# Sunrise River Watershed

## (Lower St. Croix River Watershed)

# Watershed Restoration and Protection Strategy Report

***December 2014***


wq-ws4-05a

*** Disclaimer**

*The science, analysis and strategy development described in this report began before the accountability provisions were added to the Clean Water Legacy Act in 2013 (MS114D); thus, this report does not address all of those provisions. When this watershed is revisited (according to the 10-year cycle), the information will be updated according to the statutorily required elements of a Watershed Restoration and Protection Strategy Report.*

## Contributors

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**City of Stacy**

**City of North Branch**

**City of Wyoming**

**City of Shafer**

**Comfort Lake – Forest Lake Watershed District**

**Friends of the Sunrise River**

**Isanti Soil & Water Conservation District**

**Linwood Lake Association**

**Minnesota Board of Water and Soil Resources**

**Minnesota Department of Natural Resources**

**Minnesota Department of Transportation**

**St. Croix Watershed Research Station**

**Sunrise River Watershed Management Organization**

**US Army Corps of Engineers**

**US Department of Agriculture Natural Resource Conservation Service**

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# Key Terms

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

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

**Aquatic recreation impairment:** Streams are considered impaired for impacts to aquatic recreation if fecal bacteria standards are not met. Lakes are considered impaired for impacts to aquatic recreation if total phosphorus, chlorophyll-a, or Secchi disc depth standards are not met. Aquatic recreation is denoted as AQR throughout the WRAPS Report.

**Hydrologic Unit Code (HUC):** A Hydrologic Unit Code (HUC) is assigned by the USGS for each watershed. HUCs are organized in a nested hierarchy by size. For example, the St. Croix River Basin is assigned a HUC-4 of 0703 and the Sunrise River Watershed is assigned a HUC-8 of 07030005.

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

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

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

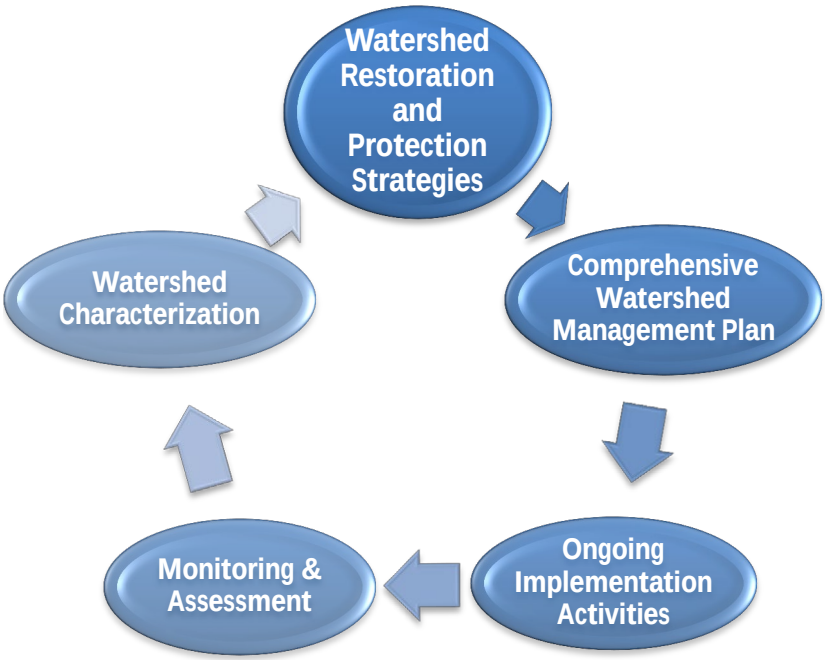
**Restoration:** This term is used to characterize actions taken in watersheds of impaired waters to improve conditions, eventually to meet water quality standards and achieve beneficial uses of the waterbodies.

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

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

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

# What is the WRAPS Report?




The State of Minnesota has adopted a "watershed approach" to address the state's 81 "major" watersheds (denoted by 8-digit hydrologic unit code or HUC). This watershed approach incorporates **water quality assessment, watershed analysis, civic engagement, planning**, **implementation**, and **measurement of results** into a 10-year cycle that addresses both restoration and protection.

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

**Purpose**

- Support local working groups and jointly develop scientifically-supported restoration and protection strategies to be used for subsequent implementation planning
- List of the Watershed Approach work done to date, as well as other reports:
  - *Lower St. Croix Watershed Monitoring and Assessment*
  - *Lower St. Croix Watershed Biotic Stressor Identification*
  - *Sunrise River Watershed Total Maximum Daily Load*
  - *Sunrise River Watershed SWAT Modeling Report*
  - *Army Corps of Engineers Watershed Study Report for the Sunrise River Watershed*

**Scope**

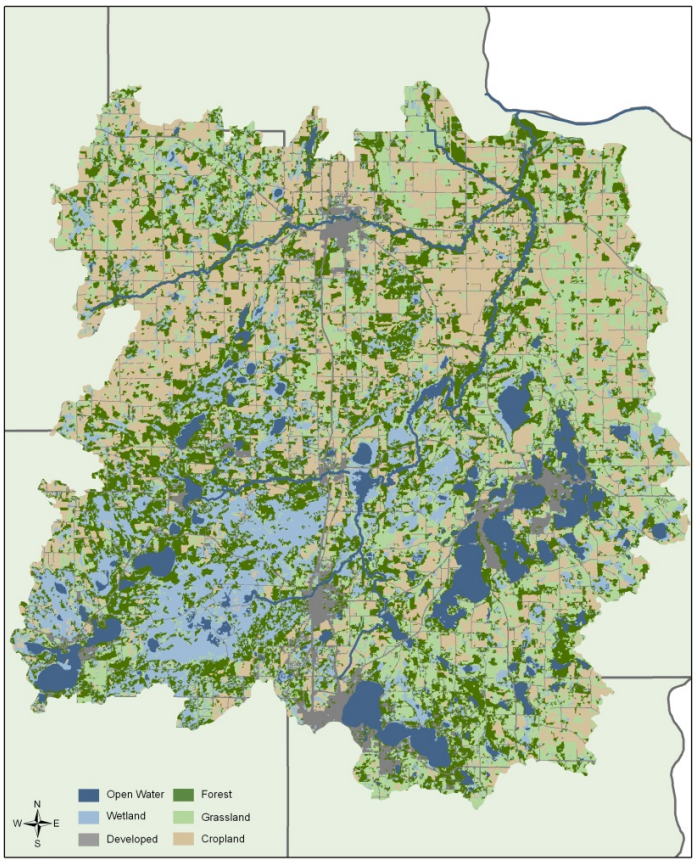
- Impacts to aquatic recreation and impacts to aquatic life in streams
- Impacts to aquatic recreation in lakes
- Create strategies for restoration and protection of watershed resources such as forested land, wetlands, native and endangered plant and biotic communities, and other priority natural resources and ecosystems

**Audience**

- Local working groups (local governments, SWCDs, watershed management groups, etc.)
- State agencies (Minnesota Pollution Control Agency, Department of Natural Resources, Board of Water and Soil Resources, etc.)

# 1. Watershed Background & Description

The Sunrise River Watershed is approximately 385 square miles and is located in parts of four counties (Anoka, Chisago, Isanti, and Washington) with the largest area in Chisago County. The area includes eight incorporated cities (North Branch, Stacy, Wyoming, Forest Lake, East Bethel, Chisago City, Lindstrom, and Center City) and covers portions of nineteen townships. Several smaller streams combine to form the Sunrise River: the North Branch, which begins in Isanti County and flows east to its confluence with the main branch in Sunrise Township; the West Branch of the Sunrise River begins in Anoka County and flows east to the confluence with the main stem in Stacy, MN; the headwaters of the main branch of the Sunrise River is located in northern Washington County; and the main branch flows north and east to its confluence with the St. Croix River at Sunrise Township.




**Sunrise Watershed Landcover**
2006 National Land Cover Data Set
Chisago SWCD 2012

The Sunrise River Watershed is a high priority subwatershed of the St. Croix River. The waters within the Sunrise River Watershed boundary outlet to the St. Croix River near the town of Sunrise in Wild River State Park. This project will not only address the impairments within the Sunrise River Watershed, but will also aid in understanding the phosphorus loading to Lake St. Croix. Lake St. Croix was listed on the 2008 303(d) Impaired Waters List for excess phosphorus. The Sunrise River was identified as one of the greatest contributors of phosphorus and sediment to the St. Croix River (U.S. Geological Survey, 1999) and was allocated a 33% reduction in phosphorus loading by the Lake St. Croix Total Maximum Daily Load Study.

Due to the geographic proximity to the Sunrise River Watershed, it was decided that the area that drains directly to the St. Croix River should be included in the protection portion of this study. This area includes Dry Creek North, Dry Creek South, Lawrence Creek, many smaller tributaries, and a few small lakes. The area is approximately seventy-nine square miles and is located in Chisago County. The area is known to be very steep and is known as The Escarpment in Chisago County.

**North Central Hardwood Forest Ecoregion:**

The watershed is part of the North Central Hardwood Forest ecoregion. According to the Minnesota Pollution Control Agency this ecoregion is an area of transition between the forested areas to the north and east and the agricultural areas to the south and west. The terrain varies from rolling hills to smaller plains. Upland areas are forested by hardwoods and conifers. Plains include livestock pastures, hay fields and row crops such as potatoes, beans, peas and corn.

The watershed contains many lakes and streams. The lakes range in size from 10 acres to over 1,000 acres. A mixture of intermittent streams and perennial streams scatter across the landscape.

**Unique Watershed Characteristics:**

**Sunrise River Watershed**

- This watershed is 385 square miles (246,450 acres) in East Central Minnesota. The watershed is on the edge of the 7-County Metropolitan Area.
- Several small cities (non-regulated MS4s) are within the watershed boundary (examples are Stacy, Shafer, Lindstrom, Chisago City, and Center City).
- Five Regulated MS4 cities fall within the watershed boundary: Forest Lake, Ham Lake, East Bethel, North Branch, Wyoming (Future).

**Table 1 - Sunrise River Watershed Land Cover**

| Land Cover | Total Acres | % of Watershed |
|---|---|---|
| FOREST | 63,650 | 26 % |
| DEVELOPED | 19,900 | 8 % |
| GRASSLAND | 43,600 | 18 % |
| CROPLAND | 59,700 | 24 % |
| WETLAND | 42,550 | 17 % |
| OPEN WATER | 17,050 | 7 % |
| **Total** | **246,450** | |

**Direct Drainage to the St. Croix River**

- This area is 79 square miles (50,570 acres) along the St. Croix National Scenic Riverway.
- The direct drainage to the St. Croix River watershed includes the cities of Taylors Falls and Shafer.
- Very steep bluffs along the river from Wild River State Park to the Chisago County line.

**Table 2 - Direct Drainage to the St. Croix River Land Cover**

| Land Cover | Total Acres | % of Watershed |
|---|---|---|
| FOREST | 9,608 | 19 % |
| DEVELOPED | 4,046 | 8 % |
| GRASSLAND | 20,228 | 40 % |
| CROPLAND | 11,125 | 22 % |
| WETLAND | 4,046 | 8 % |
| OPEN WATER | 1,517 | 3 % |
| **Total** | **50,570** | |

## 2. Watershed Conditions

The watershed has a mixture of residential, agriculture, and forested land. Water quality varies throughout the whole watershed.

As part of the Watershed Approach, streams and lakes throughout the watershed were monitored for impacts to aquatic recreation and aquatic life. From this monitoring data, several water bodies were assessed as impaired and several as not impaired (referred to as supporting). However, not all water bodies were monitored or assessed at this time due to: being classified as limited use resources, being predominately channelized, or time or budget constraints. Of the water bodies monitored, not all could be assessed due to insufficient data. Through continuing work and future iterations of the watershed approach, additional water bodies may be monitored and assessed.

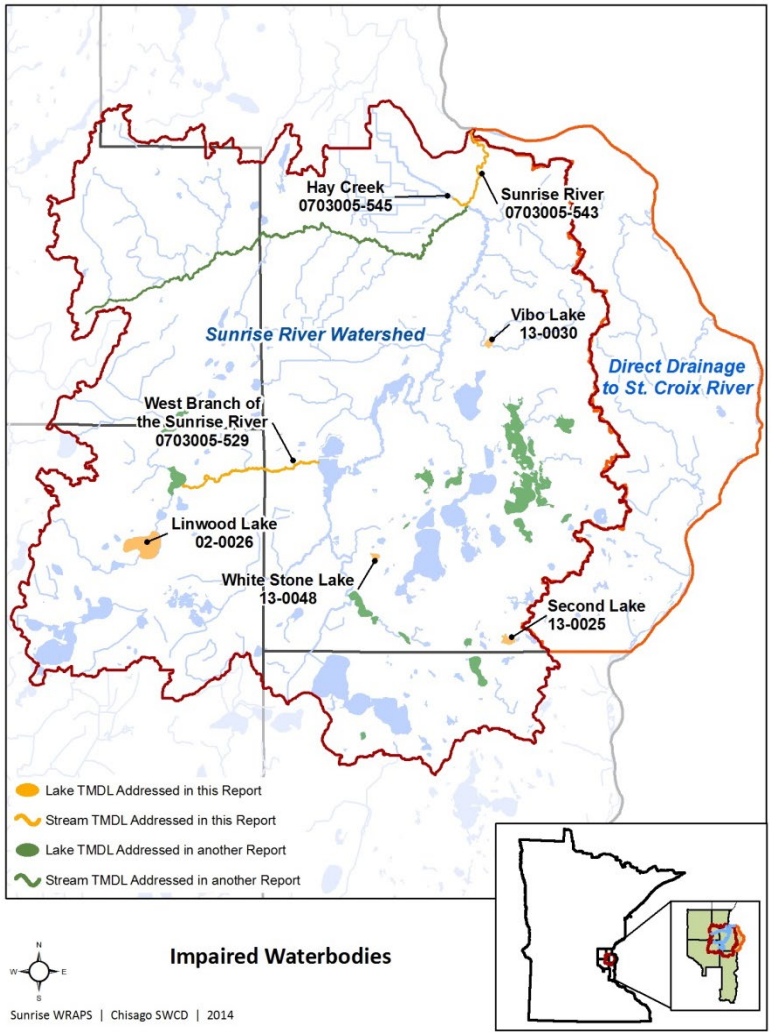



**Figure 1. Impaired Waterbodies in the Sunrise River Watershed.**

This report addresses impairments to aquatic recreation and aquatic life in stream reaches and lakes but does not address impairments to aquatic consumption (human consumption of fish) or impaired wetlands. Impairments to aquatic consumption are addressed in the *Minnesota Statewide Mercury TMDL (*http://www.pca.state.mn.us/index.php/view-document.html?gid=8507). Impaired wetlands are not addressed due to an evolving understanding of wetland processes relative to impairment status. The Minnesota Pollution Control Agency (MPCA) recently completed a Metro Chloride Feasibility study to obtain a better understanding of the extent, magnitude, and causes of chloride contamination to surface waters in the seven county Twin Cities Metropolitan Area and to explore options and strategies for addressing chloride impairments and other impacts to water resources.

Of the 140 lakes (over 10 acres in size) in the watershed, 46 lakes (or bays) have been monitored for impairments to aquatic recreation (Figure 2). Twenty-two of the monitored lakes are deemed "Non-Supporting" for aquatic recreation by the MPCA. Of the over 100 stream reaches (many reaches can make up one stream) within the region, five were found to be fully supporting (not impaired) for Aquatic Life (Figure 4) and two for Aquatic Recreation (Figure 3). Ten reaches were found to be non-supporting

for Aquatic Life (AQL) and seven for Aquatic Recreation (AQR). Many of the other reaches were monitored some, but did not have sufficient data to completely assess them. Many of these non-supporting waterbodies have approved TMDLs, and some have approved implementation plans. A list of these reports, as well as a link to them can be found in Table 11.

The ecoregion contains many lakes, and water clarity and nutrient levels are moderate. Land surrounding many of these lakes has been developed for housing and recreation, and the densely populated metropolitan area dominates the eastern portion of this region. Water quality problems that face many of the water bodies in this area are associated with contaminated runoff from paved surfaces and lawns. (http://www.pca.state.mn.us/wfhye42) Water quality is also impacted by agricultural runoff; of which is largely in row crop production.

### *Additional Sunrise River Watershed Resources*

Past MPCA studies regarding assessment, Stressor Identification, TMDLs, and implementation in the Sunrise River Watershed can be found at: http://www.pca.state.mn.us/lupgdd5

Minnesota (DNR) Watershed Assessment Mapbook for the Sunrise River Watershed: http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/wsmb37.pdf

Natural Resources Conservation Service's (NRCS) Rapid Watershed Assessment: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022726.pdf

## 2.1 Condition Status

This section summarizes impairment assessments for streams and lakes in the Sunrise River Watershed. Waters that are not listed as impaired will be subject to protection efforts (See Section 2.5). Some of the waterbodies in the Sunrise River Watershed are impaired by mercury and Polychlorinated Biphenyls (PCBs) in fish tissue; however, this report does not cover toxic pollutants. For more information on mercury impairments see the statewide mercury TMDL at: http://www.pca.state.mn.us/wfhy9ef.

### Streams

Streams are assessed for aquatic life and aquatic recreation uses. Aquatic life impairments include: fish index of biotic integrity (Fish IBI), macroinvertebrate index of biotic integrity (Invert IBI), dissolved oxygen (DO), turbidity/total suspended solids (TSS), pH, and chlorides. Aquatic recreation use impairments include: E. coli. Table 3 summarizes the stream impairment assessment by total stream length in miles and the total number of individual assessment unit IDs (AUIDs). Appendix A includes a summary of the stream impairment assessment by designated use and pollutants for all assessed AUIDs.

**Table 3. MPCA 2012 Stream Impairment Assessment Summary**

| Impairment Assessment | Stream Length (mi) | | Stream AUIDs (#) | |
|---|---|---|---|---|
| | Aquatic Life | Aquatic Recreation | Aquatic Life | Aquatic Recreation |
| Fully Supporting (FS) | 13.2 | 9.4 | 3 | 2 |
| Not Supporting (NS) | 61.3 | 35.4 | 10 | 7 |
| Insufficient Information (IF) | 37.9 | 43.1 | 15 | 18 |
| Not Assessed (NA) | 642.6 | 667.3 | 88 | 89 |
| Total | 755.1 | | 116 | |

### Lakes

Lakes are assessed for aquatic recreation uses based on ecoregion specific water quality standards for total phosphorus (TP), chlorophyll-a (chl-*a*), and secchi transparency depth. To be listed as impaired, a lake must not meet water quality standards for TP and either chl-*a* or secchi depth. Table 4 summarizes the lake impairment assessment by total lake surface area and total number of lakes (split between DNR Public Water Basins (Lakes) and Wetlands). Appendix A includes a summary of the lake aquatic recreation impairments by individual lake. For the list of lakes and streams impaired for Mercury and PCBs refer to the Lower St. Croix River Monitoring and Assessment Report.

**Table 4. MPCA 2012 Lake Impairment Assessment Summary**

| Aquatic Recreation (Eutrophication) | DNR Public Water Basin | | DNR Public Water Wetland | |
|---|---|---|---|---|
| | Surface area (ac) | Count (#) | Surface area (ac) | Count (#) |
| Fully Supporting (FS) | 8,604 | 13 | 58 | 1 |
| Not Supporting (NS) | 4,253 | 15 | 145 | 4 |
| Insufficient Information (IF) | 1,935 | 9 | 252 | 7 |
| Not Assessed (NA) | 15,139 | 55 | 4,215 | 138 |
| Total | 29,931 | 92 | 4,670 | 150 |

**Figure 2. MPCA Lake Assessment Trophic Status Map.**

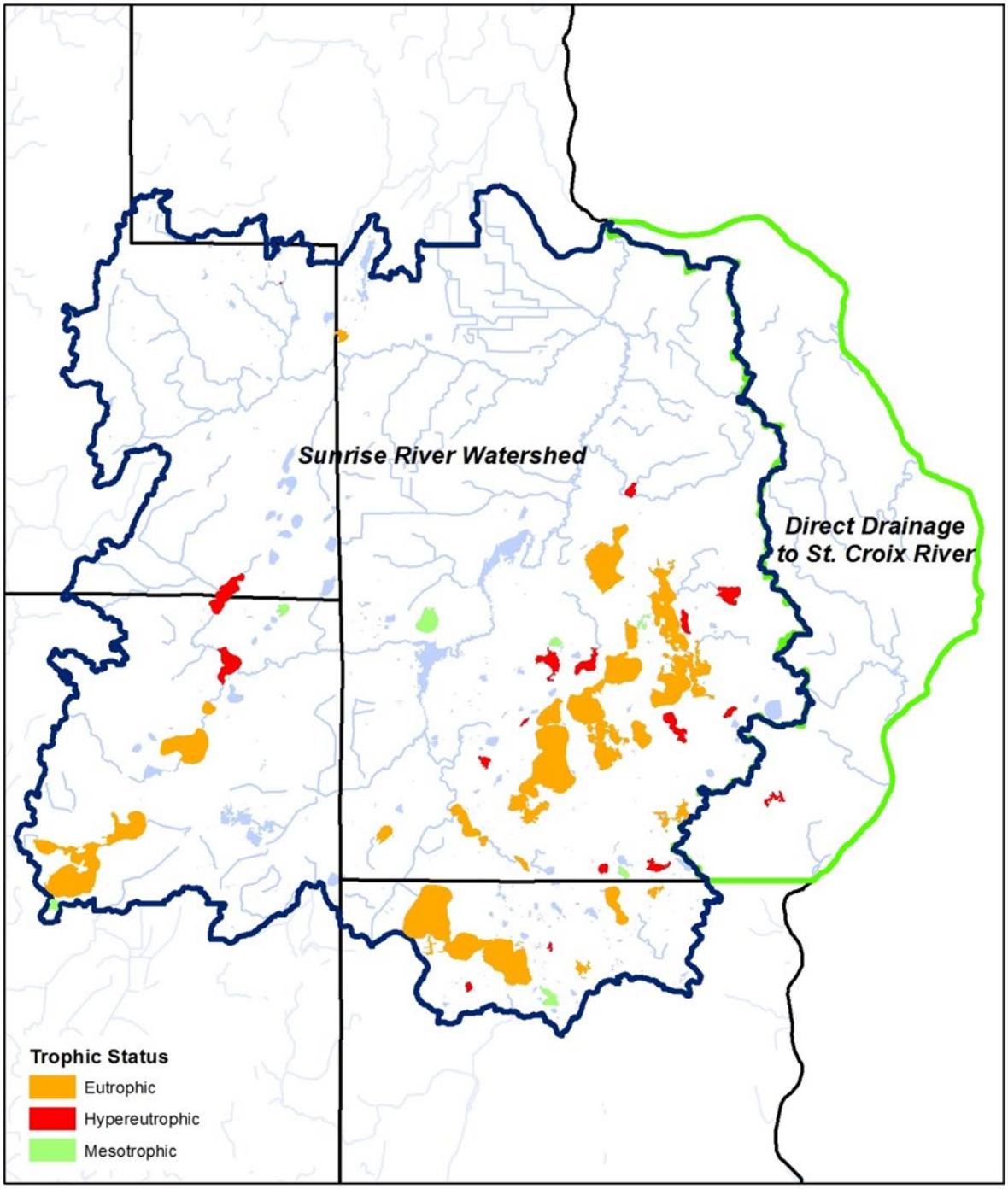


**Figure 3. MPCA Aquatic Recreation Stream Assessment Map.**

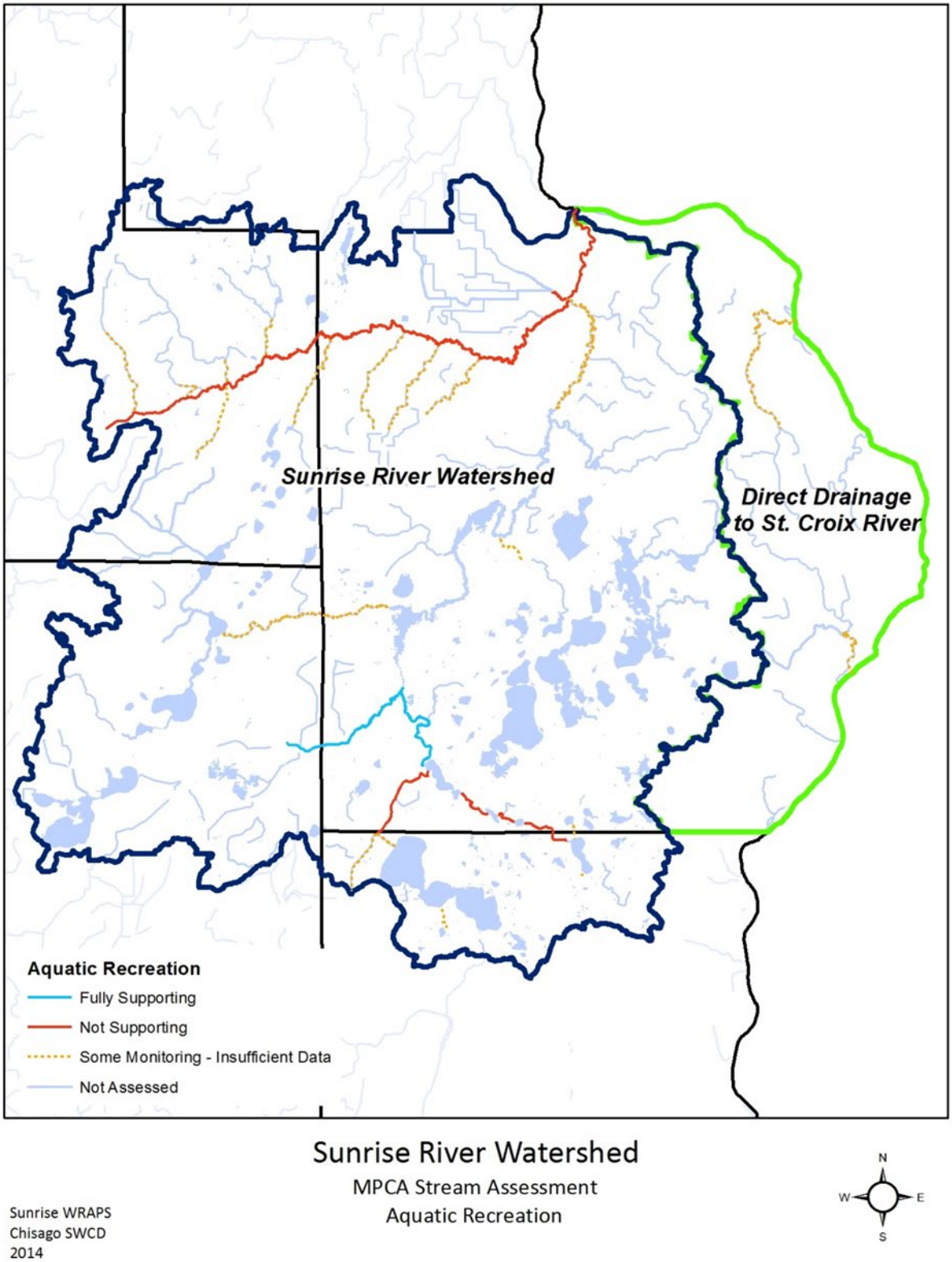
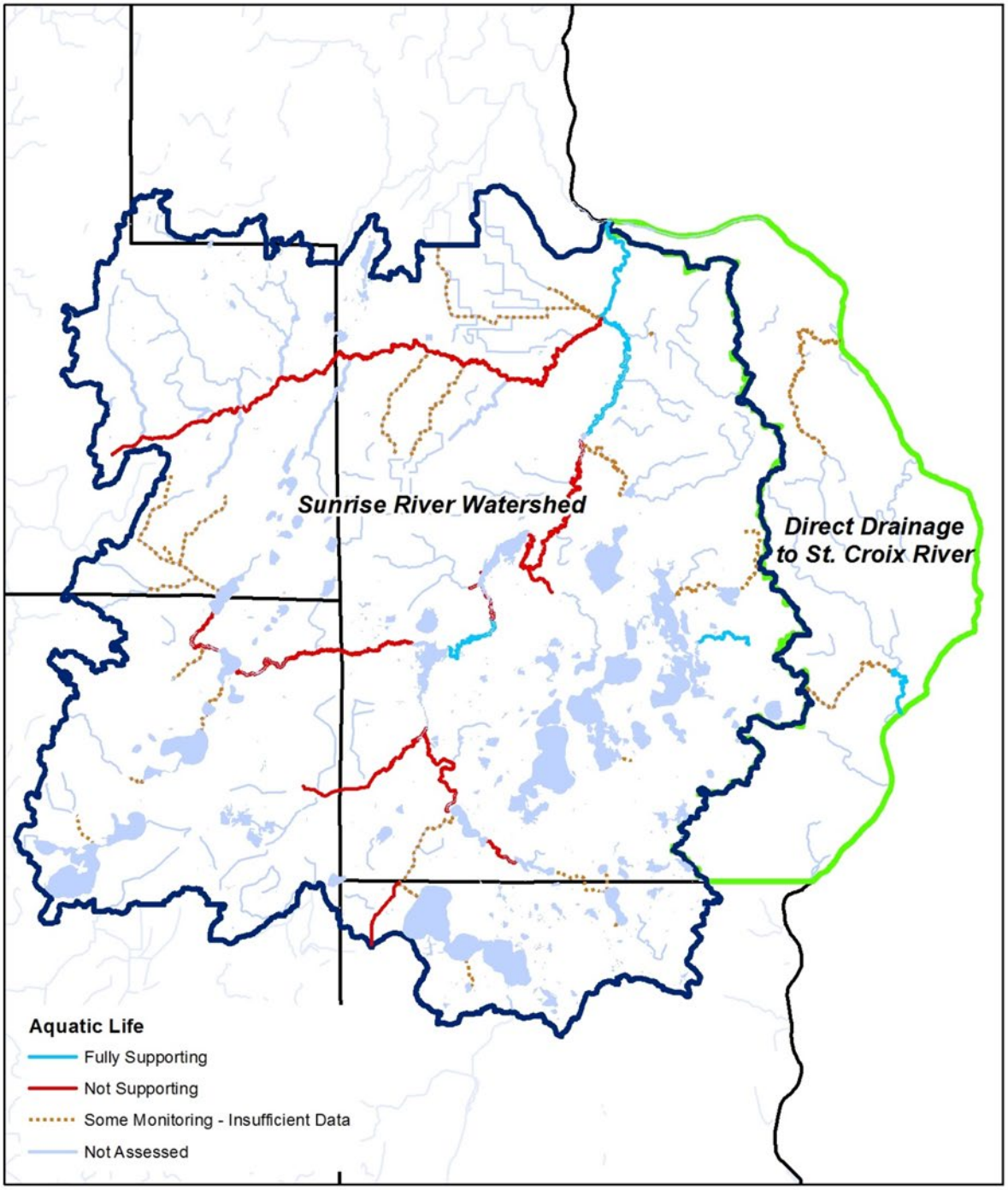


**Figure 4. MPCA Aquatic Life Stream Assessment Map.**



## 2.2 Water Quality Trends

Temporal and spatial trends in water quality are useful for identifying potential watershed-scale changes in pollutant loading or hydrology that affect lake and stream water quality. Long-term statistical trend analyses require a long, mostly continuous, monitoring record (25 years or more). Sufficient data was available to conduct a long-term statistical trend analysis for Secchi transparency depth, an overall indicator of water quality in lakes and the most frequently collected water quality parameter, for eighteen lakes in the Sunrise River Watershed. Long-term trends were calculated using the GSI Mann-Kendall Toolkit (GSI Environmental Inc., Houston, Texas, www.gsi-net.com) and are presented in Table 5 below. Insufficient data was available to conduct long-term statistical trend analyses for streams in the Sunrise River Watershed.

All but two lakes showed a stable trend (not variable), no trend (variable but not increasing or decreasing) or improving trend in water quality, indicating an overall reduction or maintenance of current phosphorus loading rates. The two lakes showing decreasing trends in water quality were rated as "probably decreasing", indicating that these trends were not severe.

**Table 5. Long-term lake transparency trends based on growing season mean secchi depth (m)**

The Mann-Kendall Statistic indicates whether the Secchi transparency depth trend versus time is generally increasing (positive value) or decreasing (negative value). The confidence factor indicates the degree of confidence in the trend result, as in "Decreasing" vs. "Probably Decreasing" and is given a numeric value and text description. Increasing transparency trends indicate an increasing trend, or improvement, in water quality. Red rows highlight decreasing trends; blue rows highlight increasing trends; and white rows highlight stable trends (not variable) or no trend (variable).

| Lake | Period | Mann-Kendall Statistic | Confidence Factor | Trend Description |
|---|---|---|---|---|
| Bone | 1975-2011 | 15 | 60.8% | No Trend |
| Chisago North | 1986-2010 | 10 | 72.7% | No Trend |
| Chisago South | 1985-2011 | 0 | 46.0% | Stable |
| Comfort | 1987-2011 | -41 | 90.2% | Probably Decreasing |
| Coon | 1973-2011 | 200 | >99.9% | Increasing |
| Fawn | 1974-2011 | 27 | 87.7% | No Trend |
| Forest | 1980-2011 | -10 | 57.0% | Stable |
| Little Green | 1986-2011 | 50 | 88.7% | No Trend |
| Green | 1986-2011 | 74 | 95.6% | Increasing |
| Sylvan/Halfbreed | 1974-2011 | 248 | >99.9% | Increasing |
| Kroon | 1994-2010 | 24 | 84.7% | No Trend |
| Linwood | 1975-2011 | -19 | 69.2% | Stable |
| Martin | 1975-2011 | 94 | 93.4% | Probably Increasing |
| North Center | 1986-2011 | 66 | 99.4% | Increasing |
| Shields | 1989-2010 | -17 | 69.6% | Stable |
| South Center | 1985-2011 | 20 | 69.0% | No Trend |
| South Lindstrom | 1975-2011 | 41 | 95.0% | Probably Increasing |
| Typo | 1974-2007 | -25 | 92.7% | Probably Decreasing |

Spatial trends in lake water quality were analyzed for forty-five lakes using mean Carlson Trophic State Index (TSI) based on water quality collected from 2001-2010. The Carlson TSI gives a standardized measure of lake fertility based on the secchi depth, total phosphorus concentration and chlorophyll A measurements, Two thirds of the lakes in the Sunrise River Watershed were classified as eutrophic with periods of algal bloom episodes that impede aquatic recreation. Nine lakes were classified as hypereutrophic with potential severe algal blooms. Only six lakes were classified as oligo-/meso-trophic with good water quality.

**Table 6. Spatial trends in lake trophic state.**
Mean Carlson TSI Index based on 10-year growing season mean TP, Chl-a, and Secchi transparency depth from 2001-2010

| Lake ID | Lake Name | Mean Carlson TSI | Predicted Water Quality |
|---|---|---|---|
| 02-0035-00 | FAWN | 38 | Oligotrophic |
| 82-0080-00 | SYLVAN/HALFBREED | 41 | Mesotrophic |
| 02-0048-00 | SOUTH COON | 44 | Mesotrophic |
| 13-0024-00 | THIRD | 47 | Mesotrophic |
| 13-0043-00 | MATTSON | 48 | Mesotrophic |
| 82-0056-00 | UNNAMED (GERMAN) | 49 | Mesotrophic |
| 13-0066-00 | MUD | 51 | Eutrophic |
| 13-0035-00 | NORTH LINDSTROM | 53 | Eutrophic |
| 13-0047-00 | ELLEN | 53 | Eutrophic |
| 02-0022-00 | ISLAND | 54 | Eutrophic |
| 13-0028-00 | SOUTH LINDSTROM | 54 | Eutrophic |
| 13-0053-00 | COMFORT | 55 | Eutrophic |
| 13-0054-00 | LITTLE COMFORT | 55 | Eutrophic |
| 02-0042-00 | COON | 56 | Eutrophic |
| 13-0012-01 | CHISAGO (NORTH BAY) | 56 | Eutrophic |
| 82-0159-00 | FOREST | 56 | Eutrophic |
| 13-0041-01 | GREEN (LITTLE GREEN) | 56 | Eutrophic |
| 13-0041-02 | GREEN (MAIN BASIN) | 57 | Eutrophic |
| 13-0031-00 | SUNRISE | 57 | Eutrophic |
| 13-0013-00 | KROON | 58 | Eutrophic |
| 13-0019-00 | SPIDER | 59 | Eutrophic |
| 82-0054-00 | BONE | 60 | Eutrophic |
| 13-0012-02 | CHISAGO (SOUTH BAY) | 60 | Eutrophic |
| 13-0056-00 | HEIMS | 61 | Eutrophic |
| 02-0026-00 | LINWOOD | 61 | Eutrophic |
| 13-0027-00 | SOUTH CENTER | 61 | Eutrophic |
| 13-0032-02 | NORTH CENTER POND | 61 | Eutrophic |
| 13-0025-00 | SECOND | 62 | Eutrophic |
| 13-0057-00 | SCHOOL | 62 | Eutrophic |
| 82-0053-00 | SEA | 63 | Eutrophic |
| 13-0011-00 | OGRENS | 64 | Eutrophic |
| 13-0048-00 | WHITE STONE | 64 | Eutrophic |
| 13-0032-01 | NORTH CENTER | 65 | Eutrophic |
| 13-0042-00 | BIRCH | 65 | Eutrophic |

| Lake ID | Lake Name | Mean Carlson TSI | Predicted Water Quality |
|---|---|---|---|
| 02-0034-00 | MARTIN | 68 | Eutrophic |
| 82-0162-00 | SHIELDS | 70 | Eutrophic |
| 13-0023-00 | MOODY | 71 | Hypereutrophic |
| 13-0034-00 | PIONEER | 72 | Hypereutrophic |
| 13-0033-00 | LITTLE | 72 | Hypereutrophic |
| 13-0014-00 | LINN | 74 | Hypereutrophic |
| 13-0044-00 | SCHOOL | 76 | Hypereutrophic |
| 13-0030-00 | VIBO | 79 | Hypereutrophic |
| 13-0046-00 | EMILY | 79 | Hypereutrophic |
| 13-0029-00 | WALLMARK | 80 | Hypereutrophic |
| 30-0009-00 | TYPO | 85 | Hypereutrophic |

## Stream Trends and Pollutant Loadings

Water quality trends and loadings across a watershed are useful in tracking the overall health of the watershed, and determining if on the ground actions are actually being reflected in local water quality. Within the Sunrise River watershed stream monitoring has been not consistent enough at this time to determine overall trends on every stream within the watershed. While monitoring throughout the watershed has not been consistent, the Watershed Districts and Watershed Management Organizations have been collecting stream data, but do not yet have enough to establish trends. As for the rest of the waterbodies outside these areas, their ability to collect a consistent amount of data on every reach for the numerous years necessary to establish trends currently exceeds their available staff time and funding.

However, while local resources may be currently limited the MPCA has been collecting data in the watershed through a few of its programs. One program with some longer term trends is the Milestones Monitoring Program. This program has been monitoring on the North Branch of the Sunrise River for several decades. The overall trends of this data can be found on the Milestone Trends by Decade Spreadsheet on the MPCA's Minnesota Milestone River Monitoring Program website. Another program that was started in the watershed in 2007 was the MPCA's Pollutant Load Monitoring Program. This program has been collecting samples and stream flow year round on the Sunrise River at the town of Sunrise. Table 7 shows the average pollutant loads and Flow Weighted Mean Concentrations at the site from 2007 – 2011. More information on this site, and others around the state, can be found on the MPCA Pollutant Load Monitoring website.

**Table 7. Average Pollutant Loads, Yields, and Flow Weighted Means for the Sunrise River at CR88 from 2007 - 2011**

| Parameter | Avg FWMC (mg/L) | Average Mass (kg) | Average Volume (acre-ft) | Average Yield (lbs/acre) |
|---|---|---|---|---|
| Dissolved Ortho-Phosphorus (OP) | 0.039 | 6,182 | 125,739 | 0.056 |
| Nitrate + Nitrite Nitrogen ($NO_2$+$NO_{3)}$ | 1.02 | 149,289 | | 1.35 |
| Total Kjeldahl Nitrogen (TKN) | 1.00 | 160,306 | | 1.45 |
| Total Phosphorus (TP) | 0.096 | 14,709 | | 0.133 |
| Total Suspended Solids (TSS) | 13 | 2,201,783 | | 19.9 |

## 2.3 Stressors and Sources

In order to develop appropriate strategies for restoring or protecting waterbodies the stressors and/or sources impacting or threatening them must be identified and evaluated. Biological stressor identification is done for streams with dissolved oxygen, fish, or macroinvertebrate biota impairments and encompasses both evaluation of pollutants and non-pollutant-related factors as potential stressors (e.g. altered hydrology, fish passage, habitat). Pollutant source assessments are done where a biological stressor ID process identifies a pollutant as a stressor as well as for the typical pollutant impairment listings. Section 3 provides further detail on stressors and pollutant sources.

### Stressors of Biologically-Impaired Stream Reaches

Stressors were identified for six streams in the Sunrise River Watershed with biological impairments, shown in Table 8. The most common stressors are stream eutrophication, indicated by high phosphorus and low dissolved oxygen stressors, and altered habitat. Likely causes of stream eutrophication are high rates of watershed phosphorus loading from cropland and impacted wetlands, or upstream impaired lakes. Likely causes of altered habitat are ditched stream channels and impoundments.

**Table 8: Primary stressors to aquatic life in biologically-impaired reaches in the Sunrise River Watershed**

| Subwater-shed | AUID (Last 3 digits) | Stream | Reach Description | Biological Impairment | Primary Stressors | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dissolved Oxygen | Nitrate | Phosphorus | Turbidity | Fish Passage (dams) | Altered Hydrology | Altered Habitat |
| Comfort - Forest Lake | 527 | Sunrise River | Comfort Lk to Pool 1 | Fish, Invert., DO | ● | | ● | | ● | | ● |
| West Branch | 529 | Sunrise R, West Br | Martin Lk to Sunrise Pool 1 | Fish, Invert., Turbidity, pH | ● | | ● | ● | | | ● |
| South Branch | 528 | Sunrise R, South Br | 02-0500-00 to Sunrise R | DO | | ● | ● | | | | |
| Chisago Chain of Lakes | 723 | Bloomquist Creek | T34 R21W S24, east line to Sunrise R | Fish | | | ● | | | | |
| Carlos Avery | 540 | Sunrise River | Pool 3 to Kost Dam Reservoir | Fish | ● | | ● | | ● | | ● |
| North Branch | 501 | Sunrise R, North Br | Headwaters to Sunrise R | Fish | ● | | ● | | ● | | ● |

## Pollutant sources

Pollutant sources were identified for point and non-point sources in the Sunrise River Watershed. There are 12 municipal wastewater point sources, one industrial wastewater point source, and four regulated municipal stormwater communities in the Sunrise River Watershed (Table 9). None of the point sources require pollutant reductions beyond their current permit conditions or limits for any of the Sunrise River Watershed TMDL. However, many did receive phosphorus limits as part of the Lake St. Croix TMDL.

The Chisago Lake Joint Sewage Treatment Facility for instance, was recently reissued a updated permit with new permit limits for un-ionized ammonia and a new permit limit for discharging Phosphorus. Fertilizer and manure runoff were identified as common non-point pollutant sources to streams and lakes. In addition, failing septic systems and in-lake sediment phosphorus release were identified as common non-point pollutant sources to lakes.

**Table 9: Point Sources in the Sunrise River Watershed.**

| Subwatershed | Point Source | | | Notes |
|---|---|---|---|---|
| | Name | Permit # | Type | |
| **Chisago Chain of Lakes** | Smith Metal Products – Industrial Storm Water | MNRNE34W9 | Industrial wastewater | |
| | Chisago Lakes Joint Sewage Treatment Facility (STF) | MN0055808 | Municipal wastewater | Recently updated permit |
| | Blue Waters Leisure Park | MN0050091 | Municipal wastewater | No surface water discharge |
| **Comfort Lake Forest Lake** | The Preserve at Birch Lake WWTP | MN0066362 | Municipal wastewater | No surface water discharge |
| | Birchwood Terrace Mobile Home Park | MN0064670 | Municipal wastewater | No surface water discharge |
| | Wyldewood Acres WWTP | MN0066567 | Municipal wastewater | No surface water discharge |
| | Liberty Ponds | MN0067466 | Municipal wastewater | No surface water discharge |
| | Forest Lake, City | MS400262 | Municipal Stormwater | |
| **West Branch, Sunrise River** | John Iacarella - Linwood Terrace Co | MN0054372 | Municipal wastewater | |
| | Independent School District 831 – Linwood Elementary School | MN0050474 | Municipal wastewater | No surface water discharge |
| | East Bethel, City | MS400087 | Municipal Stormwater | |

| Subwatershed | Point Source | | | Notes |
|---|---|---|---|---|
| **West Branch, Sunrise River** | Ham Lake, City | MS400092 | Municipal Stormwater | |
| **North Branch, Sunrise River** | North Branch WWTP | MN0024350 | Municipal wastewater | |
| | North Branch, City | MS400260 | Municipal Stormwater | |
| **Direct Drainage to the St. Croix River** | Taylors Falls WWTP | MNG580218 | Municipal wastewater | |
| | Shafer WWTP | MN0030848 | Municipal wastewater | |
| **Sunrise River Main Branch** | Trophy Lake Estates III | MN0067474 | Municipal wastewater | No surface water discharge |

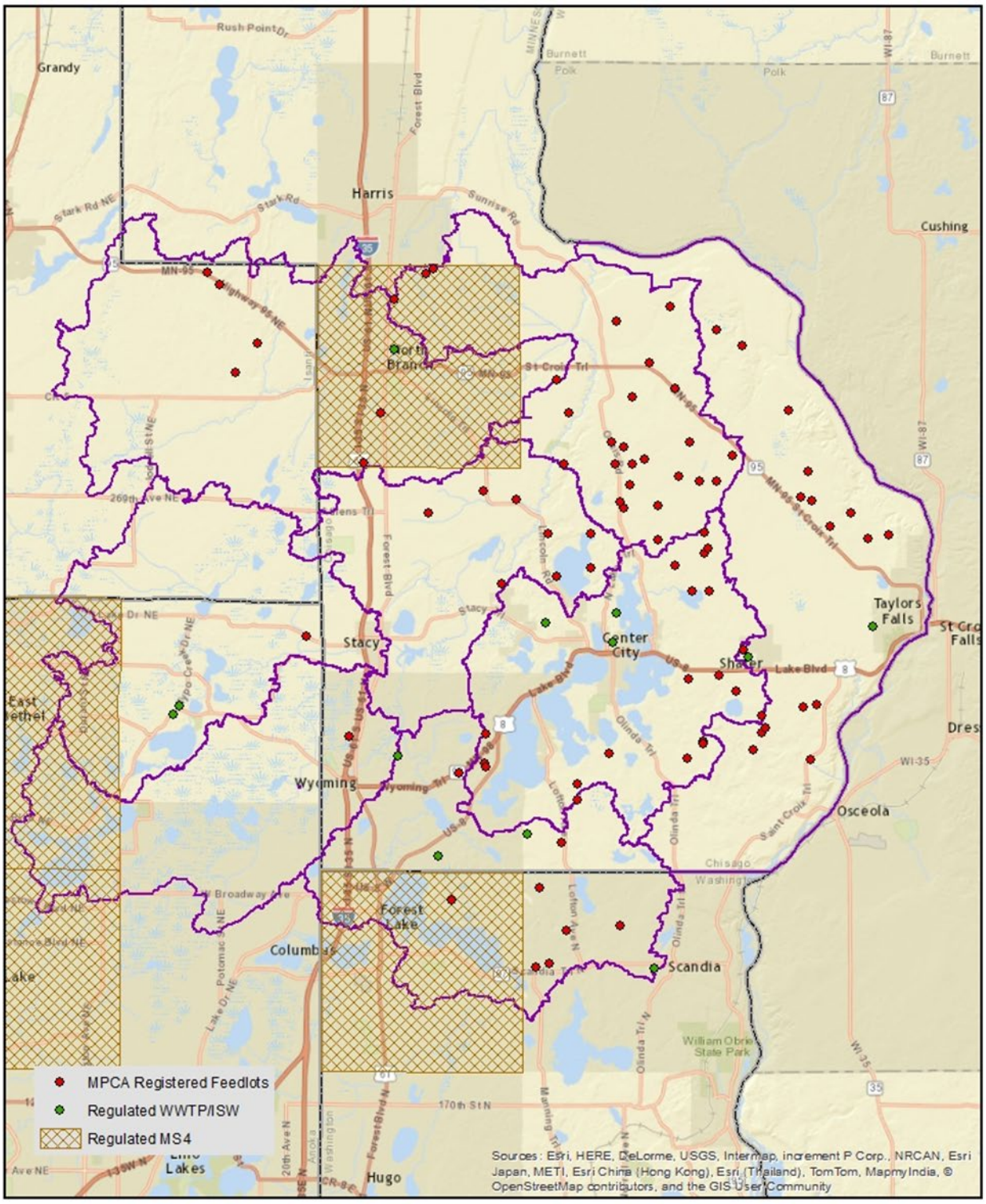
**Table 10: Nonpoint Sources in the Sunrise River Watershed. Relative magnitudes of contributing sources are indicated.**

| Subwatershed | Type | Pollutant | Stream Pollutant Sources* | | | | | | | Lake Pollutant Sources* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Fertilizer & manure run-off | Livestock overgrazing in riparian | Failing septic systems | Wildlife | Poor riparian vegetation cover | Upland soil erosion | Upstream lake effluent | Lake Sediment P release | Fertilizer & manure runoff | Failing septic systems | Atmospheric |
| South Branch Sunrise River | Streams | Bacteria | ~ | | | ™ | | | | | | | |
| | | TP | › | | | ™ | | | | | | | |
| | Lakes | TP | | | | ™ | | | | ~ | › | ~ | ™ |
| West Branch Sunrise River | Streams | Bacteria | ~ | | › | | | | | | | | |
| | | TP | | | › | | | | | | | | |
| | Lakes | TP | › | | | | | | ~ | ~ | › | ~ | ™ |
| Carlos Avery | Streams | Bacteria | ~ | | | ™ | | | | | | | |
| | | TP | | | | ™ | | | | | | | |
| | Lakes | TP | | | | | | ™ | | ™ | ™ | ™ | ™ |
| Sunrise River, Main Branch | Streams | Bacteria | › | | › | ~ | | | | | | | |
| | | TP | ™ | | | ™ | | ™ | | | | | |
| | Lakes | TP | | | | | | | | ~ | ~ | ™ | ™ |
| Comfort Lake-Forest Lake* | Streams | Bacteria | | | | | | | | | | | |
| | | TP | ~ | | | | | ~ | | | | | |
| | Lakes | TP | | | | | ™ | | | | | | |
| Chisago Chain of Lakes | Streams | Bacteria | ~ | | | | | | | | | | |
| | | TP | ™ | | | | | ~ | | | | | |
| | Lakes | TP | ™ | | | | ™ | ~ | | ~ | › | › | ™ |
| North Branch Sunrise River | Streams | Bacteria | ~ | › | ™ | | | | | | | | |
| | | TP | ~ | › | ™ | | | | | | | | |
| | Lakes | TP | | | | | | | | | | | |

**Key:** ~ = High › = Moderate ™ = Low

* All sources listed in the table are present in the Sunrise River watershed; the symbols in the table differentiate the relative ranking of implementation targeting for the more significant sources within each subwatershed. Refer to Table 11 for links to further information regarding specific sources.

**Figure 5. Sunrise River Watershed Regulated MS4s, Wastewater Treatment Facilities, and Registered Feedlots.**




Sunrise River WRAPS

Regulated MS4s, Wastewater Treatment Facilities, and Registered Feedlots.

## 2.4 TMDL Summary

There are twenty-one impaired lakes and four impaired streams in the Sunrise River Watershed with completed Total Maximum Daily Load studies (Table 11). Table 12 and Table 13 describe the current pollution loadings and load reductions needed for each source or source category to meet water quality standards and goals, including wasteload and load allocations.

**Table 11. Completed Total Maximum Daily Load studies in the Sunrise River Watershed**

| Total Maximum Daily Load Study | Impaired Waters | Online Access to the TMDL Report |
|---|---|---|
| **North Branch Sunrise River Fecal Coliform (NBSR)**<br>EPA Approval: December 2006 | Sunrise R. North Branch (07030005-501) | http://www.pca.state.mn.us/qzqha00 |
| **Comfort Lake-Forest Lake Watershed District Six Lakes Nutrients (CLFL6)**<br>EPA Approval: March 2010 | Moody Lake (13-0023-00)<br>Bone Lake (82-0054-00)<br>School Lake (13-0057-00)<br>Little Comfort Lake (13-0054-00)<br>Shields Lake (82-0162-00)<br>Comfort Lake (13-0053-00) | http://www.pca.state.mn.us/tchy9f8 |
| **Typo Lake and Martin Lake Nutrients (TLML)**<br>EPA Approval: February 2012 | Typo Lake (30-0009-00)<br>Martin Lake (02-0034-00) | http://www.pca.state.mn.us/pyri9fd |
| **Chisago Lakes Chain of Lakes Watershed Nutrients (CLCLW)**<br>EPA Approval: February 2013 | North Center Lake (13-0032-00)<br>South Center Lake (13-0027-00)<br>Emily Lake (13-0046-00)<br>Linn Lake (13-0014-00)<br>Little Lake (13-0033-00)<br>Ogren Lake (13-0011-00)<br>Pioneer Lake (13-0034-00)<br>School Lake (13-0044-00)<br>Wallmark Lake (13-0029-00) | http://www.pca.state.mn.us/wfhya0a |
| **Sunrise River Watershed Nutrients and *E. coli* (SRWS)**<br>EPA Approval: April 2014 | Linwood Lake (02-0026-00)<br>Second Lake (13-0025-00)<br>Vibo Lake (13-0030-00)<br>White Stone Lake (13-0048-00)<br>Sunrise R. West Branch (07030005-529)<br>Sunrise River (07030005-543)<br>Hay Creek (07030005-545) | http://www.pca.state.mn.us/zihya01 |

**Table 12. Allocation summary for all completed lake TMDLs in the Sunrise River watershed.**

| Lake/Stream (ID) | Pollutant | Allocations (lbs/year) | | | | | | | | | | Percent Reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wasteload Allocation | | | Load Allocation | | | | | MOS | RC | |
| | | WWTFs | Construction & Industrial Stormwater | MS4 Communities | Watershed Load | Internal Load | Upstream Lakes | Septic Systems | Atmosphere | Margin of Safety | Reserve Capacity | |
| **Sunrise River Watershed TMDL** | | | | | | | | | | | | |
| Linwood (02-0026-00) | TP | -- | 7.4 | 21.3 | 762 | 277.9 | -- | 86.4 | 152.3 | 145.3 | -- | 21% |
| Second (13-0025-00) | TP | -- | 0.14 | -- | 80.9 | -- | -- | 6.2 | 22.7 | 12.2 | -- | 40% |
| Vibo (13-0030-00) | TP | -- | 0.8 | -- | 698.0 | 28 | -- | 6.6 | 15.4 | 82.9 | -- | 93% |
| White Stone (13-0048-00) | TP | -- | 0.06 | -- | 7.7 | 23.9 | -- | 10 | 13 | 6.1 | -- | 59% |
| Sunrise River, West Branch (07030005-529) | TP | -- | 108 | -- | 6,832 | 1,356 | -- | -- | 362 | 456 | -- | 74% |
| **Typo Lake and Martin Lake TMDL** | | | | | | | | | | | | |
| Typo (13-0030-00) | TP | -- | 4.6 | -- | 1078 | 303 | -- | 0 | 78 | 163 | -- | 81% |
| Martin (13-0030-00) | TP | 47 | 40 | 7.0 | 1,790 | -- | 1,868 | 0 | 64 | 424 | -- | 41% |
| **Comfort Lake Forest Lake Watershed District Six Lakes TMDL** | | | | | | | | | | | | |
| Moody | TP | -- | 1.1 | -- | 142.9 | | | | | | | 86% |
| Bone | TP | -- | 5 | -- | 664 | | | | | | | 46% |
| School | TP | 0 | 3.3 | 1.1* | 447.6 | | | | | | | 51% |
| Little Comfort | TP | 0 | 3.5 | 113* | 460 | | | | | | | 54% |
| Shields | TP | -- | 1.5 | 18 | 175.5 | | | | | -- | -- | 83% |
| Comfort | TP | -- | 14 | 1,081* | 1,244 | | | | | -- | -- | 5% |
| **Chisago Lakes Chain of Lakes TMDL** | | | | | | | | | | | | |
| North Center | TP | -- | 2.4 | -- | 723 | 3,000 | 980 | -- | 200 | 545 | -- | 18% |
| South Center | TP | -- | 2.6 | -- | 840 | 3,292 | 490 | -- | 240 | 541 | -- | 21% |
| Lake Emily | TP | -- | .020 | -- | 6.2 | 16 | -- | -- | 4.6 | 3 | -- | 93% |
| Linn | TP | -- | 0.32 | -- | 97 | 178 | -- | -- | 49 | 36 | -- | 88% |
| Little | TP | -- | 0.48 | -- | 148 | 104 | -- | -- | 44 | 33 | -- | 90% |

| Lake/Stream (ID) | Pollutant | Allocations (lbs/year) | | | | | | | | | | Percent Reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wasteload Allocation | | | Load Allocation | | | | | MOS | RC | |
| | | WWTFs | Construction & Industrial Stormwater | MS4 Communities | Watershed Load | Internal Load | Upstream Lakes | Septic Systems | Atmosphere | Margin of Safety | Reserve Capacity | |
| Ogren | TP | -- | 1.38 | -- | 429 | 133 | -- | -- | 13 | 64 | -- | 45% |
| Pioneer | TP | -- | 0.002 | -- | 0.61 | 50 | -- | -- | 21 | 8 | -- | 96% |
| School | TP | -- | 0.26 | -- | 81 | 77 | 19 | -- | 39 | 24 | -- | 88% |
| Wallmark | TP | -- | 0.15 | -- | 46 | 103 | -- | -- | 40 | 24 | -- | 95% |

***** Includes Wasteload Allocations for future Regulated MS4 Communities.

**Table 13. Allocation summary for all completed stream TMDLs in the Sunrise River watershed.**

| Stream/Reach (AUID) | Pollutant | Flow Zone | E. coli/Fecal Coliform Allocations (billions organisms/day) Total Phosphorus (lbs/year) | | | | Percent Reduction |
|---|---|---|---|---|---|---|---|
| | | | Wasteload Allocation | | Load Allocation | MOS | |
| | | | WWTFs | Regulated Stormwater (CSW/ISW/MS4) | Watershed Load | Margin of Safety | |
| **North Branch of the Sunrise River TMDL** | | | | | | | |
| Sunrise River, North Branch | Fecal Coliform | High | 6 | 286 | 608 | 305 | 52% |
| | | Wet | 6 | 149 | 317 | 147 | |
| | | Mid | 6 | 107 | 228 | 228 | |
| | | Dry | 6 | 71 | 151 | 151 | |
| | | Low | 6 | 50 | 106 | 106 | |
| **Sunrise River Watershed TMDL** | | | | | | | |
| Sunrise River, West Branch 07030005-529 | TP | High | -- | 8.2 | 60.2 | 7.6 | 0% |
| | | Wet | -- | 3.58 | 26.3 | 3.32 | 0% |
| | | Mid | -- | 1.98 | 14.6 | 1.84 | 12% |
| | | Dry | -- | 1.16 | 8.47 | 1.07 | 18% |
| | | Low | -- | 0.74 | 5.4 | 0.68 | 0% |
| Sunrise River 07030005-543 | Fecal coliform | High | 11.7 | -- | 1384.3 | 155.1 | 0% |
| | | Wet | 11.7 | -- | 598.7 | 67.8 | 19% |
| | | Mid | 11.7 | -- | 325.8 | 37.5 | 0% |
| | | Dry | 11.7 | -- | 185.3 | 21.9 | 38% |
| | | Low | 11.7 | -- | 113.5 | 13.9 | 0% |
| Hay Creek* 07030005-545 | Fecal coliform | High | -- | 1.4 | 54.4 | 6.2 | NA |
| | | Wet | -- | 0.61 | 23.8 | 2.71 | 44% |
| | | Mid | -- | 0.34 | 13.2 | 1.5 | 67% |
| | | Dry | -- | 0.2 | 7.67 | 0.88 | 87% |
| | | Low | -- | 0.13 | 4.87 | 0.56 | 67% |

*Loading capacities and allocations based on a limited amount of data: July and August only.

## 2.5 Protection Considerations

The following is a description of how the items in the table portion of the Subwatershed Implementation Plan figures were calculated. Refer to Section 3 for Subwatershed Implementation Plan figures.

**Groundwater Pollution Sensitivity**

Groundwater's sensitivity to pollution was determined by combining layers of data in ArcGIS. The protocol was replicated from MNDNR's Geologic Atlas Program procedure to determine the length of time potentially polluted water could reach a groundwater source. Data from each county was combined to determine hydrologic soil groups, surficial geology, and transmission rates from textural classes. Hydrologic Soil Group determines the time it takes water to move through the first 3 feet, the travel time for feet 3-10 is determined by the underlying surficial geology. In this report, it was broken down into 3 equal groups of High, Medium, and Low – following the MNDNR's draft guidelines.

**Slope**

Slope data was derived from the Sunrise River Soil and Water Assessment Tool (SWAT) Model completed by the St. Croix Watershed Research Station (Almendinger, 2010). The value "Slo1" was used in determining an area weighted mean from the SWAT subbasins database to the eight subwatersheds used in this report.

Average Slope = ∑ (Area * Slo1) / ∑ (Area)

**Animal Operation Numbers**

It was determined that for the Sunrise River Watershed and the Direct Drainage to the St. Croix River area that the Minnesota Pollution Control Agency data and GIS shapefiles were not accurate enough to display. Because of this, windshield surveys of animal numbers were used where available. The Chisago SWCD has completed windshield surveys for portions of the watershed. These surveys were then verified with knowledge of animal operations within the office. Animals within the watershed include: beef cattle, dairy cattle, bison, red deer, horse, poultry, and swine. Poultry and swine numbers were converted to animal units.

**BWSR Soil Erosion/Water Quality Risk**

A visual assessment of the Board of Water and Soil Resources Soil Erosion and Water Quality Risk layers was used to determine risk value. These data can be downloaded from the Board of Water and Soil Resources Ecological Ranking Tool website. (http://www.bwsr.state.mn.us/ecological_ranking/). The raster layers were displayed in quantile classification to show one-third of the values in each level of low, medium, and high. By displaying the data in this fashion, it was easy to assign a value of high, medium, or low for each subwatershed.

**SWAT TP/TSS Output**

The Total Phosphorus (TP) and Total Suspended Solids (TSS) Soil and Water Assessment Tool (SWAT) output calculations were derived from the Sunrise River SWAT Model completed by the St. Croix Watershed Research Station (Almendinger, 2010). The TP and TSS values were used to create an area weighted mean from the SWAT model database to the eight subwatersheds used in this report.

SWAT Average TSS = ∑ (Area * TSS) / ∑ (Area)

SWAT Average TP = ∑ (Area * TP) / ∑ (Area)

**Altered Wetland Hydrology**

The Altered Wetland Hydrology percentage was calculated using the National Wetland Inventory (NWI) modifiers. The freshwater wetland classification system includes special modifiers to show manipulation to wetlands. These modifications include: b - beavers, d - partially ditched/drained, f - farmed, h - diked/impounded, r - artificial, s - spoil, and x - excavated. The NWI was clipped to each of the eight subbasins.

% Altered Wetland Hydrology = Area of Modified Wetlands / Total Subbasin Area

Additional information on altered wetland hydrology can be found in the Army Corp of Engineers Sunrise River Watershed Study.

**Dominant Hydrologic Soil Group**

A visual assessment of this layer was used to determine dominant hydrologic soil group. Soils are given a classification of A, B, C, or D based on their ability to infiltrate water and potential to have runoff from them. Some soils are classified as A/D soils – these are D soils that, if ditched, would achieve A soil quality. Most of the subwatersheds clearly fit in one hydrologic soil group. The lower Sunrise area fit in two distinct soil groups: west of the Sunrise River is D soils that are drained for agriculture (thus fitting into hydrologic group A); the area east of the Sunrise River is predominantly B soils.

**Permitted Wastewater Discharges**

Permitted wastewater discharge locations are from the MPCA Municipal Industrial Division database. These locations are discharge permits for wastewater treatment facilities. All permits are through the National Pollutant Discharge Elimination System (NPDES) permits or NPDES/State Disposal System – these could include large dischargers like the Chisago Lakes Joint Sewage Treatment Commission or smaller systems like a LSTS (large subsurface sewage treatment system).

# 3. Prioritizing and Implementing Restoration and Protection

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

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

## 3.1 Targeting of Geographic Areas

The Priority Consideration figures in this document are designed to put many layers of information that is relevant to water quality and water use in one location. These figures include a map and a table for each of the seven subwatersheds used throughout the WRAPS Report. These maps visually show the connections between recreation, water quality, invasive species, public land, and downstream waters. The tables on the right side of the figure show important facts about the subwatershed. These items are defined in Section 2.5 Priority Consideration Figure Methodology.

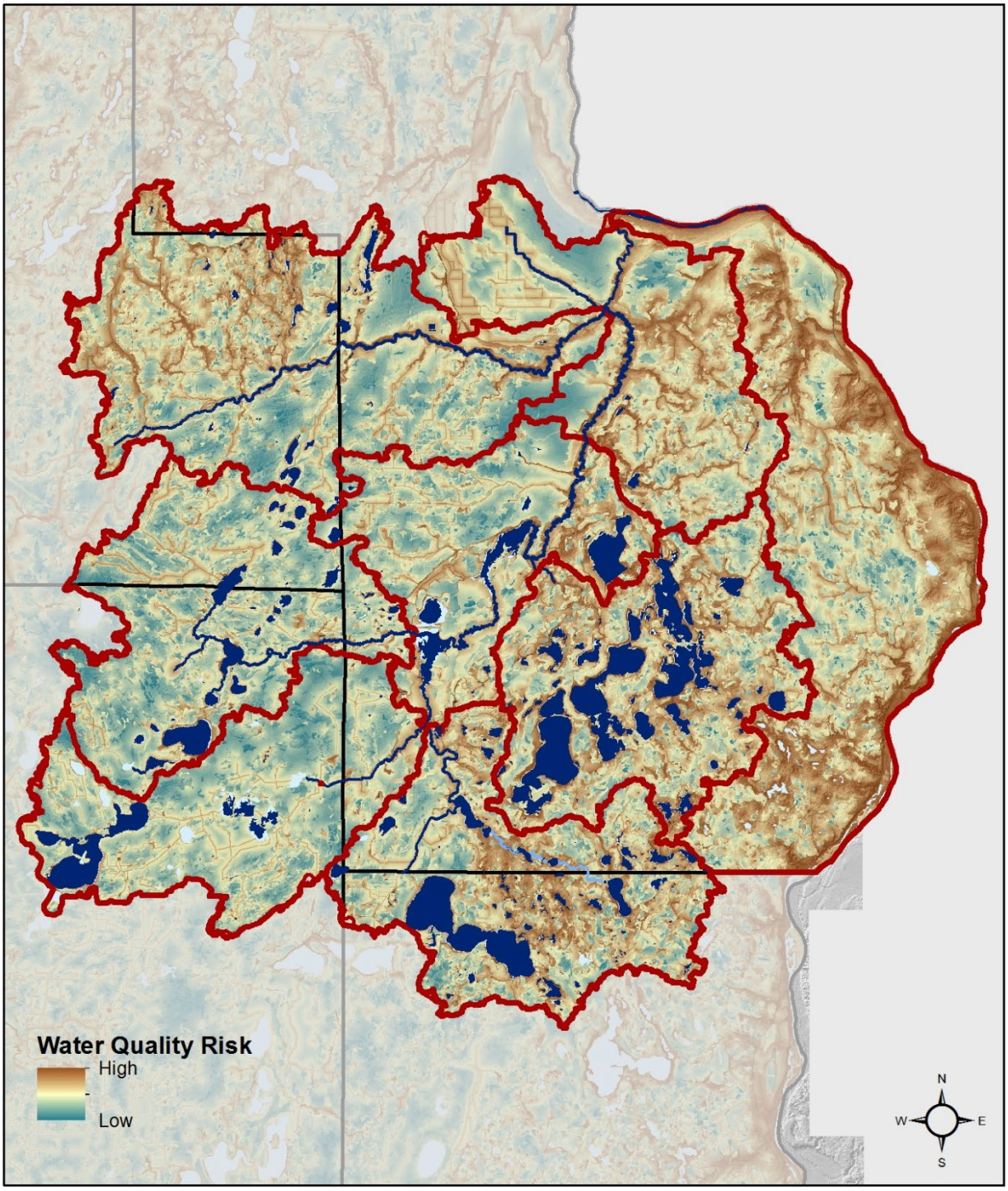
Priority areas or factors affecting priorities are different for each subwatershed. For example, one subwatershed may have increased pressure of aquatic invasive species and would benefit from watercraft inspections, while another subwatershed has a high Board of Water and Soil Resources Soil Erosion/Water Quality Risk, Board of Water and Soil Resources EBI Top 5% Priority Areas, high SWAT Outputs, or a large percentage or urban land or row crop agriculture and would benefit from concentrating BMP efforts in high priority locations. Many different scenarios of priorities are possible depending on the area of interest of the reader.

Local water resource professionals, city staff, watershed staff, and stakeholder groups can use these figures and tables in a variety of ways. The intention of these resources is that locals will be able to use the figures and tables while planning for future development, future projects, and other natural resource planning.

**Table 14 - Prioritization Tools Used in this Document**

| Tool | Description | How can the tool be used? | Notes | Link to Information and data |
|---|---|---|---|---|
| **Ecological Ranking Tool (Environmental Benefit Index - EBI)** | Three GIS layers containing: soil erosion risk, water quality risk, and habitat quality. Locations on each layer are assigned a score from 0-100. The sum of all three layer scores (max of 300) is the EBI score. This higher the score, the higher the value in applying restoration or protection. | Any one of the three layers can be used separately or the sum of the layers (EBI) can be used to identify areas that are in line with local priorities. Raster calculator allows a user to make their own sum of the layers to better reflect local values. | GIS layers are available on the Board of Water and Soil Resources website. | *BWSR* |
| **Light Detection and Ranging (LiDAR)** | Elevation data in a digital elevation model (DEM) GIS layer. Created from remote sensing technology that uses laser light to detect and measure surface features on the earth. | General mapping and analysis of elevation/terrain. These data have been used for: erosion analysis, water storage and flow analysis, siting and design of BMPs, wetland mapping, and flood control mapping. A specific application of the data set is to delineate small catchments. | The layers are available on the MN Geospatial Information website for most counties. | *MGIO* |
| **Subwatershed Stormwater Retrofit Assessments** | Identifying small catchments, pollution reduction, appropriate best management practices, and associated costs to make the best bang for the buck water quality improvements. | A cost-benefit analysis of identified best management practices will help local decision makers identify the best projects that should be completed to achieve the largest pollution reductions. | Many locations in Anoka, Chisago, and Washington Counties have been completed by the Conservation Districts | |
| **Sunrise River SWAT (Soil and Water Assessment Tool) Model** | Computer model of watershed processes to show where pollution may originate and which mitigation strategies are most effective. | This model shows the amount of phosphorus and sediment that is coming off the landscape. After these calculations are completed, the data can be used to determine scenarios for pollution reduction on a subwatershed scale. | | *Sunrise SWAT* |

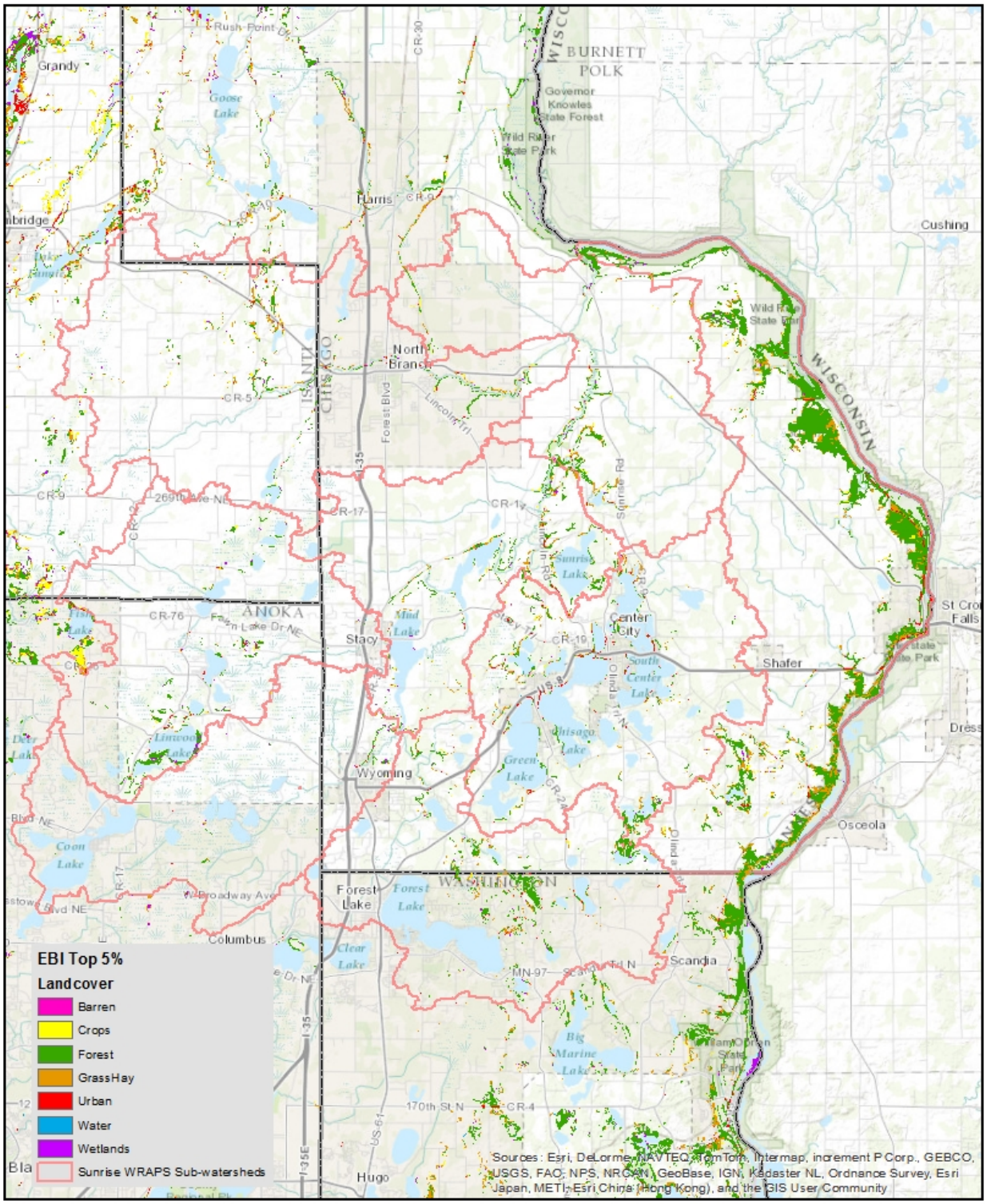
**Figure 6. BWSR Water Quality Risk Map.**




Sunrise River WRAPS

BWSR Environmental Benefits Index - Water Quality Risk

**Figure 7. Environmental Benefits Index Top Areas for Restoration and Protection**




## Top Areas for Restoration and Protection
BWSR Environmental Benefits Index

**Figure 8. Subwatershed Stormwater Retrofit and Rural Assessments for North Center Lake (from the Chisago Lakes Chain of Lakes TMDL Restoration and Protection Plan, Approved February 2013).**

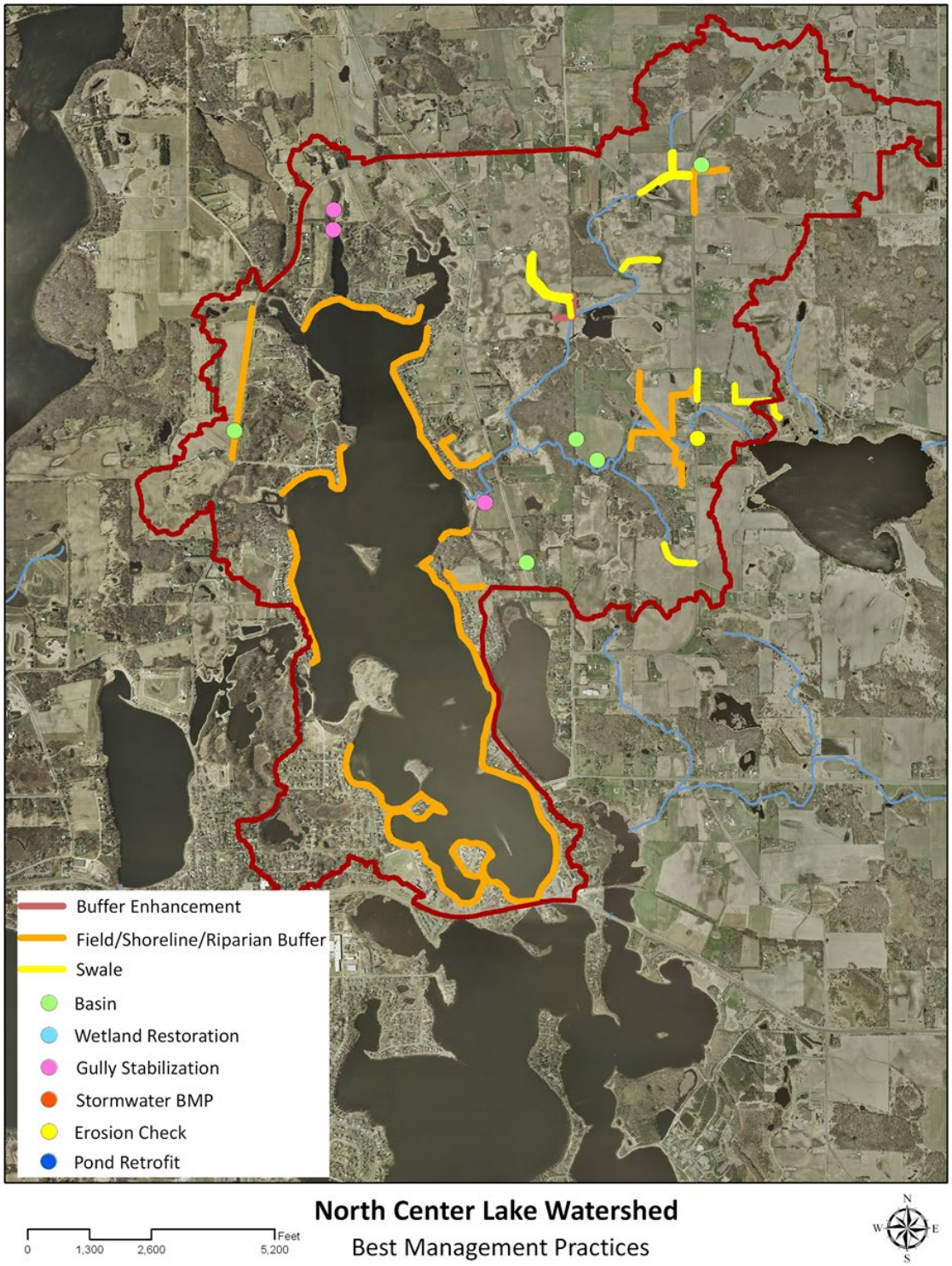


**Figure 9 – Sunrise River Watershed SWAT average modeled subbasin yields of sediment (tons/hectare), 2000-2009 (Source: Almendinger and Ulrich 2010)**

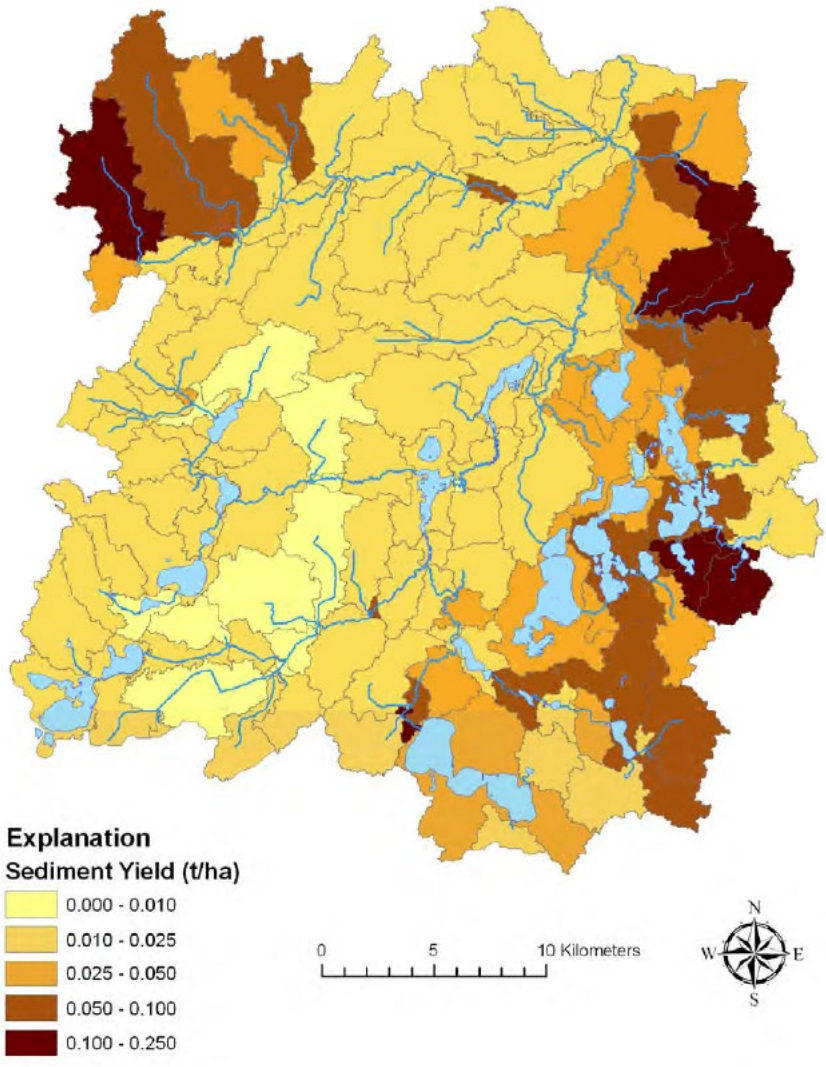



**Figure 16.** Average modeled subbasin yields of sediment in the Sunrise River watershed, 2000-09.

**Figure 10 – Sunrise River Watershed SWAT average modeled subbasin yields of total phosphorus, 2000-2009 (Source: Almendinger and Ulrich 2010)**

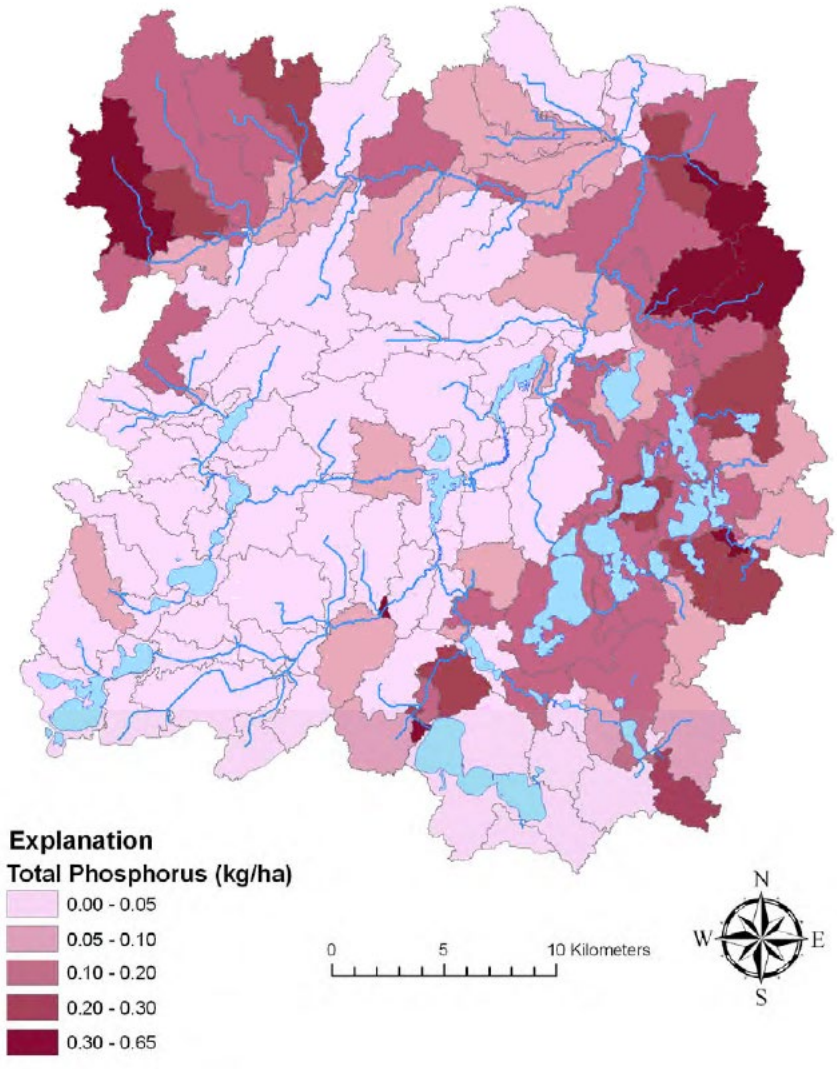
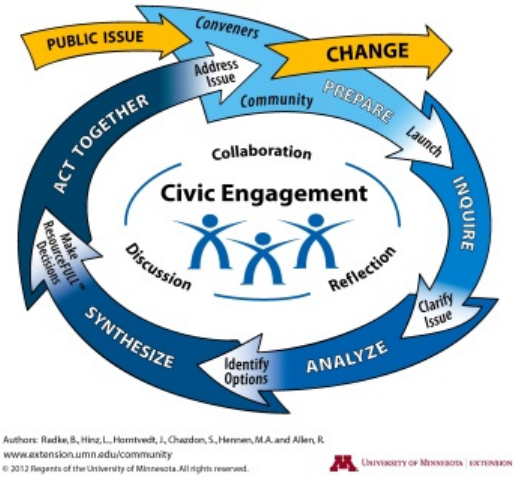



**Figure 17.** Average modeled subbasin yields of total phosphorus in the Sunrise River watershed, 2000-09.

Examples are shown above of ways to prioritize Best Management Practices based on modeled loading and erosion rates. These models give local water quality professionals a base to start working on projects in the most vulnerable locations. We use many types of prioritization strategies to determine where our work load should take place.

## 3.2 Civic Engagement




Many key partners have been brought together to make this WRAPS Report a useable document that will ultimately help us to meet the goals of the Sunrise River Watershed and the Direct Drainage to the St. Croix River. These groups include: Anoka CD, Chisago SWCD, Isanti SWCD, Washington CD, Chisago County, MN DNR (Fisheries and Eco/Waters), MPCA, City of North Branch, City of Stacy, City of Wyoming, City of Shafer, City of Taylors Falls, USDA NRCS, Sunrise River Water Management Organization, Comfort Lake-Forest Lake Watershed District, Chisago Lakes Lake Improvement District, Linwood Lake Association, and Friends of the Sunrise River. These groups have collaborated with the Chisago SWCD to provide comments and additions specific to their subwatersheds. This collaboration will prove to be pivotal in applying for funding in the future to complete projects in each constituent's jurisdiction.

### Accomplishments

- Farmer Focus Group – A group of local agricultural producers gather with staff from the SWCD and NRCS to discuss solutions to common problems the producers have concerning water quality. This includes discussing barriers to implementing practices.
- Friends of the Sunrise River – two members of the FSR group have been appointed to be involved in the steering committee. These representatives have been involved in review of the document and will relay information to/from the group.
- Sunrise River Watershed Management Organization will continue to promote BMPs and provide cost-share for projects such as: rain gardens, shoreline buffers, and erosion control projects.
- Many of the Cities within the watershed have adopted stormwater management ordinance and/or review guidance.
- Comfort Lake Forest Lake Watershed District works with the East Metro Water Resource Education Program (http://www.mnwcd.org/emwrep/) for water quality education.
- The Chisago Lakes Lake Improvement District has been successful in implementing many BMPs across the watershed. The LID and SWCD have secured CWF grants for BMPs since 2011.

### Future Plans

- Linwood Lake Association will continue to promote BMPs such as: rain gardens, shoreline buffers, and septic system upgrades within their watershed.
- Complete inventories throughout the watershed for restorable wetland locations, gully stabilizations, stormwater retrofit BMP locations, streambank corridors, etc.

- Increase education opportunities for urban and rural landowners to provide more information about best management practices for all locations.
- Determine locations and protections strategies for high quality natural communities and areas of high biological significance.

Continuing to build momentum for water quality projects, water quality improvement, and water quality protection will be important in the future. These groups and activities will benefit the individual bodies of water and the watershed as a whole.

A formal public notice period for this Sunrise River WRAPS Report was held from October 20, 2014 through November 20, 2014.

## 3.3 Restoration & Protection Strategies

Specific strategies have been developed to restore the impaired waters within the watershed and for protecting the quality of the waters within the watershed that are not impaired. The subwatershed-based implementation strategy tables that follow outline the strategies and actions that are capable of cumulatively achieving the needed pollution load reductions for point and non-point sources. The tables were developed by thoroughly reviewing the specific conditions affecting each of the waters and collecting input from watershed stakeholders. As this WRAPS Report includes waters that have been previously addressed by past TMDLs, specific implementation plans have already been developed for many of the waters. In these cases, links to the past work are provided in the table. Similarly, many of the waters within the Sunrise River Watershed are actively being managed by local organizations including the Comfort Lake Forest Lake Watershed District and the Chisago Lakes Lake Improvement District (see section 3.2 for a complete list of the entities managing waters in the watershed). In these cases, detailed management plans have been written that establish goals for these waters and detailed implementation activities have been identified and are scheduled to be completed. Links to these watershed management plans are included in the implementation strategies table. For the impaired lakes included in the Sunrise River Watershed TMDL detailed implementation plans are included that describe the in-lake and watershed improvements that are needed to meet the goal of the TMDL. The analysis includes a specific BMP selection and siting based on the specific nature of each of the waters and watersheds. The lake implementation project tables are included following the appropriate subwatershed proposed implementation strategies and actions tables.

### Watershed-wide Reductions in Phosphorus from Agricultural BMPs

The Sunrise River Soil and Water Assessment Tool (SWAT) Model completed by the St. Croix Watershed Research Station (Almendinger, 2010) evaluated the reduction s in phosphorus that could be achieved through implementation of various agricultural BMPs either singly or in combinations. The BMPs that were evaluated include conversion of conventional tilling practices to no-till, installation of vegetated buffer strips and grassed waterways, decreasing soil phosphorus levels and converting daily haul manure applications to seasonal chisel-plow incorporated applications. The findings are summarized in Table 15. Reductions in phosphorus are expressed in terms of percent reduction from the baseline condition.

The Sunrise River Soil and Water Assessment Tool (SWAT) Model was also used to evaluate various urban residential area scenarios but the model was ineffective due to the nature of its coding.

**Table 15: Phosphorus reductions from various scenarios of agricultural BMPs**

| Scenario Description | Phosphorus Reduction |
|---|---|
| 1- Conversion of ½ the grain corn/soybean and silage corn/alfalfa rotations to no-till | 1.9% |
| 2- Conversion of all of the grain corn/soybean and silage corn/alfalfa rotations to no-till | 3.9% |
| 3- Conversion of ½ the grain corn/soybean rotations to switchgrass | 18% |
| 4- Conversion of grain corn/soybean rotations found on steep slopes to switchgrass | 0.6% |
| 5- Installing a vegetated filter strip to ½ the grain corn/soybean rotations | 5.6% |
| 6- Installing a vegetated filter strip to all of the grain corn/soybean rotations | 9.7% |
| 7- Installing a vegetated filter strip to all of the grain corn/soybean rotations and all of the silage corn/alfalfa rotations | 11.1% |
| 8- Installing grassed waterways on ½ the grain corn/soybean rotations | 7.9% |
| 9- Installing grassed waterways on all of the grain corn/soybean rotations | 14.7% |
| 10- Installing grassed waterways on all of the grain corn/soybean rotations and all of the silage corn/alfalfa rotations | 17.6% |
| 11- Reducing soil phosphorus on grain corn/soybean and silage corn/alfalfa rotations with high levels (60 ppm) down to medium levels (40 ppm) | 4.1% |
| 12- Reducing soil phosphorus level on grain corn/soybean rotations with medium levels (40 ppm) down to 20 ppm and silage corn/alfalfa rotations with medium levels (40 ppm) down to 30 ppm | 17.4% |
| 13- Reducing soil phosphorus level in grass hay fields and pastures with high levels (60 ppm) down to 40 ppm | 0.4% |
| 14- Reducing soil phosphorus level in grass hay fields and pastures with high levels (60 ppm) down to 20 ppm | 1.2% |
| 15- Reducing soil phosphorus levels for all grain corn/soybean rotations, silage corn/alfalfa rotations and grass hay fields and pastures down to 20 ppm | 19.7% |
| 16- Converting all daily haul manure operations on grain corn/soybean rotations to seasonal chisel-plow incorporated | 2.1% |

## Watershed-wide Reductions in Phosphorus from Wetland Creation

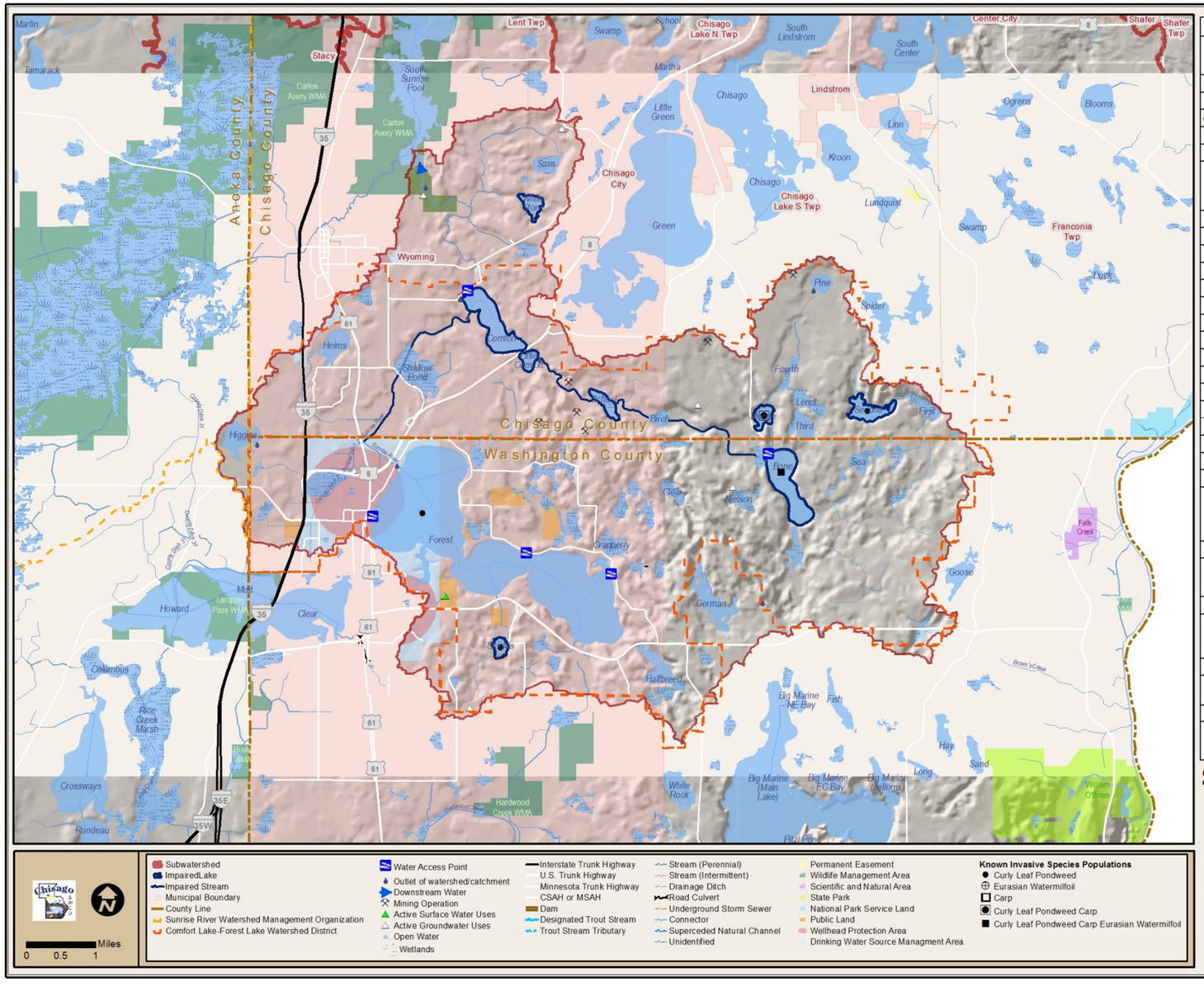
The Sunrise River Soil and Water Assessment Tool (SWAT) Model completed by the St. Croix Watershed Research Station (Almendinger, 2010) also evaluated the reduction s in phosphorus that could be achieved through creation of additional wetlands. Specifically the model evaluated the phosphorus removal for adding wetlands downstream of the north pool and found that by increasing the extent of wetland by 25% resulted in a 9% reduction in phosphorus and by increasing the extent of wetland by 50% resulted in a 19% reduction in phosphorus.

The Natural Resources Research Institute at the University of Minnesota Duluth, along with the Minnesota Pollution Control Agency and through funding by the Clean Water Land & Legacy Amendment developed a Restorable Wetland Prioritization. The tool enables users to prioritize areas for maximizing water quality improvements, in the form of nitrogen or phosphorus removal, and/or habitat and for restoring or protecting high functioning sustainable wetlands and can be found at https://beaver.nrri.umn.edu/MPCAWLPri/

## Watershed-wide Protection of High Quality Ecological Resources

The Sunrise River watershed contains a large proportion of high quality natural communities and areas of high biological significance. Protecting the quality of these upland ecological assets is an important protection consideration in the Sunrise River watershed because water quality is intimately linked to the health of aquatic organisms and the connection between land and water habitats.

## Comfort Lake-Forest Lake Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **Comfort Lake-Forest Lake** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 54 |
| Groundwater Pollution Sensitivity | Low |
| % Slope (avg.) | 3.6 |
| # of Animals | Second-18, Wh Stone-6 |
| Permitted Waste Discharges | Liberty Ponds, Preserve, Birchwood Terrace, Wyldwood Ac. |
| Impaired Lake Shoreline Septics | 221 |
| Dominant Hydrologic Soil Group | B |
| BWSR Soil Erosion Risk | High |
| BWSR Water Quality Risk | High |
| SWAT Output TP (lb/ac) | 0.30 |
| SWAT Output TSS (ton/ac) | 0.017 |
| Altered Wetland Hydrology | 23.6 % |
| Public Land | 1 % |
| **Subwatershed Land Cover** | |
| Developed | 18 % |
| Forested | 14 % |
| Cropland | 21 % |
| Grassland | 12 % |
| Wetlands | 24 % |
| Open Water | 11 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago Co, Washington CD, Washington Co, Comfort Lake-Forest Lake Watershed District, Forest Lake, Wyoming, New Scandia Township, Chisago Lakes Township | |
| **Major Water Resources** | |
| Forest, Comfort, Bone Lakes | |
| **Impairments** | |
| 1 stream chloride, 1 stream fish and macroinvertebrate bioassessment, 3 stream DO, 4 stream E. coli, 6 lake nutrient | |
| **Important Natural Resources** | |
| | |
| **Next Downstream Waterbody/Subwatershed** | |
| Sunrise River/Carlos Avery-Sunrise Unit Subwatershed | |

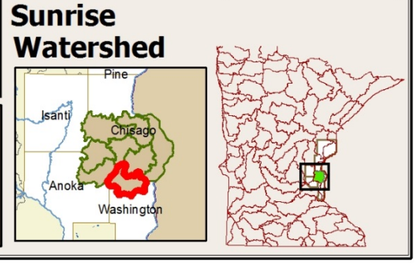


**Table 16: COMFORT LAKE-FOREST LAKE SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Judicial Ditch 2 (-525) Headwaters to Sunrise R | **Chisago** Washington | Chloride | >230 ug/L | <230 ug/L | Detailed strategies have been developed for these resources by the Comfort Lake Forest Lake Watershed District. Refer to the District's **2012-2021 Watershed Management Plan (October 2011)** for details. Specifically refer to the implementation tables which define the projects, partners and timelines that are proposed. (http://www.clflwd.org/)<br><br>Volume I – Goals & Implementation [http://www.clflwd.org/documents/CLFLWDWMPVolumeIGoalsandImplementation_000.pdf}<br><br>Volume II – Resources Inventories & Assessments [http://www.clflwd.org/documents/CLFLWDWMPVolumeIIResourceInventory_000.pdf]<br><br>Also refer to the Comfort Lake Forest Lake stormwater rules for the controls that have been established for future land use changes. [http://www.clflwd.org/resources_permits.php] These rules have also been adopted by most of the communities within the District. The City of Wyoming, for example, has developed a Water Guidance Document that incorporates the requirements of the District.<br><br>In addition, The Minnesota Pollution Control Agency (MPCA) recently completed a Metro Chloride Feasibility study to obtain a better understanding of the extent, magnitude, and causes of chloride contamination to surface waters in the seven county Twin Cities Metropolitan Area and to explore options and strategies for addressing chloride impairments and other impacts to water resources. In the next phase of the project, the MPCA will work with the multi-agency team and local stakeholders to develop a chloride restoration and protection plan which will satisfy total maximum daily load requirements for impaired waters, address waters not yet listed, and protect waters that are not yet impaired. This plan will also include implementation activities for road salt and chloride load reductions in the seven county Twin Cities Metropolitan Area. Refer to http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/metro-area-chloride-project/metro-area-chloride-project-history.html for more information.<br><br>Moody Lake, Shields Lake, Little Comfort Lake, Comfort Lake, Bone Lake, and School Lake were all include in the Comfort Lake Forest Lake Watershed District Six Lakes TMDL, and have a MPCA approved implementation plan that lays out the actions needed to achieve their necessary reductions. This report can be found online at: http://www.pca.state.mn.us/tchy9f8 | | | | | | | | | |
| Sunrise River (-526) Upstream from Comfort Lk | | *E. coli* | >126 orgs/100 mL | <126 orgs/100 mL | | | | | | | | | | | | |
| Unnamed creek (-641) Unnamed Lk to Birch Lk | | *E. coli* | >126 orgs/100 mL | <126 orgs/100 mL | | | | | | | | | | | | |
| Unnamed creek (-521) Birch Lk to School Lk | **Chisago** Washington | DO | <5mg/L | >5 mg/L | | | | | | | | | | | | |
| | | *E. coli* | >126 orgs/100 mL | <126 orgs/100 mL | | | | | | | | | | | | |
| Unnamed creek (-522) School Lk to Little Comfort Lk | **Chisago** Washington | DO | <5mg/L | >5 mg/L | | | | | | | | | | | | |
| | | *E. coli* | >126 orgs/100 mL | <126 orgs/100 mL | | | | | | | | | | | | |
| Sunrise River (-527) Comfort Lk to Pool 1 | **Chisago** Washington | Fish IBI | 33 | >50 | | | | | | | | | | | | |
| | | Invertebrate IBI | 42 | >47 | | | | | | | | | | | | |
| | | DO | <5mg/L | >5 mg/L | | | | | | | | | | | | |
| | | *E. coli* | >126 orgs/100 mL | <126 orgs/100 mL | | | | | | | | | | | | |
| Unnamed creek (-643) Shields Lk to Forest Lk<br>Unnamed ditch (-533) Heims Lk to Sunrise River | **Washington** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | | | | | | | | | | | | |
| Third (13-0024-00) | **Chisago** | All conventional parameters | 32 ug/L TP | Maintain or improve water quality | | | | | | | | | | | | |
| Sea (82-0053-00) | **Washington** | | Insufficient Data | | | | | | | | | | | | | |
| Heims (13-0056-00) | **Chisago** | | Insufficient Data | | | | | | | | | | | | | |
| Sylvan/Halfbreed (82-0080-00) | **Washington** | | 20 ug/L TP | | | | | | | | | | | | | |
| Higgins (02-0002-00) | **Anoka** | | Not Assessed | | | | | | | | | | | | | |
| German (82-0056-00) | **Washington** | | 26 ug/L TP | | | | | | | | | | | | | |
| Forest (82-0159-00) | **Washington** | | 35 ug/L TP | | | | | | | | | | | | | |
| Bone (82-0054-00) | **Washington** | Phosphorus | In-lake TP = 61 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| Shields (82-0162-00) | | | In-lake TP = 234 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| Little Comfort (13-0054-00) | | | In-lake TP = 63 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| School (13-0057-00) | **Chisago** | | In-lake TP = 67 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| Comfort (13-053-00) | | | In-lake TP = 37 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| Moody (13-0023-00) | | | In-lake TP = 167 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White Stone (13-0048-00) | **Chisago** | Phosphorus | In-lake TP = 97 ug/L | In-lake TP < 60 ug/L | Buffer Strips | 20% of Streambank and Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 10 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 20 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All comminuties within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 5 producers |
| Second (13-0025-00) | **Chisago** | Phosphorus | In-lake TP = 77 ug/L | In-lake TP < 60 ug/L | Buffer Strips | 20% of Streambank and Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 10 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 20 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All comminuties within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 5 producers |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection.

**Table 17: Potential White Stone Lake Restoration Projects.**

| WHITE STONE LAKE IMPLEMENTATION PROJECTS<br>CURRENT TP = 97 µg/L | | Treated Area [ac] | Treated Area [% Watershed] | Estimated TP Load Reduction [lb P/yr] | Estimated TP Load Reduction [% Total Needed] | Potential Granting Organization | Project Partners | Estimated 30-year Costs |
|---|---|---|---|---|---|---|---|---|
| **IN-LAKE** | **Load Reduction Needed:** | | | **40** | | | | |
| | **Load Reduction Achieved:** | | | **45** | **56%** | | | |
| Trophic state alteration | Includes complete fish kill and/or gamefish fish stocking. | | | 45 | 56% | | | Variable |
| **WATERSHED** | **Load Reduction Needed:** | | | **40** | | | | |
| | **Load Reduction Achieved:** | | | **35** | **44%** | | | |
| Biofilters | Buffer strips (2,250 feet total) | 3 | 1.3% | 0.4 | 0.5% | NRCS; CWF | NRCS; SWCD; LA; LO | $-$$ |
| Lawn management | Maintaining turfgrass and preventing transport of leaves and clippings on 100% of all parcels | 4 | 1.7% | 0.8 | 1.0% | Existing programs | City; SWCD; LA | $$ |
| Septic system upgrades | Convert all failing to conforming | N/A | N/A | 7 | 9.2% | CWF | County; Cities; LO | $ |
| | Convert all ITPHSS to conforming (completed) | N/A | N/A | 0 | 0.0% | | County, LO | |
| Bioretention & Infiltration | One rain garden on 100% of all parcels (29 total) | N/A | N/A | 15 | 18.1% | CWF; LID | SWCD; LA; LO | $$-$$$ |
| Sedimentation | Sedimentation ponds (5) | 50 | 22.8% | 8 | 9.9% | NRCS; CWF; City; LID | NRCS; SWCD; City; LO | $$ |
| Agricultural BMPs | Collection, storage, and treatment of manure (assumes 75% reduction of load) | N/A | N/A | 0 | 0.0% | NRCS; Ag BMP; CWF | NRCS; SWCD; LO | $-$$ |
| | 100% of cropland with conservation tillage | 31 | 14.0% | 4.1 | 5.1% | NRCS; Ag BMP | NRCS; SWCD; LO | Variable |
| **TOTAL** | **Load Reduction Needed:** | | | **80** | | | | |
| | **Load Reduction Achieved:** | | | **80** | **100%** | | | |

**Symbol key**

| | | | | |
|---|---|---|---|---|
| Ag BMP | MDA Agricultural BMP Loan Program | LID | Lake Improvement District | $ < $500/lb TP removed/yr |
| CWF | Clean Water Fund | LO | Landowners | $$ = $500-$1500/lb TP removed/yr |
| CWP | Clean Water Partnerships/ 319 Grants | NRCS | Natural Resources Conservation Service | $$$ > $1500 lb TP removed/yr |
| LA | Lake Associations | SWCD | Soil and Water Conservation District | |

***Note** - a 100% implementation rate for lawn management, rain gardens, and conservation tillage is required to meet the TMDL goal.

**Table 18: Potential Second Lake Restoration Projects**

| SECOND LAKE IMPLEMENTATION ACTIVITES<br>CURRENT TP = 77 µg/L | | Treated Area [ac] | Treated Area [% Watershed] | Estimated TP Load Reduction [lb P/yr] | Estimated TP Load Reduction [% Total Needed] | Potential Granting Organization | Project Partners | Estimated 30-year Costs |
|---|---|---|---|---|---|---|---|---|
| **IN-LAKE** | **Load Reduction Needed:** | | | **0** | | | | |
| | **Load Reduction Achieved:** | | | **48** | **66.8%** | | | |
| Trophic state alteration* | Includes gamefish stocking, complete fish kill, and/or curlyleaf pondweed management. | | | 48 | | | | |
| **WATERSHED** | **Load Reduction Needed:** | | | **72** | | | | |
| | **Load Reduction Achieved:** | | | **24** | **33.2%** | | | |
| Biofilters | Buffer strips (800 feet total) | 2 | 0.4% | 0.3 | 0.4% | NRCS; CWF | NRCS; CLFLWD; SWCD; LA; LO | $-$$ |
| Lawn management | Maintaining turfgrass and preventing transport of leaves and clippings on 25% of all parcels | 1.875 | 0.4% | 0.1 | 0.2% | Existing programs | City; SWCD; LA | $$ |
| Septic system upgrades | Convert all failing to conforming | N/A | N/A | 4 | 5.2% | CWF | County; Cities; LO | $ |
| | Convert all ITPHSS to conforming (completed) | N/A | N/A | 1 | 1.3% | | County, LO | |
| Bioretention & Infiltration | One rain garden on 10% of all parcels (2 total) | N/A | N/A | 1 | 1.0% | CWF; LID | SWCD; CLFLWD; LA; LO | $$-$$$ |
| Sedimentation | Sedimentation ponds (9) | 90 | 17.3% | 17 | 22.9% | NRCS; CWF; City; LID | NRCS; SWCD; LID; City; LO | $$ |
| Agricultural BMPs | Collection, storage, and treatment of manure (assumes 75% reduction of load) | N/A | N/A | 1 | 1.6% | NRCS; Ag BMP; CWF | NRCS; SWCD; LO | $-$$ |
| | 10% of cropland with conservation tillage | 2 | 0.4% | 0.3 | 0.4% | NRCS; Ag BMP | NRCS; SWCD; LO | Variable |
| **TOTAL** | **Load Reduction Needed:** | | | **72** | | | | |
| | **Load Reduction Achieved:** | | | **72** | **100%** | | | |

**Symbol key**

| | | | |
|---|---|---|---|
| Ag BMP | MDA Agricultural BMP Loan Program | CLFLWD | Comfort Lake Forest Lake Watershed District |
| CWF | Clean Water Fund | LO | Landowners |
| CWP | Clean Water Partnerships/ 319 Grants | NRCS | Natural Resources Conservation Service |
| LA | Lake Associations | SWCD | Soil and Water Conservation District |

$ < $500/lb TP removed/yr
$$ = $500-$1500/lb TP removed/yr
$$$ > $1500 lb TP removed/yr

* No internal load reductions were identified in the TMDL modeling. However, local knowledge of the watershed suggests that watershed loading problems do not currently exist. Curly-leaf pondweed and lack of game fish may be causing a food web imbalance resulting in poor water quality.

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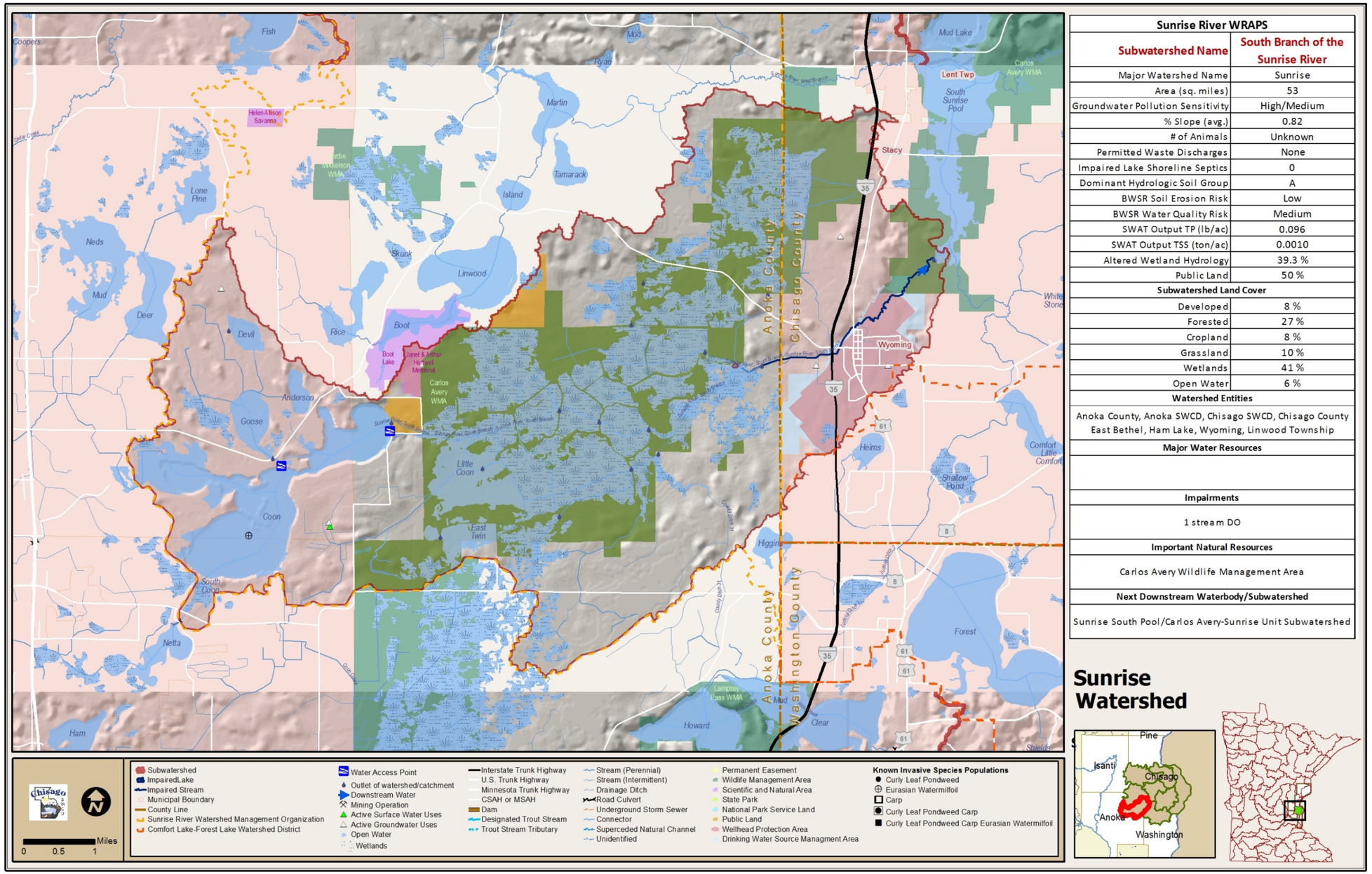
## South Branch of the Sunrise River Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **South Branch of the Sunrise River** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 53 |
| Groundwater Pollution Sensitivity | High/Medium |
| % Slope (avg.) | 0.82 |
| # of Animals | Unknown |
| Permitted Waste Discharges | None |
| Impaired Lake Shoreline Septics | 0 |
| Dominant Hydrologic Soil Group | A |
| BWSR Soil Erosion Risk | Low |
| BWSR Water Quality Risk | Medium |
| SWAT Output TP (lb/ac) | 0.096 |
| SWAT Output TSS (ton/ac) | 0.0010 |
| Altered Wetland Hydrology | 39.3 % |
| Public Land | 50 % |
| **Subwatershed Land Cover** | |
| Developed | 8 % |
| Forested | 27 % |
| Cropland | 8 % |
| Grassland | 10 % |
| Wetlands | 41 % |
| Open Water | 6 % |
| **Watershed Entities** | |
| Anoka County, Anoka SWCD, Chisago SWCD, Chisago County East Bethel, Ham Lake, Wyoming, Linwood Township | |
| **Major Water Resources** | |
| | |
| **Impairments** | |
| 1 stream DO | |
| **Important Natural Resources** | |
| Carlos Avery Wildlife Management Area | |
| **Next Downstream Waterbody/Subwatershed** | |
| Sunrise South Pool/Carlos Avery-Sunrise Unit Subwatershed | |

**Sunrise Watershed**

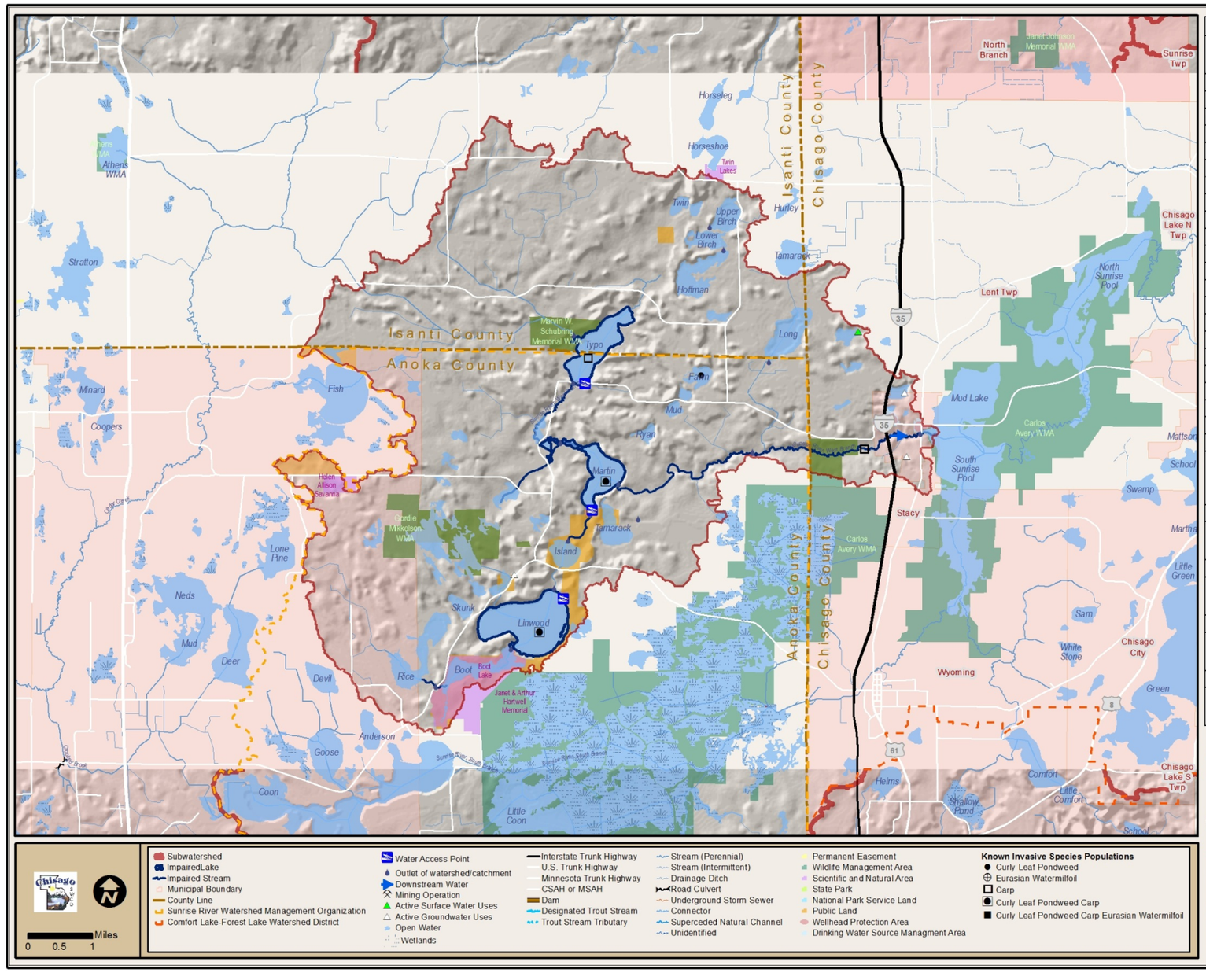
**Table 19: SOUTH BRANCH OF THE SUNRISE RIVER SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Sunrise River, S Br (-528) 02-0500-00 to Sunrise R | **Chisago** Anoka | DO | < 5 mg/L DO Daily Minimum | > 5 mg/L DO Daily minimum | Complete wetland restoration feasibility study | Wetland restoration feasibility study | • | • | • | • | • | • | • | | 2044 | Feasibility Study completed |
| | | | | | Continued Monitoring | Monitor monthly at current locations | | • | • | | | | • | | Ongoing | Monitor monthly at current locations |
| | | | | | Stormwater management | Implement actions of City of Wyoming Water Management Guidance Document | • | • | • | | • | • | • | • | 2024 | Review stormwater plan, implement 10 strategies |
| | | | | | **Refer to the Sunrise River WMO Watershed Management Plan** http://www.srwmo.org/images/SRWMO/Reports/SRWMO_Plan_Final_2011_amendments.pdf specifically Chapter 5 for the types of implementation activities that the WMO will be undertaking for their resources. Lessen the DO impact caused by wetlands (mainly background conditions) in watershed. Low DO, ditching and high organic matter soils within wetlands. | | | | | | | | | | |
| Unnamed Creek (-627) Headwaters to S Br Sunrise South Coon (02-0048-00) Anderson (02-0063-00) Devil (02-0058-00) Goose (02-0062-00) | **Anoka** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality <60 ug/L Phosphorus | Buffer Strips | 20% of Streambank and Lakeshore buffered | • | • | | • | • | | | | 2044 | 10 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | • | • | | | • | • | • | • | 2044 | Install 20 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | • | • | • | | | • | • | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | • | • | | | | | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | • | • | | • | | • | • | • | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | • | | • | | • | • | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Internal Load Management | Assessment of all lakes to determine if excessive internal loading exists | | | | • | | • | • | | 2024 | Completed |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | • | • | | • | | • | • | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | • | | • | | • | • | | 2054 | Plans written for 5 producers |
| Coon (02-0042-00) | **Anoka** | All conventional parameters | 34 ug/L TP | Maintain 34 ug/L TP | Buffer Strips | 20% of Streambank and Lakeshore buffered | • | • | | • | • | | | | 2044 | 10 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | • | • | | | • | • | • | • | 2044 | Install 20 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | • | • | • | | | • | • | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | • | • | | | | • | | Ongoing | Monitor monthly at current locations |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Internal Load Management | Assessment of all lakes to determine if excessive internal loading exists | | | | ● | | ● | ● | | 2024 | Completed |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2054 | Plans written for 5 producers |
| | | | | | Refer to Coon Lake Subwatershed Retrofit Assessment for specific strategies around Coon Lake. | Implement Top 20 projects in the assessment | ● | ● | ● | | | ● | ● | ● | 2024 | Implement 20 BMPs |
| Carlos Avery WMA Waterbodies: West Twin (02-0033-00) East Twin (02-0020-00) Little Coon (02-0032-00 | **Anoka** | All conventional parameters | Not Assessed | Maintain or improve water quality <60 ug/L Phosphorus | Maintain no increase in volume | All outlets | | | | ● | | | | | Ongoing | Determine best volumes and maintain |
| | | | | | Protect rare wetland species | All public land inventoried for rare species | | | | ● | | | | | 2034 | Public land rare species inventory funding secured |
| | | | | | Protect waterfowl habitat | Manage and protect areas known as waterfowl habitat | | | | ● | | | | | Ongoing | Inventory locations of best habitat |
| | | | | | Protect wild rice production | Manage water levels for optimal production | | | | ● | | | | | 2034 | Determine extent of wild rice populations |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Internal Load Management | Assessment of all lakes to determine if excessive internal loading exists | | | | ● | | ● | ● | | 2024 | Completed |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. *Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

## West Branch of the Sunrise River Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **West Branch of the Sunrise River** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 53 |
| Groundwater Pollution Sensitivity | High |
| % Slope (avg.) | 1.7 |
| # of Animals | Linwood - 58 |
| Permitted Waste Discharges | Linwood Terrace |
| Impaired Lake Shoreline Septics | 289 |
| Dominant Hydrologic Soil Group | A |
| BWSR Soil Erosion Risk | Medium |
| BWSR Water Quality Risk | Medium |
| SWAT Output TP (lb/ac) | 0.095 |
| SWAT Output TSS (ton/ac) | 0.0026 |
| Altered Wetland Hydrology | 25.0 % |
| Public Land | 8 % |
| **Subwatershed Land Cover** | |
| Developed | 9 % |
| Forested | 47 % |
| Cropland | 7 % |
| Grassland | 11 % |
| Wetlands | 21 % |
| Open Water | 5 % |
| **Watershed Entities** | |
| Anoka County, Anoka SWCD, Chisago SWCD, Chisago County East Bethel, Ham Lake, Linwood Lake Assoc., Stacy, Typo-Martin Lake Assoc., Oxford Twnshp, Linwood Twnshp | |
| **Major Water Resources** | |
| Linwood Lake, Typo Lake, Martin Lake, West Branch of the Sunrise River | |
| **Impairments** | |
| Nutrients, Turbidity, Fish, Invertebrates | |
| **Important Natural Resources** | |
| | |
| **Next Downstream Waterbody/Subwatershed** | |
| Sunrise South Pool/Carlos Avery-Sunrise Unit Subwatershed | |

**Sunrise Watershed**

**Table 20: WEST BRANCH OF THE SUNRISE RIVER SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Sunrise River, West Branch (-563) Typo Lk to Martin Lk | **Anoka** Isanti | Turbidity | >25 NTU | TP < 100 ug/L (Turb and pH impairments due to elevated TP) | Refer to: **TMDL Implementation Plan for Martin and Typo Lakes and the West Branch of the Sunrise River between the lakes (August 2012)** (http://www.pca.state.mn.us/pyri9fd) Specifically Table 7 that describes eleven strategies for phosphorus reduction;<br>• Plugging County Ditch 20 Lateral Ditches<br>• Data Creek Water Treatment Facility<br>• Rough Fish Control<br>• Drawdown Typo Lake<br>• Lakeshore Septic System Updates<br>• Lakeshore Restorations<br>• Martin Lake Stormwater Retrofits<br>• Stormwater and Erosion Control Permits and Regulations<br>• Agricultural Best Management Practices (BMPs)<br>• Education<br>• Effectiveness Monitoring<br>Also see the Martin Lake Sub-watershed Retrofit Assessment for specific strategies around Martin Lake (http://www.anokaswcd.org/images/AnokaSWCD/Reports/MartinLakeSWAssmtRptAppendixA.pdf) | | | | | | | | | | |
| | | pH | <6.5 | | | | | | | | | | | | | |
| Martin Lake Inlet (-579) Island Lk to Martin Lk<br>County Ditch 13 (-561) Headwaters to Typo Lk<br>Unnamed creek (-583) Headwaters to Typo Lk | **Anoka Isanti** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | | | | | | | | | | | | |
| Martin (02-0034-00) | **Anoka** | Phosphorus | 92 ug/L | <40 ug/L | | | | | | | | | | | | |
| Typo (30-0009-00) | **Anoka/ Isanti** | Phosphorus | 242 ug/L | <60 ug/L | | | | | | | | | | | | |
| Sunrise River, West Branch (-529) Martin Lk to Pool 1 | **Anoka Isanti** | Fish IBI | 20 | TP < 100 ug/L (Turb and pH impairments due to elevated TP) | Nutrient Management | Nutrient management plans for 20% of cropland | • | • | • | • | • | • | • | | 2044 | 200 acres of new nutrient management |
| | | Invertebrate IBI | 47 | | Buffer Strips | 20% of Streambank buffered | • | • | | • | • | | | | 2044 | 2 shoreline buffers installed |
| | | Turbidity | >25 NTU | | Streambank restoration | 20% of Streambanks restored to reduce erosion and increase habitat | | • | | • | • | | | | 2034 | 100 feet of streambank restored |
| | | pH | <6.5 | | Riparian Corridor Protection/Improvement | Locate areas with decent riparian buffers and improve | • | • | • | • | • | • | • | | 2044 | Locations found |
| Linwood (02-0026-00) | **Anoka** | Phosphorus | In-lake TP = 44 | In-lake TP <40 (21% Reduction) | Refer to Linwood Lake implementation projects detailed in Table 21 for more detail on the strategies provided below: | | | | | | | | | | | |
| | | | | | Internal Load Management | Evaluate boat motor restrictions, carp management, aquatic plant management | • | • | | • | | | • | | 2044 | Develop work plan |
| | | | | | Septic System Upgrades | Convert all failing and Imminent Threat to Public Health systems to compliant | • | | | | • | • | • | | 2044 | Develop work plan, document upgrades |
| | | | | | Conservation Tillage | 10% of cropland converted to conservation tillage | | • | | | | | | | 2044 | 400 acres of cropland converted |
| | | | | | Manure Management | Collection, storage, and treatment of manure at 2 sites | | • | | | | | | | 2034 | Manure storage facility at 1 site |
| | | | | | Lakeshore Lawn care | 25% off all parcels with turf grass maintained and limit runoff | • | • | | | | • | • | | 2034 | Education to all landowners 5% of parcels converted |
| | | | | | Determine Boot Lake's impact on Linwood Lake | Watershed of Boot Lake studied, monitored, and reported | • | • | | | | | | | 2024 | Start monitoring Boot Lake inlet and outlet |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Determine connection of Fertilizer to Shallow Groundwater | Complete study to determine connection | ● | | ● | ● | | | | | 2024 | Study completed |
| | | | | | Buffer strips | 22 acres of buffer strips | ● | ● | | | | ● | ● | ● | 2034 | 4 acres of buffer strips installed |
| | | | | | Sedimentation Ponds | 130 acres treated | ● | ● | | | | ● | ● | ● | 2044 | Sites chosen |
| | | | | | Bioretention & Infiltration | BMPs on 36% of all parcels | ● | ● | | | | ● | ● | ● | 2044 | Linwood Lake Watershed BMP program and funding in place |
| County Ditch 16 (-711)<br>Unnamed ditch to Rice Lk<br>Boot Lake Inlet (-576)<br>Rice Lk to Boot Lk<br>Island Lake Inlet (-578)<br>Linwood Lk to Island Lk<br>Unnamed ditch (-582)<br>Headwaters to W Br Sunrise<br>Unnamed creek (-581)<br>Unnamed ditch to W Br<br>Unnamed creek (-580)<br>Headwaters to W Br<br>Judicial Ditch 2 (-775) Long Lk to W Br | **Anoka**<br><br>**Isanti** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | Buffer Strips | 20% of Streambank buffered | ● | ● | | ● | ● | | | | 2044 | 7 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 10 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 2 producers |
| Fawn (02-0035-00)<br>Twin (30-0004-00)<br>Lower Birch (30-0007-00)<br>Upper Birch (30-0005-00)<br>Tamarack (30-0001-00)<br>Hoffman (30-0008-00)<br>Long (30-0002-00)<br><br>Island (02-0022-00)<br>Tamarack (02-0021-00)<br>Boot (02-0028-00)<br>Rice (02-004300)<br>Fish (02-0065-00) | **Anoka**<br><br>**Isanti** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | Buffer Strips | 20% of Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 7 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 10 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Internal Load Management | Assessment of all lakes to determine if excessive internal loading exists | | | | ● | | ● | ● | | 2024 | Completed |
| | | | | | Lakeshore Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 2 producers |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. *Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

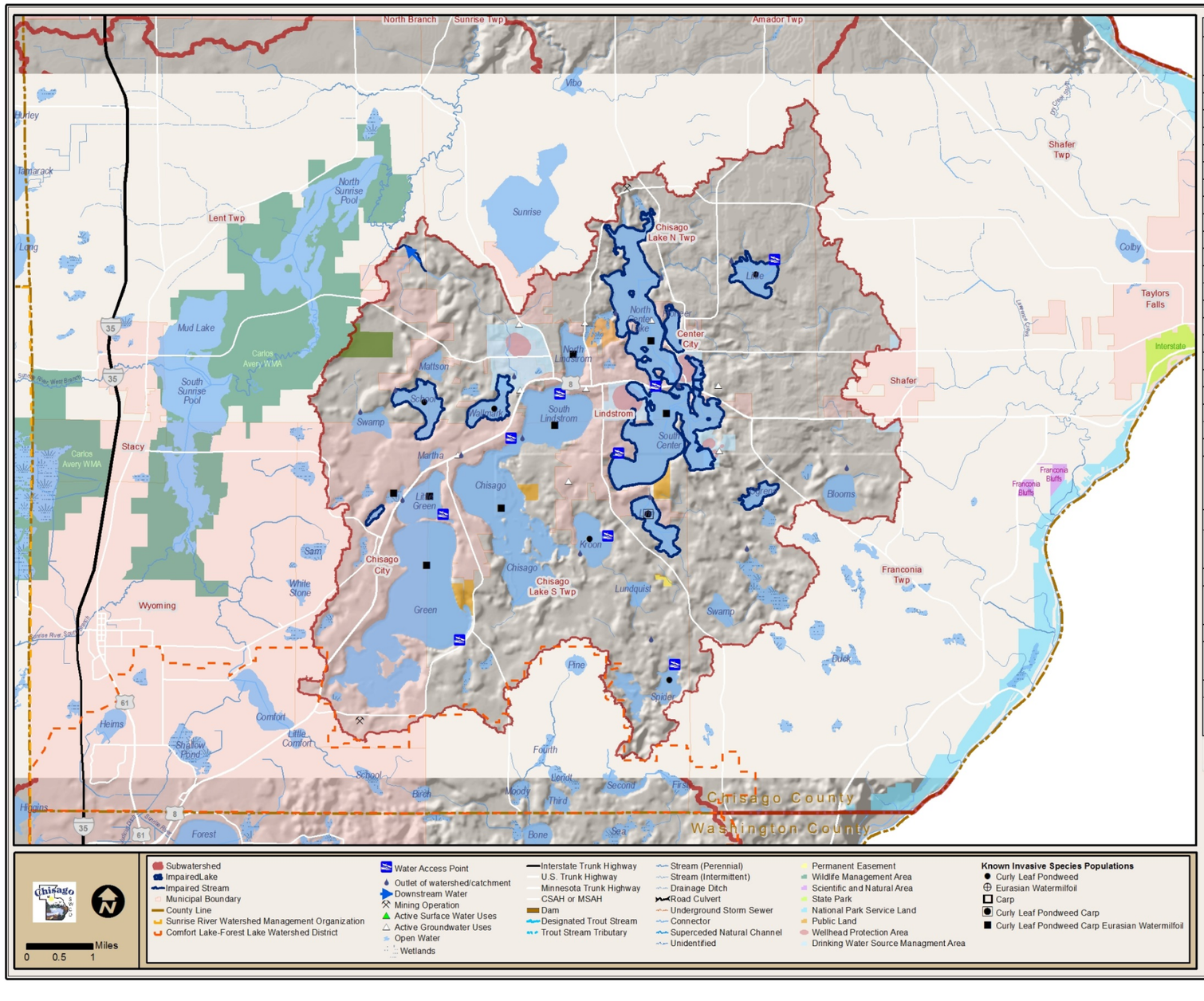
**Table 21: Potential Linwood Lake Restoration Projects**

| LINWOOD LAKE IMPLEMENTATION ACTIVITES<br>CURRENT TP = 44 µg/L | | Treated Area [ac] | Treated Area [% Watershed] | Estimated TP Load Reduction [lb P/yr] | Estimated TP Load Reduction [% Total Needed] | Potential Granting Organization | Project Partners | Estimated 30-year Costs |
|---|---|---|---|---|---|---|---|---|
| **IN-LAKE** | **Load Reduction Needed:** | | | **29** | | | | |
| | **Load Reduction Achieved:** | | | **29** | **8.5%** | | | |
| Trophic state alteration | Including, but not limited to, carp management and/or curly-leaf pondweed management. | | | 29 | 8.5% | | | |
| **WATERSHED** | **Load Reduction Needed:** | | | **312** | | | | |
| | **Load Reduction Achieved:** | | | **313** | **91.7%** | | | |
| Biofilters | Buffer strips (9,415 feet total) | 22 | 0.3% | 2 | 0.6% | NRCS; CWF | NRCS; LID; SWCD; LA; LO | $-$$ |
| Lawn management | Maintaining turfgrass and preventing transport of leaves and clippings on 25% of all parcels | 118 | 1.7% | 4 | 1.2% | Existing programs | City; SWCD; LA | $$ |
| Septic system upgrades | Convert all failing to conforming | N/A | N/A | 114 | 33.6% | CWF | County; Cities; LO | $ |
| | Convert all ITPHSS to conforming (completed) | N/A | N/A | 0 | 0.0% | | County, LO | |
| Bioretention & Infiltration | Infiltration basins and large bioretention facilities (equivalent to one individual rain gardens on 36% of all parcels, or 336) | N/A | N/A | 168 | 49.2% | CWF; LID | SWCD; LID; LA; LO | $$-$$$ |
| Sedimentation | Sedimentation ponds (13) | 130 | 1.9% | 14 | 4.0% | NRCS; CWF; City; LID | NRCS; SWCD; LID; City; LO | $$ |
| Agricultural BMPs | Collection, storage, and treatment of manure (assumes 75% reduction of load) | N/A | N/A | 2 | 0.5% | NRCS; Ag BMP; CWF | NRCS; SWCD; LO | $-$$ |
| | 10% of cropland with conservation tillage | 102 | 1.5% | 9 | 2.6% | NRCS; Ag BMP | NRCS; SWCD; LO | Variable |
| **TOTAL** | **Load Reduction Needed:** | | | **341** | | | | |
| | **Load Reduction Achieved:** | | | **342** | **100%** | | | |

**Symbol key**

| | | | | |
|---|---|---|---|---|
| Ag BMP | MDA Agricultural BMP Loan Program | LID | Lake Improvement District | $ < $500/lb TP removed/yr |
| CWF | Clean Water Fund | LO | Landowners | $$ = $500-$1500/lb TP removed/yr |
| CWP | Clean Water Partnerships/ 319 Grants | NRCS | Natural Resources Conservation Service | $$$ > $1500 lb TP removed/yr |
| LA | Lake Associations | SWCD | Soil and Water Conservation District | |

## Chisago Lakes Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **Chisago Lakes Chain of Lakes** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 56 |
| Groundwater Pollution Sensitivity | Low |
| % Slope (avg.) | 3.3 |
| # of Animals | 1480 |
| Permitted Waste Discharges | CLJSTC, Blue Waters |
| Impaired Lake Shoreline Septics | 353 |
| Dominant Hydrologic Soil Group | B |
| BWSR Soil Erosion Risk | High |
| BWSR Water Quality Risk | High |
| SWAT Output TP (lb/ac) | 0.38 |
| SWAT Output TSS (ton/ac) | 0.030 |
| Altered Wetland Hydrology | 6.7 % |
| Public Land | 0.5 % |
| **Subwatershed Land Cover** | |
| Developed | 4 % |
| Forested | 18 % |
| Cropland | 45 % |
| Grassland | 7 % |
| Wetlands | 7 % |
| Open Water | 19 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago County, Chisago Lakes LID, Center City, Chisago City, Lindstrom, Wyoming, Chisago Lakes Township, Shafer Township, Franconia Township | |
| **Major Water Resources** | |
| N. Center, S. Center, N. Lindstrom, S. Lindstrom, Chisago, Green, Little Green, Kroon, Linn, Little Lakes | |
| **Impairments** | |
| 1 stream fish bioassessment<br>9 lake nutrient | |
| **Important Natural Resources** | |
| | |
| **Next Downstream Waterbody/Subwatershed** | |
| Sunrise River/Carlos Avery-Sunrise Unit Subwatershed | |

**Sunrise Watershed**

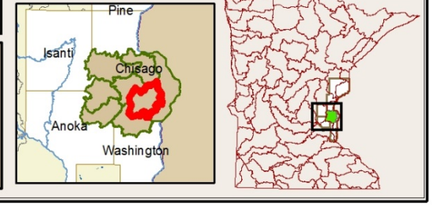
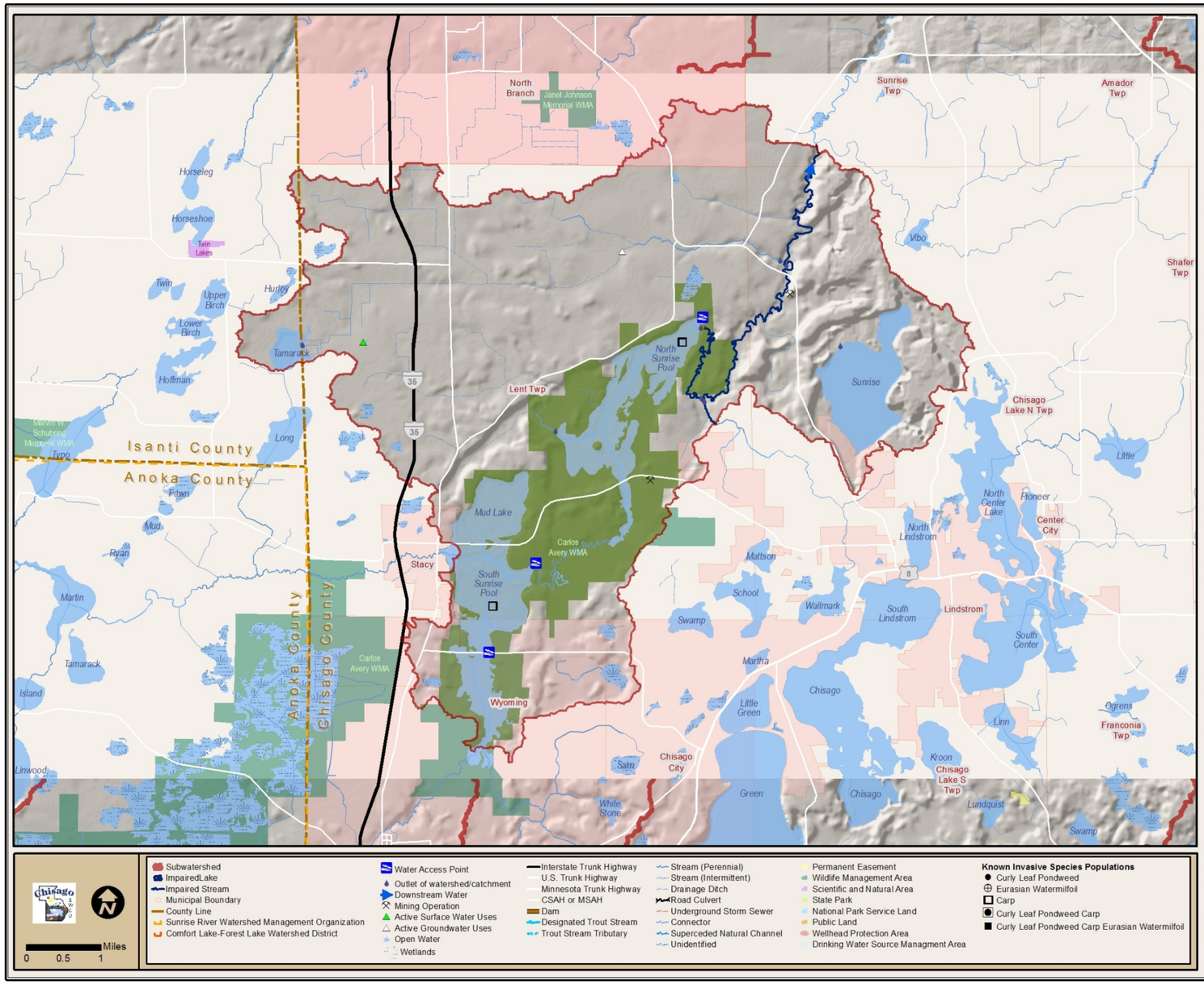


**Table 22: CHISAGO LAKES SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Bloomquist Creek (-723) T34 R21 S24, east line to Sunrise River | **Chisago** | Fish | Excess Ammonia/Low DO | Fully Support aquatic life; Fish | Monitor the effect of the Chisago Lake Joint Sewage Treatment Facility permit update. | Chisago Lakes Joint Sewage Treatment Commission - whole facility management | | | ● | | ● | ● | ● | | In progress | Meet permit standards |
| | | | | | **Refer to:** Chisago Lakes Chain of Lakes Watershed Restoration and Protection Plan (2013) (http://www.pca.state.mn.us/wfhya0a) | | | | | | | | | | | |
| Unnamed Ditch (-722) Wallmark Lk to T34 R20W S19, west line<br>Unnamed Creek (-719) Headwaters to Little Lk<br>Unnamed Creek (-721) Little Lk to North Center Lk<br>Unnamed Creek (-572) Headwaters to S. Center Lk<br>Unnamed Creek (-715) Headwaters to Unnamed Creek | **Anoka** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | Buffer Strips | 20% of Streambank and Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 10 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 20 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | ● | | ● | | ● | ● | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 5 producers |
| North Center (13-0032-01) | **Chisago** | Phosphorus | In-lake TP = 70 ug/L | In-lake TP < 60 ug/L | **Refer to:** Chisago Lakes Chain of Lakes Watershed Restoration and Protection Plan (2013) (http://www.pca.state.mn.us/wfhya0a), specifically section 3.4 Implementation Activitied: Selection and Justification for a detailed description of the specific implementation actions recommended for each lake. | | | | | | | | | | | |
| South Center (13-0027-00) | | | In-lake TP = 50 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| Emily (13-0046-00) | | | In-lake TP = 341 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| Ogrens (13-0011-00) | | | In-lake TP = 64 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| Pioneer (13-0034-00) | | | In-lake TP = 345 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| Wallmark (13-0029-00) | | | In-lake TP = 322 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| Linn (13-0014-00) | | | In-lake TP = 217 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| Little (13-0033-00) | | | In-lake TP = 173 ug/L | In-lake TP < 40 ug/L | | | | | | | | | | | | |
| School (13-0044-00) | | | In-lake TP = 216 ug/L | In-lake TP < 60 ug/L | | | | | | | | | | | | |
| North Chisago (13-0012-01) | **Chisago** | All conventional parameters | Fully Supporting | Maintain or improve water quality | **Refer to:** Chisago Lakes Chain of Lakes Watershed Restoration and Protection Plan (2013) (http://www.pca.state.mn.us/wfhya0a), specifically section 4 which describes the specific implementation actions for protection of each of the lakes currently meeting State standards. | | | | | | | | | | | |
| South Chisago (13-0012-02) | | | Fully Supporting | | | | | | | | | | | | | |
| Ellen (13-0047-00) | | | Insufficient Data | | | | | | | | | | | | | |
| Green (13-0041-02) | | | Fully Supporting | | | | | | | | | | | | | |
| Little Green (13-0041-01) | | | Fully Supporting | | | | | | | | | | | | | |
| Kroon (13-0013-00) | | | Insufficient Data | | | | | | | | | | | | | |
| North Lindstrom (13-0035-00) | | | Fully Supporting | | | | | | | | | | | | | |
| South Lindstrom (13-0028-00) | | | Fully Supporting | | | | | | | | | | | | | |
| Mattson (13-0043-00) | | | Insufficient Data | | | | | | | | | | | | | |
| Spider (13-0019-00) | | | Fully Supporting | | | | | | | | | | | | | |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. *Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

## Carlos Avery Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **Carlos Avery - Sunrise Unit** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 42 |
| Groundwater Pollution Sensitivity | High |
| % Slope (avg.) | 2.1 |
| # of Animals | 164 |
| Permitted Waste Discharges | None |
| Impaired Lake Shoreline Septics | 0 |
| Dominant Hydrologic Soil Group | A |
| BWSR Soil Erosion Risk | Medium |
| BWSR Water Quality Risk | Medium |
| SWAT Output TP (lb/ac) | 0.14 |
| SWAT Output TSS (ton/ac) | 0.0055 |
| Altered Wetland Hydrology | 21.6 % |
| Public Land | 24 % |
| **Subwatershed Land Cover** | |
| Developed | 4 % |
| Forested | 32 % |
| Cropland | 8 % |
| Grassland | 31 % |
| Wetlands | 18 % |
| Open Water | 7 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago County, Friends of the Sunrise River, North Branch, Wyoming, Lent Township, Chisago Lakes Township | |
| **Major Water Resources** | |
| Sunrise South Pool, Sunrise North Pool | |
| **Impairments** | |
| 1 stream DO<br>1 stream fish bioassessment | |
| **Important Natural Resources** | |
| Wild Rice, Carlos Avery Wildlife Management Area | |
| **Next Downstream Waterbody/Subwatershed** | |
| Kost Dam Pool/Sunrise River Subwatershed | |

**Sunrise Watershed**

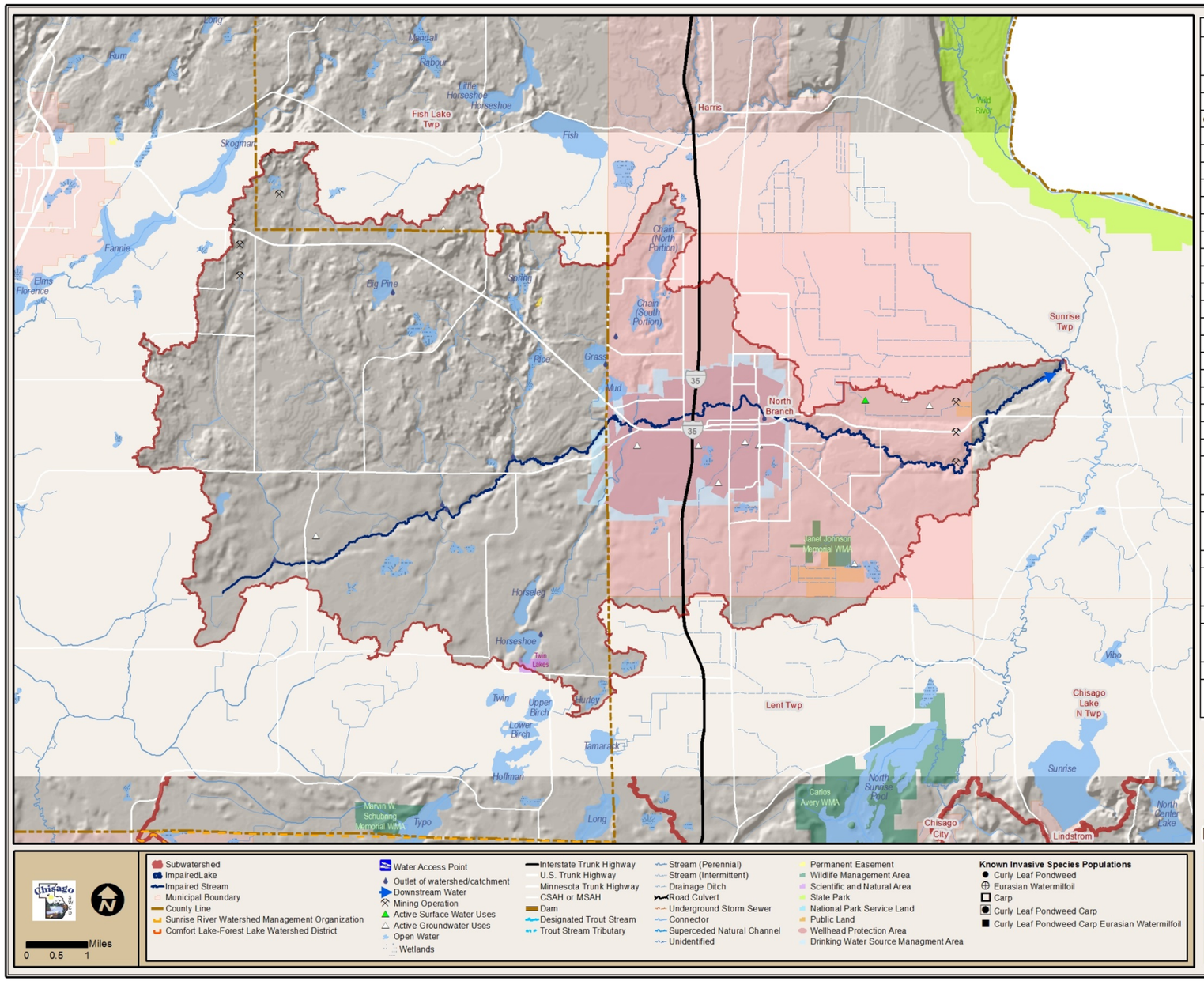
**Table 23: CARLOS AVERY SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Sunrise River, S Br (-540) North Pool to Kost Dam | **Chisago** | Fish, DO | Elevated phosphorus levels | In-stream TP <100 ug/L | Buffer Strips | 20% of Streambank buffered | • | • | • | • | • | • | • | | 2044 | 2 shoreline buffers installed |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | • | | | • | | | | 2044 | Plans written for 1 producer |
| | | | | | Soil health practices | Educate and work with agricultural producers on tillable acres | | • | | | • | | | | 2044 | Practices applied to 100 additional acres of cropland |
| | | | Sediment eroding from banks | Stabilize eroding banks | Reduce streambank erosion | Restoration of 10% of shorelines | | • | • | | | | • | | 2044 | 500 feet of eroding streambank stabilized |
| | | | < 5 mg/L DO Daily Minimum | > 5 mg/L DO Daily minimum | Dam operation and management feasibility study | Conduct water level and dam operation management feasibility study | | | | | | | | | 2024 | Complete study |
| | | | | | Wetland Restoration within watershed | Determine best locations for restoration, implement strategies | | • | | | • | • | | | 2044 | Complete list of projects for restoration |
| | | | Poor connectivity | Increase Connectivity | Increase connectivity for fish passage within the watershed | Determine locations with limited connectivity, seek opportunities to improve | | | • | | • | • | • | | Ongoing | Determine locations that will increase connectivity |
| **Carlos Avery WMA:** South Pool (13-0059-01) North Pool (13-0059-03) Mud Lake (13-0059-02) Sunrise River (-528) South Pool to North Pool County Ditch 10 (-630) Headwaters to Unnamed Creek County Ditch 5 (-708, -709, -710) Unnamed Ditch to Sunrise River | **Chisago** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality | Maintain no increase in volume | All outlets | | | | • | • | • | | | Ongoing | Determine best volumes and maintain |
| | | | | | Protect rare wetland species | All public land inventoried for rare species | | | | • | | | | | 2034 | Public land rare species inventory funding secured |
| | | | | | Protect waterfowl habitat | Manage and protect areas known as waterfowl habitat | | | | • | | | | | Ongoing | Inventory locations of best habitat |
| | | | | | Measure sediment accumulation rates | All dams within WMA | | | | • | | | | | 2034 | Monitor accumulation rates and determine if removal is feasible |
| | | | | | Expand WMA Boundaries | Prioritize tax-forfeit land for purchase | | | | • | | | | | Ongoing | Review tax-forfeit land as necessary |
| | | | | | Pool drawdowns | All pools that need maintenance and vegetation management as needed | | | | • | | | | | Ongoing | Develop schedule for drawdowns |
| | | | | | Cattail Management | Conduct cattail management study, apply plan to all waterbodies | | | | • | | | | | Ongoing | Develop cattail management study |
| | | | | | Monitoring | Monitor all drainage ditches that enter the WMA for pollutants | | | | • | | | | | 2034 | Develop work plan for monitoring and determine locations of ditches. |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sunrise Lake (13-0031-00) County Ditch 10 (-630) Headwaters to Unnamed Creek County Ditch 5 (-708, -709, -710) Unnamed Ditch to Sunrise River | **Chisago** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality <60 ug/L Phosphorus | Buffer Strips | 20% of Streambank and Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 5 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 2 BMPs |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | Sunrise Lake | | ● | | ● | | ● | ● | | 2024 | Assessment of lake for AIS status |
| | | | | | Internal Load Management | Assessment of lake to determine if excessive internal loading exists | | | | ● | | ● | ● | | 2024 | Completed |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plan written for 1 producer |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. *Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

## North Branch of the Sunrise River Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **North Branch of the Sunrise River** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 78 |
| Groundwater Pollution Sensitivity | High |
| % Slope (avg.) | 1.9 |
| # of Animals | Unknown |
| Permitted Waste Discharges | North Branch |
| Impaired Lake Shoreline Septics | 0 |
| Dominant Hydrologic Soil Group | A/C |
| BWSR Soil Erosion Risk | High |
| BWSR Water Quality Risk | Medium |
| SWAT Output TP (lb/ac) | 0.32 |
| SWAT Output TSS (ton/ac) | 0.013 |
| Altered Wetland Hydrology | 49.5 % |
| Public Land | 1 % |
| **Subwatershed Land Cover** | |
| Developed | 8 % |
| Forested | 22 % |
| Cropland | 40 % |
| Grassland | 19 % |
| Wetlands | 10 % |
| Open Water | 1 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago County, Isanti SWCD, Isanti County, North Branch, North Branch Township, Oxford Township | |
| **Major Water Resources** | |
| North Branch of the Sunrise River | |
| **Impairments** | |
| 1 stream E. coli, 1 stream fish bioassessment | |
| **Important Natural Resources** | |
| | |
| **Next Downstream Waterbody/Subwatershed** | |
| Sunrise River/Sunrise Subwatershed | |

**Sunrise Watershed**

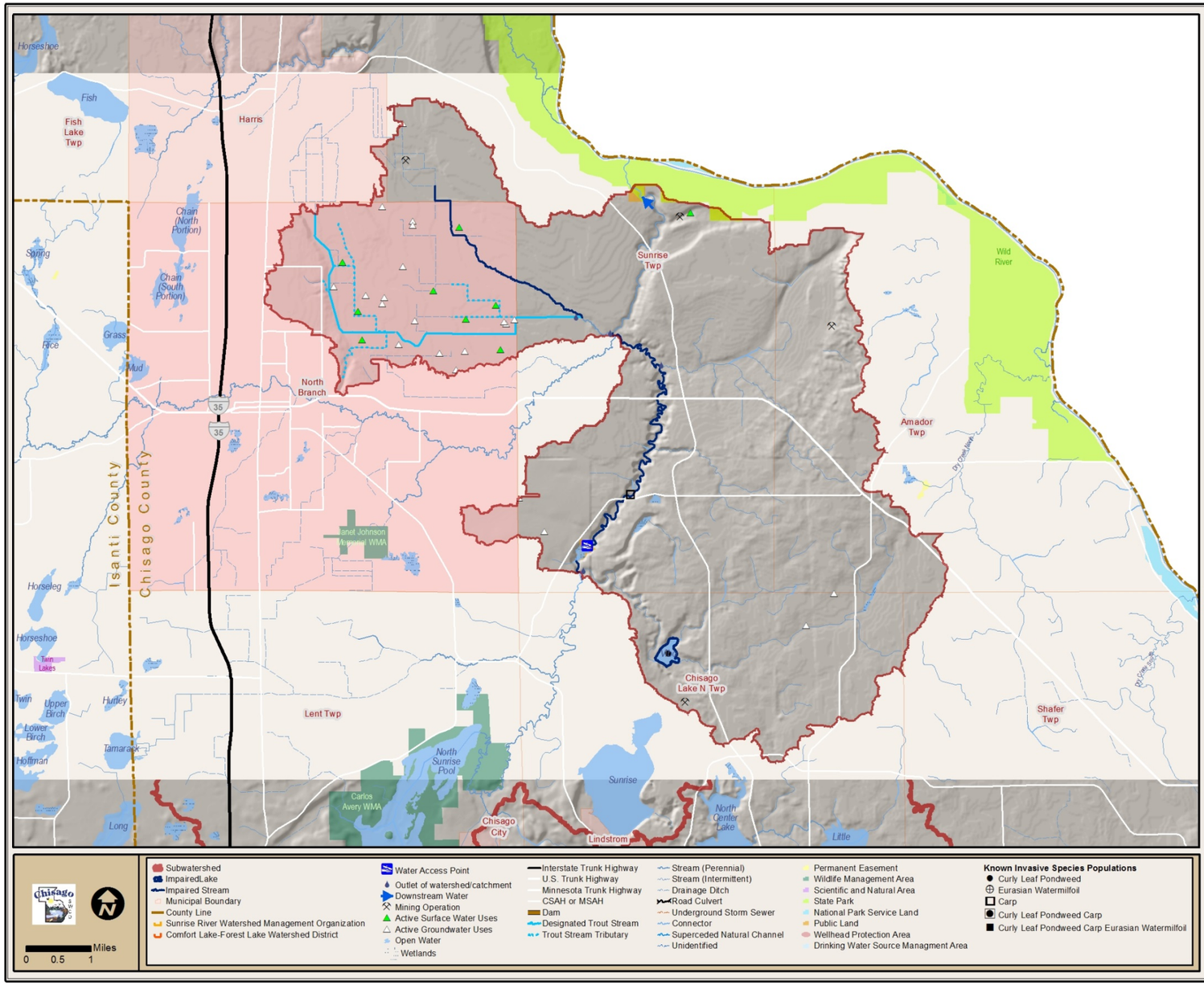
**Table 24: NORTH BRANCH OF THE SUNRISE RIVER SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Sunrise River, North Branch (-501) Headwaters to Sunrise River | **Isanti** Chisago | E. coli | Fecal coliform = 420 org/mL | Fecal coliform <200 org/100 mL | **Refer to: North Branch of the Sunrise River Fecal Coliform TMDL Implementation Plan (February 2007)** (http://www.pca.state.mn.us/qzqha00) specifically section 4.1 for implementation actions related to livestock management, section 4.2 for actions related to septic systems and section 4.3 for actions specific to pet waste. | | | | | | | | | | | |
| | | Fish | W of NB - IBI 34<br>E of NB - IBI 44 | W of NB - IBI > 40<br>E of NB - IBI > 50 | Inventory Streambank condition/Streambank restoration | 20% of Streambanks restored to reduce erosion and increase habitat | | • | | • | • | | • | • | 2034 | Inventory streambanks, 2 streambank restorations completed |
| County Ditch 19 (-728)<br>Unnamed ditch to NBSR<br>Unnamed Creek (-753)<br>Headwaters to NBSR<br>Judicial Ditch 4 (-556)<br>Unnamed Cr to NBSR<br>Hay Creek (-714)<br>Mud Lk to NBSR<br>Unnamed Creek (-569)<br>Headwaters to NBSR<br>Unnamed Creek (-755)<br>Unnamed Ditch to NBSR | **Isanti Chisago** | All conventional parameters | Insufficient Data | Maintain or improve water quality | Buffer Strips | 20% of Streambank buffered | • | • | | • | • | | | | 2044 | 2 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | • | • | | | • | • | • | • | 2044 | Install 2 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | • | • | • | | | • | • | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | • | • | | | | • | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | • | • | | • | | • | • | • | Ongoing | Acquire easements/property as needed |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | • | • | | • | | • | • | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | • | | • | | • | • | | 2044 | Plans written for 3 producers |
| Splittstoeser (30-00041-00)<br>Mud (13-0066-00)<br>Grass (30-0017-00)<br>Horseleg (30-0012-00)<br>Horseshoe (30-0003-00)<br>Big Pine (30-0015-00)<br>Chain North (13-0063-01)<br>Chain South (13-0063-02) | **Isanti Chisago** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality <60 ug/L Phosphorus | Buffer Strips | 20% of Lakeshore buffered | • | • | | • | • | | | | 2044 | 1 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | • | • | | | • | • | • | • | 2044 | Install 1 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | • | • | • | | | • | • | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | • | • | | | | • | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | • | • | | • | | • | • | • | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | All Lakes | | • | | • | | • | • | | 2024 | Assessment of all lakes for AIS status |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | • | • | | • | | • | • | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | • | | • | | • | • | | 2044 | Plan written for 1 producer |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection.

*Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

## Sunrise River Main Branch Subwatershed Strategies




| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **Sunrise River** |
| Major Watershed Name | Sunrise |
| Area (sq. miles) | 51 |
| Groundwater Pollution Sensitivity | West - High, East - Low |
| % Slope (avg.) | 2.0 |
| # of Animals | 3143 |
| Permitted Waste Discharges | Trophy Lakes Estates |
| Impaired Lakes Shoreline Septics | 5 |
| Dominant Hydrologic Soil Group | A/B |
| BWSR Soil Erosion Risk | Medium |
| BWSR Water Quality Risk | Medium |
| SWAT Output TP (lb/ac) | 0.63 |
| SWAT Output TSS (ton/ac) | 0.055 |
| Altered Wetland Hydrology | 50.2 % |
| Public Land | 0.2 % |
| **Subwatershed Land Cover** | |
| Developed | 5 % |
| Forested | 26 % |
| Cropland | 28 % |
| Grassland | 37 % |
| Wetlands | 3 % |
| Open Water | 1 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago County, Friends of the Sunrise River, North Branch, Sunrise Township, Chisago Lakes Township | |
| **Major Resources** | |
| Vibo Lake, Sunrise River, Hay Creek | |
| **Impairments** | |
| 2 stream *E. coli*<br>1 lake nutrient | |
| **Important Resources** | |
| Endangered Mussels, Portions of Hay Creek are listed as a Trout Stream | |
| **Next Downstream Waterbody/Subwatershed** | |
| St. Croix River/Lower St. Croix Subwatershed | |

**Sunrise Watershed**

**Table 25: SUNRISE RIVER MAIN BRANCH SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Hay Creek (-545) CD 3 to Sunrise River | **Chisago** | E. coli | Monthly geometric mean E. coli ranges from 94 to 609 org/100mL | E. coli <126 org/100 mL | Nutrient/Manure Management | Plans established with 50% of producers | | • | | • | | • | • | | 2044 | Plan written for 1 producer |
| | | | | | Livestock Exclusion | Exclude all livestock from lake and tributaries | | • | • | | • | | | | 2044 | 10% of livestock excluded |
| | | | | | Upgrade failing septic systems | Inventory the extent of failing septic systems | | | | | | • | • | | 2044 | 10% of failing systems identified |
| | | | | | Locate and reduce illicit discharge points | Locate and reduce illicit discharge points | | | • | | | • | • | | 2034 | Locate illicit discharges |
| | | | | | Streambank restoration | 20% of Streambanks restored to reduce erosion and increase habitat | | • | | • | • | | | | 2034 | 100 feet of streambank restored |
| Sunrise River (-543) NBSR to St. Croix River | **Chisago** | E. coli | Monthly geometric mean E. coli ranges from 326 to 511 org/100mL | E. coli <126 org/100 mL | Nutrient/Manure Management | Plans established with 50% of producers | | • | | • | | • | • | | 2044 | Plan written for 1 producer |
| | | | | | Livestock Exclusion | Exclude all livestock from lakes and tributaries | | • | • | | • | | | | 2044 | 10% of livestock excluded |
| | | | | | Upgrade failing septic systems | Inventory the extent of failing septic systems | | | | • | • | | • | | 2044 | 10% of failing systems identified |
| | | | | | Locate and reduce illicit discharge points | Locate and reduce illicit discharge points | | | • | | | | • | | 2034 | Locate illicit discharges |
| | | | | | Streambank restoration | 20% of Streambanks restored to reduce erosion and increase habitat | | • | | • | • | | | | 2034 | 100 feet of streambank restored, develop restoration plan for Wild River State Park-Sunrise River cutbank |
| Vibo Lake (13-0030-00) | **Chisago** | Phosphorus | In-lake TP = 516 ug/L | In-lake TP <60 ug/L | Buffer Strips | 20% of Lakeshore buffered | • | • | | • | • | | | | 2044 | 1 shoreline buffers installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | • | • | | | • | • | • | • | 2044 | Install 2 BMPs |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements | Acquire easements as needed | ● | | | ● | | | ● | | Ongoing | Acquire easements as needed |
| | | | | | Manage Aquatic Species | Entire lake | | ● | | ● | | ● | ● | | 2024 | Assessment of lake for AIS status |
| | | | | | Lakeshore/Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plan written for 1 producer |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection. *Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

**Table 26: Potential Vibo Lake Restoration Projects**

| VIBO IMPLEMENTATION PROJECTS<br>CURRENT TP = 516 µg/L | | Treated Area [ac] | Treated Area [% Watershed] | Estimated TP Load Reduction [lb P/yr] | Estimated TP Load Reduction [% Total Needed] | Potential Granting Organization | Project Partners | Estimated 30-year Costs |
|---|---|---|---|---|---|---|---|---|
| **IN-LAKE** | **Load Reduction Needed:** | | | **1,175** | | | | |
| | **Load Reduction Achieved:** | | | **902** | **9.3%** | | | |
| Trophic state alteration | Includes complete fish kill, gamefish fish stocking, and/or lake drawdown. | | | 902 | 9.3% | CWF; LID; LA | LID; LA; SWCD | $ |
| **WATERSHED** | **Load Reduction Needed:** | | | **8,543** | | | | |
| | **Load Reduction Achieved:** | | | **8,816** | **90.7%** | | | |
| Biofilters | Buffer strips (38,325 feet total) | 79 | 1.0% | 48 | 0.5% | NRCS; CWF | NRCS; LID; SWCD; LA; LO | $-$$ |
| Lawn management | Maintaining turfgrass and preventing transport of leaves and clippings on 100% of all parcels | 70 | 0.9% | 68 | 0.7% | Existing programs | City; SWCD; LA | $$ |
| Septic system upgrades | Convert all failing to conforming | N/A | N/A | 65 | 0.7% | CWF | County; Cities; LO | $ |
| | Convert all ITPHSS to conforming (completed) | N/A | N/A | 11 | 0.1% | | County, LO | |
| Bioretention & Infiltration | One rain garden on 100% of all parcels (562 total) | N/A | N/A | 281 | 2.9% | CWF; LID | SWCD; LID; LA; LO | $$-$$$ |
| Sedimentation | Sedimentation ponds (78) | 780 | 10.2% | 571 | 5.9% | NRCS; CWF; City; LID | NRCS; SWCD; LID; City; LO | $$ |
| | Gully stabilization (7) | N/A | N/A | | | | | #REF! |
| Agricultural BMPs | Collection, storage, and treatment of manure (assumes 75% reduction of load) | N/A | N/A | 53 | 0.5% | NRCS; Ag BMP; CWF | NRCS; SWCD; LO | $-$$ |
| | 100% of cropland with conservation tillage | 2,840 | 37.0% | 1,711 | 17.6% | NRCS; Ag BMP | NRCS; SWCD; LO | Variable |
| Inlet Chemical Treatment | | N/A | N/A | 6,009 | 61.8% | | | |
| **TOTAL** | **Load Reduction Needed:** | | | **9,718** | | | | |
| | **Load Reduction Achieved:** | | | **9,718** | **100%** | | | |

**Symbol key**

| | | | | |
|---|---|---|---|---|
| Ag BMP | MDA Agricultural BMP Loan Program | LID | Lake Improvement District | $ < $500/lb TP removed/yr |
| CWF | Clean Water Fund | LO | Landowners | $$ = $500-$1500/lb TP removed/yr |
| | | | | $$$ > $1500 lb TP |
| CWP | Clean Water Partnerships/ 319 Grants | NRCS | Natural Resources Conservation Service | removed/yr |
| LA | Lake Associations | SWCD | Soil and Water Conservation District | |

***Note** - implementation of all potential watershed best management practice does not achieve the load reductions needed to meet the TMDL without chemical treatment.

An in-line chemical treatment facility could be considered at Vibo Lake to reduce TP loads to the Sunrise River and St. Croix River. A more detailed feasibility study would be needed.

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| Sunrise River WRAPS | |
|---|---|
| **Subwatershed Name** | **Direct Drainage to the St. croix River** |
| Major Watershed Name | Lower St. Croix |
| Area (sq. miles) | 79 |
| Groundwater Interaction | |
| % Slope (avg.) | |
| # of Animals | Unknown |
| Permitted Waste Discharges | Shafer, Taylors Falls |
| Impaired Lake Shoreline Septics | 0 |
| Dominant Hydrologic Soil Group | B |
| BWSR Soil Erosion Risk | High |
| BWSR Water Quality Risk | High |
| SWAT Output TP (lb/ac) | N/A |
| SWAT Output TSS (ton/ac) | N/A |
| Altered Hydrology | 13.4 % |
| | |
| Public Land | 11 % |
| **Subwatershed Land Cover** | |
| Developed | 8 % |
| Forested | 19 % |
| Cropland | 22 % |
| Grassland | 40 % |
| Wetlands | 8 % |
| Open Water | 3 % |
| **Watershed Entities** | |
| Chisago SWCD, Chisago County, Shafer, Taylors Falls, St. Croix River Association, Amador Township, Shafer Township, Franconia Township | |
| **Major Water Resources** | |
| Lawrence Creek, St. Croix River | |
| **Impairments** | |
| None known | |
| **Important Natural Resources** | |
| Trout Stream, Wild River State Park, Interstate State Park | |
| **Next Downstream Waterbody/ Subwatershed** | |
| St. CroixRiver/Lower St. Croix Watershed | |

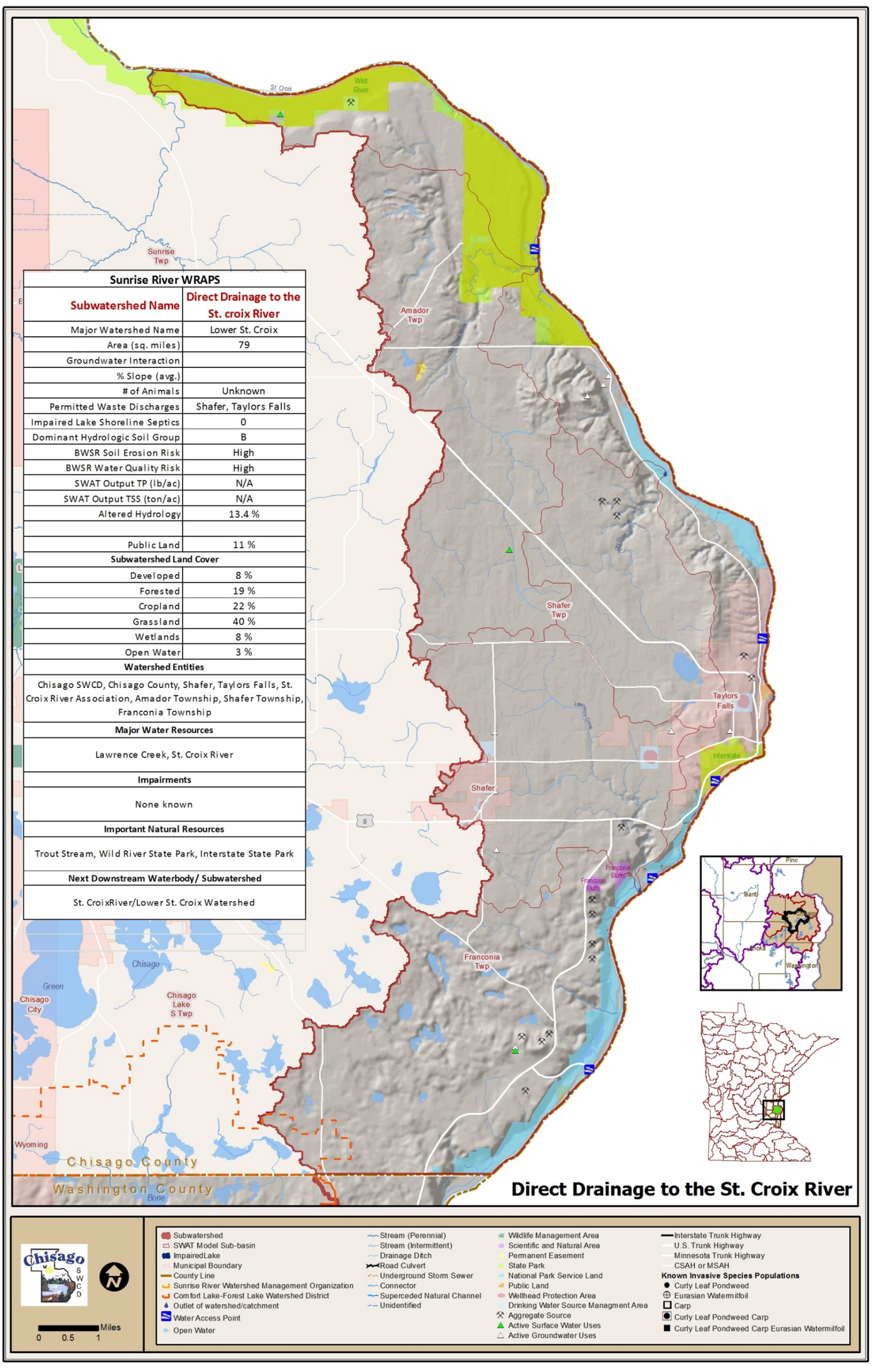

**Table 27: DIRECT DRAINAGE TO THE ST. CROIX SUBWATERSHED Proposed Implementation Strategies and Actions**

| Waterbody (ID) Location | Location and Upstream Influence Counties | Parameter | Water Quality | | Strategies | Estimated Scale of Adoption Needed | Entities with Primary Involvement and Responsibility | | | | | | | | Timeline for Achievement of Water Quality Goals | Interim 10-yr Milestones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current Conditions | Water Quality Target | | | Watershed District* | SWCD/NRCS | MPCA | DNR | Property Owners | Cities/Townships | County | BWSR | | |
| Dry Creek (-570) Unnamed Creek to St. Croix River Lawrence Creek (-574) T33 R19W S3, north line to St. Croix River Unnamed Creek (-553) Headwaters to Lawrence Creek | **Chisago** | All conventional parameters | Insufficient Data | Maintain or improve water quality | Strembank Restoration | 20% of Streambank restored | | ● | | ● | ● | | | | 2044 | 200 feet of shoreline restored |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 5 BMPs |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Streambank Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plans written for 2 producers |
| Duck Lake (13-0005-00) | **Chisago** | All conventional parameters | Insufficient Data/Not Assessed | Maintain or improve water quality <60 ug/L Phosphorus | Buffer Strips | 20% of Lakeshore buffered | ● | ● | | ● | ● | | | | 2044 | 1 shoreline buffer installed |
| | | | | | Stormwater management | Install BMPs to treat stormwater runoff on 20% of properties | ● | ● | | | ● | ● | ● | ● | 2044 | Install 1 BMP |
| | | | | | Stormwater Rule Compliance/MIDS | All communities within watershed | ● | ● | ● | | | ● | ● | | 2034 | Introduce new concepts to all communities |
| | | | | | Monitoring | Monitor monthly at current locations | | ● | ● | | | | ● | | Ongoing | Monitor monthly at current locations |
| | | | | | Conservation Easements/Property Acquisition | Acquire easements/property as needed | ● | ● | | ● | | ● | ● | ● | Ongoing | Acquire easements/property as needed |
| | | | | | Manage Aquatic Species | Duck Lake | | ● | | ● | | ● | ● | | 2024 | Assessment of lake for AIS status |
| | | | | | Lakeshore Lawn care | All parcels | ● | ● | | ● | | ● | ● | | Ongoing | Education on websites, press releases, newsletters, etc. |
| | | | | | Nutrient/Manure Management | Plans established with 50% of producers | | ● | | ● | | ● | ● | | 2044 | Plan written for 1 producer |

Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection.

*Watershed District/Lake Association/Lake Improvement District/Watershed Management Organization

**Table 28: Key for Strategies Column**

| Strategy | Description |
|---|---|
| **Nonpoint Source** | |
| **Wetland Restoration (657)** | The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site. |
| **Channel Bed Stabilization (584)** | Used to stabilize the bed or bottom of a channel. |
| **Filter Strip (393)** | A strip or area of herbaceous vegetation that removes contaminants from overland flow. |
| **Grade Stabilization Structure (410)** | A structure used to control the grade and head cutting in a natural or artificial channel. |
| **Bioretention (712M)** | Capture and treatment of stormwater runoff through a series of layers in a created depression in the landscape – also called a rain garden. |
| **Grassed Waterway (412)** | A shaped or graded channel that is established with suitable vegetation to carry surface water at a non-erosive velocity to a stable outlet. |
| **Water and Sediment Control Basin (638)** | An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to for a sediment trap and water detention basin. |
| **Streambank and Shoreline Protection (580)** | Treatment used to stabilize and protect banks of streams or constructed channels and shorelines of lakes, reservoirs, or estuaries. |
| **Residue Management (329/345)** | Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round, while limiting the soil disturbing activities used to grow crops in systems where the entire field surface is tilled prior to planting. |
| **Nutrient Management (590)** | Managing the amount, source, placement, form and timing of the applications of plant nutrients and soil amendments. |
| **Prescribed Grazing (528)** | Managing the harvest of vegetation with grazing and/or browsing animals. |
| **Lined Waterway and Outlet (438)** | A waterway or outlet having an erosion-resistant lining or concrete, stone, synthetic turf reinforcement fabric, or other permanent material. |
| **Ag Waste Facility (313)** | A waste storage impoundment made by constructing an embankment and/or excavating a pit, or by fabricating a structure to temporarily store waste and contaminated runoff. |
| **Soil Health Practices (327, 328, 340)** | Soil health practices are a group of BMPs that improve viability, reduce soil erosion potential, increase production, and enhance wildlife habitat. Main practices include: Conservation Cover (327), Conservation Crop Rotation (328), and Cover Crop (340). |
| **Drainage Water Management (554)** | The process of managing water discharges from surface or subsurface agricultural drainage systems. |
| **Structure for Water Control (587)** | A structure in a water management system that conveys water, controls direction or rate, maintains a desired water surface elevation or measures water. This can include a bioreactor. |
| **Irrigation Water Management (449)** | The process of determining and controlling the volume, frequency and application rate of irrigation water in a planned, efficient manner. |
| **Access Control (472)** | The temporary or permanent exclusion of animals, people, vehicles and/or equipment of an area. |
| **Point Source** | |
| **NPDES point source compliance** | All NPDES-permitted sources shall comply with conditions of their permits, which are written to be consistent with any assigned wasteload allocations. |
| **Watershed District stormwater rule compliance** | |

# 4. Monitoring Plan

Many organizations within the watershed do monitoring. Please refer to their websites for specific plans.

## Stream Monitoring

Each stream reach within the Sunrise River Watershed has a different monitoring schedule depending on who monitors the site.

Many Sunrise River Watershed sites in Anoka, Chisago, Isanti, and Washington Counties have been monitored through the years. There is currently not a watershed wide stream monitoring program going on at this time. However, the MPCA through its Load Monitoring Program monitors every year in the town of Sunrise, MN which is near the confluence of the Sunrise River and St. Croix River. This site (EQuIS# S004-032) is funded through the Clean Water Fund, and is monitored for a variety of parameters including: continuous flow, total suspended solids, total phosphorus, total Kjeldahl nitrogen, and nitrates. This data is then used to develop annual loads for the Sunrise River Watershed.

If funding is available, the SWCDs will set up a monitoring program to monitor for nutrients, E. coli, and flow. Ideally, it would be a twice per month plus storm event program designed to take samples at many tributaries and branches of the Sunrise River. If funding is not available for new monitoring programs, the monitoring that is completed will be done following MPCA's 10-year monitoring cycle.

Currently, streams in the direct drainage to the St. Croix River area are not being monitored on a regular basis. Some of these streams have had some monitoring in the past, but no formal plans are in place to make permanent monitoring stations.

**Table 29 - Ideal stream monitoring scenarios**

| Stream | Parameters | Frequency | Goal | Responsible Party |
|---|---|---|---|---|
| **Sunrise River Main Stem** | TP, TSS, N+N, E. coli, DO, Temp, Stage | Once monthly: April – October. Storm events when possible. | Minimum 3 locations along the river, more if possible | MPCA, SWCD, County |
| **North Branch of the Sunrise River** | TP, TSS, N+N, E. coli, DO, Temp, Stage | Once monthly: April – October. Storm events when possible. | Up to two locations. Keystone Ave., CR 13 | MPCA, SWCD, County |
| **West Branch of the Sunrise River** | TP, TSS, N+N, DO, Temp, Stage | Once monthly: April – October. Storm events when possible. | One location, Lyon's St. | MPCA, SWCD, County |
| **Bloomquist Creek (CLLID Outlet to Sunrise)** | TP, TSS, N+N, Ammonia Nitrate, DO, Temp, Stage | Once monthly: April – October. Storm events when possible. | One location, Ivywood Trail | MPCA, SWCD, County |
| **Lawrence Creek** | TP, TSS, N+N, DO, Temp, Stage | Once monthly: April – October. Storm events when possible. | One location, Franconia Trail | MPCA, SWCD, County |

## Lake Monitoring

Linwood Lake has been monitored by volunteers and staff over the years. This monitoring is planned to continue approximately every third year to keep a record of the changing water quality. The Lake is generally monitored for chlorophyll-a, total phosphorus, and Secchi disk transparency.

Second Lake is within the CLFLWD, the District has planned to do some investigative monitoring of surface total phosphorus, chlorophyll-a, Secchi disk transparency, dissolved oxygen profile, sediment sampling, and biological data collection in 2020 and 2021. Information on monitoring schedules for other lakes within the CLFLWD can be found in the Comfort Lake Forest Lake Watershed District 2012 Comprehensive Monitoring Plan.

No monitoring plans exist for White Stone Lake or Vibo Lake. Lakeshore owners and volunteers will be encouraged to monitor through the MPCA Citizen Assisted Monitoring Program in the future or have lakes added to a County wide monitoring program to be set up in the future.

Chisago County currently monitors ten lakes at thirteen locations within the Sunrise River Watershed. These include: Chisago Lake (two locations), Green Lake, Kroon Lake, Little Green Lake, Little Lake, North Center Lake (two locations), North Lindstrom Lake, South Center Lake, South Lindstrom Lake, and Spider Lake (two locations). These lakes are monitored for total phosphorus, chlorophyll-*a*, ammonia nitrogen, transparency, and temperature. These lakes are monitored once per month from May-September.

In Anoka County, monitoring is completed by a variety of groups. Island Lake is monitored annually by Anoka county Parks Department through MPCA's volunteers program. The Anoka Conservation District and Sunrise River Watershed Management Organization monitor Fawn, Typo, Martin, and Linwood Lake every third year, or after major water quality projects are completed. Coon Lake is monitored by the ACD and SRWMO every other year and the Coon Lake Improvement District monitors on the opposite years. All lakes are monitored every other week from May to September (ten times per year). Monitoring parameters include: total phosphorus, chlorophyll-*a*, pH, specific conductivity, turbidity, temperature, and dissolved oxygen. All of these locations are monitored at a depth of 1 meter.

No known monitoring locations or programs exist within the Isanti County portion of the Sunrise River Watershed.

The MN DNR will continue to conduct macrophyte and fish surveys as allowed by their regular schedule. Currently fish surveys are conducted every five years and macrophyte surveys are conducted as staffing and funding allow on a ten year rotation, unless there are special situations – this mostly applies to Linwood Lake. The smaller lakes without public access are surveyed if the opportunity arises.

## BMP Monitoring

On-site monitoring of implementation practices should also take place in order to better assess BMP effectiveness. A variety of criteria such as land use, soil type, and other watershed characteristics, as well as monitoring feasibility, will be used to determine which BMPs to monitor. Under these criteria, monitoring of a specific type of implementation practice can be accomplished at one site but can be applied to similar practices under similar criteria and scenarios. Effectiveness of other BMPs can be extrapolated based on monitoring results.

All BMP monitoring will be done in accordance with funding availability. Currently no BMP monitoring or monitoring programs are in place in Anoka, Chisago, or Isanti Counties. The Comfort Lake Forest Lake Watershed District is currently monitoring an Iron-Enhanced Sand Filter in the City of Forest Lake, MN. This monitoring will be conducted a minimum of seven times following storm events each year from 2013 to 2015. Monitoring parameters include: total phosphorus, dissolved phosphorus, and total suspended solids.

BMP effectiveness monitoring is currently not being done widespread due to funding. There are not many funding opportunities to encourage this type of practice on the local level. It would be viewed as beneficial by the local implementers if the opportunity was available.

## 5. References and Further Information


Almendinger, J.E. and J. Ulrich. 2010. Constructing a SWAT model of the Sunrise River watershed, eastern Minnesota. St. Croix Watershed Research Station, Science Museum of Minnesota and Department of Bioproducts and Biosystems Engineering, University of Minnesota.

Army Corps of Engineers. 2013. Watershed Study Report for the Sunrise River Watershed

MPCA. 2014. Lower Saint Croix Watershed Monitoring and Assessment Report

MPCA. 2014. Sunrise River Watershed Total Maximum Daily Load Report

MPCA.2013. Chisago Lakes Chain of Lakes Watershed TMDL Report

MPCA. 2012. Lake St. Croix Nutrient Total Maximum Daily Load Report

MPCA. 2012. Martin and Typo Lakes Total Maximum Daily Load Report

MPCA. 2009. Twin Cities Metro Chloride Feasibility Study

MPCA. 2009. Comfort Lake Forest Lake Watershed District Six Lakes Total Maximum Daily Load Report

MPCA. 2007. Sunrise River (North Branch) – Fecal Coliform Total Maximum Daily Load Report

MPCA. 2007. Minnesota Statewide Mercury TMDL (http://www.pca.state.mn.us/index.php/view-document.html?gid=8507)

MPCA. Lower Saint Croix Watershed Stressor Identification Report


### *Sunrise River Watershed Reports*

*All Sunrise River Watershed reports referenced in this watershed report are available at the Lower St. Croix River Watershed webpage: http://www.pca.state.mn.us/lupgdd5*

# Appendix A – Assessment Status

**Table 30. Assessment status of stream reaches in the Sunrise River watershed, presented (mostly) from headwaters to outlet**

| Subwatershed | AUID (Last 3 digits) | Stream | Reach Description | Aquatic Life Impairments | | | | | | Aq Rec |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Fish | Invert | DO | TSS | pH | Cl-d | E. coli |
| Comfort Lake-Forest Lake | 643 | Unnamed creek | Shields Lk to Forest Lk | IF | | | | | | IF |
| | 525 | Judicial Ditch 2 | Headwaters to Sunrise R | | | | | | NS | IF |
| | 533 | Unnamed ditch | Heims Lk to Sunrise R | NA | | | | | | NA |
| | 526 | Sunrise River | Upstream from Comfort Lk | IF | | | | | | NS |
| | 641 | Unnamed creek | Unnamed lk to Birch Lk | IF | | | | | | NS |
| | 521 | Unnamed creek | Birch Lk to School Lk | | | NS | | | | NS |
| | 522 | Unnamed creek | School Lk to Little Comfort Lk | | | NS | | | | NS |
| | 527 | Sunrise River | Comfort Lk to Pool 1 | NS | NS | NS | | | | FS |
| South Branch Sunrise River | 627 | Unnamed creek | Headwaters to S Br Sunrise | NA | | | | | | NA |
| | 528 | Sunrise River, S Br | 02-0500-00 to Sunrise R | | | NS | | | | FS |
| West Branch Sunrise River | 711 | County Ditch 16 | Unnamed ditch to Rice Lk | NA | | | | | | NA |
| | 576 | Boot Lake Inlet | Rice Lk to Boot Lk | NA | | | | | | NA |
| | 578 | Island Lake Inlet | Linwood Lk to Island Lk | NA | | | | | | NA |
| | 579 | Martin Lake Inlet | Island Lk to Martin Lk | NA | | | | | | NA |
| | 561 | County Ditch 13 | Headwaters to Typo Lk | IF | | | | | | NA |
| | 582 | Unnamed ditch | Headwaters to W Br Sunrise | IF | | | | | | NA |
| | 581 | Unnamed creek | Unnamed ditch to W Br | IF | | | | | | NA |
| | 583 | Unnamed creek | Headwaters to Typo Lk | NA | | | | | | NA |
| | 580 | Unnamed creek | Headwaters to W Br | NA | | | | | | NA |
| | 775 | Judicial Ditch 2 | Long Lk to W Br | NA | | | | | | NA |
| | 563 | Sunrise River, West Branch | Typo Lk to Martin Lk | | | | NS | NS | | NA |
| | 529 | Sunrise River, West Branch | Martin Lk to Sunrise Pool 1 | NS | NS | | NS | NS | | IF |

| Subwatershed | AUID (Last 3 digits) | Stream | Reach Description | Aquatic Life Impairments | | | | | | Aq Rec |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Fish | Invert | DO | TSS | pH | CLd | E. coli |
| Chisago Chain of Lakes | 723 | Bloomquist Creek | T34 R21W S24, east line to Sunrise River | NS | | | | | | IF |
| | 722 | Unnamed ditch | Wallmark Lk to T34 R20W S19, west line | NA | | | | | | NA |
| | 719 | Unnamed creek | Headwaters to Little Lk | IF | | | | | | NA |
| | 721 | Unnamed creek | Little Lk to North Center Lk | IF | | | | | | NA |
| | 572 | Unnamed creek | Headwaters to S Center Lk | FS | | | | | | NA |
| | 715 | Unnamed creek | Headwaters to unnamed cr | NA | | | | | | NA |
| Carlos Avery | 538 | Sunrise River | Pool 1 to Pool 3 | NA | | | | | | NA |
| | 630 | County Ditch 10 | Headwaters to unnamed cr | NA | | | | | | NA |
| | 708 709 710 | County Ditch 5 | Unnamed ditch to Sunrise R | NA | | | | | | NA |
| | 540 | Sunrise River | Pool 3 to Kost Dam Reservoir | NS | | NS | | | | NA |
| North Branch Sunrise River | 501 | Sunrise River, North Branch | Headwaters to Sunrise R | NS | | | | | | NS |
| | 728 | County Ditch 19 | Unnamed ditch to N Br | NA | | | | | | IF |
| | 753 | Unnamed creek | Headwaters to N Br | NA | | | | | | IF |
| | 556 | Judicial Ditch 4 | Unnamed cr to N Br | NA | | | | | | IF |
| | 707 | Unnamed creek | Unnamed cr to N Br | NA | | | | | | IF |
| | 714 | Hay Creek | Mud Lk to N Br Sunrise R | NA | | | | | | IF |
| | 514 | County Ditch 7 | Unnamed cr to N Br Sunrise | IF | | | | | | IF |
| | 569 | Unnamed creek | Headwaters to N Br | IF | | | | | | IF |
| | 755 | Unnamed creek | Unnamed ditch to N Br | NA | | | | | | IF |
| Sunrise River, Main Branch | 598 | Unnamed creek | Unnamed cr to Vibo Lk | NA | | | | | | NA |
| | 571 | Unnamed creek | Vibo Lk to Sunrise R | IF | | | | | | NA |
| | 596 | Unnamed creek | Unnamed cr to unnamed cr | IF | | | | | | NA |
| | 542 | Sunrise River | Kost Dam to N Br Sunrise R | FS | | | | | | IF |
| | 546 | Beaver Cr (CD 3) | Unnamed ditch to Hay Cr | IF | | | | | | NA |
| | 592 | Unnamed ditch | T35 R21W S12, west line to Beaver Cr (CD 3) | NA | | | | | | NA |
| | 771 | Hay Creek | Headwaters to T35 R21W S12, east line | NA | | | | | | NA |
| | 770 | Hay Creek | T35 R20W S7, west line to CD3 | IF | | | | | | NA |

| Subwatershed | AUID (Last 3 digits) | Stream | Reach Description | Aquatic Life Impairments | | | | | | Aq Rec |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Fish | Invert | DO | TSS | pH | CLd | E. coli |
| | 545 | Hay Creek | CD 3 to Sunrise River | IF | | | | | | NS |
| | 543 | Sunrise River | N Br Sunrise R to St Croix R | FS | | | | | | NS |
| Direct Drainage to the St. Croix | 570 | Dry Creek | Unnamed Cr to St. Croix R | | | IF | FS | FS | | IF |
| | 574 | Lawrence Creek | T33 R19W S3, north line to St Croix R | FS | FS | IF | FS | FS | FS | IF |
| | 553 | Unnamed Creek | Headwaters to Lawrence Cr | | | | FS | | | NA |

**Table 31. Assessment status of lakes in the Sunrise River Watershed**

Presented by subwatershed (mostly) from headwaters to outlet, and in order of increasing lake surface area within each subwatershed.

| Subwatershed | Lake ID | Lake Name | Acres | AQR |
|---|---|---|---|---|
| Comfort Lake - Forest Lake | 13-0018-00 | Pine | 45 | NA |
| | 13-0023-00 | Moody | 46 | NS |
| | 82-0162-00 | Shields | 32 | NS |
| | 13-0042-00 | Birch | 33 | IF |
| | 13-0054-00 | Little Comfort | 35 | IF |
| | 13-0057-00 | School | 47 | NS |
| | 13-0048-00 | White Stone | 49 | NS |
| | 13-0024-00 | Third | 62 | FS |
| | 82-0053-00 | Sea | 62 | IF |
| | 13-0025-00 | Second | 86 | NS |
| | 13-0056-00 | Heims | 88 | IF |
| | 82-0080-00 | Sylvan/Halfbreed | 97 | FS |
| | 02-0002-00 | Higgins | 110 | NA |
| | 82-0056-00 | German | 143 | FS |
| | 13-0053-00 | Comfort | 216 | IF |
| | 82-0054-00 | Bone | 222 | NS |
| | 82-0159-00 | Forest | 2,313 | FS |
| South Branch Sunrise River | 02-0511-03 | Avery Pond | 6 | NA |
| | 02-0033-00 | West Twin | 22 | NA |
| | 02-0048-00 | South Coon | 56 | IF |
| | 02-0063-00 | Anderson | 89 | NA |
| | 02-0058-00 | Devil | 106 | NA |
| | 02-0020-00 | East Twin | 201 | NA |
| | 02-0062-00 | Goose | 227 | NA |
| | 02-0032-00 | Little Coon | 564 | NA |
| | 02-0042-00 | Coon | 1,983 | FS |
| West Branch Sunrise River | 30-0004-00 | Twin | 57 | NA |
| | 02-0035-00 | Fawn | 58 | FS |
| | 30-0007-00 | Lower Birch | 84 | NA |
| | 02-0022-00 | Island | 99 | FS |
| | 30-0005-00 | Upper Birch | 106 | NA |
| | 02-0021-00 | Tamarack | 121 | NA |
| | 30-0001-00 | Tamarack | 140 | NA |
| | 30-0008-00 | Hoffman | 179 | NA |
| | 02-0028-00 | Boot | 184 | NA |
| | 30-0002-00 | Long | 213 | NA |
| | 02-004300 | Rice | 255 | NA |
| | 02-0034-00 | Martin | 264 | NS |

**AQR** = aquatic recreation impairment due to excess nutrients/eutrophication.
**NS** = not supporting (red),
**IF** = insufficient information to assess (yellow),
**FS** = fully supporting (blue)
**NA** = not assessed (white).

| Subwatershed | Lake ID | Lake Name | Acres | AQR |
|---|---|---|---|---|
| | 30-0009-00 | Typo | 320 | NS |
| | 02-0065-00 | Fish | 541 | NA |
| | 02-0026-00 | Linwood | 596 | NS |
| Chisago Chain of Lakes | 13-0032-02 | North Center Pond | 8 | IF |
| | 13-0046-00 | Emily | 19 | NS |
| | 13-0047-00 | Ellen | 27 | IF |
| | 13-0043-00 | Mattson | 68 | IF |
| | 13-0011-00 | Ogrens | 74 | NS |
| | 13-0034-00 | Pioneer | 77 | NS |
| | 13-0035-00 | North Lindstrom | 148 | FS |
| | 13-0029-00 | Wallmark | 149 | NS |
| | 13-0014-00 | Linn | 178 | NS |
| | 13-0033-00 | Little | 178 | NS |
| | 13-0019-00 | Spider | 195 | FS |
| | 13-0044-00 | School | 196 | NS |
| | 13-0013-00 | Kroon | 198 | IF |
| | 13-0041-01 | Little Green | 232 | FS |
| | 13-0028-00 | South Lindstrom | 505 | FS |
| | 13-0012-01 | North Chisago | 544 | FS |
| | 13-0012-02 | South Chisago | 595 | FS |
| | 13-0032-01 | North Center | 807 | NS |
| | 13-0027-00 | South Center | 998 | NS |
| | 13-0041-02 | Green | 1,688 | FS |
| Carlos Avery | 13-0059-02 | Mud Lake | 431 | IF |
| | 13-0031-00 | Sunrise | 822 | IF |
| | 13-0059-03 | North Sunrise Pool | 958 | NA |
| | 13-0059-01 | South Sunrise Pool | 1,048 | NA |
| North Branch Sunrise River | 30-0041-00 | Splittstoeser | 31 | NA |
| | 13-0066-00 | Mud | 70 | IF |
| | 30-0017-00 | Grass | 83 | NA |
| | 30-0012-00 | Horseleg | 85 | NA |
| | 30-0003-00 | Horseshoe | 108 | NA |
| | 30-0015-00 | Big Pine | 110 | NA |
| | 13-0063-01 | Chain (North Portion) | 113 | NA |
| | 13-0063-02 | Chain (South Portion) | 122 | NA |
| Sunrise River, Main Branch | 13-0030-00 | Vibo | 59 | NS |
| Direct Drainage to St. Croix | 13-0005-00 | Duck | 56 | FS |