Life	Aquatic Rec. (Bacteria)
				Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides ***	Phosphorous	Response Indicator		
HUC 12 Agg: 0702001003-01 St. James Creek																
07020010-554, Unnamed creek, Unnamed cr to St James Cr	13MN126	10.31	WWg			NA	NA	NA		NA	NA		NA			
07020010-528, St James Creek (Kansas Lake Inlet), Headwaters to Kansas Lk	13MN167	7.88	WWg	NA		NA	NA	NA		NA	NA		NA		IMP	
07020010-575, St James Creek, Unnamed lk (83-0037-00) to T106 R32W S26, east line	13MN127	4.53	WWg			NA	NA	NA		NA	NA		NA			
07020010-576, St James Creek, T106 R32W S25, west line to T106 R31W S19, north line	13MN104*	3.03	WWm	MTS	MTS	MTS	IF	MTS	NA	MTS	MTS		EX		SUP	IMP
07020010-502, St James Creek, T106 R31W S18, south line to Butterfield Cr	13MN147	9.83	LRVW			MTS				MTS	MTS					
07020010-515, St James Creek, Butterfield Cr to Watonwan R	13MN103	1.74	LRVW			MTS				MTS	MTS					

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. Minnesota Stream Habitat Assessment (MSHA): St. James Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
2	13MN126	Trib. to St James Creek	.5	8	17.68	10.5	20.5	57.18	Fair
2	13MN167	St. James Creek	1.25	10	13.83	14.5	13.5	53.08	Fair
1	13MN127	St. James Creek	0	7.5	15.4	11	17	50.9	Fair
8	13MN104	St. James Creek	0.19	8.44	8.59	8.25	4.75	31.46	Poor
10	13MN147	St. James Creek	0	6.8	15.78	6.8	8.3	37.68	Poor
7	13MN103	St. James Creek	.93	9.07	17.11	10.57	19.86	57.54	Fair
Average Habitat Results: *St. James Creek Aggregated 12-HUC*			**.48**	**8.30**	**14.73**	**10.27**	**13.99**	**47.97**	**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)

Table 13. Channel Condition and Stability Assessment (CCSI): St. James Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN104	St. James Creek	TC	20	16	26	5	67	moderately unstable
1	13MN147	St. James Creek	TCR	28	23	22	7	80	severely unstable
1	13MN103	St. James Creek	MHL	31	31	26	7	95	severely unstable
Average Stream Stability Results: *St. James Creek Aggregated 12-HUC*				**26.33**	**23.33**	**24.67**	**6.33**	**80.67**	**severely unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Outlet station stream chemistry

Data collected at the outlet chemistry station on St. James Creek (07020010-515; station S007-566) and shown in Table 14 below are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process.

St. James Creek is classified as a LRVW once it reaches the city of St. James. Streams with the LRVW designation are not expected to support AQL or AQR uses, and the standards that are in place serve the purpose of preventing nuisance conditions, and protecting human health when direct contact does occur. The parameters observed that have LRVW standards are meeting them, with the exception of *E. coli* bacteria. Three samples exceeded the individual standard of 1260 MPN/100mL indicating severely elevated bacteria levels during monitoring. This AUID of St. James Creek does not support LRVW use.

Table 14. Outlet water chemistry results: St. James Creek Aggregated 12-HUC.

Station location:	**St. James Creek - At Township Rd 74, 6.5 mi. NE of St James**						
STORET/EQuIS ID:	**S007-566**						
Station #:	**0702001003-01**						
		Limited Resource Value Water Quality Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(LRVW) WQ Standard**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	1.0	14.7	9.8	<500	0
Dissolved Oxygen (daily mean)	mg/L	19	6.6	11.2	9.1	>1	0
pH	None	19	7.7	8.4	8.0	6-9	0
Escherichia coli (geometric mean)	MPN/100ml	3	403	767	- - -	<630	2
Escherichia coli	MPN/100ml	15	154	4,884	929	<1,260	3
		Supporting Water Quality Parameters					
Chloride	mg/L	10	34.6	156.0	63.8	No Std.	No Std.
Chlorophyll-a, Corrected	µg/L	6	2	37	11	No Std.	No Std.
Phosphorus	µg/L	10	76	287	180	No Std.	No Std.
Secchi Tube	cm	19	13	100	53	No Std.	No Std.
Total Suspended Solids	mg/L	10	6	76	31	No Std.	No Std.

[1]Secchi Tube standards are surrogate standards derived from the total suspended solids standard of 65mg/L

****Data found in the table above are compiled using the results from samples collected at the outlet stream chemistry monitoring station in the St. James Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Secondary stream chemistry stations

Data collected at the chemistry station on St. James Creek (07020010-576; station S007-563) and shown in Table 15 below are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process. This station is located on the creek upstream from where it becomes a LRVW, and is held to the WCBP ecoregion water quality standards.

There are a number of water quality standards exceedances that pertain to AQL use. River eutrophication standards were adopted by the MPCA in 2014, to gauge if nutrients concentrations in streams are adversely affecting AQL use. Applicable data from this station (*i.e.* TP and chl-*a*) show exceedances and indicate nutrients levels and algal response have the potential to limit AQL use; however, the chl-*a* dataset does not meet minimum size requirements and was assessed as 'IF'. Two exceedances were observed in the TSS dataset but one of those exceedances conflicts with surrogate Secchi transparency data collected, and visual assessments made, during the same monitoring event; the judgment to remove that data point from the dataset was made by the reviewer and approved by the PJG.

All other chemistry parameters meet their respective water quality standards where they exist, but are insufficient to determine a support status for AQL use. A full support (FS) assessment for AQL use can be obtained in the absence of sufficient chemistry data, if the biological IBI criteria are met and found to be fully supporting. Such a scenario occurs on this AUID of St. James Creek.

Table 15. Secondary chemistry station results: St. James Creek.

Station location:	**St. James Creek - Upstream of CSAH 27, 0.5 mi. S of St James**						
STORET/EQuIS ID:	**S007-563**						
Station #:	**0702001003-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	8	1.2	8.4	5.1	<40	0
Chloride	mg/L	8	27.9	92.6	42.9	<230	0
Chlorophyll-a, Corrected	µg/L	10	1.4	52.2	12.5	<35	2
Dissolved Oxygen (DO)	mg/L	16	7.2	11.0	8.6	>5	0
pH	None	16	7.4	8.9	8.0	6.5 - 9	0
Phosphorus	µg/L	14	53	330	161	<150	7
Secchi Tube	cm	15	16	100	56	> 10	0
Total Suspended Solids	mg/L	9	7	130	38	< 65	2
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	1	649	649	- - -	<126	1
Escherichia coli	MPN/100ml	12	141	2,755	873	<1,260	4

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.

**Data found in the table above are compiled using the results from samples collected at a secondary chemistry monitoring station in the St. James Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.

Data collected at the chemistry station on St. James Creek (07020010-502; station S001-078) and shown in Table 16 below are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process. This station is located on the creek downstream from where it becomes a LRVW, and is held to the LRVW water quality standards. Streams with the LRVW designation are not expected to support AQL or AQR uses, and the standards that are in place serve the purpose of preventing nuisance conditions and protecting human health when direct contact does occur.

The parameters observed that have LRVW standards are meeting them, with the exception of *E. coli* bacteria. Five bacteria samples exceeded the individual standard of 1,260 MPN/100mL indicating severely elevated bacteria levels during monitoring. The monthly geometric mean calculations for the August exceeded the 630 MPN/100mL standard, indicating bacteria levels have the potential to be chronically elevated.

Other supporting water quality data without standards indicate that at times both chloride and TP concentrations are elevated. While this AUID is not assessed for AQL use, the presence of these potential pollutants may be contributing AQL and/or AQR use impairments further downstream. In this case, the next AUID immediately downstream (*i.e.* Watonwan River; 07020010-511) exceeds the river eutrophication standard of 150 µg/L but has no data for the required response variables. Likewise, this same AUID was listed for excessive fecal coliform bacteria levels in 2006, and new data support that listing as bacteria levels are still problematic.

Table 16. Secondary chemistry station results: St. James Creek.

Station location:	**St. James Creek - At Township Rd 64, 3.5 mi. NE of St James**						
STORET/EQuIS ID:	**S001-078**						
Station #:	**0702001003-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(LRVW) WQ Standard**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	1.5	18.4	10.6	<500	0
Dissolved Oxygen (daily mean)	mg/L	19	5.3	10.1	8.3	>1	0
pH	None	19	7.6	8.6	8.1	6-9	0
Escherichia coli (geometric mean)	MPN/100ml	1	502	1,489	- - -	<630	1
Escherichia coli	MPN/100ml	14	341	8,164	1,587	<1,260	5
		Supporting Water Quality Parameters					
Chloride	mg/L	10	41.5	533.0	187.3	No Std.	No Std.
Chlorophyll-a, Corrected	µg/L	13	1	14	5	No Std.	No Std.
Hardness	mg/L	10	175	536	374	No Std.	No Std.
Phosphorus	µg/L	16	103	1,410	360	No Std.	No Std.
Secchi Tube	cm	19	17	100	56	No Std.	No Std.
Total Suspended Solids	mg/L	11	5	66	27	No Std.	No Std.

****Data found in the table above are compiled using the results from samples collected at a secondary stream chemistry monitoring station in the St. James Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 17. Lake assessments: St. James Creek Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-*a* (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Kansas	83-0036-00	390	H	100	2.0	1.2	NT	131	41	0.7	NS	NA
St. James	83-0043-00	209	E	100	4.6	1.5	Inc.	41	23	1.6	FS	FS
Butterfield	83-0056-00	49	H	100	3.5	1.0*	NT	104	108	0.2	NS	IF

Key for Cell Shading: = new impairment (2015 assessment cycle)

* Mean depth estimated by MPCA staff

Abbreviations:
E – Eutrophic
H – Hypereutrophic
Inc. – Increasing Trend
NT – No trend identifiable
IF – Insufficient Information
FS – Fully Supporting
NS – Not Supporting

Summary

One AUID in the St. James Creek Subwatershed, with one station (13MN104), is fully assessable for biological data. Two AUIDs with two sample locations are located on LRVW streams, meaning they are held to lower standards than other streams and are not assessed for aquatic life. Site 13MN104 was assessed against modified use standards due to limited habitat. Habitat at this site is described as being in poor condition. The dominant substrate was sand and there was little cover for fish or macroinvertebrates. Five fish samples were collected during 2013 and 2014. All five scores were above the modified use threshold. Yellow perch were found in proportionately high numbers in most samples. In 2013, one macroinvertebrate sample collected scored above the modified use threshold. An additional sample was taken in 2014, but was not assessable because of low flow conditions at the time of sampling; the non-assessable sample also scored above the modified and the general use thresholds. The downstream AUID is a limited resource value waterway due to a facility discharging in St. James.

Throughout the subwatershed habitat is generally in fair condition and stream stability is severely degraded. None of the habitat parameters score well, but landuse scores the lowest. Dominant landuse within the subwatershed is agriculture. All of the sites in the subwatershed with habitat assessments list row crop as a dominant type of landuse near the stream. Sand is considered a dominant substrate at all sites within the subwatershed. Cover for fish and macroinvertebrates is often listed as sparse.

Lakes summary

There are five lakes greater than 10 acres in size in the St. James Creek Subwatershed. Three of those lakes had enough data to assess for AQR use: Kansas Lake (83-0036-00); St. James Lake (83-0043) and Butterfield Lake (83-0056-00). St. James Lake was also recently monitored by the MNDNR to survey both fish and aquatic plant communities with the goal of collecting enough data to assess an AQL use support status. All three lakes are classified as 'shallow lakes' and are held the to the shallow lake standards for the WCBP ecoregion. Discussion of each lake is presented in the order they appear in Table 17 above.

Kansas Lake summary (83-0036-00)

Kansas Lake has a newly identified AQR use impairment for excess nutrients/biological indicators based on data collected during the summers of 2013 and 2014, and does not support AQR use. The datasets for TP and chl-*a* had the minimum number of samples required to assessment and mean calculations for both parameters exceed the WCBP shallow lake eutrophication standards of 90 µg/L and 30 µg/L respectively. The mean for Secchi transparency was right at the standard of 0.7 meters, and was assessed as meeting the standard based on 20 observations made over four years.

Kansas Lake was not assessed for AQL use. The MNDNR visited the lake to do a fish community survey and decided to not use the data due to minor winter fish kills the occur fairly regularly, and the potential of those fish kills to skew the data that had been collected. Likewise, the aquatic plant surveys that were available for review were old and deemed by MNDNR to likely not be representative. The only chemistry parameter with data related to AQL use was chloride, which meets the chronic standard of 230 mg/L; zero exceedances of this standard were observed over two summers' worth of monitoring by the MPCA.

St. James Lake summary (83-0043-00)

St. James Lake has a history of dredging, lake reclamation and winter aeration to improve water quality and support aquatic plant and fish communities. Poor water quality and an undesirable fish community prompted such efforts in 2001. Those efforts appear to have had a positive effect on both aquatic communities as observed by the low abundance of disturbance-tolerant fish species, and a diverse aquatic plant community.

The lake is designated as a 'Tier 2' lake in the MPCA's sentinel lake program started in 2008: Sustaining Lakes in a Changing Environment (SLICE). This program is a concentrated effort by MNDNR, MPCA and other partners to repeatedly monitor 25 Minnesota lakes to understand and predict the consequences of land use and climate change on in-lake habitats. This designation also means that the lake will be revisited each time the Watonwan River watershed comes up for future monitoring work under the IWM program.

In 2012, a detailed sentinel lake assessment report was completed regarding the program's initial four years' of monitoring results. That report is available on the MPCA's webpage at: https://www.pca.state.mn.us/sites/default/files/wq-2slice83-0043.pdf. Many of the water chemistry parameters at the time of the 2012 report were as good as, or better than the WCBP reference lakes used to set water quality standards for the ecoregion. The dominance of surrounding agricultural land use and the indication of improving water quality trends make St. James Lake an ideal candidate for protection efforts in the near future to prevent the lake from slipping to an impaired state.

AQR use assessment

St. James Lake is one of only two assessed lakes in the entire Watonwan River Watershed that fully supports AQR uses. The means calculated for TP, Secchi and chl-*a* all easily meet their respective WCBP shallow lake standards. Although the water may appear green at times, it is unlikely the lake will experience frequent or prolonged nuisance algal blooms. The current water quality stands in contrast to where it was at the turn of the century. Reclamation projects were started in the lake in 2001, in response to poor water quality, algal blooms and an undesirable fish community. By 2008, water quality parameters had improved and the fish and plant communities were showing signs of rebounding. Historical Secchi transparency data show an increasing trend in water clarity, possibly as a result of the reclamation projects that have taken place.

AQL use assessment

The MNDNR has conducted both aquatic plant and fish surveys for St. James Lake in an effort to characterize the biological communities, and determine if the lake supports AQL uses. The results of those surveys indicate that both communities are above the impairment thresholds. The fish community in the lake is still relatively low-diversity when compared to similar lakes in the watershed, and no disturbance-intolerant species were identified during the fish bioassessment surveys. The fish community indicators identified during the surveys are likely reflective of the improving water quality conditions. The MNDNR assessed St. James Lake as fully supporting AQL use.

Butterfield Lake summary (83-0056-00)

Butterfield Lake has a newly identified AQR use impairment for excess nutrients/biological indicators based on data collected during the summers of 2013 and 2014. The datasets for TP, Secchi and chl-*a* all had the minimum number of samples required to assessment and mean calculations for all three parameters exceed the WCBP shallow lake eutrophication standards of 90 µg/L, 0.7 meters and 30 µg/L respectively. Chlorophyll-*a* observations were consistently above the WCBP standard, and are indicative of persistent algal blooms throughout the summer. Butterfield Lake was assessed as not supporting AQR use.

Butterfield Lake was not assessed for AQL use. There were no plant or fish bioassessment surveys carried out by the MNDNR, and the AQL use support status is listed as insufficient information. Chloride samples taken never exceeded the toxic standard of 230 mg/L, and it is unlikely that chloride is adversely affecting the aquatic communities.

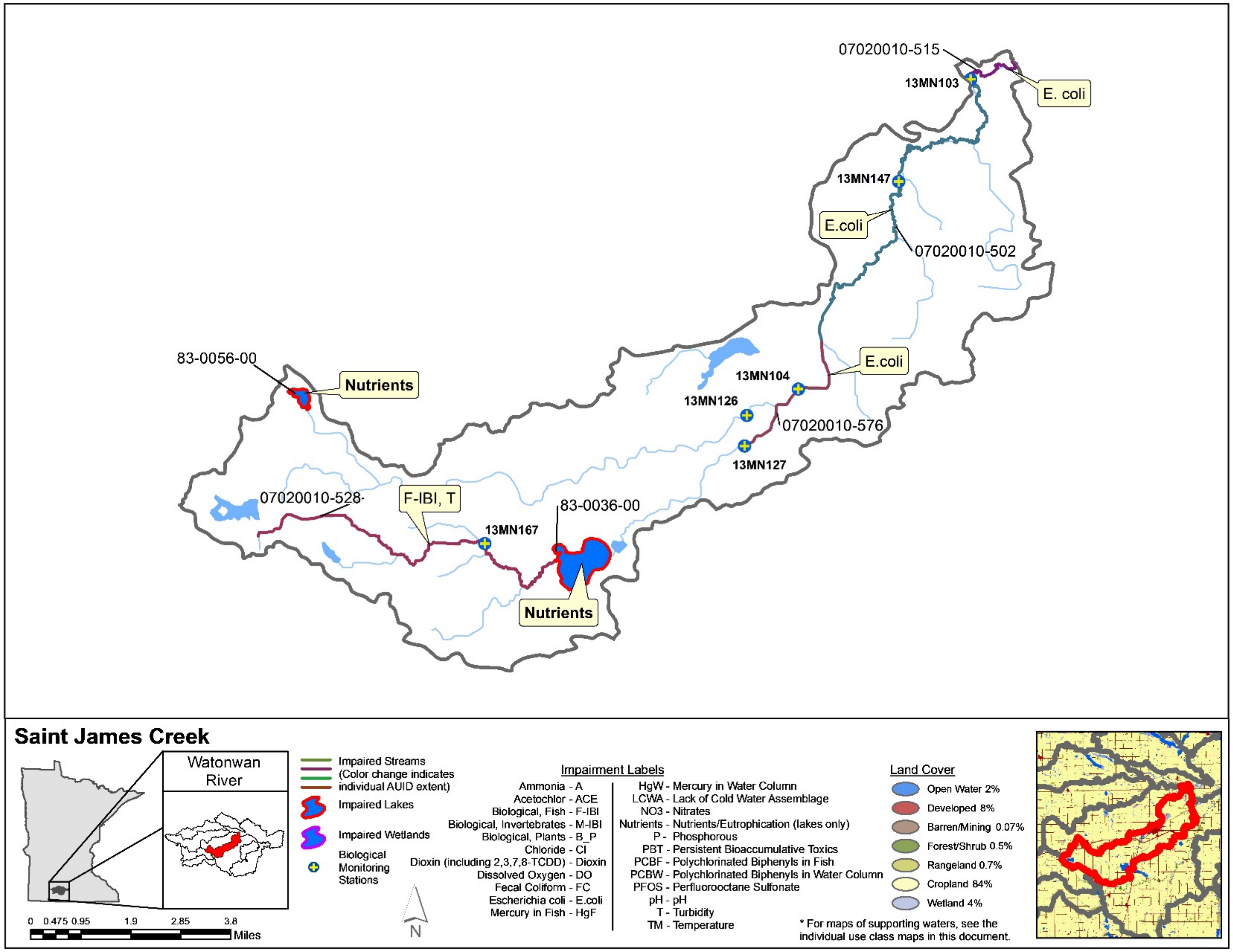


Figure 28. Currently listed impaired waters by parameter and land use characteristics in the St. James Creek Aggregated 12-HUC.

Tributary to Watonwan River Aggregated 12-HUC — HUC 0702001006-02

Located on the north end of the Watonwan River Watershed, the unnamed tributary to the Watonwan Subwatershed begins in Brown County and south east into Watonwan County. The unnamed tributary begins in the northwest region of the subwatershed before flowing through Lake Hanska. Judicial Ditch 5 flows into Lake Hanska from the south. The town of Godahl is located in the south central part of the subwatershed. Unnamed tributary to the Watonwan River flows out of the subwatershed and directly to the Watonwan River. Landuse in the subwatershed is 83% cropland.

Table 18. Aquatic life and recreation assessments on stream reaches: Tributary to Watonwan River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID *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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001006-02 Trib to Watonwan River																
07020010-542, Judicial Ditch 5, CD 2 to Lk Hanska		0.90	WWg			IF		NA		MTS			IF		IF	
07020010-545, Unnamed ditch, Unnamed ditch to N Fk Watonwan R	13MN102*	5.05	WWm	IF	MTS	IF	MTS	MTS	MTS	MTS	MTS		MTS		SUP	SUP

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. Minnesota Stream Habitat Assessment (MSHA): Trib. to Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	13MN102	Unnamed ditch	0	6.5	14	7	12	39.5	Poor
Average Habitat Results: *Trib. to Watonwan River Aggregated 12-HUC*			**0**	**6.5**	**14**	**7**	**12**	**39.5**	**Poor**

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)

Table 20. Channel Condition and Stability Assessment (CCSI): Trib. to Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN102	Unnamed ditch	TC	38	23	28	7	96	severely unstable
Average Stream Stability Results: *Trib. to Watonwan River Aggregated 12-HUC*				**38**	**23**	**28**	**7**	**96**	**severely unstable**

Qualitative channel stability ratings
= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Table 21. Outlet water chemistry results: Unnamed Tributary to Watonwan River Aggregated 12-HUC.

Station location:	Unnamed Ditch - At CR 3, 3.5 mi. E of La Salle						
STORET/EQuIS ID:	S006-462						
Station #:	0702001006-02						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	10	2.2	32.3	15.5	<40	0
Chloride	mg/L	10	19.3	25.8	22.7	<230	0
Dissolved Oxygen (DO)	mg/L	19	7.0	14.6	10.5	>5	0
pH	None	19	7.7	8.5	8.1	6.5 - 9	0
Phosphorus	µg/L	10	33	304	113	<150	2
Secchi Tube	100 cm	19	20	100	71	> 10	0
Total suspended solids	mg/L	10	5	51	17	< 65	0
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	52	99	- - -	<126	0
Escherichia coli	MPN/100ml	15	10	435	106	<1260	0
		Supporting Aquatic Life Parameters					
Hardness	mg/L	10	269	502	381	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above was compiled using the results from data collected at the outlet monitoring station in the Unnamed Tributary to Watonwan River Aggregated 12-HUC, a component of the IWM work conducted between May and September from 2013 and 2014. This specific data does not necessarily reflect all data that was used to assess the AUID.**

Table 22. Lake assessments: Unnamed Tributary to Watonwan River Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-*a* (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Hanska	83-0021-00	1,775	H	100	2.1	1.0*	NT	200	28.4	0.7	IF	NS

Key for Cell Shading: ▇ = new impairment (2015 assessment cycle)

* Mean depth estimated by MPCA staff

Abbreviations: **H** – Hypereutrophic **NT –** No trend identifiable **IF** – Insufficient Information **NA** – Not Assessed

Summary

There is one assessable AUID in the unnamed tributary to Watonwan River Subwatershed with one biological site, 13MN102. The site was sampled once for fish and once for macroinvertebrates in 2013. The AUID is being assessed against modified use standards. Habitat and channel stability are rated poorly supporting the modified use designation. The fish score is above the modified use threshold. Spotfin shiner, sand shiner and white sucker were the three dominant fish species found during the sample. All are considered generalist feeders and sand shiners and white suckers are tolerant species. The macroinvertebrate sample taken in 2013 scored above the modified and general use thresholds. The passing scores for both biological samples against modified use standards mean the AUID will not be listed for AQL. All habitat criteria scored poorly. Row crop is the dominant land use type near the site and the stream buffer is very narrow. The stream is an agricultural ditch and described as being severely unstable.

Lakes summary

There is one lake greater than 10-acres in this subwatershed. Lake Hanska (08-0026-00) is the largest lake in the Watonwan River Watershed and covers more than 1,700 acres. Since 1989, water levels have been maintained by a variable crest dam located at the outlet of the lake. Past management activities on this lake include dredging, aerating and chemical reclamation. The lake was drawn down in 1988 to promote vegetative growth on the shoreline and create habitat for waterfowl. Rotenone was applied to the lake in the fall of 1989, after an abundance of disturbance-tolerant fish species (*e.g.* carp and bullhead) were found following the previous year's draw down. Water quality appeared to improve immediately following the drawdown and chemical reclamation. In 1990, the lake was stocked with sport fish species by the MNDNR.

During the winter of 2001, the MNDNR killed large numbers of rough fish in the lake using a 'reverse aeration' technique to deplete oxygen levels below the ice. The fish kill was successful and the lake was again stocked with sport fish species. In 2005, the lake was again drawn down by about 1.5 feet as part of the lake management plan. The goals of this draw down were to further promote shoreline and emergent vegetative growth, (specifically sago pondweed) and to reduce shoreline erosion.

Fish and plant bioassessments were recently conducted by the MNDNR to assess components of AQL use. Brown County officials have indicated that residential shoreline development is increasing, especially on the north shore of the lake. The local lake association is currently seeking opportunities to help monitor and manage water quality within the lake.

Lake Hanska would benefit from landscape restoration projects and strategies. Past drawdowns appear to only have a temporary effect, as populations of undesirable fish continue to rebound. Increased use of sediment settling ponds and bioreactors on ditched tributaries/tile outlets would reduce the amounts of sediment and nutrients reaching the lake. Increased vegetative buffer widths along the ditches would also lessen the amount of nutrients and sediment reaching the lake.

Stream chemistry at large

Two AUIDs in this subwatershed have chemistry data: Judicial Ditch 5 (07020010-542) and the unnamed ditch tributary to the Watonwan River (07020010-545). There are no streams in this subwatershed that flow in their natural channel as all water courses have been manipulated to flow as agricultural drainage ditches. The majority of land use in this subwatershed is devoted to row crop agriculture and many of the drainage ditches have minimal vegetative buffers (*i.e.* less than 50 feet). Under these conditions, high levels of nutrients in surface waters are probable and expected.

The chemistry dataset for Judicial Ditch 5 (-542) does not meet the minimum requirements to be assessed for AQL use, and the final assessment is (IF). There are no available AQR use data. The data that are available show the mean TP concentration is nearly double the standard (*i.e.* 284 µg/L). However, the mean for chl-*a* is well below the standard (*i.e.* 4.9 µg/L). A large Secchi transparency dataset spanning eight years (2005-2012) shows zero exceedances of the 10 (cm) standard, and a large portion of samples exceeding the maximum value possible based on the type of transparency tube used. These data indicate that chl-*a* and transparency are not likely adversely affecting the aquatic life communities.

Chemistry data for the unnamed ditch (-545; station S006-462) were collected at the outlet chemistry station during the summers of 2013 and 2014. The data meet the minimum requirements and were assessed for AQR and AQL uses. There are very few individual water quality exceedances from this station during the two years of monitoring. On two separate occasions TP values were above the 150 µg/L standard, but the mean of all TP samples is meeting the standard. All other AQL use parameters also meet their respective standards.

Fifteen *E. coli* bacteria samples were collected over the two monitoring years, and every sample is well below the individual bacteria standard of 1,260 MPN/100mL. Monthly geometric mean calculations also meet the standard. Out of all the outlet chemistry stations in the Watonwan River Watershed that have *E. coli* bacteria standards (*i.e.* not a LRVW) this is the only one that did not have a single *E. coli* bacteria exceedance (individual or geometric mean). As such, this AUID fully supports AQR use.

Lake AQR use assessment

The data collected from Lake Hanska were inconclusive to determine a support status for AQR use (Table 22). Only four TP samples out of 12 collected are below the eutrophication standard (90 µg/L) and the calculated mean of all TP samples greatly exceeds that standard. High nutrient concentrations are expectedly due to the shallowness of the lake and the dominance of row crop agriculture in the surrounding watershed.

The means for chl-*a* and Secchi transparency both meet their respective standards; however, the standard error for the chl-a mean is large enough that the true mean may be greater than the 30 µg/L standard. Secchi transparency is right at the standard for shallow lakes in the WCBP ecoregion.

The final assessment for AQR use is IF due to TP exceeding the standard, and chl-*a* and Secchi meeting their standards.

Lake AQL use assessment

The MNDNR conducted a fish bioassessment survey on Lake Hanska in 2012. The resulting scores were below average for seven of the eight metrics used during the assessment. Five disturbance-tolerant (and no intolerant) species were captured in the net gear. Channel catfish, common carp and bluegill species respectively dominated the trap net, gill net and near shore catches. Channel catfish were stocked in the lake by the MNDNR in 2001. The poorly performing fish indicators are likely reflective of poor water quality and a stressed fish community. Based on these fish data, the MNDNR assessed Lake Hanska as not supporting AQL use.

An aquatic plant survey from 2006 indicated that the plant community is above an impairment threshold. Three other such surveys were conducted from 1993-2006 with similar results. In 2006, six submergent plant species were identified but were rare in abundance which may affect desirable fish populations by limiting available habitat. Dominance of filamentous algae was noted by the MNDNR during the 2006 survey.

Winter aeration occurs regularly in the southeastern and western bays of the lake. These two areas were dredged in the late 1980s and mid-1990s in an attempt to improve water clarity. The MNDNR made note of possible winter fish kills occurring between the two aerators.

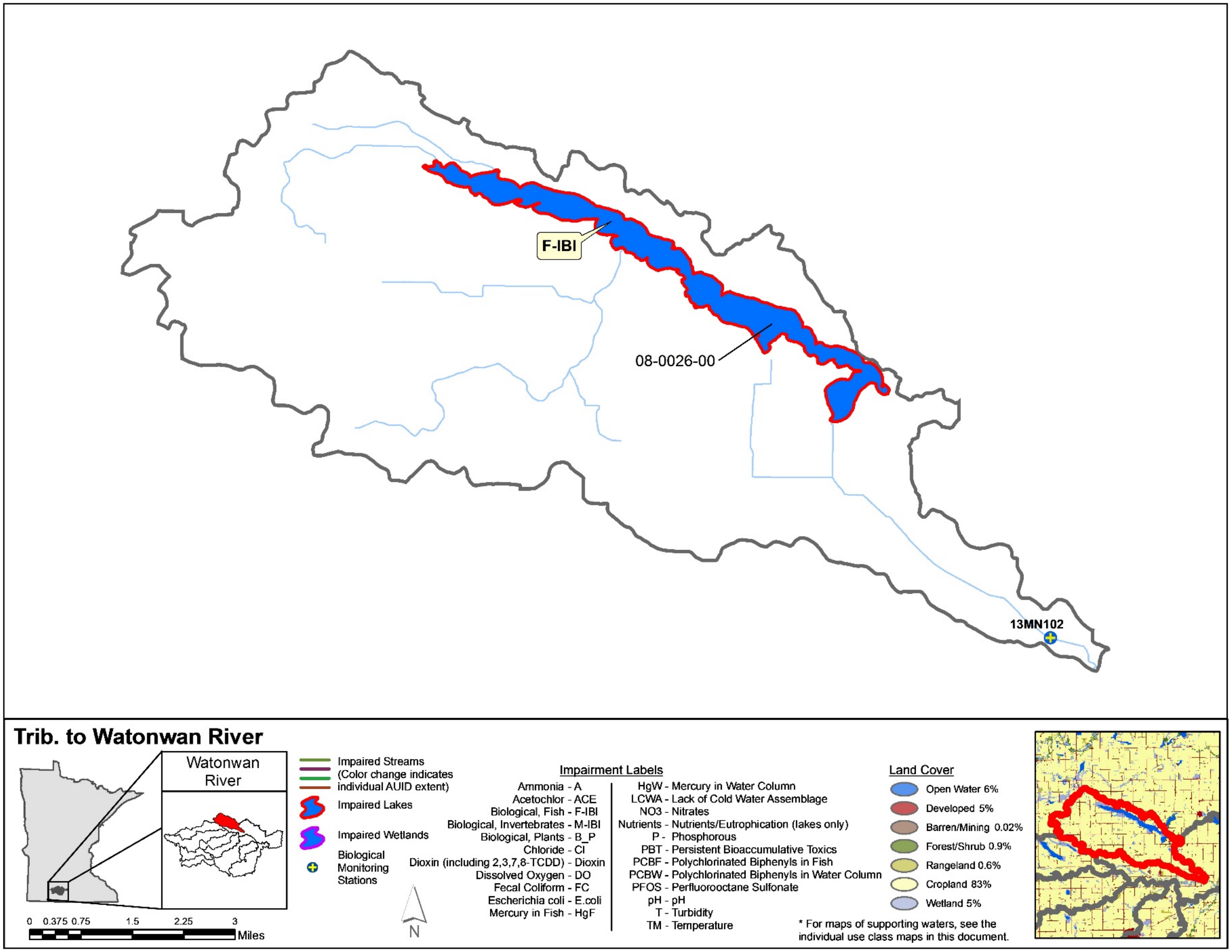


Figure 29. Currently listed impaired waters by parameter and land use characteristics in the Tributary to Watonwan River Aggregated 12-HUC.

Judicial Ditch 1 Aggregated 12-HUC HUC 0702001004-03

Judicial Ditch 1 Subwatershed is located in the southwest part of the Watonwan River Watershed. The subwatershed begins in Cottonwood County and continues into Watonwan County. Many unnamed tributaries flow into Judicial Ditch 1 throughout its 22-mile reach. Judicial Ditch 1 begins in the far west region of the subwatershed in Parson Lake, it then continues to flow eastward through Fish Lake and ultimately out of the subwatershed into Irish Lake. Bingham Lake is located in the northwest corner of the Judicial Ditch 1 Subwatershed. The town of Bingham Lake is located in the same area. The town of Mountain Lake crosses the northern border of the subwatershed. Cropland makes up 86% of the landuse within this subwatershed.

Table 23. Aquatic life and recreation assessments on stream reaches: Judicial Ditch 1 Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name***, *Reach Description*	**Biological Station ID**	**Reach Length (miles)**	**Use Class**	**Aquatic Life Indicators:**									**Eutrophication**		**Aquatic Life**	**Aquatic Rec. (Bacteria)**
				Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides ***	Phosphorous	Response Indicator		
HUC 12 Agg: 0702001004-03 Judicial Ditch 1																
07020010-561, Unnamed creek, Unnamed cr to JD 1	13MN124	1.63	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-579, Judicial Ditch 1, Headwaters to -94.9058 43.9095	13MN154, 91MN097	10.19	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-580, Judicial Ditch 1, -94.9058 43.9095 to T105 R33W S7, east line	03MN061*	4.37	WWm												NA	
07020010-581, Judicial Ditch 1, T105 R33W S8, west line to Irish Lk	13MN110	7.75	WWg	EXS	MTS	MTS	MTS	MTS	MTS	MTS	MTS		MTS		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 24. Minnesota Stream Habitat Assessment (MSHA): Judicial Ditch 1 Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
2	13MN124	Trib. to unnamed creek	0	6.75	17.23	9.5	19.5	52.98	Fair
2	13MN154	Judicial Ditch 1	.5	7	17.85	9	18.5	52.85	Fair
2	91MN097	Judicial Ditch 1	0	6	15.35	12.5	21.5	55.35	Fair
1	13MN110	Judicial Ditch 1	0	6.5	22.6	9	16	54.1	Fair
Average Habitat Results: *Judicial Ditch 1 Aggregated 12-HUC*			**.13**	**6.56**	**18.26**	**10**	**18.86**	**53.82**	**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)

Table 25. Channel Condition and Stability Assessment (CCSI): Judicial Ditch 1 Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN124	Trib. to unnamed creek	MHL	13	15	12	5	45	moderately unstable
1	91MN097	Judicial Ditch 1	MHL	24	19	8	5	56	moderately unstable
1	13MN110	Judicial Ditch 1	MHL	24	17	9	5	55	moderately unstable
Average Stream Stability Results: *Judicial Ditch 1 Aggregated 12-HUC*				**20.33**	**17**	**9.67**	**5**	**52**	**moderately unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Table 26. Outlet water chemistry results: Judicial Ditch 1 Aggregated 12-HUC.

Station location:	Judicial Ditch 1 - At CR 128 (630th Ave), 4 mi. SW of Butterfield						
STORET/EQuIS ID:	S007-567						
Station #:	0702001004-03						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	9	4.9	31.6	10.8	<40	0
Chloride	mg/L	9	23.3	41.4	28.9	<230	0
Dissolved Oxygen (DO)	mg/L	18	5.9	11.2	8.1	>5	0
pH	None	18	7.7	10.0	8.0	6.5 - 9	1
Phosphorus	µg/L	9	31	177	73	<150	1
Secchi Tube	cm	18	22	85	53	> 10	0
Total Suspended Solids	mg/L	9	6	44	17	< 65	0
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	396	888	- - -	<126	3
Escherichia coli	MPN/100ml	15	191	2,419	699	<1,260	2

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Judicial Ditch 1 Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 27. Lake assessments: Judicial Ditch 1 Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-a (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Bingham	17-0007-00	265	H	100	2.7	1.5	NT	158	41.8	0.6	NS	NS

Key for Cell Shading: = new impairment (2015 assessment cycle)
Abbreviations: **H** – Hypereutrophic **NT –** No trend identifiable **IF** – Insufficient Information
NS – Not Supporting

Summary

The Judicial Ditch 1 Subwatershed has four AUIDs assessable for AQL with four biological stations (13MN124, 13MN154, 91MN097, 13MN110). The Unnamed Creek tributary to Judicial Ditch 1 has one AUID with an assessable biological station, 13MN124. Fish were sampled twice in 2013, with only one assessable visit. Macroinvertebrates were sampled once in 2013 and once in 2014. The first fish sample was dropped due to possible impacts from drought in 2012. The second fish sample scored zero and was recommended for impairment for fish using general use thresholds. Only three creek chubs were collected during that sample. Both macroinvertebrate samples scored well below the impairment threshold. Improved flow conditions in 2014 resulted in a distinctly different invertebrate community, but scores were low nonetheless. The headwaters AUID of Judicial Ditch 1 had two sample locations; 13MN154 was sampled twice in 2013, and 91MN097 was sampled once in 2014. Scores from all three samples were below the threshold for general use. Sample scores from 13MN154 were both zero and the score from 91MN097 was 2.5. 13MN154 was not sampled for macroinvertebrates, as water levels were too low to collect a representative sample. 91MN097 was sampled twice for macroinvertebrates, once each in 2013 and 2014. Both samples scored below the general use threshold. Despite scoring below the impairment threshold, the 2014 sample was much more diverse, with a smaller proportion of tolerant taxa, this suggests a potential natural recovery from the drought-like conditions present when the 2013 sample was collected. Nitrogen was high during both samples at 13MN154. Habitat was rated fair for the entire AUID, with poor riparian landuse scores. Landuse in the subwatershed is dominated by agriculture and row crop is the primary riparian landuse at both sites.

The next downstream AUID has one biological sample location (03MN061) and is being assessed against modified use standards. The station 03MN061 was sampled for fish and macroinvertebrates in 2003. It scored zero for fish and 11.4 for macroinvertebrates resulting in the AUID being listed as impaired for biology. With no new biological data sampled from 03MN061, the impairment from 2003 will carry over.

The furthest downstream AUID of Judicial Ditch 1 (13MN110) was sampled once for fish and macroinvertebrates in 2013. The fish were scored against general use standards and failed. The three most common species were creek chub, johnny darter, and white sucker. Creek chub and white sucker are tolerant species. The macroinvertebrate community was very healthy for a ditched stream, with relatively high number of clingers and POET taxa. Habitat was scored as fair. Dominant riparian landuse was row crop and a moderate to heavy amount of erosion was noted at the station.

Stream chemistry at large

Judicial Ditch 1 (07020010-581) has a newly identified AQR use impairment for *E. coli* bacteria. New data for (-581) were collected during the summers of 2013 and 2014 at the outlet chemistry station (S007-567). Fifteen *E. coli* bacteria samples collected show chronically, and sometimes severely elevated bacteria counts. Two samples exceeded the individual *E. coli* bacteria standard of 1,260 MPN/100mL; one other sample was greater than 1,000 MPN/100mL. Three summer months exceed the geometric mean standard of 126 MPN/100mL, indicating a possible risk to human health through prolonged or repeated bodily contact. This AUID does not support AQR use.

Other chemistry data collected meet the **WCBP** water quality standards for streams in the WCBP ecoregion (Table 26). However, the AQL use assessment is If due to a lack of pre-9 a.m. dissolved oxygen samples. All other AUIDs in this subwatershed have insufficient or nonexistent data for chemistry related AQL and AQR assessments.

Lake AQR use assessment

As stated above, Bingham Lake was previously assessed and found to be not supporting for AQR use. No new data (other than Secchi transparency) exist to support or refute the previous assessment. An additional four samples for TP and chl-*a* are required to meet the minimum dataset size for assessment purposes. Based on the means of the four available observations (Table 27), it is probable that Bingham Lake would remain listed as impaired following additional monitoring.

Lake AQL use assessment

Two MNDNR fisheries bioassessments were conducted in 2010. During the second survey, only near-shore components of the survey were repeated. Results indicate that Bingham Lake scored below average on all of the metrics observed, and is below the impairment threshold. No disturbance-intolerant species were found in the monitoring gear. Fathead minnows were the dominant species found during the near show surveys conducted. Species found during retrieval of the gill net gear include walleye (most prevalent), yellow perch, common carp and black bullhead. Trap net gear captured mostly black bullhead and common carp. These fish community indicators typically suggest poor water quality and a lack of complex near-shore habitat. Two older aquatic plant surveys indicated the plant community was below the threshold for impairment, which limits the ability of vegetative dwelling species to survive; however, the most recent plant survey was above the impairment threshold. Bingham Lake has reported experienced summer kills, and substantial winter kills of the fish communities, which may be driving a shift in dominant species. Based on the results of these fish data, Long Lake was assessed as not supporting AQL use.

Lakes summary

There are seven lakes greater than 10 acres in size in this subwatershed. Fish Lake (17-0011-00) has AQR use data, but was not assessed due to the lake being drawn down during the summer of 2012. Field notes from 2012 monitoring estimate the water depth to be less than one-foot deep, and Google Earth™ aerial imagery from October of 2012, shows a control structure being installed at the east end of the lake, on the outlet channel.

Bingham Lake (17-0007-00) was previously assessed as not supporting AQR use due to excessive nutrients and biological indicators (listed in 2010). No new TP or chl-*a* data have been collected on Bingham Lake to determine if the impairment listing is supported. However, Secchi transparency data has been collected monthly during the summers through the CLMP. Those data show a mean transparency depth of 0.6 meters, which is below the WCBP standard for shallow lakes. Bingham Lake will continue to be listed as impaired.

Lake Three (17-0012-00) was visited once in 2010, by the MNDNR. A single TP sample was collected and analysis reported 260 µg/L, which is nearly threefold above the shallow lake standard. A Secchi transparency measurement was taken at the same time which was below the standard. These limited data suggest that nutrients may be problematic in this lake but more information is needed before deciding if the lake is impaired for these parameters.

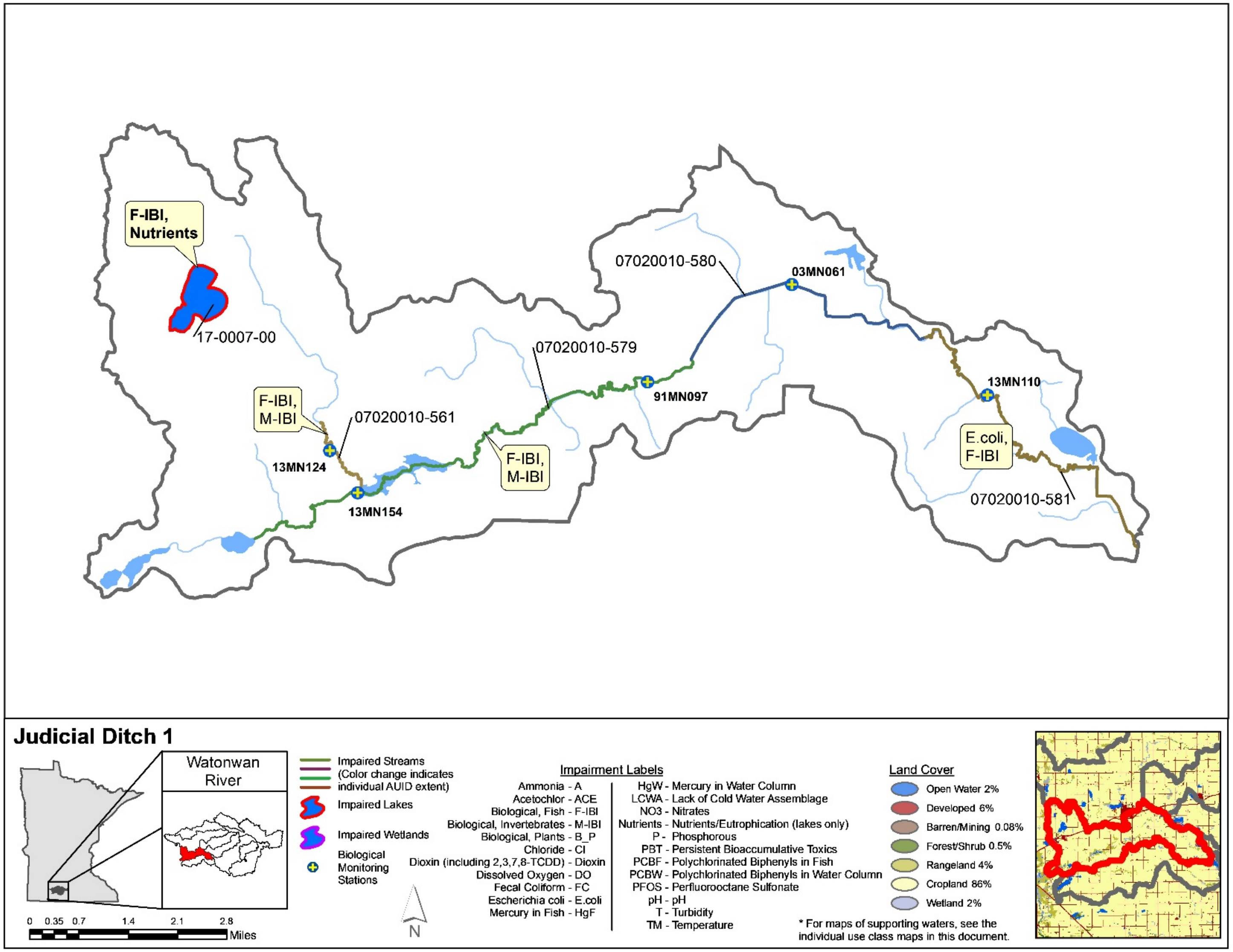


Figure 30. Currently listed impaired waters by parameter and land use characteristics in the Judicial Ditch 1 Aggregated 12-HUC.

Upper South Fork Watonwan Aggregated 12-HUC   HUC 0702001004-02

The Upper South Fork Watonwan River Subwatershed is located in the far southwest corner of the Watonwan River Watershed and is located within Jackson, Cottonwood, Watonwan and Martin counties. The Upper South Fork Watonwan River flows from west to east, beginning in Fish Lake. The Upper South Fork Watonwan flows 26 miles with many small unassessed tributaries flowing into the mainstem of the river. Before the Upper South Fork Watonwan leaves the subwatershed is flows into and then out of Irish Lake which is located on the very northeastern region of the subwatershed. Windom is located approximately three miles to the northwest of the downstream reaches of the subwatershed, Odin is approximately one mile east of the downstream region. Cropland is makes up 89% of the landuse within this subwatershed, making it the dominant landuse type.

Table 28. Aquatic life and recreation assessments on stream reaches: Upper South Fork Watonwan Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:									Eutrophication			
AUID ***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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001004-02 Upper South Fork Watonwan																
07020010-569, Watonwan River, South Fork, -94.9121 43.8594 to -94.8475 43.8813	13MN164*	6.57	WWm	EXS		NA	NA	NA		NA	NA		NA		IMP	
07020010-568, Watonwan River, South Fork, -94.8475 43.8813 to Irish Lk	13MN109	11.88	WWg	EXS	EXS	MTS	IF	MTS	NA	MTS	MTS		MTS		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 29. Minnesota Stream Habitat Assessment (MSHA): Upper South Fork Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use	Riparian (0-15)	Substrate (0-27)	Fish Cover	Channel Morph.	MSHA Score	MSHA Rating
1	13MN164	Unnamed trib. to Irish Creek	0	5	8.5	5	6	24.5	Poor
3	13MN109	Watonwan River, South Fork	0.83	10	16.37	14.33	21	62.53	Fair
Average Habitat Results: *Upper Watonwan River, South Fork Aggregated*			**.42**	**7.5**	**12.44**	**9.67**	**13.5**	**43.52**	**Poor**

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)

Table 30. Channel Condition and Stability Assessment (CCSI): Upper South Fork Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN109	Watonwan River, South Fork	MHL	31	23	13	5	72	moderately unstable
Average Stream Stability Results: *Upper South Fork Watonwan River Aggregated 12-HUC*				**31**	**23**	**13**	**5**	**72**	**moderately unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Table 31. Outlet water chemistry results: Upper South Fork Watonwan River Aggregated 12-HUC.

Station location:	South Fork, Watonwan River - At CR 9 (50th Ave), 4 mi. W of Ormsby						
STORET/EQuIS ID:	S007-568						
Station #:	0702001004-02						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	8	1.7	11.2	6.4	<40	0
Chloride	mg/L	8	20	32	24	<230	0
Dissolved Oxygen (DO)	mg/L	17	5.9	10.4	8.4	>5	0
pH	None	17	7.8	8.3	8.1	6.5 - 9	0
Phosphorus	µg/L	8	27	258	98	<150	1
Secchi Tube	cm	17	11	100	45	> 10	0
Total Suspended Solids	mg/L	8	4	90	29	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	569	850	- - -	<126	3
Escherichia coli	MPN/100ml	15	161	2,755	885	<1,260	2

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Upper South Fork, Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 32. Lake assessments: Upper South Fork Watonwan River Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-a (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Fish	32-0018-03	269	E	Unknown	8.2	3.5*	NT	39	20.9	1.4	FS	NS

Key for Cell Shading: = new impairment (2015 assessment cycle)
* Mean depth estimated by MPCA staff
Abbreviations: **E** – Eutrophic **NT –** No trend identifiable **IF** – Insufficient Information **NS** – Not Supporting

Summary

The Upper South Fork Watonwan River Subwatershed has two AUIDs with Biological sampling locations and assessable data. The AUID on the unnamed tributary to Irish Creek has one Biological sampling location, 13MN164, which was sampled once for fish in 2013. The fish score was assessed against modified use thresholds and failed, resulting in a recommendation to list for fish bioassessment. No sensitive species were found in the sample, but instead were dominated by very tolerant species. The most common species found during sampling was common carp. Macroinvertebrates were not sampled due to low water levels, and lack of sampleable habitat. Habitat was rated as poor at this site, supporting the assessment against modified use standards. All habitat categories were low scoring possibly indicating limiting factors to healthy fish populations. The stream has some indicating of riprapping in sections of the banks probably to help reduce erosion which would lead to additional sediment in the stream. The secchi tube only measured 27cm of clarity out of 100cm.

The AUID on the South Fork Watonwan River was sampled at one location, 13MN109. It was sampled once for macroinvertebrates in 2013, and once for fish and macroinvertebrates in 2014. Thee AUID was scored against general use thresholds. The fish and macroinvertebrate scores were below the impairment threshold. Fathead minnow, a very tolerant species, dominated the fish sample. The macroinvertebrate samples had relatively high numbers of POET taxa due to the presence of riffles, but all of them were tolerant forms typical of higher gradient agricultural streams. Three nitrogen samples were taken during three fish samples, two of which did not produce viable fish data. All nitrogen samples were high (9.2mg/L, 11mg/L, 16mg/L). Row crop and open pasture are the two dominant landuse types at this site. The site itself was noted as having little to no riparian zone.

Stream chemistry at large

The Upper South Fork of the Watonwan River (07020010-568) has a newly identified AQR use impairment for *E. coli* bacteria. New data for (-568) were collected during the summers of 2013 and 2014, at the outlet chemistry station (S007-568). Fifteen *E. coli* bacteria samples collected show chronically, and sometimes severely elevated bacteria counts. The highest count was approaching 2,800 MPN/100 mL which is more than double the individual bacteria standard of 1,260 MPN/100mL. Three summer months exceed the geometric mean standard of 126 MPN/100mL which may pose a risk to human health through prolonged or repeated bodily contact. This AUID does not support AQR use.

Other chemistry data collected meet the WCBP water quality standards with the exception of the TSS dataset, which was assessed as insufficient information. The resulting AQL use assessment is IF. All other AUIDs in this subwatershed had insufficient data for chemistry related AQL and AQR assessments.

Lake AQR use assessment

Fish Lake fully supports AQR use based on the most current water quality data. The means values of TP, Secchi and chl-*a* all meet their respective water quality standards for the WCBP ecoregion (65 µg/L; 0.9 meters and 22 µg/L respectively). The resident lake association on Fish Lake actively applies copper-sulfate to control the severity of algal blooms. It is likely that these treatments also influence Secchi transparency in a positive way, by limiting the amount of algae in the water column. Cottonwood County recently issued an ordinance to upgrade old or leaking septic systems, as well as require that all new buildings and residences around the lake be equipped with septic systems, in an effort to mitigate sources of phosphorous to the lake.

Lake AQL use assessment

The MNDNR conducted a fish bioassessment survey on Fisk Lake in 2011. The lake has a relatively high diversity of fish species compared to other lakes in the Watonwan River Watershed, but is dominated by disturbance-tolerant species. Only one disturbance-intolerant species (smallmouth bass) was identified during near-shore monitoring. Biennial walleye stocking appears successful, with walleye being the dominant species observed in the deeper water gill net gear. There is a low abundance of vegetative dwelling fish species, and artificial barriers impede species to and from the lake. Based on the results of the fish survey, Fish Lake is not supporting AQL use at this time.

The most recent aquatic plant survey conducted by MNDNR indicated that the plant community is below the impairment threshold. A poorly performing plant community limits the success of vegetative dwelling fish species, and can be indicative of poor water quality. Anecdotal evidence provided by a Cottonwood County employee suggests that the plant community is on the rebound, and increasing in abundance.

Lakes summary

There are three lakes that are greater than 10 acres in size in this subwatershed. Fish Lake (32-0018-03) is the only lake that has enough water chemistry and MNDNR bioassessment survey data to assess for AQR and AQL uses (Table 32). This lake is held to the WCBP lake eutrophication standards. Chemistry data submitted between 2005 and 2010 were collected under the Jackson County water quality assessment project, and the CLMP (Secchi data only). The MNDNR conducted fish and aquatic plant surveys in 2011.

Fish Lake is the headwaters for this subwatershed and has a small watershed to lake area ratio (5:1). There are two small 'bays' of Fish Lake (Bullhead Bay and Northwest Bay) that are each separated from the main body of the lake. Water moves from the main body of Fish Lake to Bullhead Bay via a channel before entering a series of wetland complexes at the start of the Upper South Fork of the Watonwan River (-568). Water levels are maintained by a dam at the outlet of Fish Lake.

In late June of 2014, the Fish Lake Association board voted to treat the lake with copper sulfate to mitigate algae levels prior to the 4th of July weekend. In May of 2015, lake residents reported a moderate fish kill and noted dead carp and bullhead washed up on the northeast shore. Another copper sulfate treatment scheduled for 2015 was voted down.

Fish Lake is an excellent candidate for implementing lake protection projects and strategies. As noted, copper sulfate has been used in the past to control algae levels and increase water clarity, but a more long-term solution exists in addressing problem areas on the surrounding landscape. Mitigating overland runoff from the surrounding agricultural fields to reduce nutrient loading should have a positive effect on in-lake algae concentrations and reduce the need for future chemical treatments. The northeast shore of the lake is relatively undeveloped, and row crop fields are encroaching on the shoreline (as close as 60 feet in some spots). Increasing and maintaining the shoreline buffer width and the widths of grass waterways from the fields should reduce nutrient loading to the lake.

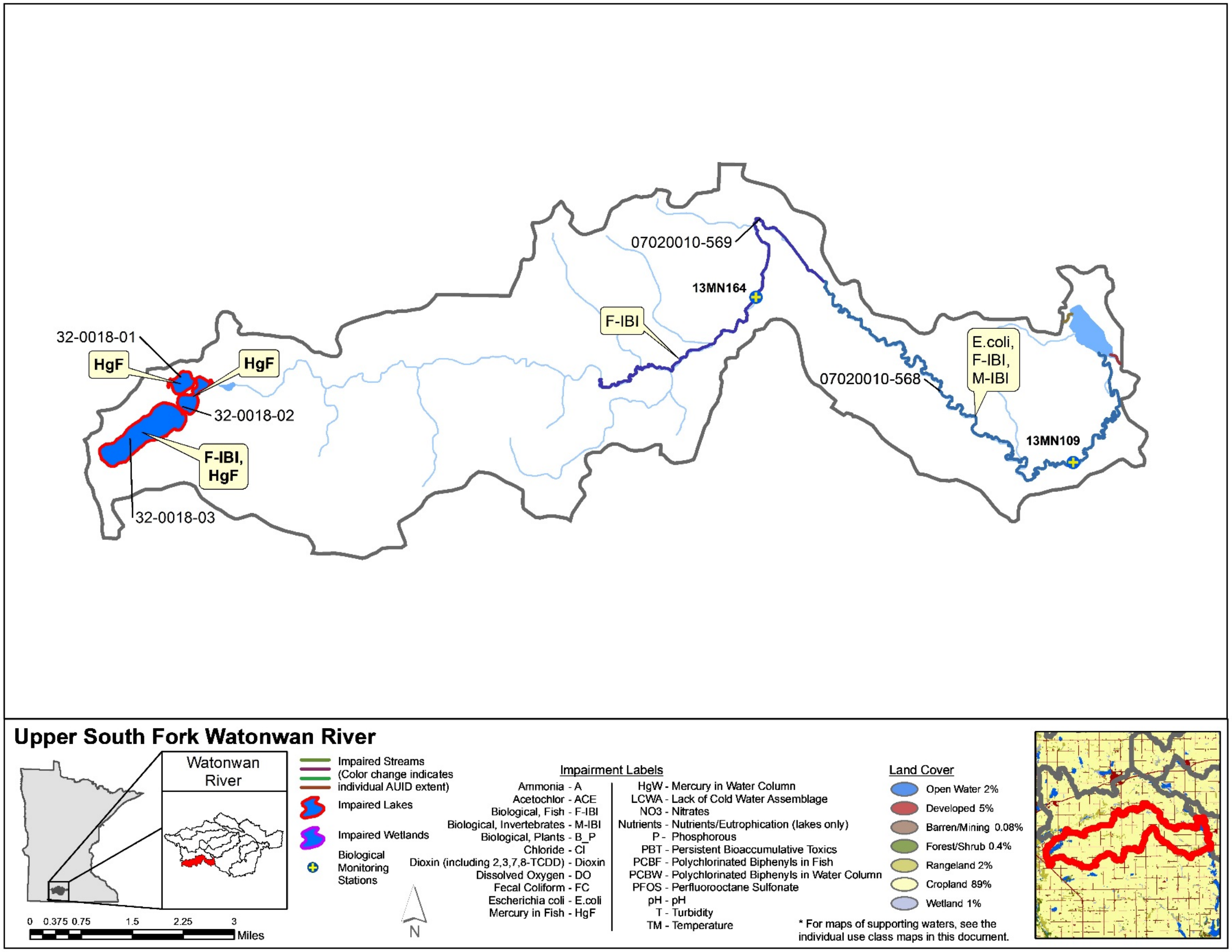


Figure 31. Currently listed impaired waters by parameter and land use characteristics in the Upper Watonwan River, South Fork Aggregated 12-HUC.

Lower South Fork Watonwan River Aggregated 12-HUC — HUC 0702001004-01

The Lower South Fork Watonwan River Subwatershed begins in Martin County and ends in Watonwan County. The Lower South Fork Watonwan River flows west to east until Willow Creek joins the river. From there the South Fork Watonwan River flows northeast before emptying into the Watonwan River about two miles west of Madelia. County Ditch 1 flows into the South Fork Watonwan River approximately five miles south east of St. James. A tributary to County Ditch 1 flows through Long Lake and then through Mary Lake before becoming County Ditch 1. Another major tributary, Spring Brook, flows into the South Fork Watonwan River just before the mouth of the subwatershed. Several other unassessed tributaries flow into the South Fork Watonwan River throughout the reach. The towns of Odin and Ormsby are located in the western region of the subwatershed. Cropland makes up 87% of the landuse within this subwatershed, another 7% consists of developed land. These two landuse types represent the dominant landuse within the subwatershed.

Table 33. Aquatic life and recreation assessments on stream reaches: Lower South Fork Watonwan River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID *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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001004-01 Lower Watonwan River, South Fork																
07020010-560, Judicial Ditch 4, 230th St to Willow Cr	13MN116	1.05	WWg			NA		NA		NA						
07020010-571, Willow Creek, JD 4 to S Fk Watonwan R	13MN119, 13MN180	8.65	WWg	EXS	IF	NA	NA	MTS		NA	NA		NA		IMP	
07020010-553, County Ditch 1, Unnamed cr to S Fk Watonwan R	13MN121*	1.39	WWm	MTS	MTS	NA	NA	NA		NA	NA		NA		SUP	
07020010-540, Spring Brook, Unnamed ditch to S Fk Watonwan R	13MN131	1.14	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-547, Watonwan River, South Fork, Irish Lk to Willow Cr	13MN134	20.71	WWg	EXS	MTS	NA	NA	MTS		NA	NA		NA		IMP	
07020010-517, Watonwan River, South Fork, Willow Cr to Watonwan R	13MN101, 13MN142, 90MN099	25.20	WWg	EXS	EXP	MTS	EX	IF	NA	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 34. Minnesota Stream Habitat Assessment (MSHA): Lower South Fork Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
1	13MN119	Willow Creek	0	9	16.5	8	18	51.5	Fair
2	13MN180	Willow Creek	1.25	13.75	15.15	6	18	54.15	Fair
1	13MN121	County Ditch 1	0	8.5	8.3	11	16	43.8	Poor
1	13MN131	Spring Brook	2.5	9.5	16.5	12	21	61.5	Fair
1	13MN134	Watonwan River, South Fork	1.5	10	14.8	11	14	51.3	Fair
2	13MN101	Watonwan River, South Fork	2.5	6.75	15.18	10.5	19.5	54.43	Fair
1	13MN142	Watonwan River, South Fork	2.5	7	13.55	8	23	54.05	Fair
3	90MN099	Watonwan River, South Fork	1.33	9	10.88	9.33	13.67	44.88	Poor
Average Habitat Results: *Lower South Fork Watonwan River Aggregated 12-HUC*			**1.45**	**9.19**	**13.86**	**9.48**	**17.90**	**51.95**	**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)

Table 35. Channel Condition and Stability Assessment (CCSI): Lower South Fork Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN119	Willow Creek	TCR	35	38	32	7	112	severely unstable
1	13MN121	County Ditch 1	TCR	34	21	15	5	75	moderately unstable
1	13MN131	Spring Brook	MHL	36	23	6	5	70	moderately unstable
1	13MN134	Watonwan River, South Fork	MHL	36	44	34	11	125	extremely unstable
1	13MN101	Watonwan River, South Fork	MHL	33	21	23	7	84	severely unstable
1	13MN142	Watonwan River, South Fork	MHL	38	35	35	11	119	extremely unstable
Average Stream Stability Results: *Lower South Fork Watonwan River Aggregated 12-HUC*				**35.33**	**30.33**	**24.17**	**7.67**	**97.5**	**severely unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Outlet station stream chemistry

Data collected at the outlet chemistry station (07020010-517; station S002-251) in the table below (Table 36) are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM program.

During the 2006, reporting cycle this AUID was listed as impaired for both AQL and AQR uses. New data collected support the existing listings. The TSS and Secchi data show that conditions are still troublesome at this station (*e.g.* more than 25% of TSS samples exceed the 65 mg/L standard), and as such the turbidity listing will remain unchanged. A single exceedance of the pH standard was observed. Total phosphorous data show nutrient concentrations found at the outlet of this subwatershed that are likely problematic. Thirty individual TP samples exceed the 150 µg/L river eutrophication standard for the southern region; however, without response parameter data it is not possible to determine if nutrients are affecting AQL use. Nonetheless, based on assessments of the TSS and Secchi data this AUID does not support AQL use.

Fifteen *E. coli* bacteria samples were collected during the IWM process; four exceed the individual standard of 1,260 MPN/100mL and show bacteria levels have the potential to be severely elevated. Likewise, monthly geometric mean calculations for *E. coli* bacteria show three months (June through August) exceed the 126 MPN/100mL standard. This suggests that bacteria levels are chronically elevated and may pose a risk to human health through prolonged bodily contact. As such, this AUID does not support AQR use. Unionized ammonia, chloride and dissolved oxygen concentrations all meet their respective standards, and show zero individual exceedances of the WCBP standards.

Table 36. Outlet water chemistry results: Watonwan River, South Fork Aggregated 12-HUC.

Station location:	South Fork, Watonwan River - At CSAH 13, 4 mi. SW of Madelia						
STORET/EQuIS ID:	S002-251						
Station #:	0702001004-01						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	9	2.3	12.9	9.1	<40	0
Chloride	mg/L	9	15.6	35.2	25.1	<230	0
Dissolved Oxygen (DO)	mg/L	64	6.9	13.2	9.2	>5	0
pH	None	63	7.5	10.0	8.1	6.5 - 9	1
Phosphorus	µg/L	58	37	970	206	<150	30
Secchi Tube	cm	63	4	100	33	> 10	6
Total Suspended Solids	mg/L	54	8.0	538.0	61.6	< 65	15
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	238	868	- - -	<126	3
Escherichia coli	MPN/100ml	15	141	2,014	780	<1,260	4
		Supporting Aquatic Life Parameters					
Hardness	mg/L	9	283	456	393	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.

****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Lower South Fork, Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 37. Lake assessments: Lower South Fork Watonwan River Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-*a* (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Long	83-0040-00	261	E	100	4.0	1.0*	NT	31	34.7	0.8	IF	NS

Key for Cell Shading: = new impairment (2015 assessment cycle)
* Mean depth estimated by MPCA staff
Abbreviations: **E** – Eutrophic **NT –** No trend identifiable **IF** – Insufficient Information
NS – Not Supporting

Summary

The Lower South Fork Watonwan River has six AUIDs with biological sampling locations. The first AUID is located on Judicial Ditch 4 and has one station. This station, 13MN116, was not sampled for fish or macroinvertebrates due to a beaver impoundment. The next AUID with assessable Biological data is located on Willow Creek, a tributary to the South Fork Watonwan River. Two biological sampling stations (13MN119 and 13MN180) are located on the AUID. One fish and one macroinvertebrate sample were taken at 13MN119 in 2013. The fish and macroinvertebrate samples were assessed against general use standards and both failed. Row crop was the dominant land use surrounding the stream and was rated as having a very narrow riparian. The fish and macroinvertebrates samples were both dominated by tolerant taxa. The second biological sampling location (13MN180) was sampled twice for fish, once in 2013 and once in 2014. No macroinvertebrate sample was taken at 13MN180. The fish samples were dominated by tolerant species and both had fewer than 25 fish sampled. During the first sample common carp were the most abundant fish. The second sample only had two species, blacknose dace and creek chub. Nitrogen was high at the time of all three fish samples on the AUID. Habitat at both sites was rated fair.

County Ditch 1 is the next downstream tributary to the South Fork Watonwan River and has one AUID with assessable Biological data. The AUID was assessed against modified use standards. Fish and macroinvertebrates were sampled at station 13MN121 once in 2013. The fish sample had a high number of fish taxa, but there were high numbers of both common carp and white sucker. The macroinvertebrate sample was taken during a time with very low flows, and the community reflected this, with high numbers of intolerant individuals and very few taxa present indicative of a flowing stream, most being indicative of wetland like conditions. Nitrogen and water temperature were both high at the time of sample. The fish and macroinvertebrates scores passed against the modified use threshold.

The last tributary to the Lower South Fork Watonwan River with an assessable AUID is Spring Brook with one sampling location (13MN131). The fish sample was dominated by tolerant species, the most abundant species being white sucker. The macroinvertebrate sample was dominated by tolerant taxa, particularly those tolerant of nitrogen. The cold temperatures present at the time of both fish and invertebrate sampling were not reflected by a coldwater invertebrate community, suggesting fairly extensive stress throughout this reach, and the adjacent upstream watershed. Nitrogen levels were high during the time of sample. This AUID was assessed against general use standards and failed for both fish and macroinvertebrates. Habitat was rated as fair and indicates the stream has a wide to extensive riparian zone consisting of both row crop and healthy riparian cover (possibilities could be forest, wetland, prairie or shrubland).

The furthest upstream AUID of the Upper South Fork Watonwan River has one station assessable for Biology. It was sampled in 2013, once for fish and twice for macroinvertebrates. The fish scored below the general use threshold. No sensitive species were found in the sample and was instead dominated by tolerant taxa. Sand shiners and bigmouth shiners were the two most abundant species found during the sample. The duplicate macroinvertebrate sample showed a community indicative of cool or coldwater conditions, with two coldwater obligate taxa.

The next downstream AUID has three stations (13MN101, 13MN142, 90MN099) sampled from 2010-2014; six times for fish and five times for macroinvertebrates. The site 90MN099 had two fish samples that did pass for general use standards. The most recent sample from that location did not pass for fish. A fish sample from 2001 was below the general use threshold, but the data was too old to be assessed for this report. Combined site data for the AUID indicates the overall condition does not meet general use standards for fish bioassessment. Sand shiners, a tolerant species, were abundant at all locations. Species counts were high at each site, but were mostly dominated by tolerant or generalist taxa. Similar to the fish community data, the most recent macroinvertebrate samples collected at site 90MN099 (2010, 2013) fell at or below the general use standard, while data collected in 2002 showed a much more robust community, with greater taxa richness and fewer tolerant taxa. Macroinvertebrate samples from 13MN101 and 13MN142 both scored above the threshold, but the deteriorating conditions at 90MN099, resulted in the AUID not meeting standards.

Stream chemistry at large

There were no new chemistry related impairments for AQL or AQR uses identified in the Lower South Fork, Watonwan River Subwatershed. However, there are two AUIDs on the South Fork Watonwan River (07020010-517; and -547) that have listings from previous assessments. Turbidity and fecal coliform bacteria were listed during the 2006, reporting cycle for (-517) and this AUID continues to not support AQL or AQR uses. New data for (-517) were collected at the subwatershed outlet chemistry station during 2013 and 2014, and are discussed in the ‘outlet station stream chemistry’ section below.

An AQL use impairment for turbidity was also listed during the 2006, reporting cycle for (-547), and this AUID continues to not support AQL use. New Secchi transparency data (collected at station S001-708) indicate that turbid conditions may still be present and adversely affecting the aquatic communities. The dataset shows a low exceedance rate which would normally justify pursuing a delisting/list correction for the impairment. However, there are a large number of observations that are barely above the stream transparency standard of 10 centimeters. In an effort to minimize the risk of assessing data that show possible ‘false-positive’ values, the overall assessment conclusion was ‘IF’. Stressor identification work will take place on this AUID to investigate sources of the newly listed impairment to the fish community, and will determine if turbidity and/or TSS are still impairing AQL use.

All other AUIDs had insufficient data to assess against AQR or AQL use standards. A full support (FS) assessment for AQL use can be obtained in the absence of sufficient chemistry data, if the biological IBI criteria are met and found to be fully supporting. Such a scenario occurs on one AUID in this subwatershed: County Ditch 1 (07020010-553).

Lake AQR use assessment

AQR use data are insufficient (IF) to determine a support status due to the fact the both TP and Secchi meet the WCBP lake eutrophication standards, but chl-*a* does not. Since TP does not exceed its respective standard, it is not practical to suggest that nutrients are limiting AQR use and fueling algal blooms to the degree seen in similar lakes in the watershed. Additionally, the standard error for the mean of all chl-*a* concentrations observed is large enough that the true mean has the potential to meet the standard; whereas the standard error for the mean of Secchi is large enough that the true mean may exceed the standard. The resulting assessment for AQR use support is lacking sufficient data to make a conclusive decision.

Lake AQL use assessment

Two MNDNR fisheries bioassessments were conducted in 2010. During the second survey, only near-shore components of the survey were repeated. Results indicate that Long Lake scored below average on all of the metrics observed, and is below the impairment threshold. No disturbance-intolerant species were found in the monitoring gear. Bluegill, freshwater drum and black crappie were the most prevalent species found observed. Black bullhead and common carp also comprise a significant percentage (by biomass) of the fish community. These fish community indicators typically suggest poor water quality and a lack of complex near-shore habitat. Two older aquatic plant surveys indicated the plant community was below the threshold for impairment, which limits the ability of vegetative dwelling species to survive. Based on the results of these fish data, Long Lake was assessed as not supporting AQL use

Lakes summary

There are five lakes greater than 10-acres in size in this subwatershed. Long Lake (83-0040-00) was the only lake with enough water chemistry and fish bioassessment survey data to be assessed for AQR and AQL uses (Table 37). Lake Mary (83-0035-00) has a single TP data point within the 10-year assessment window, and it exceeds the 90 µg/L lake eutrophication standard. Both mentioned lakes are impounded by dams to control water levels. The remaining water bodies in this subwatershed have either no data associated with them, or are classified as intermittent waters and are not assessed as lakes.

During the assessment process, the MNDNR made comment about Long Lake periodically experiencing low water levels, as indicated by the outlet dam. By MNDNR permit, water is occasionally taken from the Watonwan River to supplement lake volume. A single TP sample taken during biological monitoring of the South Fork, Watonwan River (1/3-mile south of Long Lake at station S001-708) was slightly higher than the mean TP for Long Lake. If nutrient levels in the river increase, there is likelihood that supplementing lake volume with river water may also drive an increase of in-lake TP.

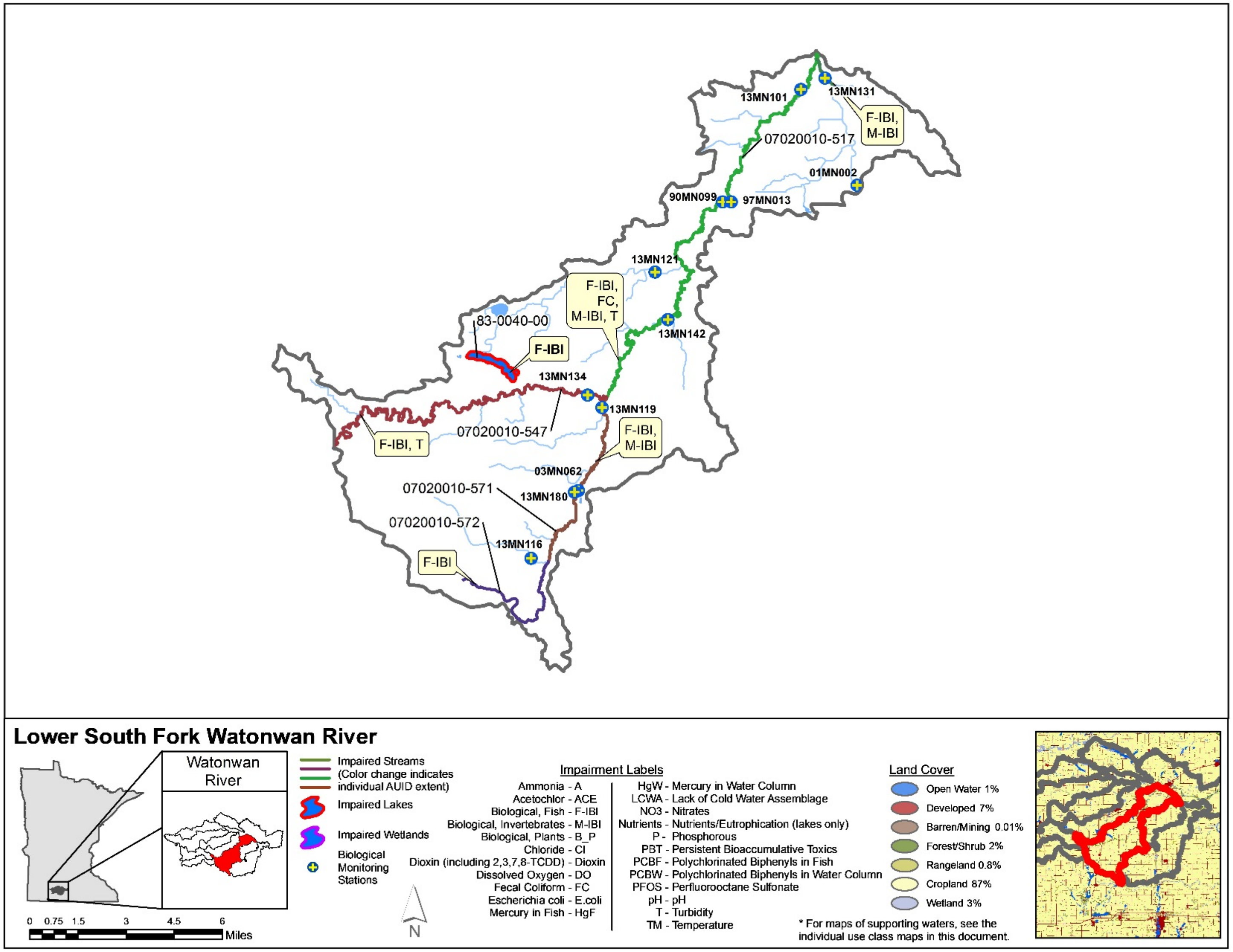


Figure 32. Currently listed impaired waters by parameter and land use characteristics in the Lower South Fork Watonwan River Aggregated 12-HUC.

Spring Branch Creek Aggregated 12-HUC — HUC 0702001005-02

The Spring Branch Creek Subwatershed is located mostly in Watonwan County with a small eastern section found in Blue Earth County. The subwatershed is located in the eastern region of the Watonwan River watershed. Spring Branch Creek flows northeast through the subwatershed. An Unnamed Ditch flows into Spring Branch Creek approximately three stream miles before Spring Branch Creek flows out of the subwatershed and into Perch Creek. The town of Lewisville is located along the eastern border of the subwatershed. Development makes up 6% of the landuse within the subwatershed, the other dominant landuse type is cropland at 92%.

Table 38. Aquatic life and recreation assessments on stream reaches: Spring Branch Creek Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

AUID ***Reach Name***, *Reach Description*	**Biological Station ID**	**Reach Length (miles)**	**Use Class**	**Aquatic Life Indicators:**									**Eutrophication**		**Aquatic Life**	**Aquatic Rec. (Bacteria)**
				Fish IBI	Invert IBI	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	Ammonia -NH_3	Pesticides ***	Phosphorous	Response Indicator		
HUC 12 Agg: 0702001005-02 Spring Branch Creek																
07020010-525, Unnamed ditch, T105 R30W S3, west line to Spring Cr	13MN111	6.49	LRVW			NA				NA	NA					
07020010-574, Spring Branch Creek, T106 R30W S22, west line to Perch Cr	13MN137*, 13MN139*, 13MN150*	7.10	WWm	EXS	MTS	MTS	IF	MTS	NA	MTS	MTS		MTS		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 39. Minnesota Stream Habitat Assessment (MSHA): Spring Branch Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use	Riparian (0-15)	Substrate (0-27)	Fish Cover	Channel Morph.	MSHA Score	MSHA Rating
1	13MN111	Unnamed ditch	0	7	12	6	3	28	Poor
1	13MN137	Spring Branch Creek	2.5	6	18	11	10	47.5	Fair
1	13MN139	Spring Branch Creek	0	5	17	5	8	35	Poor
1	13MN150	Spring Branch Creek	1.25	14	9	6	4	34.25	Poor
Average Habitat Results: *Spring Branch Creek Aggregated 12-HUC*			**.94**	**8**	**14**	**7**	**6.25**	**36.19**	**Poor**

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)

Table 40. Channel Condition and Stability Assessment (CCSI): Spring Branch Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN111	Unnamed ditch	TC	35	17	9	5	66	moderately unstable
1	13MN137	Spring Branch Creek	MHL	33	16	6	5	60	moderately unstable
1	13MN139	Spring Branch Creek	TC	36	27	8	5	76	moderately unstable
1	13MN150	Spring Branch Creek	TC	31	17	9	5	62	moderately unstable
Average Stream Stability Results: *Spring Branch Creek Aggregated 12-HUC*				**33.75**	**19.25**	**8**	**5**	**66**	**moderately unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

An AQL use assessment for river eutrophication cannot be made due to the absence of chl-*a* data paired with the TP data that exceed the standard, and TP data not meeting the minimum requirements. Without a direct measurement of the response variable (*i.e.* chl-*a*) the eutrophication assessment has insufficient information. All other chemistry parameters collected at station S007-561 meet their respective WCBP water quality standards, where they exist.

Table 41. Outlet water chemistry results: Spring Branch Creek Aggregated 12-HUC.

Station location:	**Spring Branch Creek - At CR 9 (473rd Ave), 4.5 mi. NE of Lewisville**						
STORET/EQuIS ID:	**S007-561**						
Station #:	**0702001005-02**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	9	3.3	9.3	6.3	<40	0
Chloride	mg/L	9	24.9	48.4	32.4	<230	0
Dissolved Oxygen (DO)	mg/L	18	5.3	17.3	8.2	>5	0
pH	None	18	7.5	8.7	7.9	6.5 - 9	0
Phosphorus	µg/L	9	15	243	123	<150	3
Secchi Tube	cm	18	8	100	51	> 10	1
Total Suspended Solids	mg/L	9	4	85	35	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	211	743	- - -	<126	3
Escherichia coli	MPN/100ml	15	145	2,419	566	<1,260	1

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Spring Branch Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Summary

The Spring Branch Creek Subwatershed has two AUIDs with biological sampling locations. The AUID on the unnamed ditch is not assessable for Biology because it is a limited resource value water. The assessable AUID is located on Spring Branch Creek and has three sample locations (13MN137, 13MN139, 13MN150) with Biological data. All three sites were sampled at least once for fish and macroinvertebrates in 2013. The AUID was assessed against modified use standards. Fish scores were all below the modified use threshold. Two of the three samples had less than 25 fish collected. Sites 13MN137 and 13MN150 bracket the confluence with the limited resource tributary. All macroinvertebrate scores were above the modified used threshold, with scores from 13MN137 and 13MN139 scoring very near the general use threshold. Habitat scores throughout the subwatershed are all considered poor with the exception of 13MN137. Agriculture is the dominant landuse throughout the subwatershed and all the sites list row crop as the dominant landuse surrounding the sample locations. Sites on Spring Branch Creek indicated there was little fish habitat and poor channel morphology.

Stream chemistry at large

Only one stream AUID (07020010-574) has enough chemistry data to assess against AQR and AQL use standards. Data for this AUID were collected during the summers of 2013 and 2014 at the outlet chemistry station (-574; station S007-561) and are shown in Table 41. Fifteen *E. coli* bacteria samples collected and analyzed show chronically, and sometimes severely, elevated bacteria count. A single sample exceeded the individual *E. coli* bacteria standard of 1,260 MPN/100mL. However, three summer months exceed the geometric mean standard of 126 MPN/100mL, indicating a possible risk to human health through prolonged or repeated bodily contact. Based on these data, this AUID does not support AQR use.

Lakes summary

There are three lakes greater than 10 acres in size in this subwatershed. None of them have any chemistry data to assess against AQR use standards.

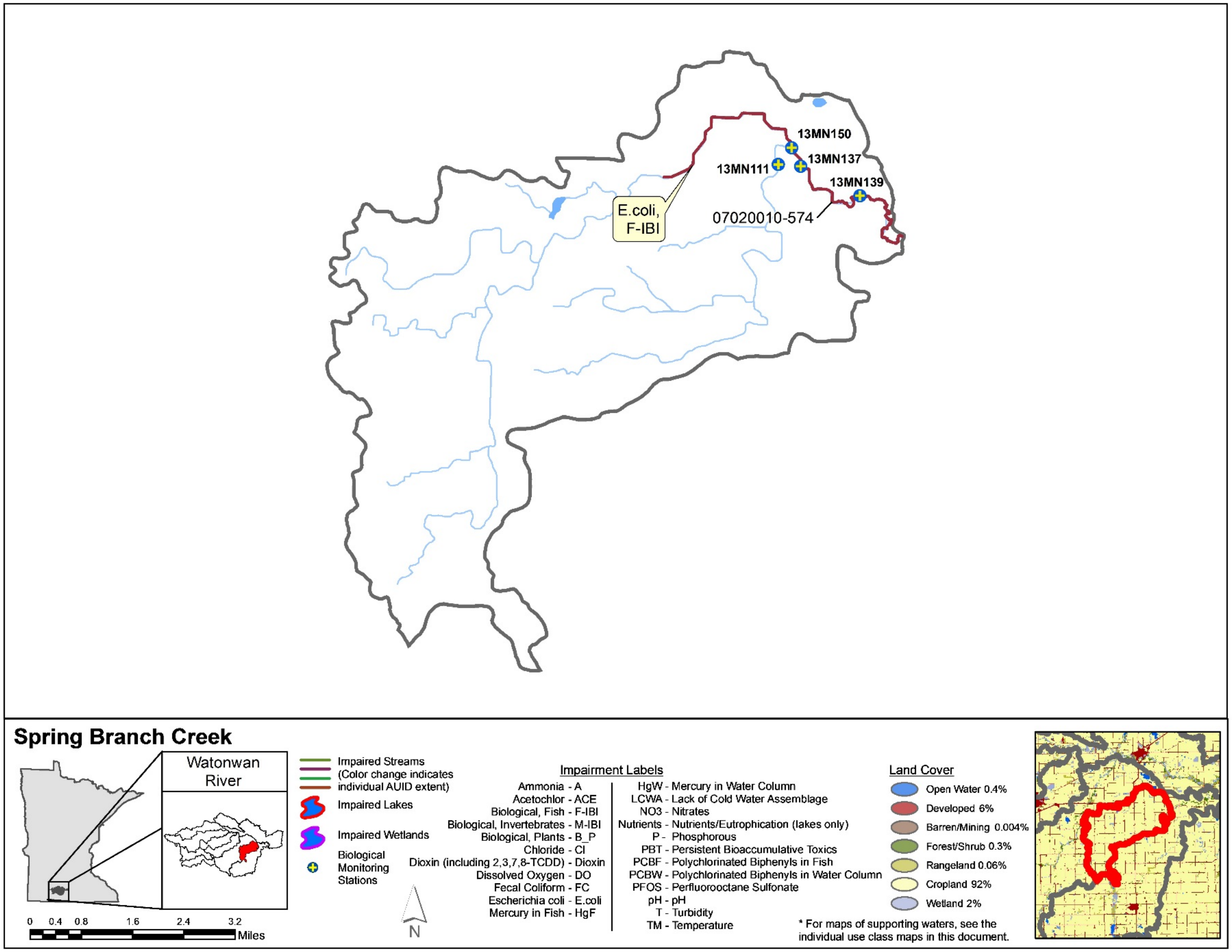


Figure 33. Currently listed impaired waters by parameter and land use characteristics in the Spring Branch Creek Aggregated 12-HUC.

Perch Creek Aggregated 12-HUC — HUC 0702001005-01

The Perch Creek Subwatershed is located in the southeast region of the Watonwan River Watershed. The subwatershed begins in Martin County and continues into Watonwan County and Blue Earth County. Perch Creek flows northeast and flows into the Watonwan River. Judicial Ditch 60 begins in the southern region of the subwatershed and flows into Mink Creek. Mink Creek then flows into Perch Creek roughly two miles northwest of the town of Truman. Less than a quarter mile downstream an Unnamed Creek also flows into Perch Creek. Spring Branch Creek is a large tributary to Perch Creek and flows into Perch Creek in the northern region of the subwatershed. The town of Lewisville is located on the western border of the subwatershed. The town of Truman is located in the southeastern region of Perch Creek Subwatershed. Developed land makes up 6% of the landuse in the subwatershed. The dominant landuse, with 88%, is cropland.

Table 42. Aquatic life and recreation assessments on stream reaches: Perch Creek Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID ***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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001005-01 Perch Creek (continued)																
07020010-577, Mink Creek, Unnamed cr to Perch Cr	13MN118	3.68	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-557, Unnamed creek, Unnamed cr to Perch Cr	13MN144	2.03	WWg	EXS		NA	NA	NA		NA	NA		NA		IMP	
07020010-535, Unnamed creek, Headwaters to T105 R30W S25, north line	13MN168	6.48	LRVW			NA				NA	NA					
07020010-526, Unnamed creek, T105 R30W S24, south line to Perch Cr	13MN158*	2.32	WWm	EXS	EXS	NA	NA	NA		NA	NA		IF		IMP	
07020010-584, Unnamed creek, Unnamed cr to T105 T29W S6, east line	13MN122*	0.85	WWm	MTS	MTS	NA	NA	NA		NA	NA		NA		SUP	
07020010-524, Perch Creek, Headwaters (Perch Lk 46-0046-00) to Spring Cr	13MN129, 13MN143	25.23	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-523, Perch Creek, Spring Cr to Watonwan R	97MN011	12.09	WWg	EXS	MTS	MTS	IF	MTS	NA	MTS	NA		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 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 43. Minnesota Stream Habitat Assessment (MSHA): Perch Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover (0-17)	Channel Morph. (0-36)	MSHA Score (0-100)	MSHA Rating
2	13MN118	Mink Creek/ Judicial	0	10.25	14.33	12.5	15	52.08	Fair
1	13MN144	Judicial Ditch 72	0	9	9.6	11	24	53.6	Fair
1	13MN168	Trib. to Perch Creek	0	7	18	11	28	64	Fair
1	13MN158	Trib. to Perch Creek	0	7.5	16	7	7	37.5	Poor
1	13MN122	Trib. to Perch Creek	0	6	8	7	7	28	Poor
1	13MN129	Perch Creek	0	9	14.45	12	18	53.45	Fair
2	13MN143	Perch Creek	1.25	5.75	9.65	6.5	16	39.15	Poor
1	97MN011	Perch Creek	1	5.5	18.8	13	28	66.3	Good
Average Habitat Results: *Perch Creek Aggregated 12-HUC*			**0.28**	**7.5**	**13.6**	**10**	**17.88**	**49.26**	**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)

Table 44. Channel Condition and Stability Assessment (CCSI): Perch Creek Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN118	Mink Creek/ Judicial Ditch 60	MHL	40	43	28	11	122	extremely unstable
1	13MN168	Trib. to Perch Creek	MHL	37	23	27	7	94	severely unstable
1	13MN158	Trib. to Perch Creek	TC	34	19	13	5	71	moderately unstable
1	13MN122	Trib. to Perch Creek	TC	38	20	15	5	78	moderately unstable
1	13MN129	Perch Creek	MHL	32	36	28	7	103	severely unstable
1	13MN143	Perch Creek	MHL	40	25	28	7	102	severely unstable
1	97MN011	Perch Creek	MHL	42	35	30	11	118	extremely unstable
Average Stream Stability Results: Perch Creek *Aggregated 12-HUC*				**32.88**	**25.13**	**21.13**	**6.63**	**86**	**severely unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Outlet station stream chemistry

Data collected at the outlet chemistry station (-523; station S007-560) and shown in Table 45 below were collected during the summers of 2013 and 2014. Fifteen *E. coli* bacteria samples collected and analyzed show chronically, and sometimes severely, elevated bacteria counts. Two samples exceeded the individual *E. coli* bacteria standard of 1,260 MPN/100mL. Three summer months exceed the geometric mean standard of 126 MPN/100mL, indicating a possible risk to human health through prolonged or repeated bodily contact. Based on these data, this AUID does not support AQR use.

An AQL use assessment for river eutrophication cannot be made due to the absence of chl-*a* data paired with TP standard exceedances, and TP data not meeting the minimum requirements. Without a direct measurement of the response variable (*i.e.* chl-*a*) the eutrophication assessment has insufficient information. All other chemistry parameters collected at station S007-560 meet their respective WCBP water quality standards, where they exist.

Table 45. Outlet water chemistry results: Perch Creek Aggregated 12-HUC.

Station location:	**Perch Creek - At CR 135 (154th St), 10 mi. SE of Madelia**						
STORET/EQuIS ID:	**S007-560**						
Station #:	**0702001005-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	9	3.9	20.4	9.8	<40	0
Chloride	mg/L	9	23.5	42.2	33.4	<230	0
Dissolved Oxygen (DO)	mg/L	18	5.0	12.9	7.8	>5	1
pH	None	18	7.4	8.7	8.0	6.5 - 9	0
Phosphorus	µg/L	9	23	244	121	<150	2
Secchi Tube	cm	18	16	76	40	> 10	0
Total Suspended Solids	mg/L	9	8	92	27	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	291	1,156	- - -	<126	3
Escherichia coli	MPN/100ml	15	173	2,419	698	<1,260	2

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Perch Creek Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Summary

The Perch Creek Subwatershed has six AUIDs with assessable biological data. An additional AUID with a biological station is a limited resource stream. The furthest downstream AUID with Biological data is on Mink Creek and has one station (13MN118) with one fish and one macroinvertebrate sample taken in 2013. Nitrogen was extremely high during the fish sample (24mg/L). Four species of fish (28 individuals) were collected in the sample and 75% of them were tolerant species. The macroinvertebrate community was reflective of the high nitrogen values, with 85% of all individuals, and 75% of all taxa being tolerant of high nitrogen conditions. The site was scored against general use standards and failed for both assemblages. The next assessable downstream tributary to Perch Creek is an unnamed creek with one biological sampling location (13MN144) that was sampled once for fish in 2013, but not sampled for macroinvertebrates as the site was nearly dry. The site was scored against general use standards and failed. The sample was dominated by tolerant species. The most abundant fish collected were johnny daters, bluntnose minnows and white suckers. It was indicated at the time of sampling the dominant land use surrounding the stream was row crop and there was heavy erosion along the stream banks. The next AUID with assessable Biological data is unnamed creek with one site, 13MN158, sampled once for fish and once for macroinvertebrates in 2013. The stream was assessed against modified use standards. Fish scored 1.2 out of a total score of 100. Fathead minnows, a tolerant species, made up 79% of the fish collected. Macroinvertebrates scored 18 out of 100. The community was dominated by taxa tolerant of high nitrogen and degraded habitat conditions. Side swimmers and phyid snails were the dominant taxa, and they are often indicative of streams that have wetland-like characteristics, including low dissolved oxygen and abundant primary production. Habitat was rated as poor at this site. No pool or riffle was recorded and the channel morphology scores were low. Row crop was the dominant land use type surrounding the stream. Nitrogen was high at 13MN158, measured at 32mg/L. The furthest downstream tributary to Perch Creek, Unnamed Creek, has one biological sampling location, 13MN122, which was sampled once for fish and once for macroinvertebrates in 2013. The site was assessed against modified use standards. Fish and macroinvertebrate scores were above the modified use threshold. The fish sample was dominated by white sucker and common carp, both tolerant species. An Iowa dater was collected in the sample and is a sensitive species, but no intolerant species were collected. The macroinvertebrate sample lacked any intolerant taxa and was over 90% tolerant individuals. The habitat assessment of the site indicated row crop was the prevailing landuse surrounding the stream and the riparian zone was very narrow.

Perch Creek has two AUIDs with assessable biological data. The furthest downstream AUID has two sample locations; 13MN129 and 13MN143. The sites were assessed against general use standards. The first location, 13MN143, was sampled once for fish and once for macroinvertebrates in 2013 and once for fish in 2014. The fish sample in 2013 scored 0, while the fish sample in 2014 scored 59. During the first fish sample three species were collected (white sucker, bluntnose minnow and johnny darter). During the second sample the most abundant species collected were blackside darter and white sucker, out of a total of six species. In both fish samples a low number of individuals were collected. The first macroinvertebrate sample scored just below the threshold, and had an invertebrate community similar to what could be found in a wetland. The second macroinvertebrate visit resulted in a sample not being collected due to low water levels. The averaged habitat scores were poor at this site. Sand and silt were the most common substrate types and there was poor fish cover. The second site, 13MN129, was sampled once for fish and macroinvertebrates in 2013. Nitrogen was high at the time of the fish sample (18mg/L). The fish score was below the general use threshold. During the sample 14 species were collected, the most common species collected were bluntnose minnow, bigmouth shiner and sand shiner. The three species are all considered tolerant. The macroinvertebrate score was also below the general use threshold. The sample was collected when the stream was rapidly losing water, but there were stagnant pools present. Species indicatoring a well flowing stream were still present in the stream, including giant stoneflies, net-spinning caddisflies, and blackflies. Landuse around the stream was listed as row crop and the overall habitat condition was rated fair. Heavy bank erosion was observed at the time of sample.

The furthest downstream AUID on Perch Creek has one biological sampling location (97MN011) that was sampled once for fish and macroinvertebrates in 2013. The AUID is held to general use standards. During the fish sample 18 species were collected and the two most common were bluntnose minnow and sand shiners. The fish score was below the general use threshold. Half of the taxa collected were tolerant. Habitat scores indicate good habitat in and around the stream. The habitat assessment lists row crop and fenced pasture as the two most prevalent landuse types surrounding the stream.

Stream chemistry at large

Perch Creek (07020010-523) has a newly identified AQR use impairment for *E. coli* bacteria. The chemistry data for this AUID (-523) are discussed in the 'outlet station stream chemistry' section below. All other AUIDs in this subwatershed were lacking sufficient, or had non-existing chemistry data to assess against AQR and AQL use standards. A full support (FS) assessment for AQL use can be obtained in the absence of sufficient chemistry data, if the biological IBI criteria are met and found to be fully supporting. Such a scenario occurs on an unnamed, modified use AUID (-584) found in the southeast ¼ section T105 R29W S6 in southwest Blue Earth County.

There is an existing impairment to AQL use for turbidity on Perch Creek (-524) from the 2006 reporting cycle. Three new TSS samples have been collected since the 2006 listing and they are all well below the 65 mg/L standard. However, the dataset does not meet minimum size requirements to determine if turbid conditions are still problematic. As a result of the newly identified impairments to the biological communities in this creek, stressor identification work will take place to determine if TSS is adversely affecting the aquatic life communities.

Lakes summary

This subwatershed has six lakes greater than 10 acres in size. None of them have sufficiently sized datasets (if any) to assess against AQR use standards. Two small lakes in the headwaters of the subwatershed each had a single TP sample from September of 2011. The results were both greater than 300 µg/L.

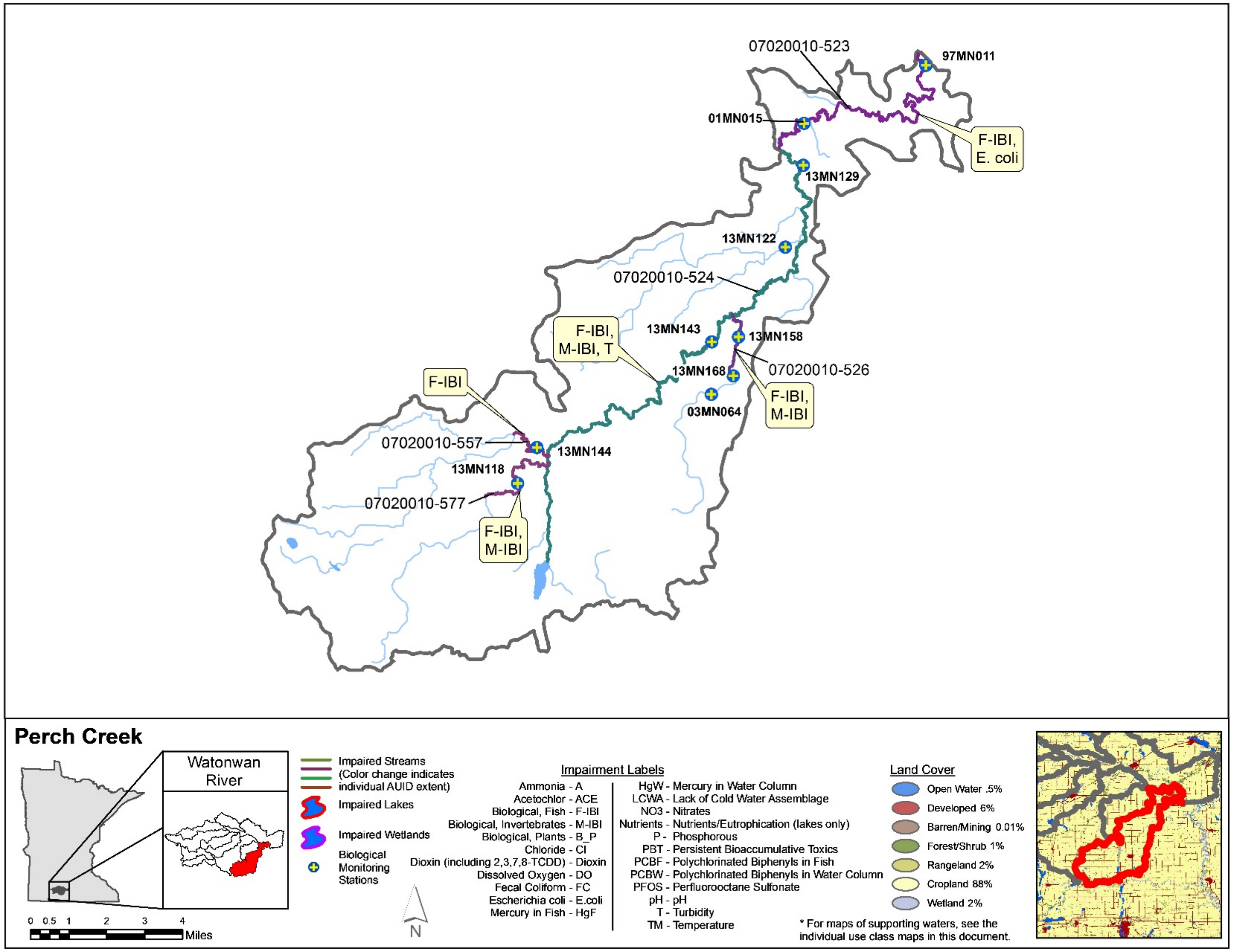


Figure 34. Currently listed impaired waters by parameter and land use characteristics in the Perch Creek Aggregated 12-HUC.

Upper Watonwan River Aggregated 12-HUC HUC 0702001001-01

The Upper Watonwan River Subwatershed is centrally located in the western side of the Watonwan River Watershed. The Upper South Fork Watonwan River flows mostly eastward, and slightly north, beginning in Cottonwood County and ending in Watonwan County. The town of Jeffers is approximately a mile and a half north of the western most end of the subwatershed. The town of Mountain Lake is located in the southwest region of the subwatershed and Darfur is located near the northern border. LaSalle is located roughly three miles east of the eastern border or the Upper Watonwan River Subwatershed. A small tributary flows through Arnolds Lake western region of the subwatershed before the tributary flows into the Watonwan River. Two other lakes centrally located in the subwatershed with tributaries flowing into the Watonwan River are Rat Lake and Barish Lake. Long Lake, located three and a half miles northwest of the town of Mountain Lake does not have any tributaries flowing into the Watonwan River. West of the town of Mountain Lake a tributary flows through Eagle Lake before flowing through Mountain Lake and finally the Unnamed Creek flows into the Watonwan River. Another Unnamed Creek flows into the Watonwan River roughly a mile southwest of Darfur. A finally Unnamed Creek flows into the Watonwan River one and a half river miles before the river leaves the Upper Watonwan River Subwatershed. Small tributaries along the entire reach also contribute to the Watonwan River. In this subwatershed 6% of landuse is defined as developed. The majority of the landuse, 88%, is cropland.

Table 46. Aquatic life and recreation assessments on stream reaches: Upper Watonwan River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID ***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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001001-01 Upper Watonwan River																
07020010-505, Unnamed creek (Mountain Lake Inlet), Headwaters to Mountain Lk	91MN098*	3.20	WWm	MTS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-555, Unnamed creek, Unnamed cr to Watonwan R	13MN157*	1.24	WWm	MTS	MTS	NA	NA	NA		NA	NA		NA		SUP	

07020010-566, Watonwan River, Headwaters to T107 R33W S33, east line	01MN047, 13MN115, 13MN146, 13MN148	47.14	WWg	EXS	EXS	NA	NA	IF		NA	NA		NA		IMP	NA
07020010-567, Watonwan River, T107 R33W S34, west line to N Fk Watonwan R	13MN106, 13MN166	12.31	WWm	EXS	MTS	MTS	IF	IF	MTS	MTS	MTS		MTS		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 47. Minnesota Stream Habitat Assessment (MSHA): Upper Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use	Riparian (0-15)	Substrate (0-27)	Fish Cover	Channel Morph.	MSHA Score	MSHA Rating
1	91MN098	Mountain Lake Inlet	0	12	7	12	13	44	Poor
1	13MN157	Trib. to Watonwan River	0	6	16	4	5	31	Poor
2	01MN047	Watonwan River	1.25	11	18.85	13	24.5	68.6	Good
1	13MN115	Watonwan River	2.5	8.5	20.2	12	21	64.2	Fair
1	13MN146	Watonwan River	0	9	16.4	14	19	58.4	Fair
1	13MN148	Watonwan River	0	7.5	17.5	12	18	55	Fair
1	13MN106	Watonwan River	5	11	14	5	8	43	Poor
	13MN166	Watonwan River	0	7	15.7	7	19	48.7	Fair
Average Habitat Results: *Upper Watonwan River Aggregated 12-HUC*			**1.09**	**9**	**15.7**	**9.88**	**15.94**	**51.6**	**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)

Table 48. Channel Condition and Stability Assessment (CCSI): Upper Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	91MN098	Mountain Lake Inlet	TCR	10	8	15	3	36	fairly stable
1	13MN157	Trib. to Watonwan River	TC	40	19	6	5	70	moderately unstable
1	01MN047	Watonwan River	MHL	24	21	10	5	60	moderately unstable
1	13MN115	Watonwan River	MHL	13	13	17	5	48	moderately unstable
1	13MN146	Watonwan River	MHL	28	30	26	7	91	severely unstable
1	13MN106	Watonwan River	TC	34	19	13	5	71	moderately unstable
1	13MN166	Watonwan River	MHL	38	25	24	7	94	severely unstable
Average Stream Stability Results: *Upper Watonwan River Aggregated 12-HUC*				**26.7**	**19.3**	**15.9**	**5.3**	**67.1**	**moderately unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Outlet station stream chemistry

Data collected at the outlet chemistry station (07020010-567; station S002-252) in the table below are from the 2013 and 2014 monitoring seasons. These data are reflective of stream conditions and impairments (if any) found higher up in the subwatershed. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process.

Secchi tube transparency and total suspended solids data were both insufficient to determine if the 2006 turbidity listing is still affecting AQL use. Both datasets are small in size, but indicate that the water quality standard exceedance rate is still at or near the 10% threshold for impairment, and the turbidity listing will be unchanged. New *E. coli* bacteria data show zero exceedances of the individual standard for AQR use; however, monthly geometric mean calculations spanning the two monitoring seasons suggest bacteria concentrations are chronically elevated to levels which may pose a risk to human health through bodily contact. These data support the 2006 listing for fecal coliform bacteria, and the assessment of not supporting (NS) AQR use will remain unchanged. Other conventional chemistry parameters are within their designated use class standards, where they exist (Table 49).

Table 49. Outlet water chemistry results: Upper Watonwan River Aggregated 12-HUC.

Station location:	Watonwan River - At Township Rd 116(710th Ave), 6 mi. W of St James						
STORET/EQuIS ID:	S002-252						
Station #:	0702001001-01						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	10	4.5	19.5	10.8	<40	0
Chloride	mg/L	10	23.6	29.7	26.6	<230	0
Dissolved Oxygen (DO)	mg/L	19	7.4	12.6	9.3	>5	0
pH	None	19	7.8	9.0	8.2	6.5 - 9	0
Phosphorus	µg/L	10	26	268	92	<150	3
Secchi Tube	cm	19	6	100	43	> 10	3
Total Suspended Solids	mg/L	10	3	158	47	< 65	2
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	350	504	- - -	<126	3
Escherichia coli	MPN/100ml	15	116	1,162	486	<1,260	0
		Supporting Water Chemistry Parameters					
Hardness	mg/L	10	290	446	374	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Upper Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Table 50. Lake assessments: Upper Watonwan River Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-a (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Mountain	17-0003-00	220	E	100	2.3	1.0*	NT	76	30.0	1.0	IF	NS

Key for Cell Shading: ▇ **= new impairment (2015 assessment cycle)**

* Mean depth estimated by MPCA staff
Abbreviations: **E** – Eutrophic **NT** – No Trend **NS** – Non-Support **IF** – Insufficient Information

Summary

The Upper Watonwan River Subwatershed has four AUIDs that are assessable for Biology. An unnamed tributary to the Watonwan River has one sample station, 91MN098, that was sampled once for fish and twice for macroinvertebrates in 2010. The fish sample collected four species, 93% of the fish collected were fathead minnows. The AUID was assessed against modified use standards and passed. The duplicate macroinvertebrate sampled resulted in two very low scores, both falling below the modified use threshold. Both samples lacked taxa indicative of flowing water, suggesting a long-term lack of significant flow. High abundance of nitrogen tolerant taxa suggests a link with Eagle Lake. Eagle Lake, located upstream, is impaired for nutrients. The next downstream tributary, Unnamed Creek, has one Biological sample location (13MN157) which was sampled once for fish and macroinvertebrates in 2013. Nitrogen and DO were high at the time of the fish sample. The AUID was assessed against modified use standards and passed for both fish and macroinvertebrate. Yellow perch was the most abundant fish species collected at the sample. As with other, similar streams, side swimmers and phyid snails were the dominant taxa, suggesting the potential for abundant algae and/or aquatic plants (high primary productivity), and potentially high nutrients – high numbers organisms tolerant of high phosphorus levels may validate this potential. Habitat is poor at the site, indicating there was only over hanging vegetation for fish cover. Row crop was the dominant land use around the stream and there was a very narrow riparian zone.

The furthest upstream AUID on the Watonwan River has four biological sample locations (01MN047, 13MN115, 13MN146, 13MN148) and was assessed against general use standards. The four sites represent four fish and two macroinvertebrates samples from 2013, and one fish visit from 2014. The fish samples do not pass the general use standards. All samples were dominated by tolerant fish taxa, especially creek chubs, bluntnose minnows and sand shiners. The macroinvertebrate samples from 01MN047 and 13MN146 both scored near, but below the general use threshold. Sites 13MN115 and 13MN148 were not sampled for macroinvertebrates due to a lack of flow. Nitrogen was high during samples at 13MN146 and 13MN148 measuring up to 12mg/L. Row crop was listed as the dominant landuse at all sites.

The furthest downstream AUID in the Upper Watonwan River subwatershed has two biological stations (13MN166, 13MN106) with assessable data. The AUID was assessed against modified use standards and both sites scored below the threshold. Both sites were sampled once for fish and macroinvertebrates in 2013. No sensitive species were found during the sample of 13MN166, tolerant taxa accounted for more than half the fish sampled. Bluntnose minnow, bigmouth shiner and creek chub were the most abundant species found during the sample. The downstream sample location, 13MN106, was dominated by tolerant fish species, the most abundant were sand shiners and bigmouth shiners. In contrast to the fish community, the macroinvertebrate samples collected at 13MN166 and 13MN106 score just below, and just above the general use threshold, respectively, easily exceeding the modified use threshold.

Stream chemistry at large

There are no new chemistry impairments proposed for this assessment cycle. However, two stream AUIDs on the Watonwan River (07020010-566; and -567) have existing turbidity listings from to the 2006 reporting cycle, and the new data continue to not support AQL use. The Watonwan River (-567) also has a fecal coliform bacteria listing from the same reporting cycle, and it also continues to not support AQR use. Data for (-567) were collected at the subwatershed outlet chemistry station and are discussed in the 'outlet station stream chemistry' section below. New Secchi transparency data were collected for (-566) and a robust dataset meets the standard of 10 (cm). However, a new impairment to the aquatic macroinvertebrate community was identified on this AUID and stressor identification monitoring will determine if the turbidity listing is the primary stressor. The 2006, turbidity listing and the assessment of ‘not supporting’ (NS) for AQL use will not change. A full support (FS) assessment for AQL use can be obtained in the absence of sufficient chemistry data, if the biological IBI criteria are met and found to be fully supporting. Such a scenario occurs on one stream AUID in this subwatershed (07020010-555; an unnamed tributary to the Watonwan River, ~1.5 miles upstream from the confluence of the Watonwan River and the North Fork of the Watonwan River).

Lake AQR use assessment

Mountain Lake is a shallow reservoir just north of the City of Mountain Lake. Aeration occasionally takes place during the winter months on this lake. The surrounding land use is dominated by agricultural practices which make the lake susceptible to excessive nutrient loading from overland runoff. The presence of a dam forces the lake to act as a sink for nutrients and other chemistry parameters that might affect water quality. It is the only lake that has enough AQR use data to assess; however, those data were assessed as insufficient to determine a support status for AQR use. The means of TP and Secchi meet the WCBP ecoregion standards (90 µg/L and 0.7-meter transparency respectively). The mean for chl-*a* is right at the 30 µg/L WCBP standard and considered to be inconclusive to determine if this parameter is consistently above or below the water quality standard (Table 50).

Lake AQL use assessment

In 2014, the MNDNR completed an aquatic plant survey and two fish bioassessment surveys on Mountain Lake. The second fish survey was focused only on the near shore components of fish monitoring. Mountain Lake’s watershed-lake ratio of 29:1 is the largest of all assessed lakes in the Watonwan River watershed, making it very susceptible to influences from upland land uses.

The results of the MNDNR aquatic plant survey scored above an impairment threshold identified for similar lakes in the ecoregion. Lake residents have been harvesting submerged aquatic vegetation for a number of seasons in an attempt to thin out some of the annually dense growth.

Mountain Lake scored ‘below average’ for seven out of eight metrics developed for the fish bioassessment surveys. The overall IBI score was well below the impairment threshold suggesting the fish community is struggling under current conditions. There is low-diversity within the fish community when compared to similar lakes in the watershed. Gill net and trap net fish surveys were dominated by disturbance-tolerant species including common carp and black bullhead. Near-shore netting was dominated by bluegill and largemouth bass. No intolerant species were identified during either of the fish surveys. Based on these results, Mountain Lake is not supporting AQL use.

Lakes summary

There are eight lakes in this subwatershed that are at least 10 acres in size. Mountain Lake (17-0003-00) has a completed TMDL for mercury in fish tissue, which was first listed during the 1998 reporting cycle. Eagle Lake (17-0020-00) has an excessive nutrient impairment which was identified during the 2010 reporting cycle and a TMDL will be completed in the near future to address the sources of excess nutrients in the lake. Both Mountain and Eagle Lakes are impounded by dams to maintain water levels. Upland land use practices in this area are heavily dominated by row crop agricultural, which is a likely source of nutrients found in these lakes. Data are insufficient or non-existent for the remaining six water bodies to determine a support status for AQR use.

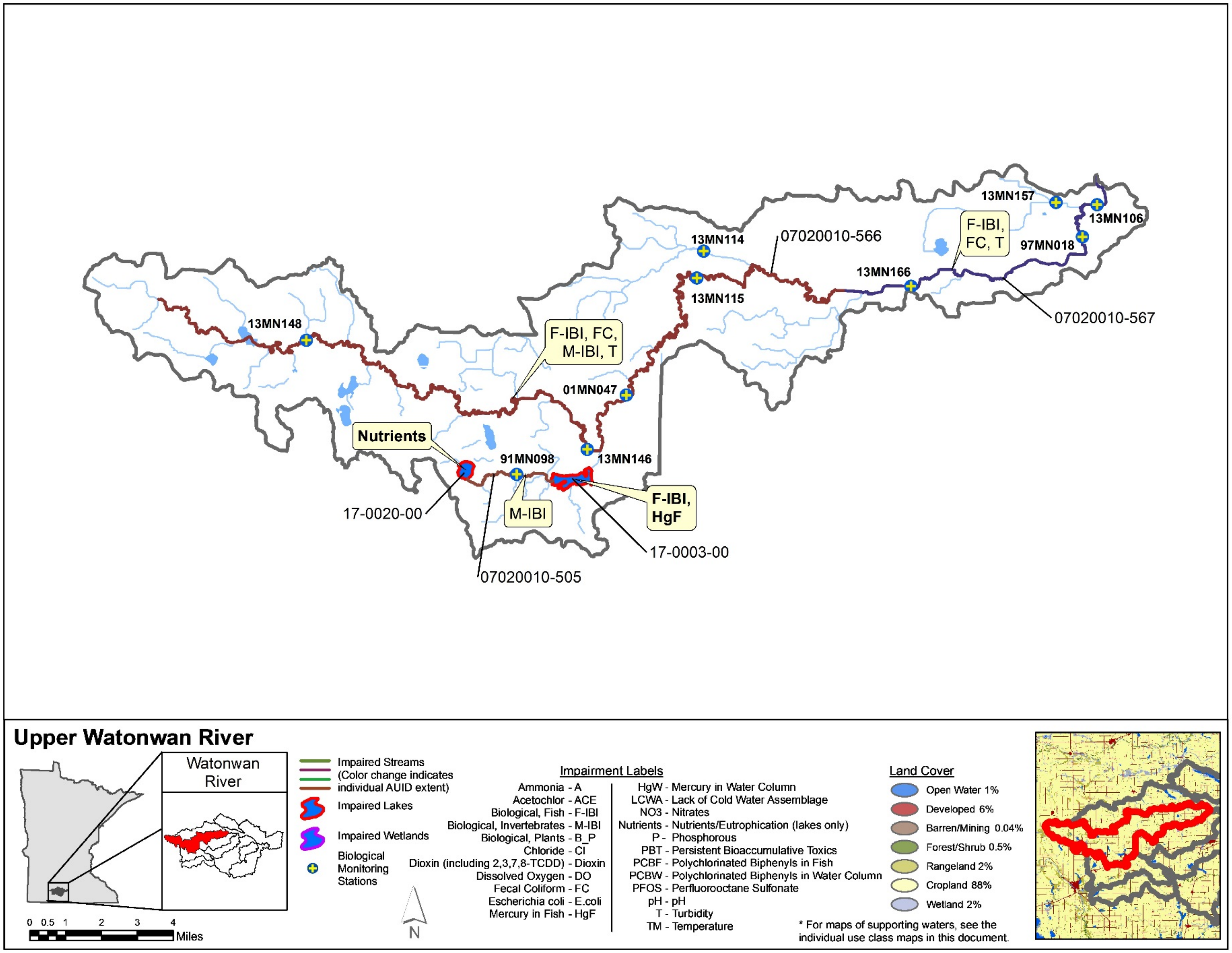


Figure 35. Currently listed impaired waters by parameter and land use characteristics in the Upper Watonwan River Aggregated 12-HUC.

Lower Watonwan River Aggregated 12-HU HUC 0702001006-01

The Lower Watonwan River Subwatershed is the farthest northeast subwatershed in the Watonwan River Watershed. The subwatershed is located in three different counties: Watonwan, Brown and Blue Earth. The town of La Salle is in the western end of the subwatershed. Madelia is located in the center of the subwatershed. Garden city if in the northeast corner of the subwatershed and Vernon Center is located almost directly south of there on the southern border of the subwatershed. Many of the other subwatersheds that make up the Watonwan River watershed are tributaries to the Lower Watonwan River. In the most upstream section of the subwatershed the North Fork Watonwan joins the mainstem Watonwan River. From there the Watonwan River flows west to east, and drains into the Blue Earth River east of Garden City. Between La Salle and Madelia, the unnamed tributary to the Watonwan River and the South Branch Watonwan River flow into the mainstem. Elm Creek joins the Watonwan River after flowing south out of Wilson Lake one and a half miles west of Madelia. Perch Creek flows from the south into the Watonwan River near in the southeastern region of the subwatershed. In the north central region of the subwatershed a series of ditches are connected to Linden Lake but do not flow into the Watonwan River. Fedji Lake is approximately three miles east of Wilson Lake, but no tributaries flow into or out of the lake. In Garden City County Ditch 78 flows north into the Watonwan River and is the last major tributary before the river flows into the Blue Earth River. The dominant landuse is 83% cropland with an additional 6% of developed land and 5% wetland.

Table 51. Aquatic life and recreation assessments on stream reaches: Upper Watonwan River Aggregated 12-HUC. Reaches are organized upstream to downstream in the table.

				Aquatic Life Indicators:												
													Eutrophication			
AUID ***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 ***	Phosphorous	Response Indicator	**Aquatic Life**	**Aquatic Rec. (Bacteria)**
HUC 12 Agg: 0702001006-01 Lower Watonwan River																
07020010-551, Judicial Ditch 7, Headwaters to Watonwan R		4.77	WWg					MTS							IF	
07020010-559, County Ditch 78, 164th St to Watonwan R	13MN120	3.96	WWg	EXS	EXS	NA	NA	NA		NA	NA		NA		IMP	
07020010-563, Watonwan River, T107 R31W S18, west line to Butterfield Cr	13MN145	5.81	WWg	EXS	MTS	IF	IF	MTS	MTS	MTS	MTS		MTS		IMP	IMP
07020010-511, Watonwan River, Butterfield Cr to S Fk Watonwan R	13MN135	7.54	WWg	EXS	EXP	IF	EX	MTS	NA	MTS	NA		EX		IMP	IMP

07020010-510, Watonwan River, S Fk Watonwan R to Perch Cr	13MN130, 13MN161, 13MN162	16.13	WWg	EXS	EXS	MTS	IF	MTS	MTS	MTS	MTS		EX		IMP	IMP
07020010-501, Watonwan River, Perch Cr to Blue Earth R	03MN068	17.88	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 52. Minnesota Stream Habitat Assessment (MSHA): Lower Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Reach Name	Land Use (0-5)	Riparian (0-15)	Substrate (0-27)	Fish Cover	Channel Morph.	MSHA Score (0-100)	MSHA Rating
1	13MN120	County Ditch 78	0	5.5	13.9	11	27	57.4	Fair
2	13MN145	Watonwan River	2.5	8.25	15.78	8.5	20	55.03	Fair
2	13MN135	Watonwan River	2.5	10.75	15.9	9.5	22.5	61.15	Fair
1	13MN130	Watonwan River	2.5	8.5	20.05	11	20	62.05	Fair
2	13MN161	Watonwan River	1.63	9.25	14.7	11.5	21	58.08	Fair
1	13MN162	Watonwan River	5	7	18	12	18	60	Fair
2	03MN068	Watonwan River	2.5	7.75	17.85	10	18.5	56.6	Fair
Average Habitat Results: *Lower Watonwan River Aggregated 12-HUC*			**2.36**	**8.14**	**16.58**	**10.5**	**21**	**58.62**	**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)

Table 53. Channel Condition and Stability Assessment (CCSI): Lower Watonwan River Aggregated 12-HUC.

# Visits	Biological Station ID	Stream Name	Stream Type	Upper Banks (43-4)	Lower Banks (46-5)	Substrate (37-3)	Channel Evolution (11-1)	CCSI Score (137-13)	CCSI Rating
1	13MN120	County Ditch 78	MHL	40	27	12	7	86	severely unstable
1	13MN145	Watonwan River	MHL	36	29	28	7	100	severely unstable
1	13MN135	Watonwan River	MHL	36	29	20	7	92	severely unstable
1	13MN130	Watonwan River	MHL	32	21	22	7	82	severely unstable
1	13MN162	Watonwan River	MHL	36	40	34	11	121	extremely unstable
1	03MN068	Watonwan River	MHL	32	23	22	7	84	severely unstable
Average Stream Stability Results: *Lower Watonwan River Aggregated 12-HUC*				**35.33**	**28.17**	**23**	**7.67**	**94.17**	**severely unstable**

Qualitative channel stability ratings

= stable: CCSI < 27 = fairly stable: 27 < CCSI < 45 = moderately unstable: 45 < CCSI < 80 = severely unstable: 80 < CCSI < 115 = extremely unstable: CCSI > 115

Outlet station stream chemistry

Data collected at the outlet of the 8-HUC Watonwan River Watershed (07020010-501; station S000-163) and shown in Table 54 below are from the 2013 and 2014 monitoring seasons. The data found in the table below do not necessarily reflect all data available at that station, but only those collected during the IWM process. These data are reflective of conditions and impairments found higher up in the overall watershed, as all water moving through the subwatersheds flows past this station on its way to the Blue Earth River.

Fifteen *E. coli* bacteria samples were collected over the two monitoring seasons. Two samples exceeded the individual standard of 1,260 MPN/100mL and two months exceeded the monthly geometric mean standard of 126 MPN/100mL. These data indicated that bacteria concentrations are chronically, sometime severely, elevated and may pose a risk to human health through prolonged or repeated bodily contact. This AUID does not support AQR use, and the previous listing for fecal coliform is valid.

The turbidity listing from the 2002 reporting cycle is validated by new data collected at station S000-163. These new data (collected more than a decade after the original listing) show that total suspended solids and Secchi transparency frequently exceed their respective WCBP water quality standards, and are likely adversely affecting the aquatic life communities.

Total phosphorous also appears to be problematic; more than half of the samples collected exceed the regional river eutrophication standard, and at times TP is severely elevated. The nutrient response variable, chl-*a*, does not indicate that the elevated TP concentrations are affecting aquatic life use, as none of the chl-*a* samples collected exceed the standard. As such, this AUID was assessed as IF during the river eutrophication assessment.

All other chemistry parameters meet their respective water quality standards, where they exist.

Table 54. Outlet water chemistry results: Lower Watonwan River Aggregated 12-HUC.

Station location:	Watonwan River - Upstream of CR 13 (173rd St), 1.5 mi. W of Garden City						
STORET/EQuIS ID:	S000-163						
Station #:	0702001006-01						
		Aquatic Life Parameters and Standards					
Parameter	Units	# of Samples	Minimum	Maximum	Mean	(2B) WQ Standard[1]	# of WQ Exceedances
Ammonia (Unionized)	µg/L	10	2.4	9.3	6.5	<40	0
Chloride	mg/L	10	20.9	64.5	40.9	<230	0
Chlorophyll-a, Corrected	µg/L	13	2.6	31.0	11.5	<35	0
Dissolved Oxygen (DO)	mg/L	61	6.5	17.1	9.7	>5	0
pH	None	60	7.4	8.8	8.0	6.5 - 9	0
Phosphorus	µg/L	80	21	1,110	213	<150	45
Secchi Tube	cm	63	4	100	34	> 10	8
Total Suspended Solids	mg/L	54	12	654	76	< 65	17
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	106	511	- - -	<126	2
Escherichia coli	MPN/100ml	15	21	3,873	632	<1,260	2
		Supporting Aquatic Life Parameters					
Hardness	mg/L	10	341	426	391	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at the outlet chemistry monitoring station in the Lower Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

Secondary stream chemistry stations

The secondary chemistry station S002-253 was established on the Watonwan River (-563) approximately 1-mile east-southeast of the city of La Salle, at the County Road 16 crossing. This station is upstream of the confluence with a LRVW (St. James Creek) and is paired with station S002-254, which is downstream of the LRVW. Data collected at the two stations give a direct comparison of before and after conditions of the river in relationship to the LRVW tributary. Data collected at S002-253 and shown in Table 55 below represent the condition of the river prior to the LRVW additions. These data are similar to other water chemistry stations in the watershed and show a handful of water quality exceedances observed for *E. coli* bacteria, TSS, Secchi transparency and TP. The previous listings for AQR and AQL impairments (*i.e.* fecal coliform and turbidity) are supported by these data and the listings will remain unchanged.

Bacteria data show that *E. coli* concentrations are severely elevated at times, and may pose a risk to human health through prolonged or repeated bodily contact. Other chemistry parameters meet their respective standards where they exist. This AUID does not support AQR or AQL uses.

Table 55. Secondary chemistry station results: Lower Watonwan River

Station location:	**Watonwan River - At CSAH 16, 1 mi SE of La Salle**						
STORET/EQuIS ID:	**S002-253**						
Station #:	**0702001006-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	1.6	23.6	9.8	<40	0
Chloride	mg/L	10	21.5	30.4	25.9	<230	0
Dissolved Oxygen (DO)	mg/L	19	7.0	9.8	8.6	>5	0
pH	None	19	7.4	9.0	8.0	6.5 - 9	0
Phosphorus	µg/L	10	63	232	114	<150	3
Secchi Tube	cm	19	8	67	35	> 10	2
Total Suspended Solids	mg/L	10	7	85	37	< 65	3
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	415	616	- - -	<126	3
Escherichia coli	MPN/100ml	15	172	3,448	685	<1,260	2
		Supporting Aquatic Life Parameters					
Hardness	mg/L	10	320	454	393	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
**Data found in the table above are compiled using the results from samples collected at a secondary chemistry monitoring station in the Lower Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.

The secondary chemistry station S002-254 was established on the Watonwan River (-511) approximately 4.5-miles west of the city of Madelia, at the township road 99 crossing. This station is downstream of the confluence with the LRVW (St. James Creek) and is paired with station S002-253. There are approximately four river miles between the two paired stations, with two notable tributaries entering between them (St. James Creek and a poorly buffered agricultural drainage ditch).

The data collected at this downstream station exhibit a greater number of water quality exceedances than the upstream station. Justification for this is partly due to the greater number of observations made at the downstream station and partly due to the tributary additions to the river between the two stations. The means calculated for TSS and TP (shown in Table 56 below) both exceed the WCBP water quality standards; whereas a short distance upstream at station S002-253, both parameters meet their standards.

Currently, it is impossible to identify the source(s) of the excessive nutrients and suspended solids loads, but there is high probability that the LRVW and poorly buffered agricultural drainage ditch tributaries are contributors. The data also reflect the upstream AQR and AQL use impairments for fecal coliform bacteria and turbidity. As such, the listings for both impairments will remain unchanged.

Table 56. Secondary chemistry station results: Lower Watonwan River

Station location:	**Watonwan River - Township Rd 99, 4.5 miles west of Madelia**						
STORET/EQuIS ID:	**S002-254**						
Station #:	**0702001006-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	1.4	13.9	9.4	<40	0
Chloride	mg/L	10	27.6	120.0	50.5	<230	0
Chlorophyll-a, Corrected	µg/L	1	9.4	9.4	- - -	<35	0
Dissolved Oxygen (DO)	mg/L	68	6.1	12.7	9.1	>5	0
pH	None	66	7.6	9.2	8.0	6.5 - 9	1
Phosphorus	µg/L	61	63	999	218	<150	37
Secchi Tube	cm	64	5	100	33	> 10	6
Total Suspended Solids	mg/L	59	5	296	65	< 65	23
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	297	955	- - -	<126	3
Escherichia coli	MPN/100ml	15	100	3,223	727	<1,260	2
		Supporting Aquatic Life Parameters					
Hardness	mg/L	10	359	451	416	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
**Data found in the table above are compiled using the results from samples collected at a secondary chemistry monitoring station in the Lower Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.

The secondary stream chemistry station S007-564 was established on the Watonwan River (-510) in Watona Park just upstream of CSAH 9, in the city of Madelia. Data were collected during the IWM process and are shown in Table 57 below. These data reflect conditions and impairments found higher up in the subwatershed, and indicate that those issues are still problematic at this site.

The AQR use impairment for *E. coli* bacteria is justified by analysis of data collected at this station. Exceedances of both the individual and monthly geometric mean standards indicate this AUID may pose a risk to human health through prolonged or repeated bodily contact. As such, this AUID does not support AQR use.

Secchi transparency and TSS data are inconclusive to determine if the 2008 turbidity listing is still valid. Water quality exceedances for both parameters suggest that turbid conditions are likely still affecting the aquatic communities. Total phosphorous frequently exceeds the regional river eutrophication standard; however, the nutrient response variable (*i.e.* chl-*a*) does not. This may be an indicator that nutrients and algae growth are not limiting the aquatic life communities' performance. More definitive conclusions will hopefully surface following stressor identification work to investigate the newly proposed impairments to the fish and macroinvertebrate communities. This AUID does not support AQL use.

Table 57. Secondary chemistry station results: Lower Watonwan River

Station location:	**Watonwan River - At City Park upstream of CSAH 9 in Madelia**						
STORET/EQuIS ID:	**S007-564**						
Station #:	**0702001006-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	3.7	17.0	9.7	<40	0
Chloride	mg/L	10	23.2	125.0	47.2	<230	0
Chlorophyll-a, Corrected	µg/L	6	1.1	13.7	5.9	<35	0
Dissolved Oxygen (DO)	mg/L	19	6.5	11.5	7.9	>5	0
pH	None	19	7.6	8.4	8.0	6.5 - 9	0
Phosphorus	µg/L	16	60	370	191	<150	10
Secchi Tube	cm	19	8	61	28	> 10	1
Total Suspended Solids	mg/L	10	15	196	54	< 65	2
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	155	520	- - -	<126	3
Escherichia coli	MPN/100ml	15	28	1,935	529	<1,260	3

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
****Data found in the table above are compiled using the results from samples collected at a secondary chemistry monitoring station in the Lower Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.**

The secondary stream chemistry station S000-354 was established on the Watonwan River (-510) at the County Road 30 crossing, three miles southeast of the city of Madelia. Data were collected during the IWM process and are shown in Table 58 below. These data reflect conditions and impairments found higher up in the subwatershed.

The AQR use impairment for *E. coli* bacteria is justified by analysis of data collected at this station. Exceedances of both the individual and monthly geometric mean standards indicate this AUID may pose a risk to human health through prolonged or repeated bodily contact. As such, this AUID does not support AQR use.

Secchi transparency and TSS data are inconclusive to determine if the 2008 turbidity listing is still valid. Total phosphorous frequently exceeds the regional river eutrophication standard; however, the nutrient response variable (*i.e.* chl-*a*) seasonal average was well below the threshold. This is an indicator that nutrients and algae growth are not limiting the aquatic life communities' performance. More definitive conclusions will hopefully surface following stressor identification work to investigate the newly proposed impairments to the fish and macroinvertebrate communities. This AUID does not support AQL use.

Table 58. Secondary chemistry station results: Lower Watonwan River

Station location:	**Watonwan River - At CSAH 30, 3 mi SE of Madelia**						
STORET/EQuIS ID:	**S000-354**						
Station #:	**0702001006-01**						
		Aquatic Life Parameters and Standards					
Parameter	**Units**	**# of Samples**	**Minimum**	**Maximum**	**Mean**	**(2B) WQ Standard[1]**	**# of WQ Exceedances**
Ammonia (Unionized)	µg/L	10	4.9	12.8	8.5	<40	0
Chloride	mg/L	10	23.8	74.8	42.3	<230	0
Chlorophyll-a, Corrected	µg/L	13	1.4	46.1	12.0	<35	1
Dissolved Oxygen (DO)	mg/L	19	6.7	11.4	8.0	>5	0
pH	None	19	7.6	8.5	8.0	6.5 - 9	0
Phosphorus	µg/L	16	67	377	188	<150	11
Secchi Tube	cm	19	8	58	34	> 10	1
Total Suspended Solids	mg/L	10	6	97	36	< 65	1
		Aquatic Recreation Parameters and Existing Standards					
Escherichia coli (geometric mean)	MPN/100ml	3	121	497	- - -	<126	2
Escherichia coli	MPN/100ml	15	28	1,467	460	<1,260	2
		Supporting Aquatic Life Parameters					
Hardness	mg/L	10	345	434	395	No Std.	No Std.

[1]**Secchi Tube** standards are surrogate standards derived from the Total Suspended Solids standard of 65 mg/L.
**Data found in the table above are compiled using the results from samples collected at a secondary chemistry monitoring station in the Lower Watonwan River Subwatershed, as a component of the IWM work conducted between May and September from 2013 and 2014. These specific data do not necessarily reflect all data that were used to assess the AUID.

Table 59. Lake assessments: Lower Watonwan River Aggregated 12-HUC.

Lake Name	DNR Lake ID	Area (acres)	Trophic Status	Percent Littoral	Max. Depth (m)	Mean Depth (m)	CLMP Trend	Mean TP (µg/L)	Mean Chl-*a* (µg/L)	Mean Secchi (m)	AQR Support Status	AQL Support Status
Fedji	83-0021-00	162	E	100	2.4	1.0*	NT	80	61.3	1.0	IF	NA

* Mean depth estimated by MPCA staff

Abbreviations: **E** – Eutrophic **NT –** No trend identifiable **IF** – Insufficient Information **NA** – Not Assessed

Summary

The Lower Watonwan River Subwatershed has five AUIDs assessable for biological data. County Ditch 78 has one AUID with one biological station (13MN120) that was sampled once for fish and macroinvertebrates in 2013. Nitrogen was measured at 20mg/L during the time of sample, which agrees with the high relative abundance (74%) and relative taxa richness (70%) of macroinvertebrates tolerant of high nitrogen levels. Both fish and macroinvertebrates scored below the general use threshold. A northern hogsucker was collected during the sample and is a sensitive species. The sample was made up of 73% tolerant fish taxa. Heavy to moderate erosion was noted on the banks of the stream and row crop is the dominant landuse type surrounding the stream was row crop.

The furthest upstream AUID of the Lower Watonwan River Subwatershed has one biological sampling location, 13MN145, which was sampled twice for fish and once for macroinvertebrates in 2013. Both fish samples scored below the threshold for general use. Sand shiners, a tolerant species, and spotfin shiners were the two most abundant species found during both samples. The macroinvertebrate sample scored above the general use threshold, with taxa indicative of relatively healthy instream substrates and habitat. The next downstream AUID on the Watonwan River has one sample location, 13MN135, with one two fish and one macroinvertebrate sample from 2013. The AUID was previously listed in 2004 for an aquatic life impairment resulting from a fish sample taken in 2001. That data from that sample expired and not assessed in 2015. The new fish data scored below the general use threshold and will continue the aquatic life impairment. Spotfin shiner was the most abundant species found during both samples. In the first sample common carp, a tolerant species, was also abundant. During the second sample sand shiner, also a tolerant species, were the second most abundant species collected. The macroinvertebrate sample scored just below the impairment threshold, indicating a potential impairment at this AUID. As with other reaches on the mainstem of the Watonwan, a high diversity of POET taxa is suggestive of relatively intact streams substrates and habitat, and a more stable, consistent flow regime. The upstream and downstream AUIDs on the Watonwan River are suggested for impairment based on fish samples.

The next downstream AUID on the Watonwan River has three biological sampling locations (13MN161, 13MN162, 13MN130) that were sampled four times for fish and twice for macroinvertebrates in 2013. The AUID was assessed using general use standards and all fish and macroinvertebrates samples were below the threshold. Sand shiners, a tolerant species, were one of the most abundant species found in all samples on this AUID. Both macroinvertebrate samples had the abundant POET taxa typical of large, flowing rivers, but both samples were still dominated by tolerant taxa. The AUIDs upstream and downstream are also being suggested for non-support for aquatic life based on fish scores. The furthest downstream AUID of the Watonwan River was sampled twice for fish and macroinvertebrates at one Biological site (03MN068). The AUID was assessed using general use standards and both fish and macroinvertebrate samples failed. Habitat scores from the samples were averaged and recorded as fair. Heavy to moderate erosion was noted on the stream banks. Agriculture is the dominant landuse within the subwatershed. The majority of habitat assessments done during these fish samples indicate row crop is dominant landuse surrounding the sites.

Stream chemistry at large

There are four consecutive AUIDs (07020010-563; -511; -510; and -501) of the lower Watonwan River that have newly or previously listed AQR use impairments for bacteria (*E. coli* or fecal coliform). The impairments reach from the County Road 115 crossing (2.5 miles west of the City of La Salle; on -563) all the way downstream to the confluence with the Blue Earth River, two miles northeast of the City of Garden City (-501). Three of the bacteria related AQR use impairments are from previous assessments (two were listed during the 2006 reporting cycle, and the third during the 1994 cycle); the fourth impairment is newly proposed for the Watonwan River (-510). These four AUIDs also have previous AQL use impairments related to turbidity. The listings occurred during three different reporting cycles: the 2002 cycle (-501); the 2006 cycle (-511 and -563) and the 2008 cycle (-510).

Four secondary chemistry stations were established upstream of the outlet chemistry station in an effort to bracket two points of interest along the Watonwan River (the LRVW tributary: St. James Creek; and the city of Madelia's WWTP). Observing multiple chemistry stations in this manner allows for data to be collected both upstream and downstream of the point of interest to quantify the immediate impacts that point has on stream conditions, and ensures that appropriate limits are assigned to facilities. Judicial Ditch 7 has Secchi transparency data submitted by a CSMP volunteer from the summers of 2011-2013. Those data show zero exceedances out of 74 observations made. All other AUIDs have insufficient chemistry data to assess against AQR and AQL use standards.

Lake AQR use assessment

Fedji Lake is held to the shallow lake WCBP eutrophication standards. Aquatic recreational use data presented in Table 59, are insufficient (IF) to determine a support status due to the fact the both TP and Secchi meet the WCBP lake eutrophication standards, but chl-*a* does not. Secchi transparency changed greatly from 2013 to 2014 (*e.g.* the highest measurement in 2013 was 0.4 meters and the lowest measurement in 2014 was 1.6 meters); the large disparity in measurements from one-year to the next provides very little confidence in the mean calculated, and the validity of the mean is questionable. Since TP does not exceed its respective standard, it is not practical to suggest that nutrients are limiting AQR use and fueling algal blooms to the degree seen in similar lakes in the watershed. The resulting assessment for AQR use support is insufficient information (IF) to make a conclusive decision.

Lakes summary

There are four lakes greater than 10 acres in size in this subwatershed. Fedji Lake (83-0021-00) was the only lake with enough water chemistry data assess for AQR use. Limited fish data available on the MNDNR 'lake finder' website indicate Fedji Lake is susceptible to winter fish kills. A 2010 survey found only black bullhead present in the lake. Anecdotal evidence during the2013-2014 monitoring work suggests that the fish community is dominated by bullhead and common carp. Species recently stocked in the lake include walleye, northern pike, black crappie and yellow perch. The MNDNR has not conducted any recent plant surveys on Fedji Lake, and the lake was not assessed for AQL use.

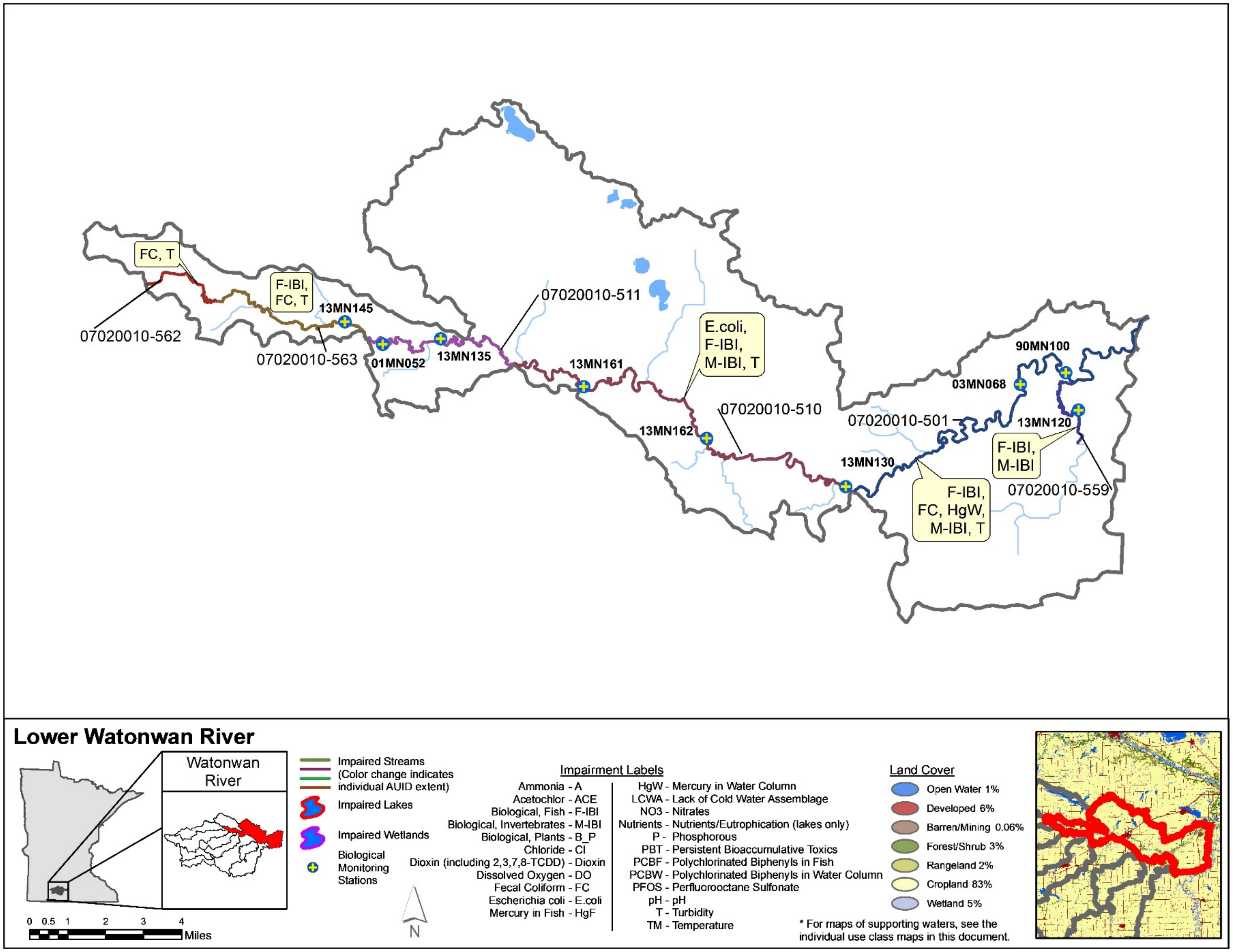


Figure 36. Currently listed impaired waters by parameter and land use characteristics in the Lower Watonwan River Aggregated 12-HUC.

Watershed-wide results and discussion

Assessment results and data summaries are included below for the entire HUC-8 watershed unit of the Watonwan River, grouped by sample type. Summaries are provided for load monitoring data results near the mouth of the river, aquatic life and recreation uses in streams and lakes throughout the watershed, and for aquatic consumption results at select river and lake locations along the watershed. Additionally, groundwater monitoring results and long-term monitoring trends 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 Watonwan River Watershed.

Pollutant load monitoring

Samples have been collected and loads calculated for the Watonwan River near Garden City, CSAH 13 beginning in 2007. The two subwatershed sites were established in 2013 (Table 60). Because of the recent establishment of the subwatershed sites, subwatershed data was not available at the time of this report. Analysis and results within this report are limited to the data collected at the Watonwan River near Garden City.

Table 60. WPLMN Stream Monitoring Sites for the Watonwan River Watershed

Site type	Stream name	USGS	MNDNR/MPCA	EQuIS
Major Watershed	Watonwan River near Garden City, CSAH13	05319500	E31051001	S000-163
Subwatershed	Watonwan River near La Salle, near CSAH3	NA	H31028001	S002-254
Subwatershed	South Fork Watonwan River near Madelia, MN	NA	H31021001	S002-251

Pollutant loads are influenced by land use, land management, watershed size, hydrology, climate, and other factors. Watershed size and differences in flow volume greatly influences pollutant loads; therefore, when comparing watersheds across a region or state, it is often useful to normalize the results for these differences. The flow weighted mean concentration (FWMC) is calculated by dividing the total load (mass) by the total flow volume, which normalizes load data for both spatial and volumetric difference in flow between watersheds. The FWMC is an estimate of the average concentration (mg/L) of a pollutant for the entire flow volume that passed the monitoring location over the monitoring season. This allows for the direct comparison of water quality between watersheds regardless of watershed size or annual discharge volume. In this report, WPLMN data will be expressed primarily as loads and FWMCs.

Many years of water quality data from throughout Minnesota combined with the previous analysis of Minnesota's ecoregion patterns, resulted in the development of three "River Nutrient Regions" (RNR), each with unique nutrient standards (MPCA, 2013). Of the state's three RNRs (North, Central, South), the Watonwan River's monitoring stations are located within the South RNR.

Annual flow weighed mean concentrations for the Watonwan River near Garden City were calculated for 2007-2013 and compared with South RNR standards (only TP and TSS river standards exist for Minnesota at this time) to give an indication of the overall water quality of the watershed and contrast year to year variability. See below for specific parameter results and discussion. It should be noted that while a FWMC exceeding a water quality standard is generally a good indicator that the water body is out of compliance with the RNR standard, the rule may not always hold true. Waters of the state are listed as impaired based on the percentage of individual samples exceeding the numeric standard, generally 10% and greater, over the most recent 10-year period (MPCA, 2014) and not based on comparisons with FWMCs. A river with a FWMC above a water quality standard, for example, would not be listed as impaired if less than 10% of the individual samples collected over the assessment period exceeded the standard.

Pollutant sources and source contributions affecting rivers can be diverse from one watershed to the next depending on land use, climate, soils, slopes, and other watershed factors. Regional correlations between landuse, percent land disturbance, and water quality can be observed with figures Figure 37, Figure 38 and Figure 39. Elevated nutrient and sediment levels in streams and rivers can occur naturally in landscapes composed of young glacial soils, steep slopes or other natural factors; however, landuse, percent disturbance and other anthropogenic influences also strongly influence measured water quality. As a general rule, elevated levels of total suspended solids (TSS) and nitrate plus nitrite-nitrogen (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 total phosphorus (TP) and dissolved orthophosphate (DOP) can be attributed to both non-point as well as point sources such as industrial or waste water treatment plants. Major "non-point" sources of phosphorus include dissolved phosphorus from fertilizers and phosphorus adsorbed to and transported with sediment during runoff.

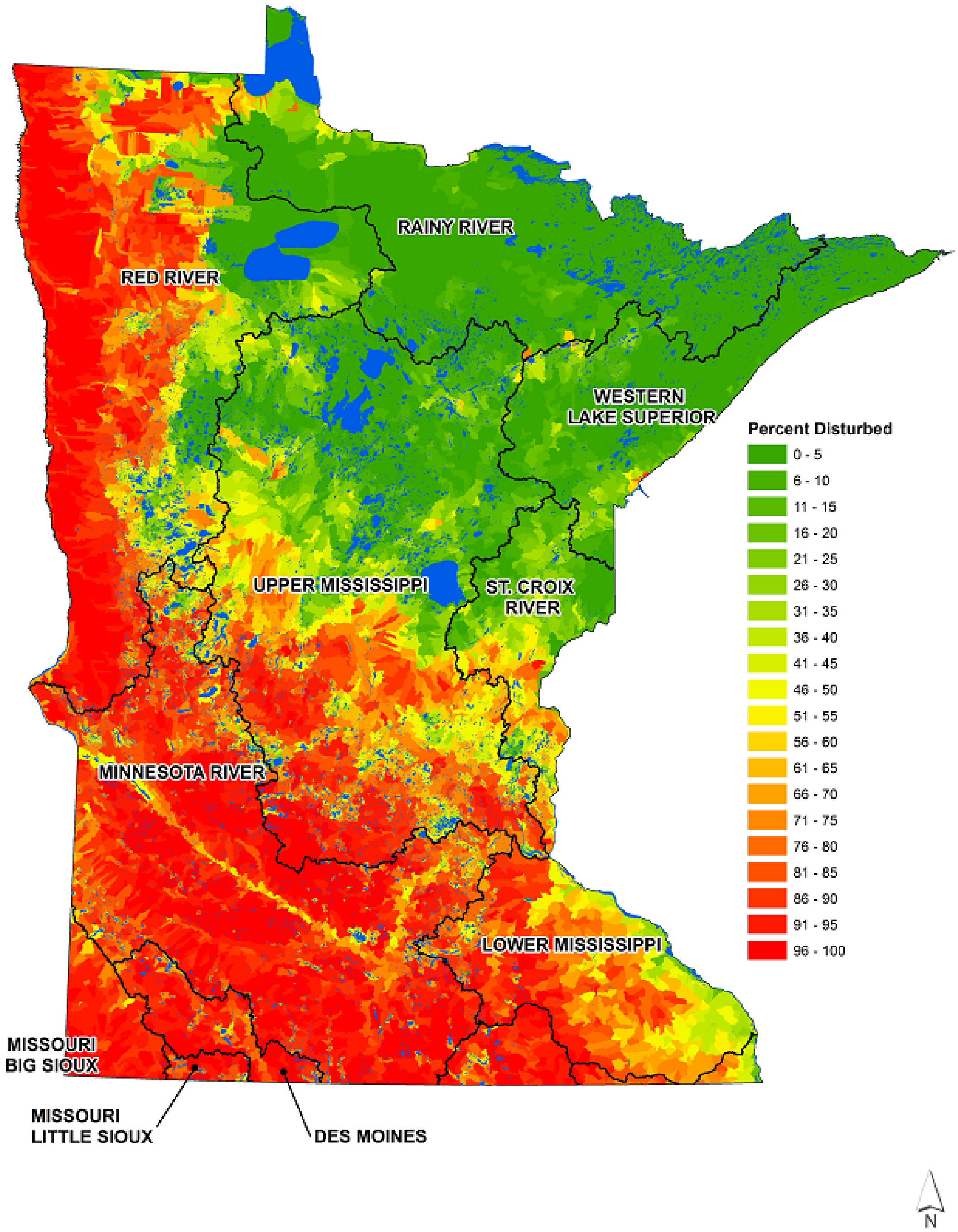


Figure 37. Percent land disturbance.

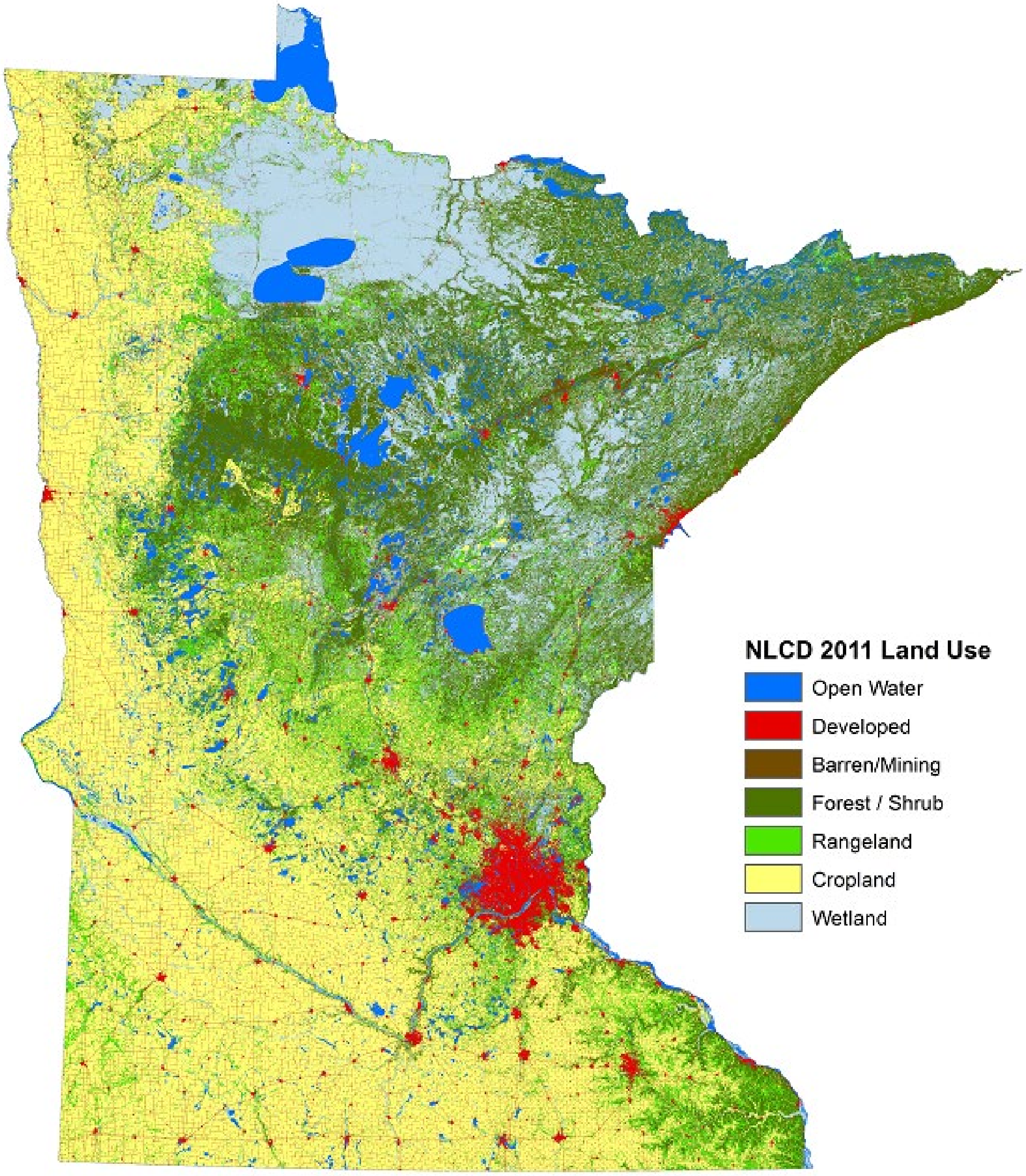


Figure 38. NLCD 2011 landuse for the state of Minnesota.

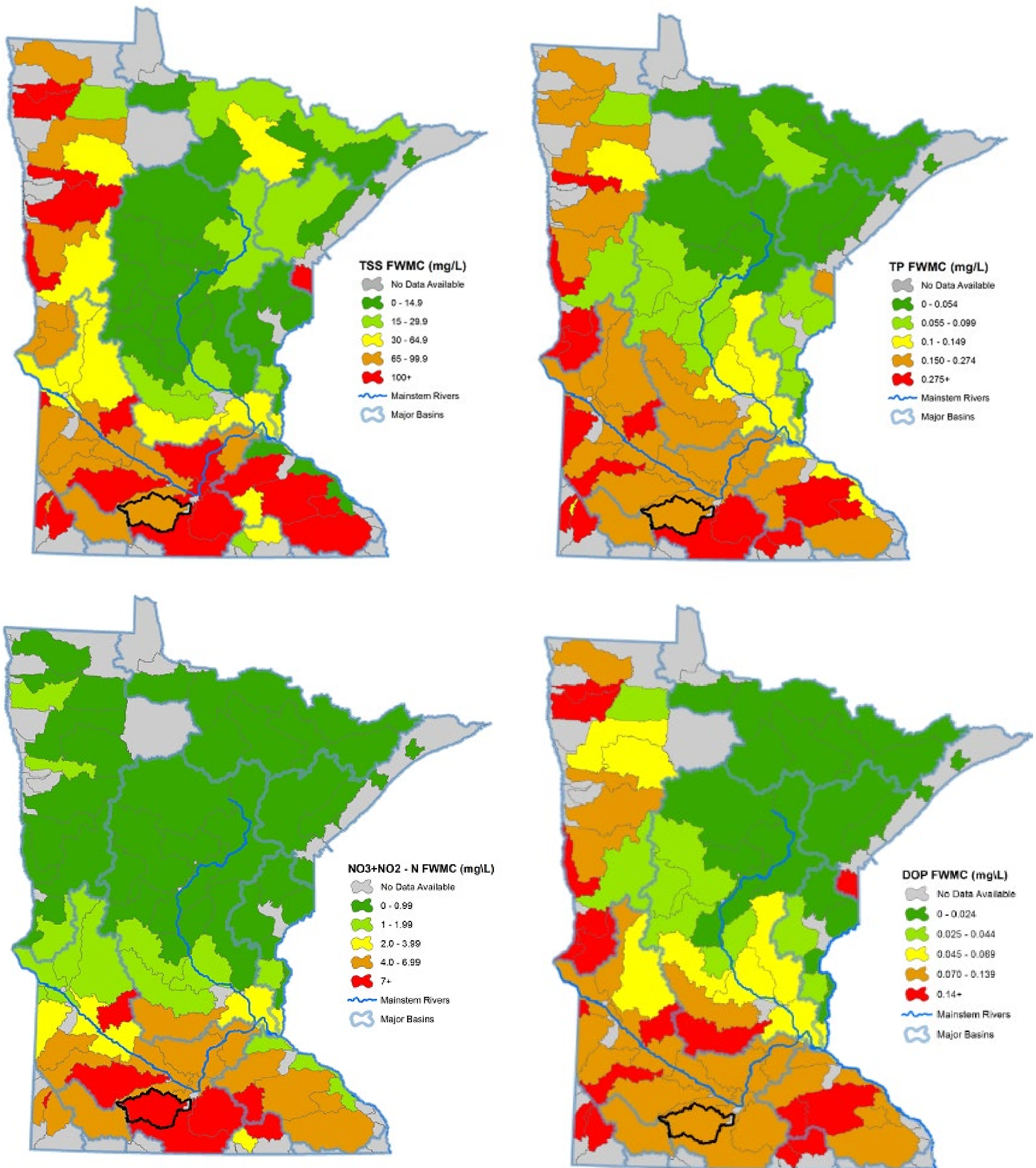


Figure 39. 2007-2013 WPLMN average annual TSS, TP, NO_3-NO_2-N and DOP flow weighted mean concentrations by major watershed.

Within a given watershed, pollutant sources and source contributions can also be quite variable from one runoff event to the next depending on factors such as: vegetative canopy development, soil conditions (frozen/unfrozen saturation level, etc.), and precipitation type, intensity, and amount. Surface erosion and in-stream sediment concentrations, for example, will typically be much higher following high intensity rain events prior to canopy development when compared to post-canopy events where soils are more protected and less surface runoff and more infiltration occur. Precipitation type and intensity can influence the major course of storm runoff, routing water through several potential pathways including overland, shallow and deep groundwater, or through artificial agricultural and urban drainage networks. Runoff pathways along with other factors determine the type and levels of pollutants transported in runoff to receiving waters and help explain between-storm and temporal differences in in-stream pollutant concentrations. Pollutant loads, the product of concentration and flow, are influenced not only by in-stream pollutant concentrations but also the volume of runoff delivered to the stream. During years when high intensity rain events provide the greatest proportion of total annual runoff, FWMCs of TSS and TP tend to be higher and DOP and NO_3+NO_2-N concentrations tend to be lower. In contrast, during years with high snow melt runoff and less intense rainfall events, TSS FWMCs tend to be lower while TP, DOP, and NO_3+NO_2-N levels tend to be elevated. Years with larger runoff volumes will typically have larger loads when compared to years with lesser runoff volumes. Table 61 for example, shows the 2010 TSS load to be approximately thirteen times higher than the previous year's load, largely because of differences in runoff volume.

Table 61. Annual Pollutant Loads (kg) for the Watonwan River near Garden City, Minnesota.

Parameter	2007	2008	2009	2010	2011	2012	2013
TSS	34,844,420	23,817,930	5,887,334	71,984,848	50,362,520	27,281,190	22,312,490
TP	108,296	56,173	30,868	232,257	180,861	69,503	58,130
DOP	68,854	29,202	17,427	120,949	90,174	29,553	26,674
NO_3+NO_2-N	2,808,012	3,557,957	718,753	6,917,026	6,452,424	2,109,854	1,722,023

Total suspended solids

Water clarity refers to the transparency of water. 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. By definition, turbidity is caused primarily by suspension of particles that are smaller than one micron in diameter in the water column.

Analysis has shown a strong correlation to exist between the measures of TSS and turbidity. The greater the level of TSS, the murkier the water appears and the higher the measured turbidity. High turbidity results in reduced light penetration that harms beneficial aquatic species and favors undesirable algae species (MPCA and MSUM, 2009). An overabundance of algae can lead to increases in turbidity, further compounding the problem. Periods of high turbidity often occur when heavy rains fall on unprotected soils. Upon impact, raindrops dislodge soil particles and overland flow transports fine particles of silt and clay into rivers and streams (MPCA and MSUM, 2009).

Minnesota's water quality standards for river eutrophication and total suspended solids were adopted into State R. ch 7050 in 2014 and approved by the Environmental Protection Agency (EPA) in January 2015. Within the South RNR, a river is considered impaired when greater than 10% of the individual samples exceed the TSS standard of 65 mg/L. (MPCA, 2011). From 2007 through 2013, 40% of the 300 water quality samples collected at the Watonwan River near Garden City monitoring site exceeded this standard. TSS FWMCs for this site also exceeded the 65 mg/L standard six out of seven years as shown in Figure 40.

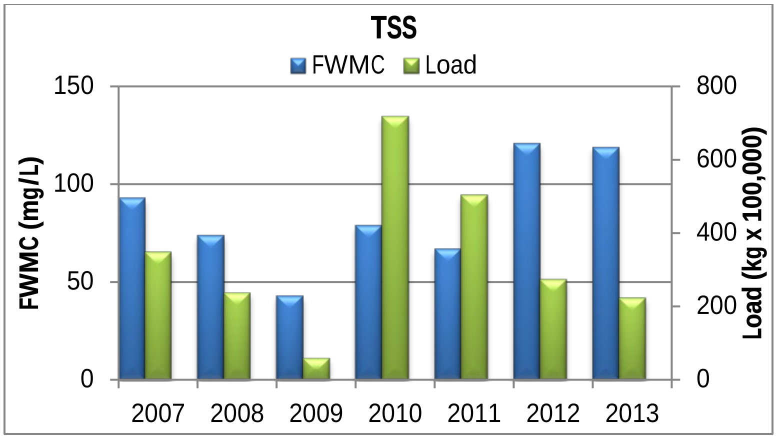
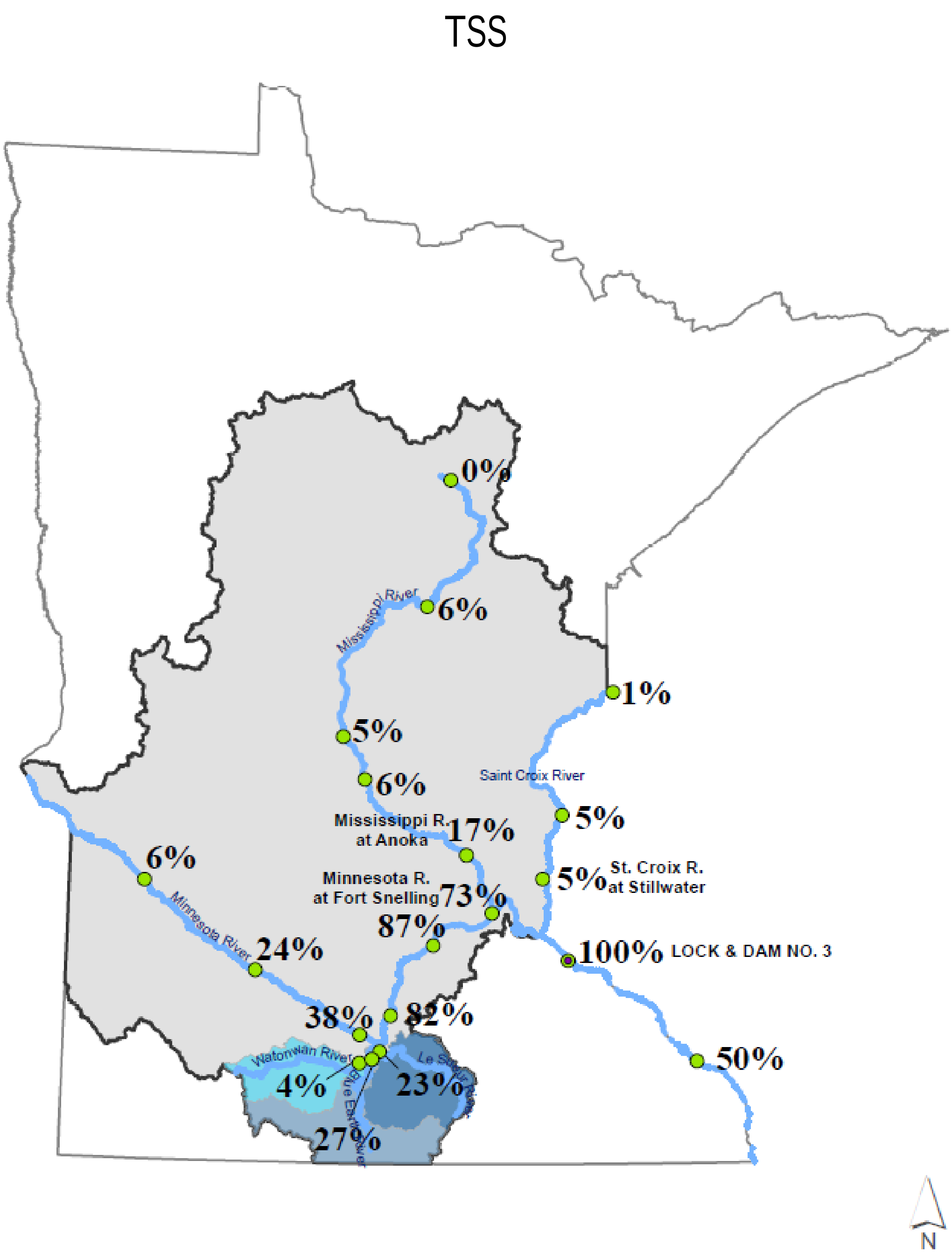


Figure 40. TSS Flow Weighted Mean Concentrations and Loads for the Watonwan River near Garden City, Minnesota.

When compared with other 8-digit HUC watersheds throughout the state Figure 39 shows the average annual TSS FWMC to be several times higher for the Watonwan River Watershed than watersheds in north central and northeast Minnesota, but in line with the agriculturally rich watersheds found in northwest, north central, and southern regions of the state. When compared to the other two watersheds that comprise the Greater Blue Earth River Basin, (Blue Earth and Le Sueur rivers), the Watonwan River's average TSS FWMC is substantially less at 80 mg/L compared to 215 and 225 mg/L, respectively.

Figure 41 illustrates the how the Minnesota River, in particular the watersheds of the Greater Blue Earth River, including the Watonwan, contribute a disproportionate amount to the Mississippi River sediment load. The diagram presents 2008-2012 average TSS loads at sites along the Mississippi, St. Croix, and Minnesota rivers expressed as a percentage of the average load measured at Lock and Dam #3 (site load/LD#3 load). Lock and Dam #3 (LD#3) is the first downstream monitoring location below the Twin Cities Metropolitan Area (TCMA) and includes inputs from the upper Mississippi, St. Croix and Minnesota rivers and the TCMA. It should be noted; some river reaches may gain additional sediment inputs with LD#3 equivalents increasing as one moves downstream. Others, with perhaps lakes, wetlands, or extensive floodplain between sites, may be losing reaches with a net loss of sediment between upstream and downstream monitoring sites.

A comparison of average annual pollutant loads from the Upper Mississippi, St. Croix, and Minnesota rivers as they enter the metropolitan area show the average annual load for the St. Croix River near Stillwater to be the equivalent of 5% of the average annual load measured at LD#3, 17% for the Mississippi River at Anoka, and a disproportionate 73% equivalent for the Minnesota River at Fort Snelling. The map illustrates the summation and comparison of loading inputs into the TCMA are the near equivalent to the average TSS load leaving the Twin Cities as measured at LD#3. The data show the TCMA, while contributing approximately 5% to the Mississippi River load, is a net sediment source but a much lesser source of sediment to the Mississippi River than the Minnesota River basin.



	St Croix R at Stillwater	Mississippi R. at Anoka	Minnesota R. at Ft. Snelling	Watonwan R. Watershed	Blue Earth R. Watershed	Le Sueur R. Watershed
TSS	5%	17%	73%	4%	27%	23%
TP	8%	35%	56%	4%	10%	9%
NO_3+NO_2 -N	2%	20%	74%	7%	13%	9%

Figure 41. 2008-2012 average annual TSS, TP and NO_3+NO_2-N loads for Mississippi River Basin mainstem sites and select watersheds, expressed as a percentage of the average load measured at Lock and Dam #3.

Within the Minnesota River Basin, the average loads from the major watersheds within the GBE watershed are the combined equivalent of 54% of the LD#3 average TSS load. While the Le Sueur River and Blue Earth River Watersheds are clearly Minnesota's two major TSS loading 8-digit HUC watersheds to the Mississippi River, the Watonwan River watershed, at a 4% LD#3 TSS load equivalent, is not insignificant. This is similar to the average TSS load from nearly the entire St. Croix River basin (St. Croix River at Stillwater, MN 36. Hydstra ID 37061001), despite the Watonwan River watershed being only 12% of the drainage area of the St. Croix River above Stillwater.

Seasonality and climate influence the timing and size of TSS loads. Figure 42 illustrates the majority of the average annual flow volume (68%) and average annual TSS load (78%) pass through the watershed beginning in March and running through the end of June, the period when vegetative canopy is lacking or minimal. Further analysis of daily loads show most of the loading during this period can be attributed to two to four major runoff/storm events per year, again, primarily during the period when vegetative canopy is lacking or poorly developed.

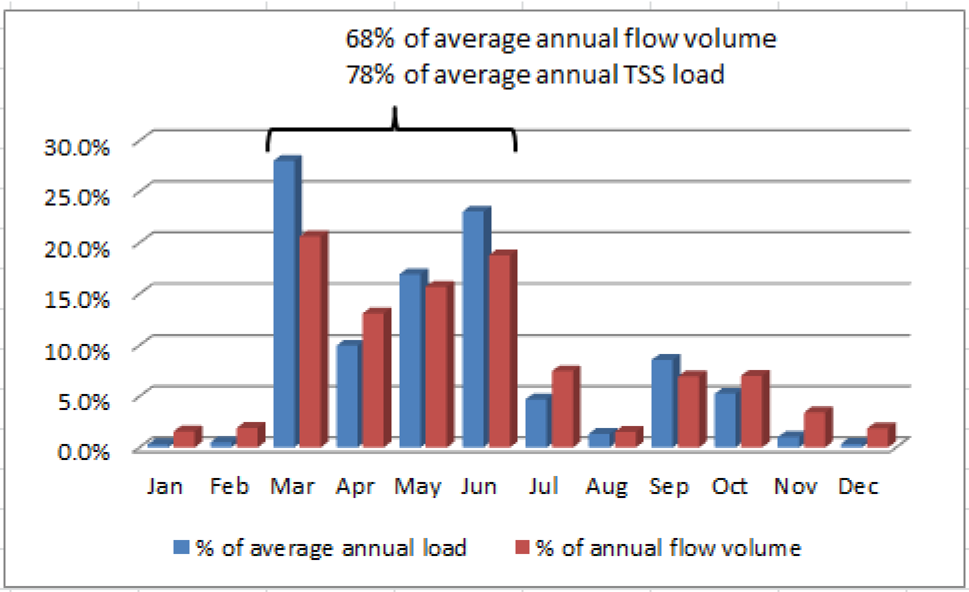


Figure 42. Monthly percentages of the average annual TSS load for the Watonwan River near Garden City, 2007-2013.

Flow conditions under which violations in Minnesota's TSS standard are most likely to occur for the Watonwan River is best illustrated with the TSS load duration curve for the Watonwan River near Garden City (Figure 43). A load duration curve of is a plot of daily loads computed from TSS sample concentrations plotted against the exceedance curve, above which daily loads are considered non-compliant with TSS water quality standards for the South RNR. Figure 43 shows most exceedances of the TSS standard occur under "moist" to "high flow" conditions and during the spring and summer seasons.

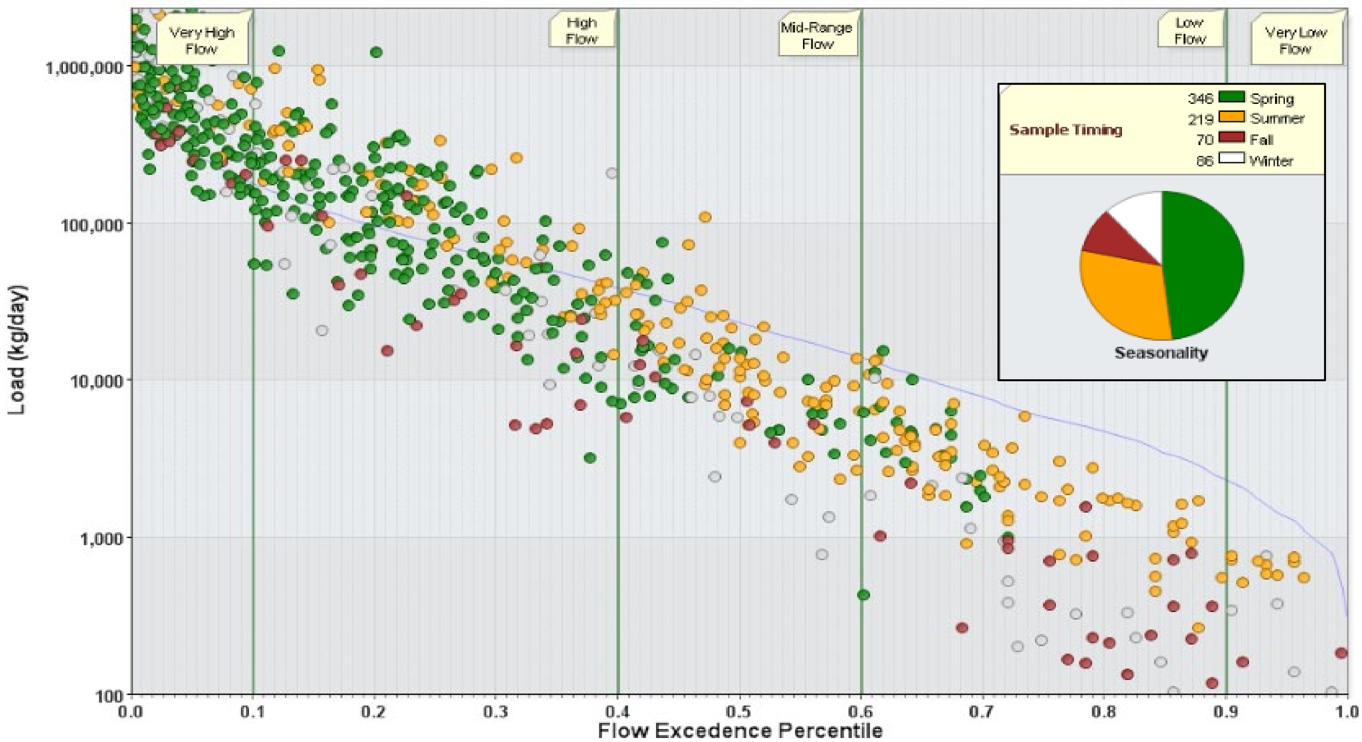


Figure 43. TSS load duration curve for the Watonwan River near Garden City, 1985-2015.

Total phosphorus

Nitrogen, phosphorus, and potassium are essential macronutrients and are required for growth by all animals and plants. Lack of sufficient nutrient levels in surface water often restricts the growth of aquatic plant species (University of Missouri Extension, 1999). In freshwaters such as lakes and streams, phosphorus is typically the nutrient limiting growth; increasing the amount of phosphorus entering a stream or lake will increase the growth of aquatic plants and other organisms. Although phosphorus is a necessary nutrient, excessive levels overstimulate aquatic growth in lakes and streams resulting in reduced water quality. The progressive deterioration of water quality from overstimulation of nutrients is called eutrophication where, as nutrient concentrations increase, the surface water quality is degraded (University of Missouri Extension, 1999). Elevated levels of phosphorus in rivers and streams 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 (University of Missouri Extension, 1999).

Within the south RNR, a violation of Minnesota's water quality standard for river eutrophication occurs when the total phosphorus (TP) summer mean concentration (June through September) is at or above 0.150 mg/L along with a summer average violation of one or more "response" variables (pH, biological oxygen demand, dissolved oxygen flux, chlorophyll-a). A comparison of all 2007-2013 total phosphorus data collected for the Watonwan River near Garden City show TP concentrations at or above the 0.150 mg/L south RNR TP standard 58% of the time. The summer TP averages were above the standard in all years except 2008. Total phosphorus flow weighted mean concentrations were also greater than the standard in all years (Figure 44). When compared with other 8-digit HUC watersheds, Figure 39 shows the average annual TP FWMC to be several times higher for the Watonwan River Watershed than watersheds in north central and northeast Minnesota, but in line with the agriculturally rich watersheds found in the remainder of the state.

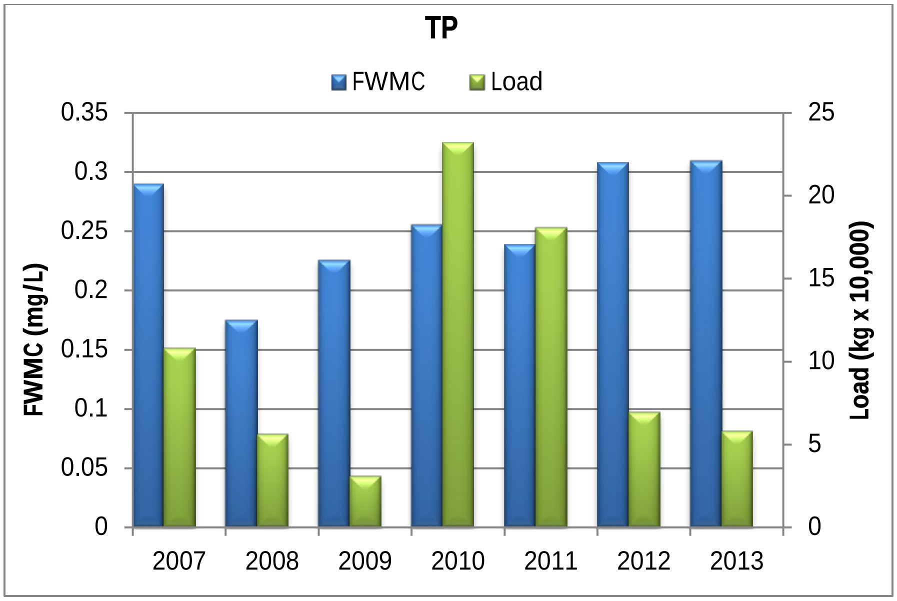


Figure 44. TP flow weighted mean concentrations for the Watonwan River near Garden City.

Similar to TSS, NO_3+ NO_2-N, and flow, Figure 45 illustrates the majority of the average annual TP load (71%) passes through the system beginning in March and running through the end of June. Notably, 32% of the average annual load is carried through the system during the month of March alone, a month largely dominated by snowmelt runoff.

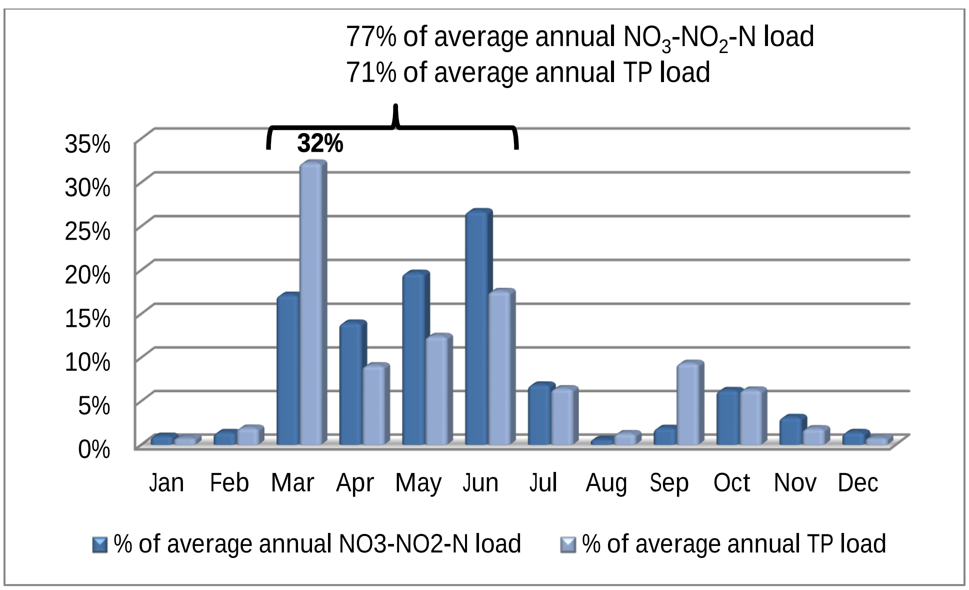


Figure 45. Monthly percentages of the average annual NO_3-NO_2-N and TP loads for the Watonwan River Near Garden City, 2007-2013

Dissolved orthophosphate

DOP is a water soluble form of phosphorus that is readily available to algae (bioavailable) (MPCA and MSUM 2009). While orthophosphates occur naturally in the environment, river and stream concentrations may become elevated with additional inputs from waste water treatment plants, noncompliant septic systems, and fertilizers in urban and agricultural runoff.

Due to soil frost and snow packed ditches, melt water can be trapped on the landscape for days or weeks at a time allowing for desorption of phosphorus from agricultural soils and plant residue resulting in elevated dissolved orthophosphate concentrations. During years with sudden spring thaws, surface soils can also be eroded when surface frost lets go, allowing the transport of sediment bound phosphorus to receiving streams. Further analysis of 322 water quality samples show the month of March to have a very high mean TP concentration at 0.416 mg/L (Table 62), 71% in the form of dissolved orthophosphate. The average TP concentration for the other eleven months of the year is less than half the March average at 0.188 mg/L, 43% in the form of dissolved orthophosphate. Orthophosphate is a form of phosphorus directly available for biological uptake.

Table 62. Mean TP and DOP concentrations during March and the remainder of the year for the Watonwan River near Garden City.

	Mean TP (mg/L)	Mean DOP (mg/L)	DOP/TP ratio
March	0.416	0.295	71%
April-Feb	0.188	0.08	43%

The table in Figure 41 shows the impact the Minnesota River in particular the Greater Blue Earth Watershed has on the average phosphorus load measured at LD#3. Proportionally, the Minnesota River's impact on the Mississippi River with regard to phosphorus is less than both TSS and NO_3+ NO_2-N but still significant at an equivalent of 56% of the LD#3 load. Within the Minnesota River Basin, the Watonwan, Blue Earth and Le Sueur rivers alone accounted for a combined equivalent of 23% of the LD#3 TP load. The 1985-2015 TP load duration curve of data from the Watonwan River near Garden City (Figure 46) shows daily load exceedances occur under all flow conditions but violations are most frequent under "moist" to "high flow" conditions.

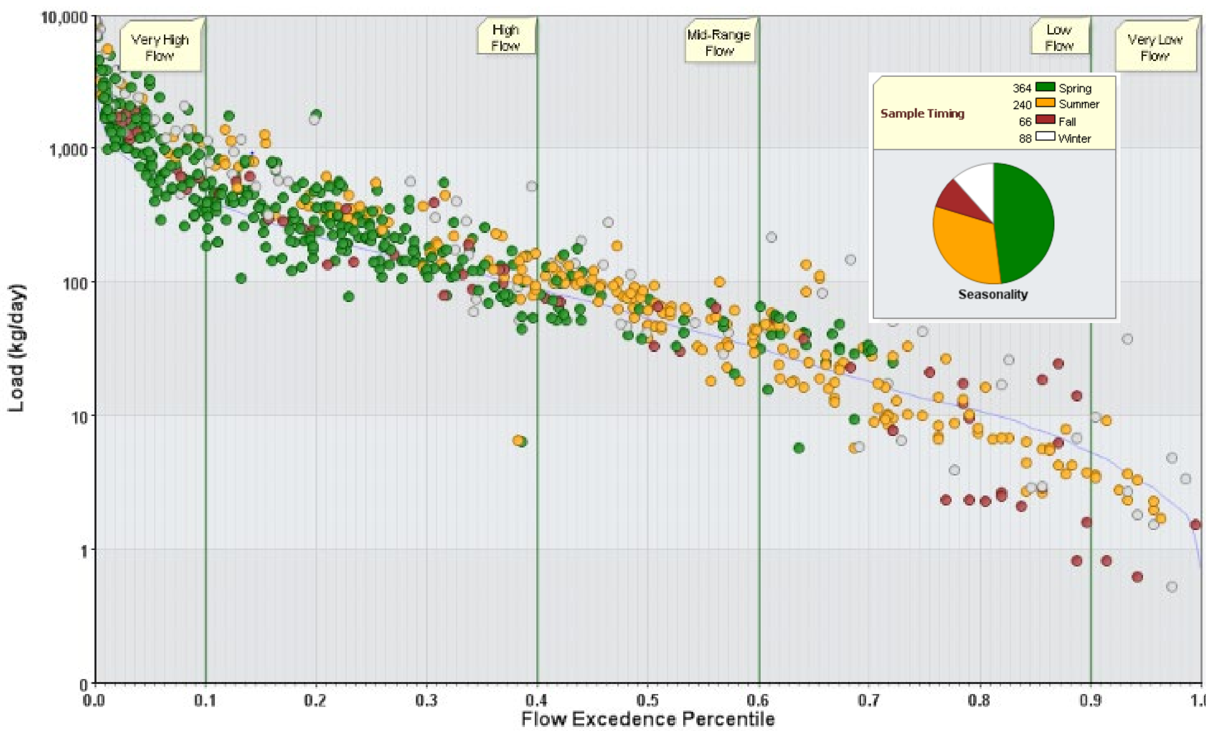


Figure 46. TP load duration curve for the Watonwan River near Garden City, 1985-2015.

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, they too, like phosphorus, can stimulate excessive levels of some algae species in streams (MPCA, 2013). Because nitrate and nitrite-nitrogen are water soluble, transport to surface waters is enhanced through agricultural drainage. The ability of nitrite-N to be readily converted to nitrate-nitrogen is the basis for the combined laboratory analysis of nitrate plus nitrite-nitrogen, 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. Environmentally, studies have shown that the elevated nitrate-nitrogen levels in the Minnesota River Basin contribute to hypoxia (low levels of dissolved oxygen) in the Gulf of Mexico. This occurs by nitrate-nitrogen stimulating the growth of algae which, through death and biological decomposition, consume large amounts of dissolved oxygen and thereby threaten aquatic life (MPCA and MSUM, 2009).

Nitrate-N can also be a common toxicant to aquatic organisms in Minnesota's surface waters with invertebrates appearing to be the most sensitive to nitrate toxicity. Draft nitrate-N standards have been proposed for the protection of aquatic life in lakes and streams. A draft acute value (maximum standard) for all Class 2 surface waters is 41 mg/L nitrate-N for a 1-day duration, and the draft chronic value for Class 2B (warm water) surface waters is 4.9 mg/L nitrate-N for a 4-day duration. In addition, a draft chronic value of 3.1 mg/L nitrate- N (4-day duration) was determined for protection of Class 2A (cold water) surface waters (MPCA, 2010).

Infants less than six months old who drink water with high levels of nitrate can become critically ill and develop methemoglobinemia, which is also known as "Blue Baby Syndrome". As such, the Minnesota Department of Health (MDH) has set a standard of 10 mg/L for nitrate in drinking water. For means of this discussion, data comparisons will be limited to MDH Drinking Water Standard.

From a statewide perspective, Figure 39 shows the average annual NO_3+NO_2-N FWMCs to be highest in the southern part of the state. These FWMCs are several times higher than watersheds north of the twin cities metropolitan area. Watersheds characterized as having low or medium levels of nitrate generally have more land in forest or grasses, more in wetlands, more in small grains, and less land in row crops and tile drainage (MPCA 2013-2).

Figure 47 shows the NO_3+ NO_2-N FWMCs over the seven year period for the Watonwan River near Garden City. Flow weighted mean concentrations for the site ranged from 5.3 to 11 mg/L over the monitoring period with a seven-year average of 8.3 mg/L. Of the 343 individual samples collected between 2007 and 2013, 27% exceeded the nitrate drinking water standard of 10 mg/L.

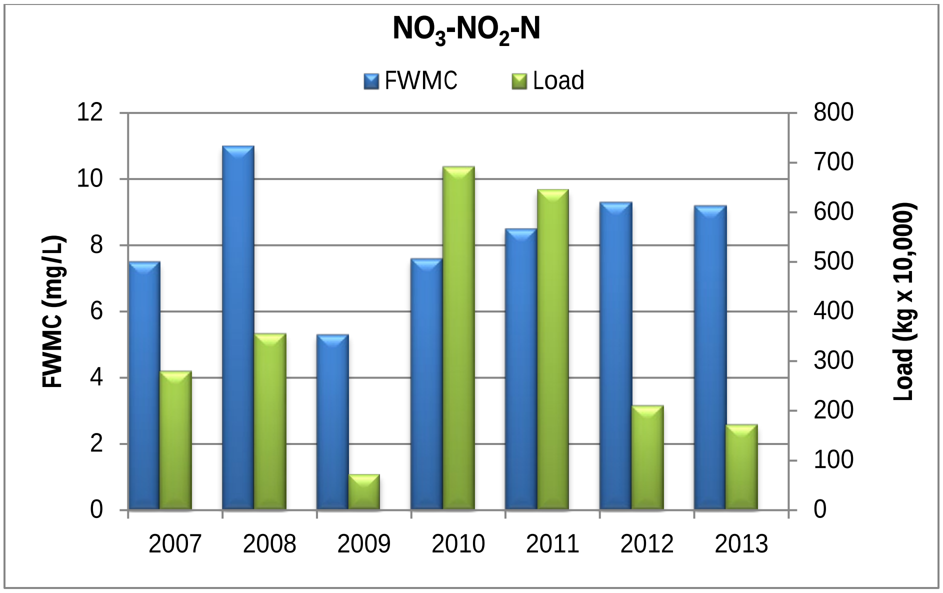


Figure 47. NO_3+NO_2-N Flow Weighted Mean Concentrations and Loads for the Watonwan River near Garden City, Minnesota.

Seasonal NO_3+ NO_2-N load dynamics for the Watonwan River are similar to TSS, TP and runoff with 77% of the load (Figure 45) passing through the system beginning in March and running through the end of June when vegetative canopy is lacking or in the early stages of development and transpiration rates are low.

Figure 22 and Figure 47 shows the influence annual runoff volume has on annual NO_3+ NO_2-N loads. For example, the combined load associated with the years of the two highest runoff volumes, 2010 and 2011, is shown to be 125% of the combined load from the other five years of the monitoring period.

The table within Figure 41 shows the significance the Minnesota River has on the Mississippi River with regard to NO_3+ NO_2-N loads. Average inputs from the Minnesota River are the equivalent of 74% of the load measured at Mississippi River Lock and Dam #3, with the Watonwan River's average load equivalent to 7% of this value.

A review of the NO_3+ NO_2-N load duration curve of the 10 mg/L drinking water standard (Figure 48) shows most exceedances of the standard occur under "moist" to "high flow" conditions for the Watonwan River.

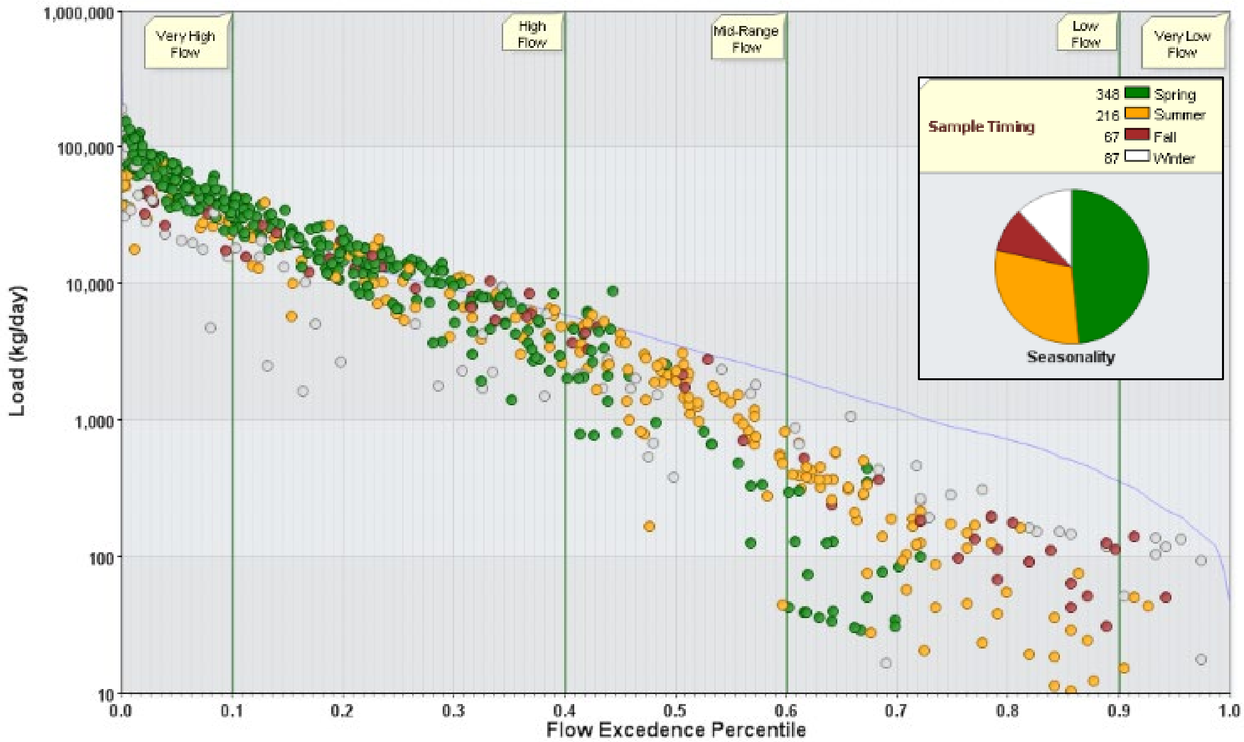


Figure 48. NO_3+ NO_2-N load duration curve for the Watonwan River near Garden City, Minnesota.

Stream water quality

A summary of stream AUID counts and their determined support statuses for AQL and AQR uses, per individual subwatershed, is provided in Table 63 below. At the 8-digit HUC scale, 39 of the 72 established stream AUIDs in the watershed were assessed for AQL use, AQR use or both. For AUIDs where data are insufficient or inconclusive, the resulting support status of IF is assigned.

Only five AUIDs fully support AQL use; one of those five AUIDs also fully supports AQR use. All five of these AUIDs are modified use streams, and are held to a lower standard of aquatic life integrity. A total of 30 AUIDs have impaired fish or macroinvertebrate (or both) communities and do not support AQL use. Four other AUIDs assessed for AQL uses have insufficient data do determine a support status. Thirteen AUIDs do not support AQR use do to elevated bacteria levels and may pose a risk to human health. Two limited resource value water (LRVW) AUIDs do not support the limited use they are intended for, due to very high bacteria levels.

New data available for comparison against previously listed chemistry impairments either still support those listings, or are insufficient to determine if the listing should be changed. As such, there are no AUIDs that will undergo a list correction or delisting of chemistry related impairments from previous reporting cycles.

Table 63. Assessment summary for stream water quality in the Watonwan River Watershed.

				Supporting		Non-supporting		
Watershed	Area (acres)	# Total AUIDs	# Assessed AUIDs	# Aquatic Life	# Aquatic Recreation	# Aquatic Life	# Aquatic Recreation	Insufficient Data
HUC-8 07020010	558,964	72	39	5	1	30	13	2
0702001001-01	77,862	11	4	1	--	3	1	--
0702001002-01	48,499	5	4	--	--	4	1	--
0702001003-01	39,430	9	4	1	--	1	1	2
0702001003-02	39,936	2	2	--	--	2	1	--
0702001004-01	76,883	10	5	1	--	4	1	--
0702001004-02	26,963	4	2	--	--	2	1	--
0702001004-03	33,421	4	3	--	--	3	1	--
0702001005-01	70,010	9	6	1	--	5	1	--
0702001005-02	25,792	5	1	--	--	1	1	--
0702001006-01	86,963	9	6	--	--	5	4	--
0702001006-02	33,178	4	2	1	1	--	--	--

Lake water quality

A summary of lake counts and determined support statuses for AQL (where available data exist) and AQR uses, per individual subwatershed is provided in Table 64 below. At the 8-digit HUC scale, 10 of the 51 waterbodies that meet the definition of a lake or reservoir were assessed for AQL use, AQR use or both. For lakes where data are insufficient or non-existent, a support status of either IF or NA is assigned and additional data is needed before a conclusion can be reached.

Aquatic life bioassessments were conducted by the MNDNR on six lakes. Only one lake (St. James Lake, 83-0043-00) fully supports aquatic life use. The other five lakes do not support AQL use mostly due to poorly performing fish communities and an abundance of disturbance-tolerant species. Occasionally the plant communities in these five lakes were above an impairment threshold, but more often than not they also showed signs of stress. Poor water quality is a likely influence on the aquatic life communities.

Eutrophication is an expected phenomenon throughout the watershed due to the dominance of row crop agriculture land use practices. Excessive nutrients observed in surface water are a commonplace occurrence in areas statewide where agriculture dominates the landscape. Ten lakes in this watershed had at least some quantity of data related to AQR use.

Four lakes have newly identified, or previously listed, impairments to AQR use due to excessive nutrients and eutrophication. All four lakes are shallow, and have TP concentrations in excess of the WCBP ecoregion standard. These lakes are good candidates for restoration activities to lessen the amount of nutrients reaching the lake from the surrounding landscape. In-lake recycling of nutrients will remain problematic until sources of excess nutrients are addressed and mitigated.

Only two lakes (St. James Lake; and Fish Lake, 32-0018-03) fully support AQR use. Both of these lakes are in an excellent position to implement protection strategies to prevent them from falling into an impaired state. Past protection and restoration activities on these two lakes should be continued and/or expanded to promote the continued support of AQR uses.

Table 64. Assessment summary for lake water chemistry in the Watonwan River Watershed.

			Supporting		Non-supporting		
Watershed	**Area (acres)**	**Lakes >10 Acres**	**# Aquatic Life**	**# Aquatic Recreation**	**# Aquatic Life**	**# Aquatic Recreation**	**Insufficient Data**
HUC 8 07020010	**558,964**	**37**	**1**	**2**	**5**	**4**	**4**
070200101-01	**77,862**	**9**	--	--	**1**	**1**	**1**
070200103-01	**39,430**	**7**	**1**	**1**	--	**2**	--
070200104-01	**76,883**	**6**	--	--	**1**	--	**1**
070200104-02	**26,963**	**2**	--	**1**	**1**	--	--
070200104-03	**33,421**	**7**	--	--	**1**	**1**	--
070200106-01	**86,963**	**5**	--	--	--	--	**1**
070200106-02	**33,178**	**1**	--	--	**1**	--	**1**

Remote satellite transparency sensing

Remote satellite sensing data are used to describe the estimated transparency of lakes where water chemistry data are insufficient to assess for AQR use. Satellite data are temporally paired with available Secchi transparency data to form a relationship that allows for predictive analysis of lakes with no Secchi data. Plausible limits to this approach include: cloud cover; transparency limited by lake depth; and overall lake water color. Satellite pass-over occurs roughly on a five-year average. Seven years of data are available from 1975 to 2008. These data do not allow for long term trend analysis at this time, due to the very limited number of data points.

Remote sensing data were used to estimate lake transparency on 21 lakes in the Watonwan River Watershed that have insufficient Secchi data (Figure 49). Five lakes are estimated to meet the WCBP eutrophication standard for shallow lake transparency (*i.e.* greater than 0.7 meters). Sixteen lakes are estimated to exceed the WCBP standard (*i.e.* less than 0.7 meters). Lakes that are estimated to exceed the WCBP standard may warrant further monitoring work to determine actual water quality conditions. Lakes that are estimated to meet the standard should be considered for protection strategies to prevent them from falling below the standard. Overall, the estimated transparencies agree with the expected results for a watershed full of shallow lakes, and dominated by agricultural practices.

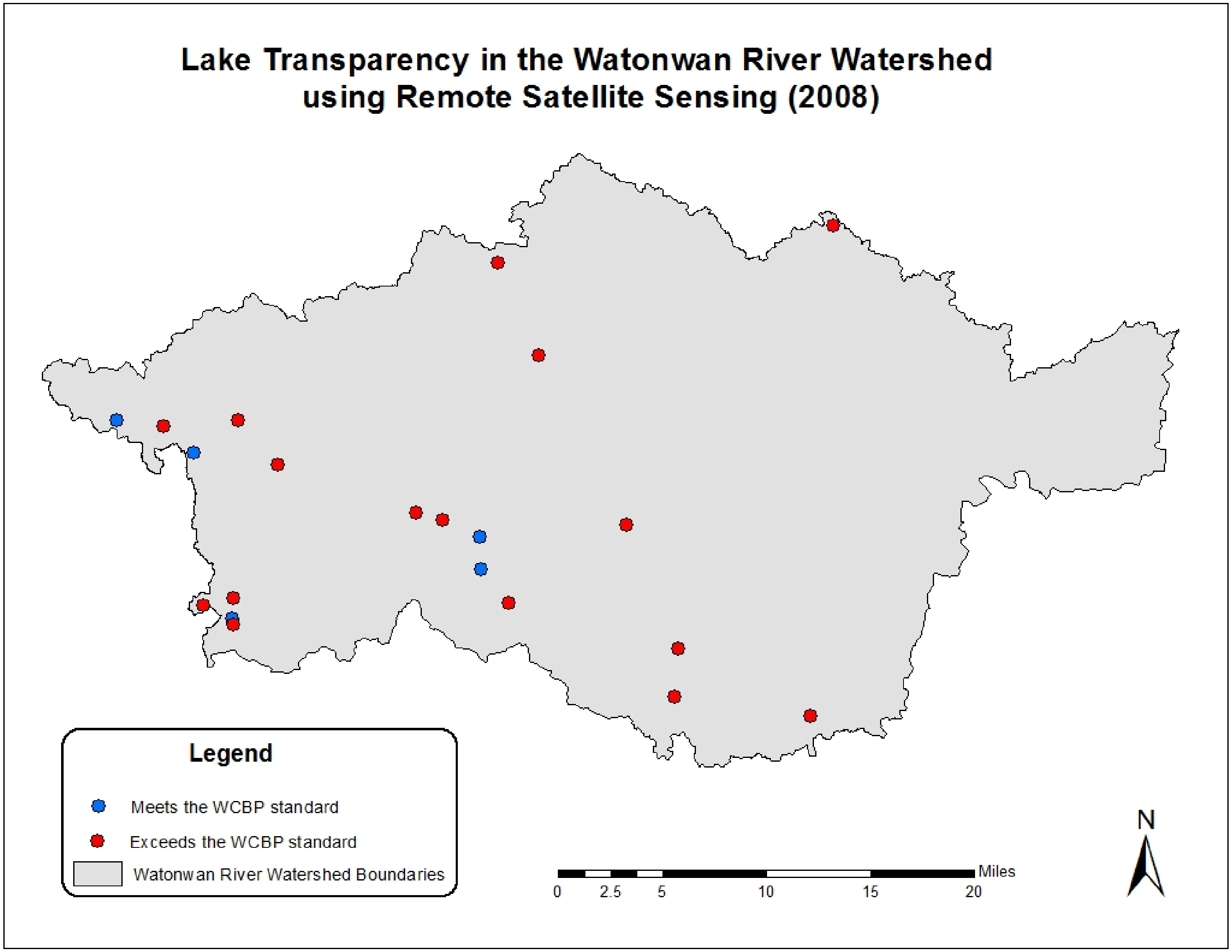


Figure 49. Estimated lake transparency using (2008) remote satellite sensing data.

Fish contaminant results

Mercury was analyzed in fish tissue samples collected from five Watonwan River Watershed lakes. Polychlorinated biphenyls (PCBs) were measured in fish from Wood, Mountain, and Hanska lakes, as well as from the Watonwan River. Eight fish species were tested for contaminants. Fish species are identified by codes that are defined by their common and scientific names (Table 65). A total of 442 fish were collected for contaminant analysis between 1988 and 2014.

Contaminant concentrations are summarized by waterway, fish species, and year (Table 66). "Total Fish" indicates the total number of fish analyzed and "N" indicates the number of samples. The number of fish exceeds the number of samples when fish are combined into a composite sample. This was typically done for panfish, such as bluegill sunfish (BGS) and yellow perch (YP). "Anat." refers to the sample anatomy. Since 1989, most of the samples have been skin-on fillets (FILSK) or for fish without scales (catfish and bullheads), skin-off fillets (FILET). Occasionally whole fish (WHORG) are analyzed.

Of the five lakes tested for fish contaminants within the Watonwan River Watershed, only Mountain Lake is listed as impaired for mercury in fish tissue and none are impaired for PCBs in fish (MPCA's 2014 draft Impaired Waters List). The impaired waters are identified in Table 66 with a red asterisk (*). Four of the impaired lakes are covered under the Statewide Mercury TMDL and do not need additional TMDLs for mercury in fish tissue.

PCBs are not a concern for the tested waters. All PCB concentrations in fish tissue were near or below the reporting limit (0.01 - 0.05 mg/kg).

Overall, mercury remains the dominant fish contaminant in the watershed. The Fish Contaminant Monitoring Program will continue to retest the fish from impaired waters to assess if mercury levels are changing.

Table 65. Fish species codes, common names, and scientific names

SPECIES	COMMON NAME	*SCIENTIFIC NAME*
BGS	Bluegill sunfish	*Lepomis macrochirus*
BKB	Black bullhead	*Ameiurus melas*
BKS	Black crappie	*Pomoxis nigromaculatis*
C	Carp	*Cyprinus carpio*
CHC	Channel catfish	*Ictalurus punctatus*
NP	Northern pike	*Esox lucius*
WE	Walleye	*Sander vitreus*
YP	Yellow perch	*Perca flavescens*

Table 66. Summary statistics of fish length, mercury, and PCBs, by waterway-species-year

Waterway	HUC8	AUID	Waterway	Species	Year	Anat.	Total Fish	N	Length (in) Mean	Min	Max	Mercury (mg/kg) Mean	Min	Max	PCBs (mg/kg) N	Mean	Max	< RL
Watonwan R.	07020010	07020010-501	RIVER	C	2013	FILSK	5	5	19.3	18.1	20.5	0.171	0.126	0.207	2	0.026	0.027	
				CHC	2013	FILET	5	5	17.8	13.8	23.7	0.105	0.074	0.148	3	0.025	0.025	
				WE	2013	FILSK	2	2	17.2	16.9	17.4	0.411	0.351	0.471				
		08002600	HANSKA	BGS	1993	FILSK	10	1	7.3	7.3	7.3	0.098	0.098	0.098				
					2011	FILSK	10	2	7.7	7.4	7.9	0.033	0.032	0.034				
				C	1993	FILSK	17	3	17.9	14.2	21.7	0.042	0.037	0.045	1	0.01	0.01	Y
					2011	FILSK	5	1	18.5	18.5	18.5	0.021	0.021	0.021				
				CHC	2011	FILET	8	8	19.3	16.0	23.4	0.026	0.010	0.043	2	0.025	0.025	Y
				WE	1993	FILSK	11	2	15.9	12.3	19.5	0.150	0.100	0.200	1	0.01	0.01	Y
		17000300	MOUNTAIN*	BGS	1990	FILSK	10	1	6.1	6.1	6.1	0.099	0.099	0.099	1	0.01	0.01	Y
					2014	FILSK	10	1	6.6	6.6	6.6	0.039	0.039	0.039				
				BKB	1990	FILET	10	1	8.7	8.7	8.7	0.031	0.031	0.031	1	0.01	0.01	Y
				C	2014	FILSK	3	1	18.2	18.2	18.2	0.015	0.015	0.015				
				NP	1990	FILSK	17	5	21.9	13.3	30.7	0.194	0.150	0.290	5	0.01	0.01	Y
				WE	1990	FILSK	4	2	14.9	13.3	16.5	0.195	0.170	0.220	2	0.01	0.01	Y
					2014	FILSK	4	4	15.6	11.8	19.5	0.101	0.073	0.161				
		32001800	FISH	BKB	2011	FILET	5	1	9.3	9.3	9.3	0.024	0.024	0.024				
				BKS	2011	FILSK	8	2	8.5	7.9	9.0	0.023	0.022	0.024				
				C	2011	FILSK	5	1	17.5	17.5	17.5	0.026	0.026	0.026				
				CHC	2006	FILET	5	5	13.3	12.3	14.8	0.079	0.061	0.092				
				WE	1998	FILSK	23	23	18.8	10.8	27.3	0.142	0.010	0.430				
					2002	FILSK	14	14	16.8	11.1	26.5	0.096	0.027	0.341				
					2006	FILSK	3	3	12.8	12.3	13.1	0.129	0.114	0.137				
					2011	FILSK	8	8	18.5	16.8	21.3	0.134	0.095	0.240				
				YP	1998	FILSK	10	1	7.8	7.8	7.8	0.050	0.050	0.050				
		83004300	ST. JAMES	BGS	2009	FILSK	10	2	6.3	6.3	6.3	0.089	0.089	0.089				
				NP	2013	FILSK	13	13	19.4	17.6	21.1	0.264	0.197	0.337				
		83006000	WOOD	BGS	1990	FILSK	10	1	7.0	7.0	7.0	0.091	0.091	0.091	1	0.01	0.01	Y
				BKB	1988	FILET	8	1	10.5	10.5	10.5	0.090	0.090	0.090	1	0.01	0.01	Y
					1990	FILET	8	1	10.5	10.5	10.5	0.091	0.091	0.091	1	0.01	0.01	Y
				BKS	1990	FILSK	10	1	8.6	8.6	8.6	0.058	0.058	0.058	1	0.01	0.01	Y
				WE	1990	FILSK	8	1	10.6	10.6	10.6	0.051	0.051	0.051	1	0.01	0.01	Y

*** Impaired for mercury in fish tissue as of 2014 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 Species codes are defined in Table FC1
2 Anatomy codes: FILSK – edible fillet, skin-on; FILET—edible fillet, skin-off; PLUG—dorsal muscle piece, without skin; WHORG—whole organism

Groundwater monitoring

There are no current MPCA Ambient Groundwater monitoring sites within the Watonwan Watershed. From 1992 to 1996, the MPCA conducted a statewide baseline water quality study of Minnesota's principal aquifers based on dividing Minnesota into six hydrogeologic regions: Northwest, northeast, southwest, southeast, north central and Twin Cities Metropolitan Regions.

The regional assessment of southwest Minnesota, including the area around the Watonwan Watershed, concluded the deeper aquifers produced water with high mineral content making it difficult to use as drinking water and the more productive surficial aquifers are very susceptible to nitrate contamination (MPCA, 1998).

The Minnesota Department of Agriculture (MDA) monitors pesticides and nitrate on an annual basis in groundwater across agricultural areas in the state. The MDA also separates the state into regions, which consist of ten regional water quality monitoring networks that are referred to as Pesticide Monitoring Regions (PMRs). The Watonwan River Watershed lies within the regional water quality monitoring networks Region 8 (PMR 8), referred to as the South Central Region. For PMR 8, nitrate-nitrogen was detected in 67% of samples with a median of 1.00 mg/L, 22% were at or below background level of 3.00 mg/L, 14% were within 3.01 and 10.00 mg/L, and 25% were above drinking water standard of 10.00 mg/L (MDA, 2015).

Another source of information on groundwater quality comes from the MDA. Mandatory testing for arsenic, a naturally occurring but potentially harmful contaminant for humans, of all newly constructed wells statewide 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, 2015) 68% of the wells tested in Watonwan County – which covers much of the Watonwan River Watershed – had arsenic concentrations over two micrograms per liter (ug/L) and 13% of wells had arsenic concentrations above the Maximum Contaminant Level (MCL) of 10 ug/L. The median concentration of arsenic in the wells tested was 3.4 ug/L.

Groundwater quantity

Monitoring wells from the MNDNR 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. To access the MNDNR Observation Well Network, please visit http://www.dnr.state.mn.us/waters/cgm/index.html.

There are two MNDNR observation wells within the Watonwan River Watershed. Well 8011 (MDH Unique Number 623068) is on the northern border of the watershed and well number 83016 (MDH Unique Number 623097) is located in the center of the watershed. Neither of these wells shows a statistically significant change in water level over the past 10 years.

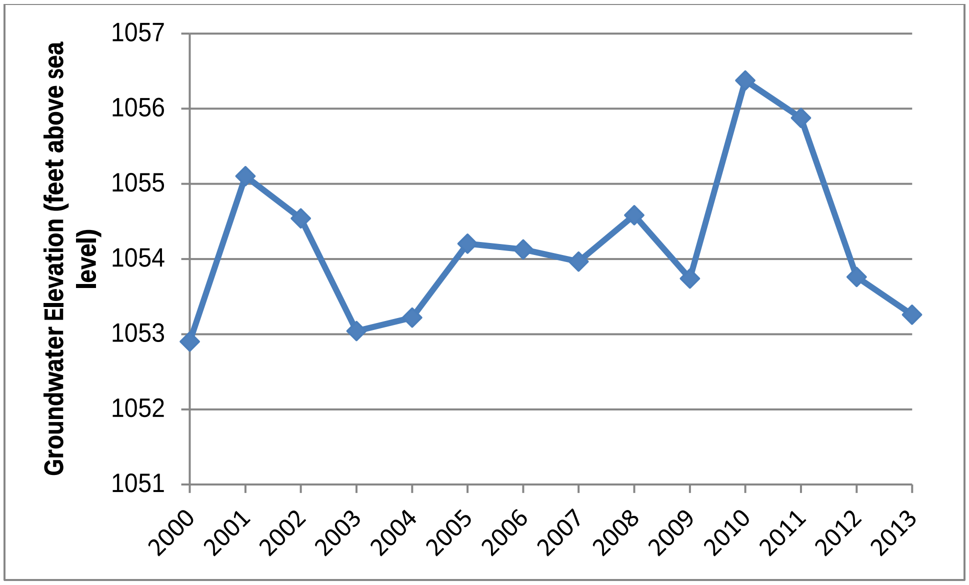


Figure 50. Average annual groundwater elevations, MNDNR Well #8011 near Comfrey, Minnesota (2000-2013).

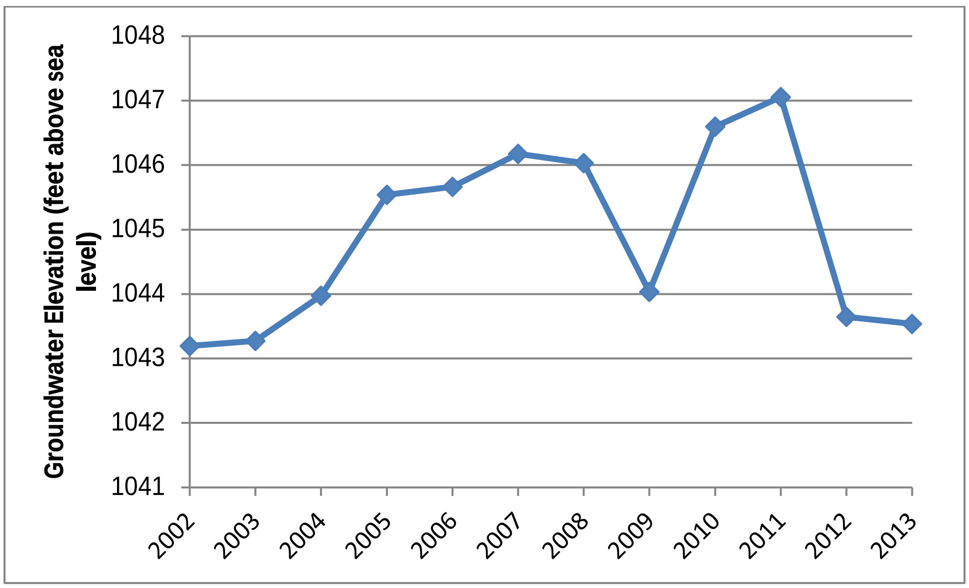


Figure 51. Average annual groundwater elevations, MNDNR Well #83016 near St. James, Minnesota (2002-2013).

Stream flow

Figure 52 and Figure 53 display mean flows in the Watonwan River near Garden City from 1993-2013. Both graphs produce decreasing linear trend lines, but vary in significance – mean annual discharge has not decreased at a statistically significant rate but mean summer flows have decreased significantly over that time period (July at $p=0.10$ and August at $p=0.01$). By way of comparison, summer month flows have declined at a statistically significant rate at a majority of streams selected randomly for a study of statewide trends.

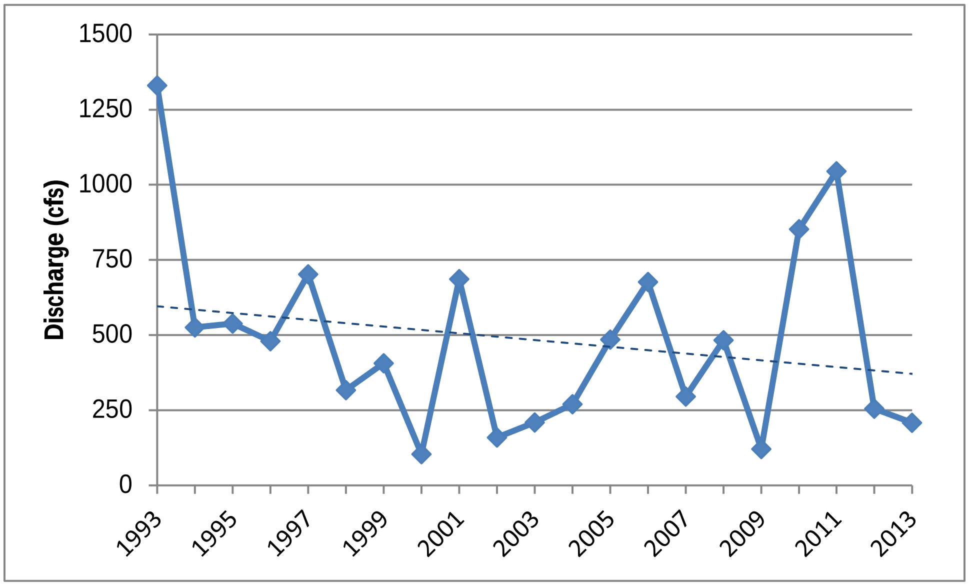


Figure 52. Mean annual discharge, Watonwan River near Garden City (1993-2013).

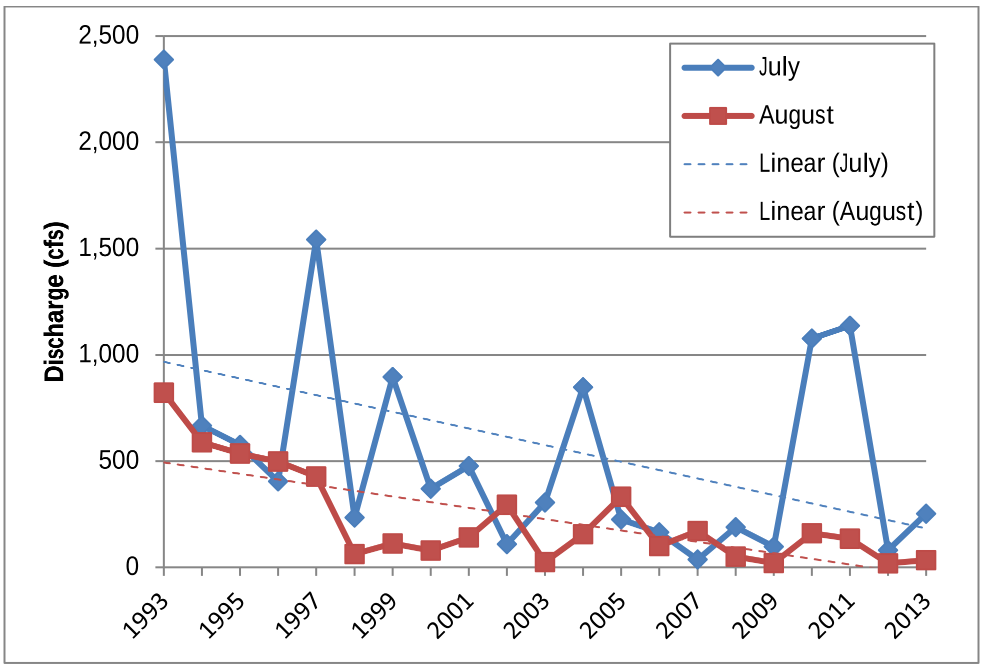


Figure 53. Mean monthly discharge for July and August, Watonwan River near Garden City (1993-2013).

Wetland condition

The MPCA began biological monitoring of wetlands in the early 1990s, focusing on wetlands with emergent vegetation (i.e., marshes) in a depressional geomorphic setting. This work resulted in the development of plant and macroinvertebrate (aquatic bugs, snails, leeches, and crustaceans) IBIs for evaluating the ecological condition or health of this type of wetland habitat. Both IBIs are on a 0 to 100 scale with higher scores indicating better condition. Today, these indicators are used to survey wetland condition where results can be summarized regionally for Minnesota's ecoregions (Genet 2012). One hundred percent of the Watonwan watershed occurs in the Temperate Prairies Ecoregion. Wetland condition in the Temperate Prairies Ecoregion is among the worst in the state. Invertebrate index results found 47% of depressional wetlands are in poor condition while 33% of these marsh-type wetlands are in good condition (Genet 2012). Plant index results show 17% of the depressional wetlands are estimated to be in good condition and 54% in poor condition. Invasive plants, particularly narrow-leaf (*Typha angustifolia*) and hybrid cattails (*Typha* X *glauca*) and also reed canary grass (*Phalaris arundinacea*) are believed to contribute to the difference between invertebrate and plant results as their ubiquity in this region of the state is likely more detrimental to plant communities. These invasive plants readily often dominate wetland habitats outcompeting native species (Genet 2012). Their invasiveness is aided by their tolerance of nutrient enrichment, hydrologic alterations and toxic pollutants such as chlorides (Galatowitsch 2012).

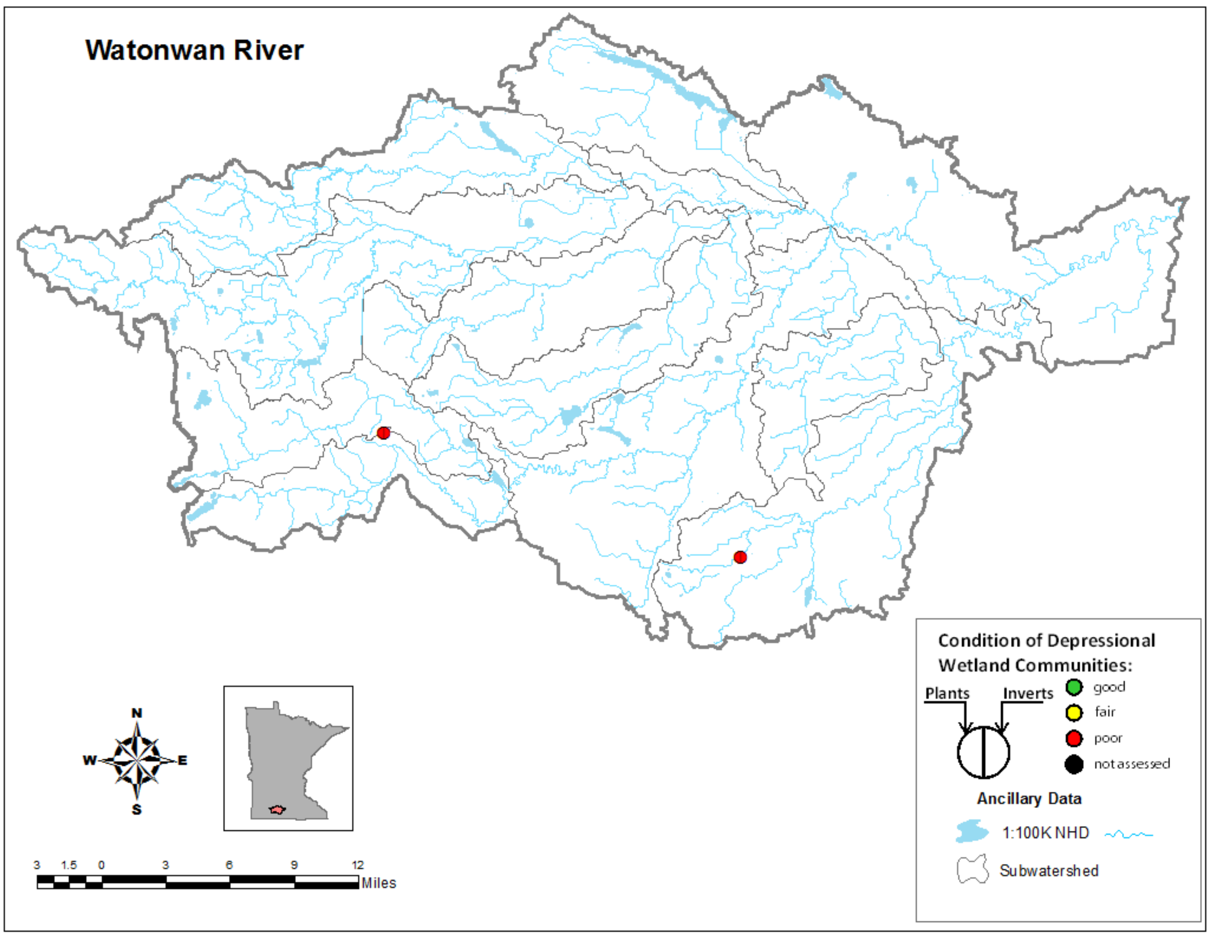


Figure 54. Depressional wetland IBI results (invertebrate and plant community indices) for the two MPCA wetland biological study sites located in the Watonwan Watershed.

MPCA ambient wetland condition data is available for two depressional wetlands in the Watonwan watershed. Invertebrate and plant condition results for these sites are presented in Figure 54. Five of these eight wetland study sites were randomly selected to estimate wetland quality in the Temperate Prairie Ecoregion. One of the wetlands surveyed was a targeted site to develop invertebrate and plant biological indicators and one of the sites was randomly selected. The invertebrate community IBI scores were 46 and 49 (0 to 100 scale with 100 being high integrity) both corresponding to 'poor' condition. Plant community scores in these two wetlands were similar, 53.9 and 31.7 respectively (0 to 100 scale with 100 being high integrity) both also corresponding to 'poor' condition. Overall no watershed pattern is evident in this small set of wetland condition study sites. Both of these wetlands were privately owned.

The first of these two wetlands was a moderate sized semi-permanent wetland connected to an unassessed altered hydrology (partially ditched) stream. It was dominated by invasive cattails and a narrow-leaved pondweed.

The second one was a moderate sized semi-permanent marsh in the upper reach of the Upper South Fork of the Watonwan river subwatershed. The plant community in this wetland was dominated by invasive cattails, two species of duckweed and coontail.

Wetland hydrogeomorphic classification

Not all wetlands provide the same functions, e.g. human benefits or services. Position in the watershed and hydrologic connectivity between the wetland and the associated stream network determines many of the functions provided by individual wetlands. Plant community types, water source, duration, frequency and magnitude of inundation or saturation and soil properties are also significant determinants of wetland function. Hydrogeomorphic (HGM) classification of wetlands characterizes the hydrologic regime and expected primary water flow paths of individual wetlands (Tiner 2011). The HGM approach is a hierarchical classification based on physical attributes including landscape (River, Stream; Lake and Inland [terrene]; major land form (Fringe, Island, Basin, Floodplain, Flat, Slope, Pond, Lake); water flow path (bi-directional, throughflow, outflow, inflow, isolated, paludified -- organic material deposition as in peatlands) and waterbody type. Several dozen possible combinations occur when the landscape, major land form, and water flow path descriptors are combined hierarchically. Thirty five unique HGM descriptor combinations ("classes") occur in the Watonwan watershed. Twenty seven of these classes each make up less than 2% of the total wetland area in this watershed and are not specified. The remaining eight HGM classes each comprising at least 2% of the Watonwan wetland area is presented in Table 67. All of the eight predominant wetland HGM classes present have discharging hydrology as either "flow through discharge" or outflows, none of the dominant HGM classes present in the Watonwan watershed have isolated hydrology. This suggests that most of the wetlands in the Watonwan watershed are connected to the watershed; river, stream and related drainage system. Historically it is likely in this relatively flat landscape that a large portion of the wetlands had more isolated hydrology that could be expected to have long retention times. Based on results presented in Table 67 the current wetland system in general is well connected to the drainage system and can be expected to have shorter retention times during high and moderate flow periods. As a result in general wetlands in the Watonwan watershed have reduced assimilative and storage capacities as once saturated they can be expected to freely discharge flow and pollutants downstream.

Table 67. Predominant (> 2.0%) simplified hydrogeomorphic (HGM) wetland functional classes present in the Watonwan watershed along with percent of the total watershed area (38,300 acres) and the number of polygons of each respective HGM class and the types of simplified plant communities present in each respective HGM class.

HGM Class Code	Wetland HGM landform description	%of Total wetland area	Number of polgons	Simplified wetland plant community classes present	HGM Class area (ac)
LELKOU	Shallow lake open water community with water flowing out via a stream or ditch and no descernable inflows	2.70	18	Aquatic bed, Unconsolidated bed	1034
LELKTH	Shallow lake open water community with inlet and outlet "flow through" hydrology	9.76	23	Aquatic bed, Unconsolidated bed	3738
LRFPTH	River floodplains with "flow through" hydrology	14.24	2968	Emergent, Forested, Shrub carr, Unconsolidated shore	5455
LSBATH	River and stream depressions (basins) with inflow and outflow "throughflow" hydrology	6.11	91	Emergent, Forested, Shrub carr	409
LSFLTH	Wetlands adjacent "fringing" to streams with inflow and outflow "throughflow" hydrology	5.05	381	Emergent, Forested, Shrub carr	1934
LSPDTH	Twenty acre or smaller open water depressions adjacent to streams with inflow and outflow "throughflow" hydrology	6.23	14	Aquatic bed, Unconsolidated bed	796
TEBAOU	Inland basins having outflow hydrology	4.68	661	Emergent, Forested, Shrub carr	1794
TEFLOU	Inland wetlands in level landscapes "flats" with outflowing hydrology	14.87	2004	Emergent, Forested, Shrub carr	5693

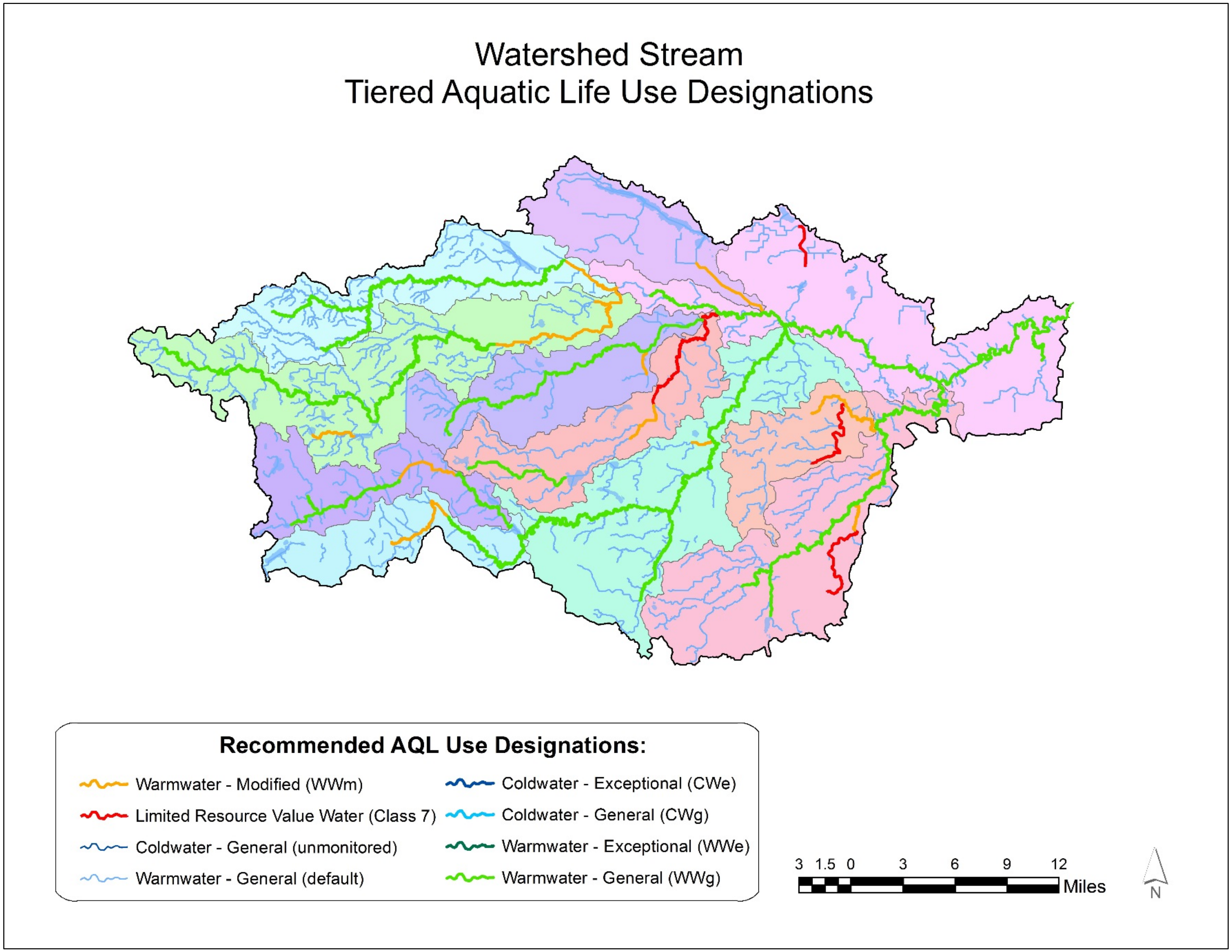


Figure 55. Stream Tiered Aquatic Life Use Designations in the Watonwan River Watershed.

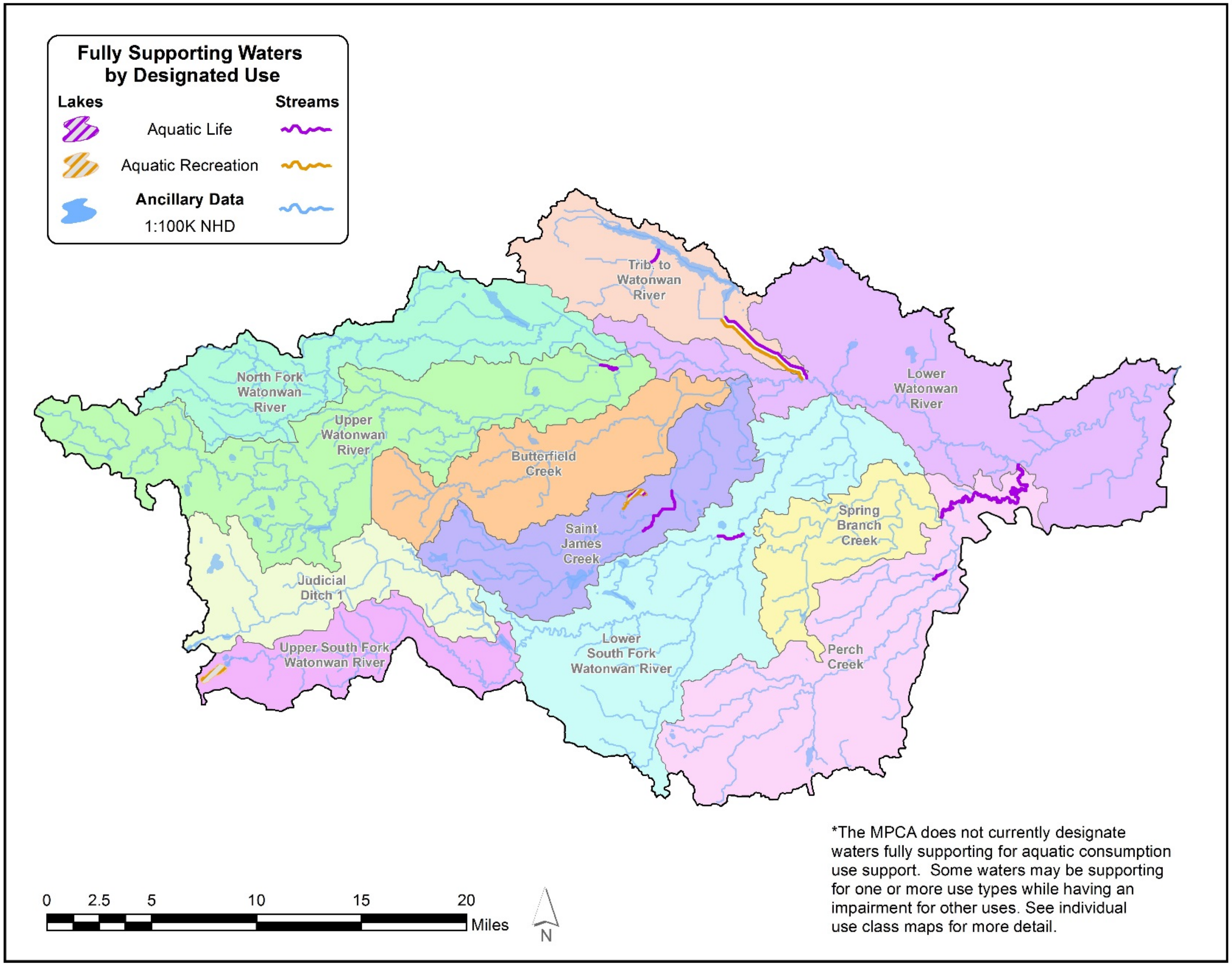


Figure 56. Fully supporting waters by designated use in the Watonwan River Watershed.

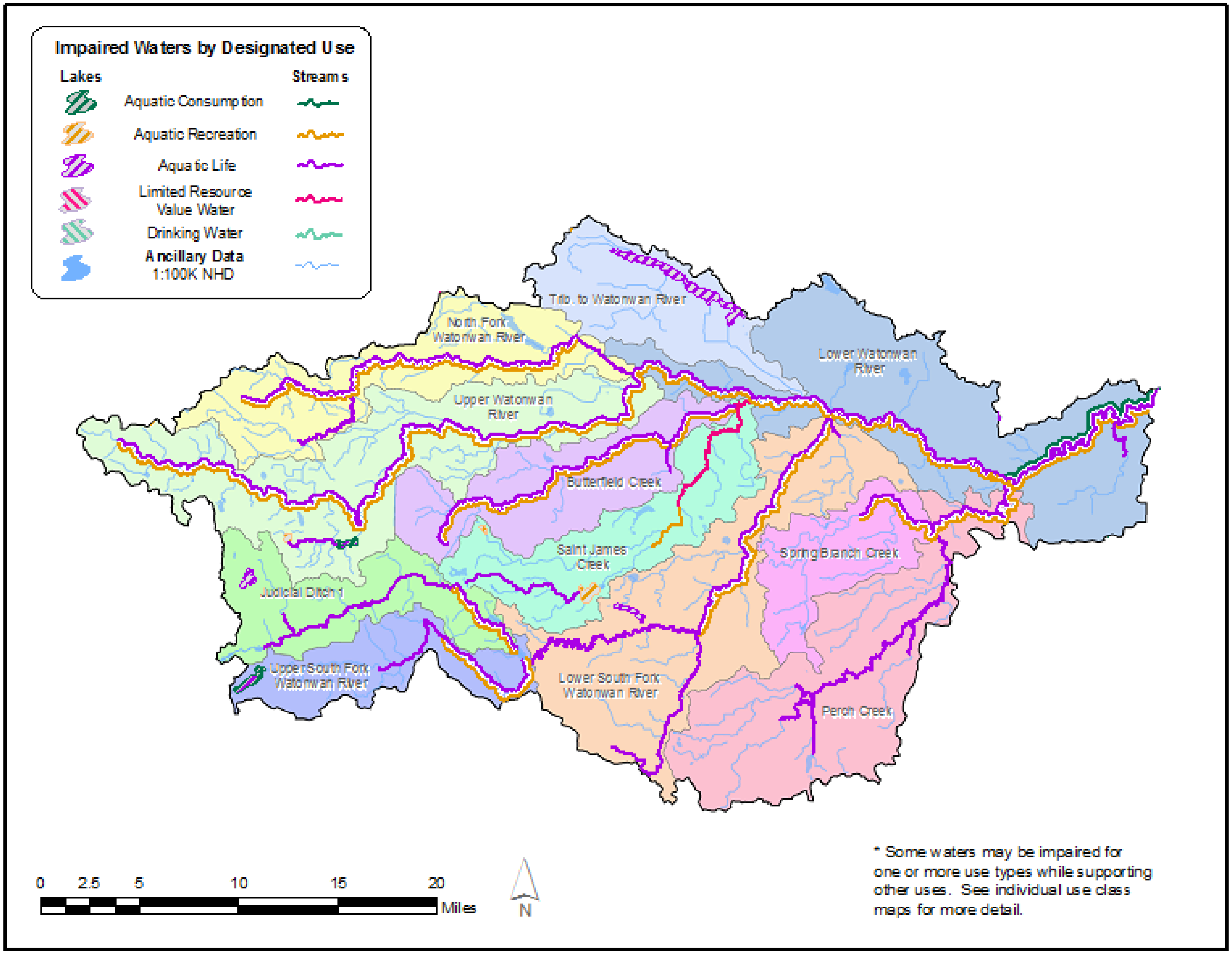


Figure 57. Impaired waters by designated use in the Watonwan River Watershed.

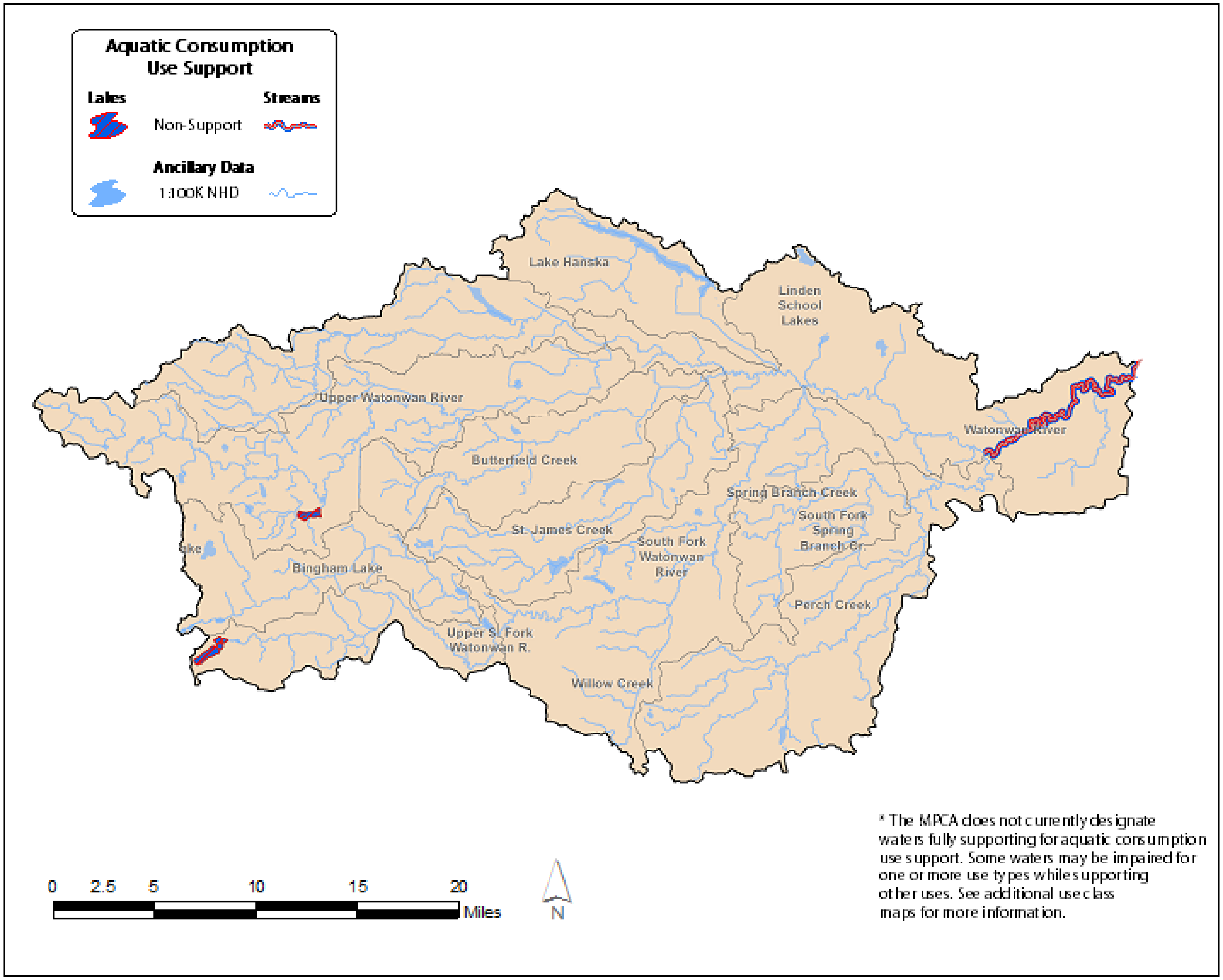


Figure 58. Aquatic consumption use support in the Watonwan River Watershed.

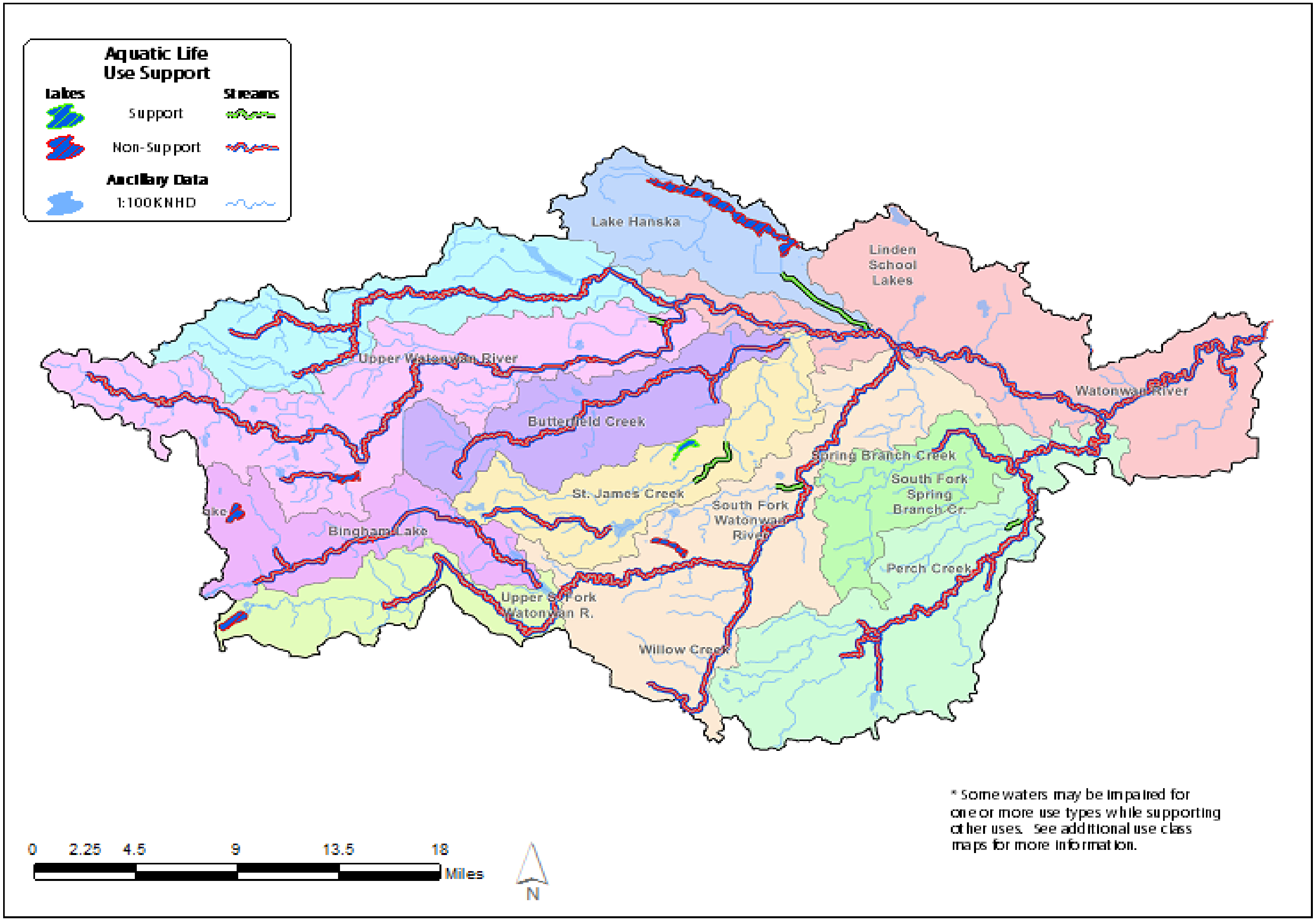


Figure 59. Aquatic life use support in the Watonwan River Watershed.

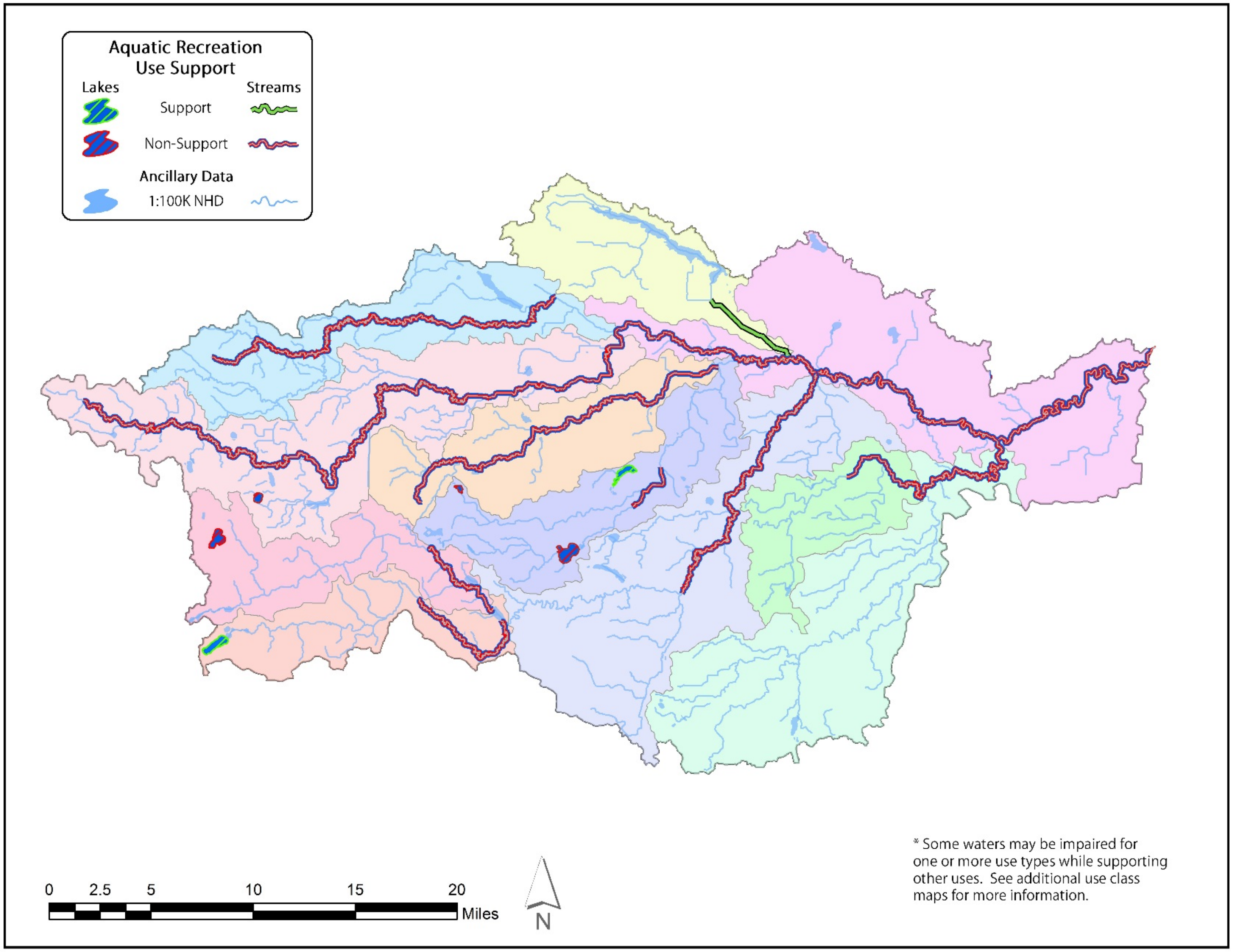


Figure 60. Aquatic recreation use support in the Watonwan River Watershed.

Pollutant trends for the Watonwan River

Water quality trends at long-term monitoring stations

Water chemistry data were analyzed for trends (Table 68) for the long term period of record (1968-2009) and near term period of record (1995-2009). An increase was seen in the concentration of chloride. There were significant decreases in total phosphorus, ammonia, and biological oxygen demand for the long term period of record and a decrease in total suspended solids from the near term period. An increase was observed for chloride in the overall trend; however, in the near term period there was insufficient data. No trends were seen in the parameters not discussed.

Table 68. Trends in the Watonwan River Watershed.

	Total Suspended Solids	Total Phosphorus	Nitrite/ Nitrate	Ammonia	Biochemical Oxygen Demand	Chloride
Watonwan River at Bridge on CSAH 13, 1mi west of Garden City (S000-163) (WA-6) (period of record 1968-2009)						
overall trend (1968–2009)	**no trend**	**decrease**	**no trend**	**decrease**	**decrease**	**increase**
average annual change		-0.5%		-1.8%	-2.3%	1.8%
total change		**-20%**		**-41%**	**-62%**	105%
recent trend (1995 – 2009)	**decrease**	**no trend**	**no trend**	**no trend**	**no trend**	little data
average annual change	-5.4%					
total change	-59%					
median concentrations first 10 years	70	0.3	2	0.07	5	28
median concentrations most recent 10 years	52	0.2	6	<0.05	2	42

Analysis was performed using the Seasonal Kendall Test for Trends. Trends shown are significant at the 90% confidence level. Percentage changes are statistical estimates based on the available data. Actual changes could be higher or lower. A designation of "no trend" means that a statistically significant trend has not been found; this may simply be the result of insufficient data.

Concentrations are median summer (Jun-Aug) values, except for chlorides, which are median year-round values. All concentrations are in mg/L.

Water clarity trends at citizen monitoring sites in 2014

Citizen volunteer monitoring was conducted at two stream sites and two lakes in the Watonwan River Watershed during the summer of 2014. Long term data at the two stream sites indicated that there are no trends in water transparency, either increasing or decreasing for either site. Long term data at the two lake sites indicated that one lake (St. James, 83-0043-00) has an increasing transparency trend somewhere between 0.05 and 1.11 feet per decade. No long term transparency trend was detected on the other lake monitored by the CLMP (Bingham, 17-0007-00).

Table 69. Water clarity trends at citizen stream monitoring sites

Watonwan River Watershed [8-HUC: 07020010]	Citizen Stream Monitoring Program	Citizen Lake Monitoring Program
number of sites w/ increasing trend	0	1
number of sites w/ decreasing trend	0	0
number of sites w/ no trend	2	1

Summaries and recommendations

Flowing from west to east for 113 miles the Watonwan River Watershed drains roughly 878 square miles of land (MNDNR 2104). The watershed begins in Cottonwood County and flows east through Watonwan County and Blue Earth County before meeting the Blue Earth River east of Garden City. Lakes and streams are assessed using both biological and water chemistry monitoring. The Watonwan River Watershed was sampled at 60 stream monitoring stations and in 15 lakes. Two years of water chemistry sampling was done at 15 of the 60 stream sites. Streams and lakes were assessed for aquatic life and aquatic recreation. In some locations there was not enough data to assess for both, and in such cases the note of insufficient data was made. Assessment Unit Identification Determinations (AUID) separate streams into assessable reaches. Located in the Watonwan Watershed are 53 AUIDs with data to be assessed for biology and/or water chemistry.

Degraded water quality and biological communities were found throughout the Watonwan River Watershed. No AUIDs passed for aquatic life general use and only five passed with modified use standards. Modified use AUIDs were determined to have degraded conditions before assessment and could not be expected to meet general use thresholds. The combined river miles of the five passing AUIDs is only about 11 miles. Of the 16 AUIDs with data assessable for aquatic recreation none passed for general use, one did pass for modified use thresholds.

Streams

Definitively the water quality in the Watonwan River Watershed is in need of attention to address the many biological, chemical and bacterial impairments identified in this paper. Of the 53 AUIDs identified in the watershed with assessable data, only five of them were above the modified use threshold for biological sampling, none passed for general use threshold. Tolerant fish account for 74% of the total number of fish collected. Tolerant species persist in degraded systems and can begin to dominate the fish community, ultimately leaving little resources for other fish. The most abundant fish captured (by total number) during surveys were sand shiner, bluntnose minnow, creek chub, spotfin shiner and white sucker. White sucker were found at 83% of the sites and creek chub at 88% of sites, both are tolerant species. These species are known to exist in streams that are chemically impaired, habitat limited, sediment laden and/or high in nitrates. Furthering conditions for tolerant species to thrive in the Watonwan River Watershed were the water chemistry results taken at the time of the fish sample. A large number of these samples were found to have very high nitrogen levels. Existing turbidity and new turbidity impairments contribute to deteriorating water quality.

Only seven sensitive fish species were found throughout the entire watershed and made up 0.007% of the total number of fish collected. The most abundant of these species was the slenderhead darter with only 111 individuals. All but one of the sites where the slenderhead darters were found was on the Watonwan River or its southern branch where higher habitat scores were recorded. The one exception was St. James Creek near the confluence with the Watonwan River. Throughout the watershed sand and silt are common substrates and only 22% of streams are natural. These characteristics can contribute to poorer conditions in the streams and lead to an abundance of tolerant species. Five current AUIDs have existing fish bioassessment impairment and will continue to be listed after this report.

A similar trend was seen with the aquatic macroinvertebrates sampled in the Watonwan River Watershed. There were four sites where the macroinvertebrates scored above the general use threshold. However, both the fish and macroinvertebrates must pass in order for the biology to pass. The same five sites that were above the modified use threshold for fish were also above the modified use for macroinvertebrates.

Macroinvertebrates also respond to habitat and water chemistry conditions and degraded systems will see a higher relative abundance and relative richness of tolerant taxa. The Watonwan River Watershed has an abundance of tolerant macroinvertebrate species and a relatively low number of intolerant ones. The most abundant taxa collected (by total number of individuals) were Physid snails, Polypedilum midges, and Cheumatopsyche, net-spinning caddisflies. The large abundance of Physid snails is a strong indicator that many of the stream in the watershed have sustained periods of low flows, accompanied by high levels of nutrients and primary productivity. Polypedilum midges are tolerant ubiquitous taxa, and are often the most common taxa found in a watershed. Cheumatopsyche caddisflies, are relatively tolerant caddisflies, that can persist through relatively low flow conditions, when other caddisfly and EPT taxa may disappear.

Existing turbidity and bacteria impairments were common throughout the watershed. None of them have been suggestion for de-listing. Turbidity has long been a problem in the watershed highlighting the persisting sediment problems. While heavy erosion was not noted at many sites, there was consistently some level of erosion noted at most sites. In time those small areas could become problems, especially during high water events. High water events can be exaggerated by the altered hydrology (ditched streams, drained wetlands and drain tiling) because it removes natural water storage and streamlines the water's path to a stream. Bacteria levels were high enough in new locations to result in ten additional AUIDs being listed for aquatic recreation.

Lakes

Lake assessments in the Watonwan River Watershed were done for aquatic life (biology) and aquatic recreation. The MNDNR conducted fish surveys on six lakes. Only one of the fifteen lakes assessed was fully supporting for aquatic life, five were not supporting. Most likely the fish community scored poorly and contained a large number of tolerant species. Plant communities would also be a contributor to a failing score. The remainder of the lakes did not have sufficient data to assess. Bingham Lake and Eagle Lake had existing impairments for aquatic recreation. Butterfield Lake and Kansas Lake were added to that impairment list. Only two of the fifteen lakes passed for aquatic recreation (Fish Lake and St. James Lake). Listings were a result of excess nutrients and eutrophication. The remainder of the lakes did not have enough information to be assessed.

Wetlands

Substantial wetland loss is seen through all the subwatersheds within the Watonwan River Watershed. The largest losses being in the Perch Creek and Spring Branch Creeks with at least 51% loss of total wetlands. Currently only about 3.65% in the land use of within the Watonwan River Watershed is defined as wetland. Two watersheds had data within the 10-year window that could be used in this paper. As was seen with the stream and lake condition, both of these wetlands were considered to be in poor condition. Scores for macroinvertebrates and plant communities were calculated. Both of these scores rated poorly between the two watersheds. The first watershed was dominated by invasive cattail species and narrow-leaved pond weed. The second watershed was dominated by invasive cattail species, duckweed and coontail. Invasive species of cattails often invade a system and eliminate native plant species competing for the same resources. They can also be an indicator of poor water quality as they are tolerant to excess nutrients and altered hydrology.

Groundwater

The primary concerns for groundwater quality within the Watonwan River Watershed are sensitivity of the surficial aquifers to nitrate contamination and naturally-occurring arsenic concentrations. Nitrates are addressed through agricultural BMPs and is assisted by the

Concerns for groundwater quantity within the watershed should be considered due to a statistically significant increase in groundwater withdrawals as well as the potential for limiting groundwater recharge through tile drainage of agricultural lands. Eighty-six percent of the land use in the Watonwan River Watershed is row crop agriculture and one quarter of those lands are flat and poorly-drained, requiring tile drainage (NRCS, 2007).

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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 waste water 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.

Specific Conductance - The amount of ionic material dissolved in water. Specific conductance is influenced by the conductivity of rainwater, evaporation and by road salt and fertilizer application.

Temperature - Water temperature in streams varies over the course of the day similar to diurnal air temperature variation. Daily maximum temperature is typically several hours after noon, and the minimum is near sunrise. Water temperature also varies by season as doe's air temperature.

Total Kjehldahl 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.

Total Suspended Volatile Solids (TSVS) - Volatile solids are solids lost during ignition (heating to 500 degrees C.) They provide an approximation of the amount of organic matter that was present in the water sample. ''Fixed solids'' is the term applied to the residue of total, suspended, or dissolved solids after heating to dryness for a specified time at a specified temperature. The weight loss on ignition is called ''volatile solids.''

Unnionized 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 Watonwan River Watershed

Biological Station ID	STORET/ EQuIS ID	Water Body Name	Location	12-digit HUC
13MN106	S002-252	Watonwan River	At Township Rd 116, 6 mi. W of St James	0702001001-01
13MN107	S007-565	Watonwan River, North Fork	At CSAH 1, 5 mi. E of Darfur	0702001002-01
13MN147	S001-078	St James Creek	At Township Rd 64, 3.5 mi. NE of St James	0702001003-01
13MN104	S007-563	St James Creek	US of CSAH 27, 0.5 mi. S of St James	0702001003-01
13MN103	S007-566	St James Creek	At Township Rd 74, 6.5 mi. NE of St James	0702001003-01
13MN105	S007-562	Butterfield Creek	At CSAH 27 (740th Ave), 2 mi SW of La Salle	0702001003-02
13MN101	S002-251	Watonwan River, South Fork	At CSAH 13, 4 mi. SW of Madelia	0702001004-01
13MN109	S007-568	Watonwan River, South Fork	At CR 9 (50th Ave), 4 mi. W of Ormsby	0702001004-02
13MN110	S007-567	Judicial Ditch 1	At CR 128 (630th Ave), 4 mi. SW of Butterfield	0702001004-03
97MN011	S007-560	Perch Creek	At CR 135 (154th St), 10 mi. SE of Madelia	0702001005-01
13MN137	S007-561	Spring Branch Creek	At CR 9 (473rd Ave), 4.5 mi. NE of Lewisville	0702001005-02
03MN068	S000-163	Watonwan River	Upstream of CR 13, 1.5 mi. W of Garden City	0702001006-01
13MN162	S000-354	Watonwan River	At CSAH 30, 3 mi SE of Madelia	0702001006-01
13MN161	S007-564	Watonwan River	At City Park off CSAH 9 in Madelia	0702001006-01
13MN145	S002-253	Watonwan River	At CSAH 16, 1 mi SE of LaSalle	0702001006-01
13MN135	S002-254	Watonwan River	Township Rd 99, 4.5 mi west of Madelia	0702001006-01
13MN102	S006-462	Unnamed ditch	At CR 3, 3.5 mi. E of La Salle	0702001006-02

Appendix 2.2 – Intensive watershed monitoring biological monitoring stations in the Watonwan River Watershed

AUID	Biological Station ID	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
07020010-501	03MN068	Watonwan River	1.5 mi .W of Garden City on CR 13	Blue Earth	0702001006-01
07020010-502	13MN147	St. James Creek	Downstream of 320th St, 3.5 mi. NE of St James	Watonwan	0702001003-01
07020010-505	91MN098	Unnamed creek	Upstream of CR 99, 2 mi W of Mountain Lake	Cottonwood	0702001001-01
07020010-510	13MN130	Watonwan River, South Fork	Downstream of CR 32 (494th Ave), 7 mi. SW of Garden City	Blue Earth	0702001003-02
07020010-510	13MN161	Watonwan River, South Fork	Upstream of CR 9, in Madelia	Blue Earth	0702001003-02
07020010-510	13MN162	Watonwan River, South Fork	Upstream of CSAH 30 (164th St) 3 mi SE of Madelia	Blue Earth	0702001003-02
07020010-511	13MN135	Watonwan River	Downstream of 783rd Ave, 4.5 mi. W of Madelia	Watonwan	0702001006-01
07020010-515	13MN103	St. James Creek	Downstream of 300th St, 6.5 mi. NE of St James	Watonwan	0702001003-01
07020010-516	13MN105	Butterfield Creek	Downstream of CSAH 27(At 740th Ave), 2 mi. SW of La Salle	Watonwan	0702001003-02
07020010-516	13MN125	Butterfield Creek	Downstream of CSAH 3, 5 mi. NW of Butterfield	Watonwan	0702001003-02
07020010-516	13MN128	Butterfield Creek	Upstream of Hwy 4 (720th Ave), 2.5 mi. N of St James	Watonwan	0702001003-02
07020010-516	13MN156	Butterfield Creek	Downstream of 350th St, 2mi NW of Butterfield	Watonwan	0702001003-02
07020010-517	13MN101	Watonwan River, South Fork	Downstream of CSAH 13, 4 mi. SW of Madelia	Watonwan	0702001004-01
07020010-517	13MN142	Watonwan River, South Fork	Upstream of CSAH 12, 5.5 mil. SE of St James	Watonwan	0702001004-01
07020010-517	90MN099	Watonwan River, South Fork	Downstream of Hwy 60 at Wayside Rest, 5 mi. E of St. James	Watonwan	0702001004-01
07020010-523	97MN011	Perch Creek	below Vernon Center, MN	Watonwan	0702001005-01
07020010-524	13MN129	Perch Creek	Downstream of 140th St, 6.5 mi. NE of Lewisville	Blue Earth	0702001005-01
07020010-524	13MN143	Perch Creek	Downstream of 840th Ave, 3.5 mi. SE of Lewisville	Blue Earth	0702001005-01
07020010-525	13MN111	Unnamed ditch	Upstream of CSAH 26, 5 mi. SE of Madelia	Watonwan	0702001005-02
07020010-526	13MN158	Unnamed creek	Upstream of Hwy 30, 4.5 mi. NE of Truman	Watonwan	0702001005-01

AUID	Biological Station ID	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
07020010-528	13MN167	St. James Creek	Upstream of CSAH 19, 3.5mi SE of Butterfield	Watonwan	0702001003-01
07020010-535	13MN168	Unnamed creek	Downstream of 840th Ave, 4 mi. NE of Truman	Martin, Watonwan	0702001005-01
07020010-540	13MN131	Spring Brook	Downstream of CSAH 13, 3 mi. SW of Madelia	Watonwan	0702001004-01
07020010-545	13MN102	Unnamed ditch	Downstream of CSAH 3, 3.5 mi. E of La Salle	Watonwan	0702001006-02
07020010-547	13MN134	Watonwan River, South Fork	Upstream of 737th Ave, 7 mi. SE of St James	Watonwan	0702001004-01
07020010-549	13MN123	Unnamed creek	Downstream of Hwy 30 (300th St), 6 mi. SW of Comfrey	Cottonwood	0702001002-01
07020010-552	13MN153	Unnamed creek	Upstream of CR 127, 1 mi. N of St James	Watonwan	0702001003-02
07020010-553	13MN121	County Ditch 1	Upstream of 755th Ave, 5 mi. SE of St James	Watonwan	0702001004-01
07020010-554	13MN126	Unnamed creek	Upstream of CR 104 (720th Ave), 1.5 mi. S of St. James	Watonwan	0702001003-01
07020010-555	13MN157	Unnamed creek	Upstream of CR 132, 5 mi. W of La Salle	Watonwan	0702001001-01
07020010-557	13MN144	Unnamed creek	Downstream of CSAH 54 (250th St), 3mi NW of Truman	Martin, Watonwan	0702001005-01
07020010-559	13MN120	County Ditch 78	Upstream of 527th Ave, 0.75 mi. S of Garden City	Blue Earth	0702001006-01
07020010-560	13MN116	Judicial Ditch 4	Upstream of 120th Ave, 4 mi. SE of Ormsby	Martin	0702001004-01
07020010-561	13MN124	Unnamed creek	Downstream of 410th St, 2 mi. SE of Bingham Lake	Cottonwood	0702001004-03
07020010-563	13MN145	Watonwan River	Downstream of CSAH 16, 1 mi SE of LaSalle	Watonwan	0702001006-01
07020010-564	13MN107	Watonwan River, North Fork	Downstream of CSAH 1, 5 mi. E of Darfur	Cottonwood	0702001002-01
07020010-564	13MN136	Watonwan River, North Fork	Upstream of CR 29 (560th Ave), 6 mi. SW of Comfrey	Cottonwood	0702001002-01
07020010-564	13MN165	Watonwan River, North Fork	Downstream of CSAH 4, 2mi N of Darfur	Cottonwood	0702001002-01
07020010-565	13MN133	Watonwan River, North Fork	Upstream of CSAH 1, 5 mi. Darfur	Cottonwood	0702001002-01
07020010-566	01MN047	Watonwan River	Downstream of CR 1, 2 mi. N of Mountain Lake	Cottonwood	0702001001-01
07020010-566	13MN115	Watonwan River	Upstream of CR 8 (600th Ave), 2.5 mi. SW of Darfur	Cottonwood	0702001001-01
07020010-566	13MN146	Watonwan River	Upstream of 570th Ave, 1 mi. NW of Mountain Lake	Cottonwood	0702001001-01

AUID	Biological Station ID	Waterbody Name	Biological Station Location	County	Aggregated 12-digit HUC
07020010-566	13MN148	Watonwan River	Downstream of 490th Ave, 1.5 mi. NE of Delft	Cottonwood	0702001001-01
07020010-567	13MN106	Watonwan River	Downstream of 710th Ave, 6 mi. W of St James	Watonwan	0702001001-01
07020010-567	13MN166	Watonwan River	Upstream of 660th Ave, 4mi SE of Darfur	Watonwan	0702001001-01
07020010-568	13MN109	Watonwan River, South Fork	Downstream of CR 9 (50th Ave), 4 mi. W of Ormsby	Martin, Watonwan	0702001004-02
07020010-569	13MN164	Watonwan River, South Fork	Downstream of CSAH 13, 5mi SE of Mountain Lake	Cottonwood, Watonwan	0702001004-02
07020010-571	13MN119	Willow Creek	Downstream of CR 101, 8 mi. SSE of St James	Watonwan	0702001004-01
07020010-571	13MN180	Willow Creek	Upstream of CSAH 8 (250th St), 8.5mi W of Truman	Martin	0702001004-01
07020010-574	13MN137	Spring Branch Creek	Downstream of CSAH 26 (350th St), 5 mi. SE of Madelia	Watonwan	0702001005-02
07020010-574	13MN139	Spring Branch Creek	Downstream of CSAH 9 (473rd Ave), 4.5 mi. NE of Lewisville	Blue Earth	0702001005-02
07020010-574	13MN150	Spring Branch Creek	Adjacent to 840th Ave, 6.5 mi. NE of Lewisville	Watonwan	0702001005-02
07020010-575	13MN127	St. James Creek	Downstream of CR 104 (720th Ave), 2 mi. S of St James	Watonwan	0702001003-01
07020010-576	13MN104	St. James Creek	Upstream of CSAH 27, 0.5 mi. S of St James	Watonwan	0702001003-01
07020010-577	13MN118	Mink Creek	Downstream of 240th St, 3 mi. W of Truman	Martin	0702001005-01
07020010-579	13MN154	Judicial Ditch 1	Upstream of CSAH 46, 3 mi. SE of Bingham lake	Cottonwood	0702001004-03
07020010-579	91MN097	Judicial Ditch 1	Downstream of CR 1, in wayside park, 2 mi. S of Mountain Lake	Cottonwood	0702001004-03
07020010-581	13MN110	Judicial Ditch 1	Upstream of CR 128 (630th Ave), 4 mi. SW of Butterfield	Watonwan	0702001004-03
07020010-583	10EM071	Unnamed creek	Downstream of CSAH 9, 6 mi. NW of Mountain Lake	Cottonwood	0702001002-01
07020010-584	13MN122	Unnamed creek	Upstream of 478th Ave, 4.5 mi. E of Lewisville	Blue Earth	0702001005-01

Appendix 3.1 - AUID table of stream assessment results (by parameter and beneficial use)

AUID DESCRIPTIONS		USES						Aquatic Life Indicators:														Aquatic Recreation Indicators:
Assessment Unit ID (AUID), Stream Reach Name, Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water	303d listed impairments 2014	Fish	Macroinvertebrates	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	AmmoniaNH3	Phosphorous	Chlorophyll A	Chlorophyll A Uncorrected	BOD	DO Flux	Pesticides	Bacteria
HUC 12 Agg: 0702001002-01 Watonwan River, North Fork																						
07020010-582, Unnamed creek, Unnamed cr to T106 R35W S2, east line	5.58	WWg																				
07020010-583, Unnamed creek, T106 R35W S1, west line to Unnamed cr	0.79	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-549, Unnamed creek, Unnamed cr to N Fk Watonwan R	6.93	WWg	NS					EXS	EXP	NA	NA	NA		NA	NA	NA						
07020010-564, Watonwan River, North Fork, Headwaters to T107 R32W S6, east line	34.89	WWg	NS	NS			Turbidity	EXS	EXS	MTS	MTS	MTS	MTS	MTS	MTS	NA						EX
07020010-565, Watonwan River, North Fork, T107 R32W S5, west line to Watonwan R	4.34	WWm	NS					EXS	MTS	NA	NA	NA		NA	NA	NA						
HUC 12 Agg: 0702001003-02 Butterfield Creek																						
07020010-516, Butterfield Creek, Headwaters to St James Cr	25.18	WWm	NS	NS				EXS	EXS	MTS	MTS	IF	MTS	MTS	MTS	MTS						EX
07020010-552, Unnamed creek, CD 4 to Butterfield Cr	1.49	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
HUC 12 Agg: 0702001003-01 St. James Creek																						
07020010-554, Unnamed creek, Unnamed cr to St James Cr	10.31	WWg								NA	NA	NA		NA	NA	NA						
07020010-528, St James Creek (Kansas Lake Inlet), Headwaters to Kansas Lk	7.88	WWg	NA				Turbidity	NA		NA	NA	NA		NA	NA	NA						
07020010-575, St James Creek, Unnamed lk (83-0037-00) to T106 R32W S26, east line	4.53	WWg								NA	NA	NA		NA	NA	NA						
07020010-576, St James Creek, T106 R32W S25, west line to T106 R31W S19, north line	3.03	WWm	FS	NS				MTS	MTS	MTS	IF	MTS	NA	MTS	MTS	EX	MTS					EX
07020010-502, St James Creek, T106 R31W S18, south line to Butterfield Cr	9.83	LRVW								MTS				MTS	MTS							EX
07020010-515, St James Creek, Butterfield Cr to Watonwan R	1.74	LRVW								MTS				MTS	MTS							EX
HUC 12 Agg: 0702001006-02 Trib to Watonwan River																						
07020010-542, Judicial Ditch 5, CD 2 to Lk Hanska	0.90	WWg	IF							IF		NA		MTS		IF	IF					
07020010-545, Unnamed ditch, Unnamed ditch to N Fk Watonwan R	5.05	WWm	FS	FS				IF	MTS	IF	MTS	MTS	MTS	MTS	MTS	MTS						MTS
HUC 12 Agg: 0702001004-03 Judicial Ditch 1																						
07020010-561, Unnamed creek, Unnamed cr to JD 1	1.63	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-579, Judicial Ditch 1, Headwaters to -94.9058 43.9095	10.19	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-580, Judicial Ditch 1,-94.9058 43.9095 to T105 R33W S7, east line	4.37	WWm	NA				FIBI															
07020010-581, Judicial Ditch 1, T105 R33W S8, west line to Irish Lk	7.75	WWg	NS	NS				EXS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS						EX

Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedance (EXP), Exceeds standards or ecoregion expectations (EX/EXS).

Key for Cell Shading: = existing impairment, listed prior to 2015 reporting cycle; = new impairment; = full support of designated use.

AUID DESCRIPTIONS		USES						Aquatic Life Indicators:														Aquatic Recreation Indicators:
Assessment Unit ID (AUID), Stream Reach Name. Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water	303d listed impairments 2014	Fish	Macroinvertebrates	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	AmmoniaNH3	Phosphorous	Chlorophyll A	Chlorophyll A Uncorrected	BOD	DO Flux	Pesticides	Bacteria
HUC 12 Agg: 0702001004-02 Upper Watonwan, South Fork																						
07020010-570, Watonwan River, South Fork, Headwaters (Unnamed lk 17-0014-00) to -94.9121 43.8594	7.60	WWg																				
07020010-569, Watonwan River, South Fork, -94.9121 43.8594 to -94.8475 43.8813	6.57	WWm	NS					EXS		NA	NA	NA		NA	NA	NA						
07020010-568, Watonwan River, South Fork, -94.8475 43.8813 to Irish Lk	11.88	WWg	NS	NS				EXS	EXS	MTS	IF	MTS	NA	MTS	MTS	MTS						EX
HUC 12 Agg: 0702001004-01 Lower Watonwan River, South Fork																						
07020010-560, Judicial Ditch 4, 230th St to Willow Cr	1.05	WWg								NA		NA		NA								
07020010-572, Willow Creek, Headwaters to JD 4	5.73	WWg																				
07020010-553, County Ditch 1, Unnamed cr to S Fk Watonwan R	1.39	WWm	FS					MTS	MTS	NA	NA	NA		NA	NA	NA						
07020010-540, Spring Brook, Unnamed ditch to S Fk Watonwan R	1.14	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-547, Watonwan River, South Fork, Irish Lk to Willow Cr	20.71	WWg	NS				Turbidity	EXS	MTS	NA	NA	MTS		NA	NA	NA						
07020010-517, Watonwan River, South Fork, Willow Cr to Watonwan R	25.20	WWg	NS	NS			Turbidity, Fecal Coliform	EXS	EXP	MTS	EX	IF	NA	MTS	MTS	EX						EX
HUC 12 Agg: 0702001005-02 Spring Branch Creek																						
07020010-525, Unnamed ditch, T105 R30W S3, west line to Spring Cr	6.49	LRVW								NA				NA	NA							
07020010-573, Spring Branch Creek, T106 R30W S31, south line to T106 R30W S21, east line	5.46	WWg																				
07020010-574, Spring Branch Creek, T106 R30W S22, west line to Perch Cr	7.10	WWm	NS	NS				EXS	MTS	MTS	IF	MTS	NA	MTS	MTS	MTS				IF		EX
HUC 12 Agg: 0702001005-01 Perch Creek																						
07020010-578, Judicial Ditch 60, Headwaters to Unnamed cr	7.60																					
07020010-577, Mink Creek, Unnamed cr to Perch Cr	3.68	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-557, Unnamed creek, Unnamed cr to Perch Cr	2.03	WWg	NS					EXS		NA	NA	NA		NA	NA	NA						
07020010-535, Unnamed creek, Headwaters to T105 R30W S25, north line	6.48	LRVW								NA				NA	NA							
07020010-526, Unnamed creek, T105 R30W S24, south line to Perch Cr	2.32	WWm	NS					EXS	EXS	NA	NA	NA		NA	NA	IF						
07020010-584, Unnamed creek, Unnamed cr to T105 T29W S6, east line	0.85	WWm	FS					MTS	MTS	NA	NA	NA		NA	NA	NA						
07020010-585, Unnamed creek, T105 R29W S5, west line to Perch Cr	0.70	WWg																				
07020010-524, Perch Creek, Headwaters (Perch Lk 46-0046-00) to Spring Cr	25.23	WWg	NS				Turbidity	EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-523, Perch Creek, Spring Cr to Watonwan R	12.09	WWg	NS	NS				EXS	MTS	MTS	IF	MTS	NA	MTS	NA	IF				IF		EX

Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedance (EXP), Exceeds standards or ecoregion expectations (EX/EXS).

Key for Cell Shading: = existing impairment, listed prior to 2015 reporting cycle; = new impairment; = full support of designated use.

AUID DESCRIPTIONS		USES						Aquatic Life Indicators:														Aquatic Recreation Indicators:
Assessment Unit ID (AUID), Stream Reach Name, Reach Description	Reach Length (Miles)	Use Class	Aquatic Life	Aquatic Recreation	Aquatic Consumption	Drinking Water	303d listed impairments 2014	Fish	Macroinvertebrates	Dissolved Oxygen	TSS	Secchi Tube	Chloride	pH	AmmoniaNH3	Phosphorous	Chlorophyll A	Chlorophyll A Uncorrected	BOD	DO Flux	Pesticides	Bacteria
HUC 12 Agg: 0702001001-01 Upper Watonwan River																						
07020010-505, Unnamed creek (Mountain Lake Inlet), Headwaters to Mountain Lk	3.20	WWm	NS					MTS	EXS	NA	NA	NA		NA	NA	NA						
07020010-556, Unnamed creek, Unnamed cr to Watonwan R	1.91	WWg																				
07020010-555, Unnamed creek, Unnamed cr to Watonwan R	1.24	WWm	FS					MTS	MTS	NA	NA	NA		NA	NA	NA						
07020010-566, Watonwan River, Headwaters to T107 R33W S33, east line	47.14	WWg	NS	NA			Fecal Coliform, Turbidity, FIBI	EXS	EXS	NA	NA	IF		NA	NA	NA						
07020010-567, Watonwan River, T107 R33W S34, west line to N Fk Watonwan R	12.31	WWm	NS	NS			Fecal Coliform, Turbidity, FIBI	EXS	MTS	MTS	IF	IF	MTS	MTS	MTS	MTS						EX
HUC 12 Agg: 0702001006-01 Lower Watonwan River																						
07020010-551, Judicial Ditch 7, Headwaters to Watonwan R	4.77	WWg	IF									MTS										
07020010-559, County Ditch 78, 164th St to Watonwan R	3.96	WWg	NS					EXS	EXS	NA	NA	NA		NA	NA	NA						
07020010-562, Watonwan River, N Fk Watonwan R to T107 R32W S13, east line	3.02	WWg	NS	NS	NS		Fecal Coliform, Turbidity															
07020010-563, Watonwan River, T107 R31W S18, west line to Butterfield Cr	5.81	WWg	NS	NS			Fecal Coliform, Turbidity	EXS	MTS	IF	IF	MTS	MTS	MTS	MTS	MTS						EX
07020010-511, Watonwan River, Butterfield Cr to S Fk Watonwan R	7.54	WWg	NS	NS			Fecal Coliform, Turbidity, FIBI	EXS	EXP	IF	EX	MTS	NA	MTS	NA	EX	IF					EX
07020010-510, Watonwan River, S Fk Watonwan R to Perch Cr	16.31	WWg	NS	NS			Turbidity	EXS	EXS	MTS	IF	MTS	MTS	MTS	MTS	EX	MTS			MTS		EX
07020010-501, Watonwan River, Perch Cr to Blue Earth R	17.88	WWg	NS	NS	NS		Fecal Coliform, Turbidity, Mercury in water	EXS	EXS	MTS	EX	EX	MTS	MTS	MTS	EX	MTS		IF	IF		EX

Full Support (FS); Not Supporting (NS); Insufficient Data (IF); Not Assessed (NA); Meets standards or ecoregion expectations (MT/MTS), Potential Exceedance (EXP), Exceeds standards or ecoregion expectations (EX/EXS).

Key for Cell Shading: = existing impairment, listed prior to 2015 reporting cycle; = new impairment; = full support of designated use.

Appendix 3.2 - Assessment results for lakes in the Watonwan River Watershed

Lake ID	Lake Name	County	HUC-12	Ecoregion	Lake Area (acres)	Max Depth (m)	Watershed Area (acres)	% Littoral	Mean depth (m)	AQR Support Status	AQL Support Status
08-0026-00	Hanska	Brown	0702001006-02	WCBP	1775	2.1	24,798	100	1.0*	IF	NS
17-0003-00	Mountain	Cottonwood	0702001001-01	WCBP	220	2.3	6,314	100	1.2	IF	NS
17-0007-00	Bingham	Cottonwood	0702001004-03	WCBP	265	2.7	1,656	100	1.5	NS	NS
17-0012-00	Three	Cottonwood	0702001004-03	WCBP	111	Unknown	549	100	1.0*	IF	NA
17-0020-00	Eagle	Cottonwood	0702001001-01	WCBP	105	2.4	529	100	1.0*	NS	IF
32-0018-03	Fish (main)	Jackson/ Cottonwood	0702001004-02	WCBP	296	8.2	1,452	Unknown	3.5*	FS	NS
46-0084-00	Round	Martin	0702001005-01	WCBP	41	Unknown	111	100	1.0*	IF	NA
83-0021-00	Fedji	Watonwan	0702001006-01	WCBP	163	2.4	2,423	100	1.0*	IF	IF
83-0035-00	Mary	Watonwan	0702001004-01	WCBP	122	Unknown	2,897	100	1.0*	IF	NA
83-0036-00	Kansas	Watonwan	0702001003-01	WCBP	390	2.0	9,179	100	1.2	NS	IF
83-0040-00	Long	Watonwan	0702001004-01	WCBP	261	4.0	1,750	100	2.4	IF	NS
83-0043-00	St. James	Watonwan	0702001003-01	WCBP	209	4.6	2,344	100	1.5	FS	FS
83-0051-00	Sulem	Watonwan	0702001003-01	WCBP	89	1.4	845	100	1.0*	IF	NA
83-0056-00	Butterfield	Watonwan	0702001003-01	WCBP	49	3.5	484	100	1.0*	NS	IF
83-0060-00	Wood	Watonwan/Brown	0702001002-01	WCBP	478	1.3	8,884	100	1.0*	IF	IF

Key for Support Status Cell Shading: = existing impairment (listed prior to 2015 assessment cycle) = new impairment (2015 assessment cycle) = full support of intended use

Abbreviations: **WCBP** – Western Corn Belt Plains **NS –** Not supporting **FS –** Fully supporting **IF** – Insufficient Information **NA** – Not Assessed

* Mean depth estimated by MPCA staff

Appendix 4.1 - 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 4.2 - Biological monitoring results – Fish IBI

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi^2	Fish Class	Threshold	FIBI	Visit Date
HUC 12: 0702001002-01 (Watonwan River, North Fork)							
07020010-583	10EM071	Unnamed creek	8.45	3	55	58.97	8/4/2010
07020010-583	10EM071	Unnamed creek	8.45	3	55	45.14	6/18/2013
07020010-549	13MN123	Unnamed creek	15.1	3	55	42.14	7/8/2013
07020010-564	13MN136	Watonwan River, North Fork	14.65	3	55	49.09	6/17/2013
07020010-564	13MN165	Watonwan River, North Fork	44.14	2	50	30.29	6/11/2013
07020010-564	13MN107	Watonwan River, North Fork	50.7	2	50	28.35	6/11/2013
07020010-565	13MN133	Watonwan River, North Fork	74.96	2	35	29.55	6/12/2013
HUC 12: 0702001003-02 (Butterfield Creek)							
07020010-552	13MN153	Unnamed creek	9.42	3	33	0	7/23/2013
07020010-516	13MN156	Butterfield Creek	10.4	3	55	33.47	7/11/2013
07020010-516	13MN156	Butterfield Creek	10.4	3	55	42.79	7/1/2014
07020010-516	13MN156	Butterfield Creek	10.4	3	55	28.38	7/22/2014
07020010-516	13MN156	Butterfield Creek	10.4	3	55	28	8/26/2014
07020010-516	13MN125	Butterfield Creek	17.16	3	55	0	7/10/2013
07020010-516	13MN125	Butterfield Creek	17.16	3	55	43.52	7/30/2013
07020010-516	13MN125	Butterfield Creek	17.16	3	55	42.64	7/1/2014
07020010-516	13MN125	Butterfield Creek	17.16	3	55	37.67	7/22/2014
07020010-516	13MN125	Butterfield Creek	17.16	3	55	35.61	8/26/2014
07020010-516	13MN128	Butterfield Creek	43.55	2	50	32.15	7/10/2013
07020010-516	13MN128	Butterfield Creek	43.55	2	50	48.9	7/30/2013
07020010-516	13MN128	Butterfield Creek	43.55	2	50	52.45	8/28/2013
07020010-516	13MN128	Butterfield Creek	43.55	2	50	44.52	7/21/2014
07020010-516	13MN128	Butterfield Creek	43.55	2	50	51.51	8/26/2014
07020010-516	13MN105	Butterfield Creek	60.17	2	50	50.11	7/10/2013
07020010-516	13MN105	Butterfield Creek	60.17	2	50	30.02	7/30/2013
07020010-516	13MN105	Butterfield Creek	60.17	2	50	20.51	8/27/2013
07020010-516	13MN105	Butterfield Creek	60.17	2	50	44.02	7/21/2014

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Fish Class	Threshold	FIBI	Visit Date
HUC 12: 0702001003-02 (Butterfield Creek) (continued)							
07020010-516	13MN105	Butterfield Creek	60.17	2	50	32.03	8/25/2014
HUC 12: 0702001003-01 (St. James Creek)							
07020010-554	13MN126	Unnamed creek	15.31	3	55	0	41435
07020010-554	13MN126	Unnamed creek	15.31	3	55	35.6	41479
07020010-528	13MN167	St James Creek (Kansas Lake Inlet)	7.07	3	55	0	41466
07020010-576	13MN104	St James Creek	35.3	2	35	51.16	41465
07020010-576	13MN104	St James Creek	35.3	2	35	58.8	41487
07020010-576	13MN104	St James Creek	35.3	2	35	42.06	41822
07020010-576	13MN104	St James Creek	35.3	2	35	46.24	41842
07020010-576	13MN104	St James Creek	35.3	2	35	36.56	41877
07020010-502	13MN147	St James Creek	51.16	2	no expectation	25.76	41436
07020010-502	13MN147	St James Creek	51.16	2	no expectation	31.64	41465
07020010-502	13MN147	St James Creek	51.16	2	no expectation	44.63	41485
07020010-502	13MN147	St James Creek	51.16	2	no expectation	31.94	41514
07020010-502	13MN147	St James Creek	51.16	2	no expectation	25.14	41802
07020010-502	13MN147	St James Creek	51.16	2	no expectation	28.14	41822
07020010-502	13MN147	St James Creek	51.16	2	no expectation	23.07	41842
07020010-502	13MN147	St James Creek	51.16	2	no expectation	29.97	41877
07020010-515	13MN103	St James Creek	122.44	2	no expectation	42.69	41465
07020010-515	13MN103	St James Creek	122.44	2	no expectation	42.52	41485
07020010-515	13MN103	St James Creek	122.44	2	no expectation	32.69	41513
07020010-515	13MN103	St James Creek	122.44	2	no expectation	40.37	41841
07020010-515	13MN103	St James Creek	122.44	2	no expectation	37.46	41876
HUC 12: 070200106-02 (Trib to Watonwan River)							
07020010-545	13MN102	Unnamed Ditch	51.56	2	35	43.21	6/11/2013
HUC 12: 070200104-03 (Judicial Ditch 1)							
07020010-561	13MN124	Unnamed creek	12.58	3	55	0	6/18/2013
07020010-561	13MN124	Unnamed creek	12.58	3	55	0	6/11/2014

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi2	Fish Class	Threshold	FIBI	Visit Date
HUC 12: 070200104-03 (Judicial Ditch 1) (continued)							
07020010-579	13MN154	Judicial Ditch 1	6.49	3	55	0	6/18/2013
07020010-579	13MN154	Judicial Ditch 1	6.49	3	55	0	7/24/2013
07020010-579	91MN097	Judicial Ditch 1	31.69	2	50	2.54	6/11/2014
07020010-581	13MN110	Judicial Ditch 1	45.69	2	50	38.44	7/23/2013
HUC 12: 070200104-02 (Upper South Fork Watonwan)							
07020010-569	13MN164	Watonwan River, South Fork	27.13	3	33	23.42	7/23/2013
07020010-568	13MN109	Watonwan River, South Fork	37.97	2	no expectation	0	6/11/2014
07020010-568	13MN109	Watonwan River, South Fork	37.97	2	no expectation	32.33	7/22/2014
HUC 12: 070200104-01 (Lower South Fork Watonwan)							
07020010-571	13MN180	Willow Creek	18.56	3	55	5.32	7/18/2013
07020010-571	13MN180	Willow Creek	18.56	3	no expectation	0	6/11/2014
07020010-57107020010-553	13MN121	County Ditch 1	13.42	3	33	50.03	7/18/2013
07020010-540	13MN131	Spring Brook	15.16	3	55	38.9	6/10/2013
07020010-547	13MN134	Watonwan River, South Fork	116.05	2	50	25.14	7/30/2013
07020010-517	13MN142	Watonwan River, South Fork	155.17	2	50	40.13	7/17/2013
07020010-517	90MN099	Watonwan River, South Fork	187.05	2	50	59.7	8/17/2010
07020010-517	90MN099	Watonwan River, South Fork	187.05	2	50	59.87	9/1/2010
07020010-517	90MN099	Watonwan River, South Fork	187.05	2	50	44.78	7/16/2013
07020010-517	13MN101	Watonwan River, South Fork	197.37	2	50	43.92	7/17/2013
07020010-517	13MN101	Watonwan River, South Fork	197.37	2	50	39.02	7/22/2014
HUC 12: 070200105-02 (Spring Branch Creek)							
07020010-525	13MN111	Unnamed ditch	12.82	3		30.15	6/11/2013
07020010-574	13MN150	Spring Branch Creek	23.9	7	15	15.75	6/11/2013
07020010-574	13MN137	Spring Branch Creek	37.76	2	35	20.1	6/11/2013
07020010-574	13MN139	Spring Branch Creek	39.45	2	35	32.09	7/10/2013
HUC 12: 0702001005-01 (Perch Creek)							
07020010-577	13MN118	Mink Creek	16.81	3	55	28.27	7/9/2013
07020010-557	13MN144	Unnamed creek	19.08	3	55	37.62	7/10/2013

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi2	Fish Class	Threshold	FIBI	Visit Date
HUC 12: 0702001005-01 (Perch Creek) (continued)							
07020010-535	13MN168	Unnamed creek	19.36	3	no expectation	0	6/11/2013
07020010-526	13MN158	Unnamed creek	20.11	3	33	1.22	6/11/2013
07020010-584	13MN122	Unnamed creek	15.85	7	15	31.38	7/9/2013
07020010-524	13MN143	Perch Creek	52.35	2	50	0	7/10/2013
07020010-524	13MN143	Perch Creek	52.35	2	50	59.04	7/22/2014
07020010-524	13MN129	Perch Creek	98.41	2	50	30.44	6/10/2013
07020010-523	97MN011	Perch Creek	194.62	2	50	41.2	6/10/2013
HUC 12: 0702001001-01 (Upper Watonwan River)							
07020010-555	13MN157	Unnamed creek	17.61	3	33	52.14	7/10/2013
07020010-566	13MN148	Watonwan River	17.06	3	55	21.62	7/8/2013
07020010-566	13MN146	Watonwan River	46.67	2	50	17.36	6/12/2013
07020010-566	01MN047	Watonwan River	60.81	2	50	19.3	6/12/2013
07020010-566	01MN047	Watonwan River	60.81	2	50	37.59	8/28/2013
07020010-566	13MN115	Watonwan River	69.78	2	50	25.46	7/15/2013
07020010-567	13MN166	Watonwan River	94.85	2	35	31.26	7/16/2013
07020010-567	13MN106	Watonwan River	119.81	2	35	32.5	8/1/2013
HUC 12: 0702001006-01 (Lower Watonwan River)							
07020010-559	13MN120	County Ditch 78	17.3	3	55	53.5	7/9/2013
07020010-563	13MN145	Watonwan River	208.72	2	50	37.32	7/19/2013
07020010-563	13MN145	Watonwan River	208.72	2	50	36.5	8/27/2013
07020010-511	13MN135	Watonwan River	337.62	1	49	52.91	7/18/2013
07020010-511	13MN135	Watonwan River	337.62	1	49	50.53	8/26/2013
07020010-510	13MN161	Watonwan River	637.16	1	49	40.7	7/16/2013
07020010-510	13MN161	Watonwan River	637.16	1	49	45.04	8/8/2013
07020010-510	13MN162	Watonwan River	665.79	1	49	38.55	7/23/2013
07020010-510	13MN130	Watonwan River	678.57	1	49	41.76	7/22/2013
07020010-501	03MN068	Watonwan River	847.29	1	49	43.69	7/24/2013
07020010-501	03MN068	Watonwan River	847.29	1	49	37.47	8/7/2013

Appendix 4.3 - Biological monitoring results-macroinvertebrate IBI

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	MIBI	Visit Date
HUC 12: 0702001002-01 (Watonwan River North Fork)							
07020010-583	10EM071	Unnamed creek	8.45	5	37	16.32	8/13/2013
07020010-583	10EM071	Unnamed creek	8.45	5	37	26.54	8/17/2010
07020010-549	13MN123	Unnamed creek	15.1	7	41	36.43	8/13/2013
07020010-564	13MN136	Watonwan River, North Fork	14.65	7	41	9.77	8/13/2013
07020010-564	13MN165	Watonwan River, North Fork	44.14	7	41	47.51	8/13/2013
07020010-564	13MN107	Watonwan River, North Fork	50.7	7	41	40.63	8/13/2013
07020010-565	13MN133	Watonwan River, North Fork	74.96	7	22	37.63	8/15/2013
HUC 12: 0702001003-02 (Butterfield Creek)							
07020010-552	13MN153	Unnamed creek	9.42	7	22	4.93	8/14/2013
07020010-516	13MN156	Butterfield Creek	10.4	7	41	7.09	8/8/2013
07020010-516	13MN156	Butterfield Creek	10.4	7	41	18.19	8/12/2014
07020010-516	13MN125	Butterfield Creek	17.16	7	41	32.28	8/15/2013
07020010-516	13MN125	Butterfield Creek	17.16	7	41	42.9	8/12/2014
07020010-516	13MN128	Butterfield Creek	43.55	7	41	33.87	8/13/2014
07020010-516	13MN128	Butterfield Creek	43.55	7	41	31.21	8/14/2013
07020010-516	13MN105	Butterfield Creek	60.17	7	41	51.9	8/15/2013
07020010-516	13MN105	Butterfield Creek	60.17	7	41	40.77	8/13/2014
HUC 12: 0702001003-01 (St. James Creek)							
07020010-576	13MN104	Saint James Creek	35.3	7	22	25.74	8/8/2013
07020010-576	13MN104	Saint James Creek	35.3	7	22	30.4	8/13/2014
07020010-502	13MN147	Saint James Creek	51.16	5	no expectation	20.8	8/8/2013
07020010-502	13MN147	Saint James Creek	51.16	5	no expectation	17.42	8/13/2014
07020010-515	13MN103	Saint James Creek	122.44	5	no expectation	24.48	8/8/2013
07020010-515	13MN103	Saint James Creek	122.44	5	no expectation	18.26	8/13/2014

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	MIBI	Visit Date
HUC 12: 0702001006-02 (Unnamed Tributary to Watonwan River)							
07020010-545	13MN102	Unnamed ditch	51.56	7	2	49.3	8/15/2013
HUC 12: 0702001004-03 (Judicial Ditch 1)							
07020010-561	13MN124	Unnamed creek	12.58	5	37	22.55	8/14/2013
07020010-561	13MN124	Unnamed creek	12.58	5	37	15.18	8/12/2014
07020010-579	91MN097	Judicial Ditch 1	31.69	5	37	17.18	8/14/2013
07020010-579	91MN097	Judicial Ditch 1	31.69	5	37	29.76	8/12/2014
07020010-581	13MN110	Judicial Ditch 1	45.69	5	37	42.07	8/14/2013
HUC 12: 0702001004-02 (Upper South Fork Watonwan River)							
07020010-568	13MN109	Watonwan River, South Fork	37.97	5	37	29.91	8/14/2013
07020010-568	13MN109	Watonwan River, South Fork	37.97	5	37	25.2	8/12/2014
HUC 12: H0702001004-01 (Lower South Fork Watonwan River)							
07020010-560	13MN116	Judicial Ditch 4	6.39	5	37	16.64	8/13/2013
07020010-571	13MN119	Willow Creek	31.03	7	41	35.23	8/13/2013
07020010-553	13MN121	County Ditch 1	13.42	7	22	25.04	8/14/2013
07020010-540	13MN131	Spring Brook	15.16	7	41	33.5	8/14/2013
07020010-547	13MN134	Watonwan River, South Fork	116.05	7	41	49.31	8/14/2013
07020010-547	13MN134	Watonwan River, South Fork	116.05	7	41	35.68	8/14/2013
07020010-517	13MN142	Watonwan River, South Fork	155.17	7	41	42.99	8/14/2013
07020010-517	90MN099	Watonwan River, South Fork	187.05	7	41	40.98	8/19/2010
07020010-517	90MN099	Watonwan River, South Fork	187.05	7	41	33.6	8/14/2013
07020010-517	13MN101	Watonwan River, South Fork	197.37	7	41	34.76	8/14/2013
07020010-517	13MN101	Watonwan River, South Fork	197.37	7	41	49.85	8/13/2014
HUC 12: 0702001005-02 (Spring Branch Creek)							
07020010-525	13MN111	Unnamed ditch	12.82	7	no expectation	24.75	8/13/2013
07020010-574	13MN150	Spring Branch Creek	23.9	7	22	29.9	8/13/2013
07020010-574	13MN137	Spring Branch Creek	37.76	7	22	40.12	8/12/2013
07020010-574	13MN139	Spring Branch Creek	39.45	7	22	38.86	8/13/2013
07020010-574	13MN139	Spring Branch Creek	39.45	7	22	34.74	8/13/2013

National Hydrography Dataset (NHD) Assessment Segment AUID	Biological Station ID	Stream Segment Name	Drainage Area Mi²	Invert Class	Threshold	MIBI	Visit Date
HUC 12: 0702001005-01 (Perch Creek)							
07020010-577	13MN118	Mink Creek	16.81	7	41	36.42	8/13/2013
07020010-535	13MN168	Unnamed creek	19.36	7	no expectation	16.72	8/13/2013
07020010-526	13MN158	Unnamed creek	20.11	7	22	17.96	8/13/2013
07020010-584	13MN122	Unnamed creek	15.85	7	41	26.82	8/13/2013
07020010-524	13MN143	Perch Creek	52.35	7	41	39.41	8/13/2013
07020010-524	13MN129	Perch Creek	98.41	5	41	32.27	8/13/2013
07020010-523	97MN011	Perch Creek	149.62	5	41	40.67	8/12/2013
HUC 12: 0702001001-01 (Upper Watonwan River)							
07020010-505	91MN098	Unnamed creek (Mountain Lake Inlet)	2.32	7	22	14.72	8/19/2010
07020010-505	91MN098	Unnamed creek (Mountain Lake Inlet)	2.32	7	22	9.05	8/19/2010
07020010-555	13MN157	Unnamed creek	17.61	7	22	28.52	8/15/2013
07020010-566	13MN146	Watonwan River	46.67	7	41	34.23	8/14/2013
07020010-566	01MN047	Watonwan River	60.81	5	37	35.72	8/14/2013
07020010-567	13MN166	Watonwan River	94.85	7	22	40.02	8/15/2013
07020010-567	13MN106	Watonwan River	119.81	7	41	43.05	8/15/2013
HUC 12: 0702001006-01 (Lower Watonwan River)							
07020010-559	13MN120	County Ditch 78	17.3	7	41	38.18	8/12/2013
07020010-563	13MN145	Watonwan River	208.72	7	41	50.38	8/15/2013
07020010-511	13MN135	Watonwan River	337.62	5	37	35.13	8/15/2013
07020010-510	13MN162	Watonwan River	665.79	2	31	17.21	8/12/2013
07020010-510	13MN130	Watonwan River	678.57	2	31	14.45	8/12/2013
07020010-501	03MN068	Watonwan River	847.29	2	31	25.19	8/12/2013

Appendix 5.1 - Minnesota's ecoregion-based lake eutrophication standards

Ecoregion	TP µg/L	Chl-a µg/L	Secchi meters
NLF – Lake Trout (Class 2A)	< 12	< 3	> 4.8
NLF – Stream trout (Class 2A)	< 20	< 6	> 2.5
NLF – Aquatic Rec. Use (Class 2B)	< 30	< 9	> 2.0
NCHF – Stream trout (Class 2A)	< 20	< 6	> 2.5
NCHF – Aquatic Rec. Use (Class 2B)	< 40	< 14	> 1.4
NCHF – Aquatic Rec. Use (Class 2B) Shallow lakes	< 60	< 20	> 1.0
WCBP & NGP – Aquatic Rec. Use (Class 2B)	< 65	< 22	> 0.9
WCBP & NGP – Aquatic Rec. Use (Class 2B) Shallow lakes	< 90	< 30	> 0.7

Appendix 5.2 - MINLEAP model estimates of phosphorus loads for lakes in the Watonwan River Watershed

Lake ID	Lake Name	Obs TP (µg/L)	MINLEAP TP (µg/L)	Obs Chl-a (µg/L)	MINLEAP Chl-a (µg/L)	Obs Secchi (m)	MINLEAP Secchi (m)	Avg. TP Inflow (µg/L)	TP Load (kg/yr)	Background TP (µg/L)	%P Retention	Outflow (hm3/yr)	Residence Time (yrs)	Areal Load (m/yr)	Trophic Status
08-0026	Hanska	200	183	28	133	0.7	0.4	568	7,652	0.0	68%	13.48	0.5	1.88	H
17-0003	Mountain	76	220	30	174	0.9	0.4	569	1,920	0.0	61%	3.38	0.3	3.79	E
17-0007	Bingham	158	114	42	67	0.6	0.7	565	529	0.0	80%	0.94	1.7	0.87	H
17-0020	Eagle	154	124	96	76	0.4	0.6	564	171	0.0	78%	0.3	1.4	0.71	H
32-0018-03	Fish	39	70	21	33	1.4	1.0	564	471	0.0	88%	0.84	5.0	0.70	E
83-0021	Fedji	80	187	61	137	1.0	0.4	568	746	0.0	67%	1.31	0.5	1.99	E
83-0036	Kansas	131	206	41	158	0.7	0.4	569	2,800	0.0	64%	4.92	0.4	3.12	H
83-0040	Long	31	95	35	51	0.8	0.8	565	556	0.0	83%	0.98	2.6	0.93	E
83-0043	St. James	41	144	23	94	1.6	0.5	567	728	0.0	75%	1.28	1.0	1.52	E
83-0056	Butterfield	104	161	108	110	0.2	0.5	567	151	0.0	72%	0.27	0.7	1.34	H

Abbreviations: **H** – Hypereutrophic, **E** – Eutrophic, **M** – Mesotrophi -- No data, **O** – Oligotrophic

Appendix 6 – Fish species found during biological monitoring surveys

Common name	Quantity of stations where present	Quantity of individuals collected
bigmouth buffalo	13	98
bigmouth shiner	42	1971
black bullhead	30	73
black crappie	3	3
blacknose dace	38	1424
blackside darter	26	232
bluegill	4	19
bluntnose minnow	47	3366
brassy minnow	16	236
brook stickleback	8	300
central mudminnow	3	7
central stoneroller	40	841
channel catfish	9	22
common carp	38	865
common shiner	23	293
creek chub	53	2114
fantail darter	1	1
fathead minnow	32	1716
freshwater drum	1	1
Gen: redhorses	1	7
golden redhorse	14	269
golden shiner	1	1
green sunfish	20	92
highfin carpsucker	2	2
hybrid sunfish	1	1
Iowa darter	2	2
johnny darter	47	1353

Common name	Quantity of stations where present	Quantity of individuals collected
largemouth bass	16	260
mimic shiner	1	3
northern hogsucker	14	77
northern pike	32	155
orangespotted sunfish	12	209
pumpkinseed	2	22
quillback	12	93
river carpsucker	2	13
sand shiner	33	4915
shorthead redhorse	19	321
silver redhorse	14	69
slenderhead darter	13	111
smallmouth buffalo	1	1
spotfin shiner	24	2185
stonecat	5	15
tadpole madtom	8	32
walleye	15	69
white sucker	50	2331
yellow bullhead	17	54
yellow perch	29	1609

Appendix 7 – Macroinvertebrate species found during biological monitoring surveys

Taxonomic name	Number of stations where present	Total number of individuals collected
Ablabesmyia	42	294
Acari	41	237
Acentrella	13	32
Acerpenna	1	4
Acroneuria	4	5
Aedes	1	4
Aeshna	21	48
Aeshnidae	6	9
Agabus	2	1
Anacaena	1	2
Anafroptilum	9	36
Anax	6	1
Anisoptera	2	2
Anopheles	10	21
Anthopotamus	3	30
Aplexa	1	1
Atherix	6	13
Atrichopogon	22	53
Baetidae	5	9
Baetis	30	527
Baetisca	4	8
Belostoma	16	13
Belostomatidae	2	4
Berosus	3	3
Bezzia	1	1
Bezzia/Palpomyia	1	1

Taxonomic name	Number of stations where present	Total number of individuals collected
Boyeria	11	16
Brachycentrus	1	1
Branchiobdellida	10	28
Brillia	30	132
Caecidotea	3	5
Caenidae	1	1
Caenis	41	558
Callibaetis	19	68
Calopterygidae	6	11
Calopteryx	5	8
Cambaridae	5	5
Cambarus	1	1
Ceraclea	3	3
Ceratopogonidae	7	14
Ceratopogoninae	1	1
Ceratopsyche	14	81
Cheumatopsyche	37	1249
Chironomini	21	93
Chironomus	17	128
Chrysops	1	1
Cladopelma	3	5
Cladotanytarsus	14	35
Clinotanypus	1	2
Coenagrionidae	24	174
Conchapelopia	14	35
Constempellina	1	2
Corduliidae	1	1
Corixidae	35	373
Corynoneura	16	24

Taxonomic name	Number of stations where present	Total number of individuals collected
Cricotopus	36	207
Cryptochironomus	25	57
Cryptotendipes	5	8
Culex	4	26
Culicidae	10	27
Dasyhelea	1	2
Decapoda	2	2
Desmopachria	2	2
Dicranota	1	1
Dicrotendipes	43	443
Dineutus	1	1
Dubiraphia	37	413
Dytiscidae	4	9
Elmidae	5	26
Empididae	1	1
Enallagma	2	7
Endochironomus	7	17
Enochrus	3	3
Ephoron	3	42
Ephydridae	29	157
Erioptera	1	1
Eukiefferiella	3	6
Fallceon	4	6
Ferrissia	12	33
Forcipomyiinae	2	3
Fossaria	32	170
Gerridae	5	5
Glossosomatidae	1	2
Glyptotendipes	28	103

Taxonomic name	Number of stations where present	Total number of individuals collected
Gomphidae	3	4
Gyraulus	9	49
Gyrinus	1	7
Haliplus	1	1
Helichus	7	12
Helicopsyche	2	3
Helophorus	1	1
Hemerodromia	6	14
Heptagenia	38	620
Heptageniidae	18	202
Hesperocorixa	1	1
Hetaerina	1	1
Hexagenia	2	6
Hexatoma	1	1
Hirudinea	25	70
Hyalella	25	697
Hydatophylax	1	0
Hydridae	1	3
Hydrobiidae	2	35
Hydrochara	2	0
Hydrochus	3	6
Hydrophilidae	11	11
Hydropsyche	10	135
Hydropsychidae	11	147
Hydroptila	28	195
Hydroptilidae	11	23
Hydrozoa	1	1
Ischnura	1	1
Isonychia	14	84

Taxonomic name	Number of stations where present	Total number of individuals collected
Iswaeon	1	1
Labiobaetis	24	132
Labrundinia	45	463
Laccophilus	1	1
Larsia	2	6
Leptoceridae	11	13
Leptophlebiidae	1	1
Lestes	1	1
Leucrocuta	15	75
Libellulidae	1	1
Limnophyes	13	22
Limonia	2	3
Liodessus	1	1
Lymnaeidae	8	14
Maccaffertium	16	55
Macronychus	12	85
Mayatrichia	1	1
Merragata	1	1
Mesovelia	1	1
Metrobates	1	1
Micropsectra	17	462
Microtendipes	5	9
Microvelia	1	0
Muscidae	2	3
Naidinae	1	1
Nais	1	1
Nanocladius	15	47
Nectopsyche	43	440
Nehalennia	1	0

Taxonomic name	Number of stations where present	Total number of individuals collected
Nemata	8	28
Nematomorpha	4	12
Neoplasta	1	1
Neoplea	7	12
Neoporus	3	3
Nilotanypus	7	10
Nixe	1	1
Notonectidae	2	2
Ochrotrichia	4	21
Ochthebius	1	1
Odontomyia/Hedriodiscus	1	1
Oecetis	8	11
Oligochaeta	41	614
Optioservus	1	1
Orconectes	42	45
Orthocladiinae	7	20
Orthocladius	11	51
Ostracoda	1	3
Oxyethira	1	1
Palmacorixa	10	23
Parachironomus	5	9
Paracladopelma	2	2
Paracloeodes	1	1
Paracymus	2	4
Parakiefferiella	4	5
Paralauterborniella	5	7
Paraleptophlebia	5	16
Paramerina	22	289
Parametriocnemus	1	1

Taxonomic name	Number of stations where present	Total number of individuals collected
Paraphaenocladius	1	2
Paratanytarsus	43	733
Paratendipes	21	172
Peltodytes	2	2
Perlesta	4	8
Perlidae	2	2
Perlodidae	1	1
Phaenopsectra	39	251
Phryganeidae	1	1
Physa	49	3993
Physella	11	644
Pisidiidae	27	177
Planorbella	4	2
Planorbidae	1	1
Platambus	1	1
Plauditus	5	20
Polycentropodidae	1	1
Polycentropus	1	6
Polypedilum	52	2513
Procladius	36	168
Procloeon	7	23
Psectrocladius	1	1
Pseudocloeon	1	7
Pseudosuccinea	1	0
Pteronarcys	12	15
Ptilostomis	1	1
Pycnopsyche	2	1
Ranatra	4	2
Rheocricotopus	13	62

Taxonomic name	Number of stations where present	Total number of individuals collected
Rheotanytarsus	28	313
Rheumatobates	1	1
Saetheria	2	2
Sciomyzidae	7	7
Scirtes	3	10
Scirtidae	2	2
Sialis	1	0
Sigara	16	33
Simulium	21	393
Somatochlora	2	2
Sphaeriidae	10	33
Stagnicola	7	18
Stempellina	1	1
Stempellinella	2	3
Stenacron	18	145
Stenelmis	21	608
Stenochironomus	21	83
Stenonema	5	128
Stictochironomus	8	16
Stratiomyidae	3	3
Tabanidae	1	1
Tanypodinae	30	80
Tanypus	2	2
Tanytarsini	16	41
Tanytarsus	41	440
Thienemanniella	15	39
Thienemannimyia	4	134
Thienemannimyia Gr.	51	816
Tipula	3	21

Taxonomic name	Number of stations where present	Total number of individuals collected
Trepaxonemata	3	25
Trichocorixa	7	9
Trichoptera	2	2
Tricorythodes	35	1208
Tropisternus	1	1
Tubificinae	1	3
Turbellaria	3	4
Tvetenia	2	4
Xenochironomus	2	5
Zavrelimyia	3	37