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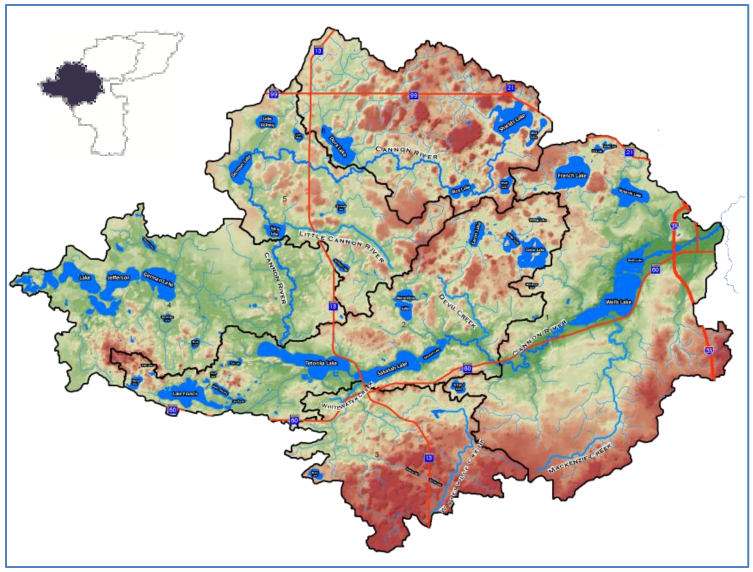


Introduction

As discussed in Chapter 1, watershed management and monitoring strategies in this document are broken up by watershed lobe. The Upper Cannon Lobe includes portions of three counties: Waseca, Le Sueur, and Rice. It begins at Shields Lake, the Cannon River's headwaters, and ends in Faribault at the confluence of the Cannon River and the Straight River. This chapter contains a brief overview of the Upper Cannon River Lobe's physical landscape and land use, a summary of monitoring data collected on the lobe's lakes and streams, priority management zones and concepts with suggested actions and/or projects to be implemented, and finally a monitoring strategy to guide future work to assess the health of the lakes and streams and track progress in making improvements.

Overview of Physical Landscape and Land Use

The Upper Cannon lobe contains most of the Cannon River watershed's lakes and wetlands. The lakes are a result of its recent glaciation. Many of the lakes and marshes were created by ice blocks left to melt within the glacial debris. Originally, large numbers of these water-filled basin had no outlets, but humans have connected them to each other and to surrounding streams through the construction of ditches, thus enlarging the Cannon River watershed and bringing more water into its streams and rivers. The hydrology of the lakes differs depending on their own watersheds and whether they are along the main stem of the Cannon. Gorman, Sabre, Tetonka, Upper and Lower Sakatah, Cannon and Wells Lakes are flow-through lakes which receive drainage from the entire Cannon watershed above them.

This area also has a large number of ditches and tile lines, many of them convey water into the lakes from former wetlands nearby. Despite the rural nature of the Upper Cannon lobe, most of the lakes are at least partially ringed by houses. Small scattered woodlots and trees around the lakeshore are reminders that most of the area was once forested. To see a breakdown of land use in the Upper Cannon Lobe, see Figure 6.

Summary of Water Quality Data

Upper Cannon Lakes Excess Nutrients Total Maximum Daily Load (TMDL)

As of June 30, 2011, a draft of the Upper Cannon Lakes Excess Nutrients TMDL and implementation plan has been submitted by the Minnesota State-Mankato Water Resources Center to the MPCA. The focus of this study and implementation plan was phosphorus reductions in two impaired lakes in the Upper Cannon River Lobe, German-Jefferson Lakes and Lake Volney. Both the draft TMDL report and implementation plan are included in the Watershed Library on the CRWP website at http://www.crwp.net/upper-cannon-river-lobe-librar/ under German-Jefferson Lakes or Lake Volney.

The TMDL study sets some significant total phosphorus load reductions for German-Jefferson Lakes and Lake Volney. For Lake Volney a 72.4% reduction in the total phosphorus load would be required to reach its the total phosphorus standard of 40 ug/L. For German-Jefferson Lakes, total phosphorus reductions range from 60% for West Jefferson to 85% for Swedes Bay.

The Metropolitan Council, a governmental unit that plans for metropolitan growth in the Twin Cities metro area, has developed a grading scale for metro lakes using three parameters: total phosphorus and chlorophyll a concentrations, and Secchi disc transparencies, shown in Table 6. The grading criteria are based on a range of data collected from metropolitan lakes.

Table 6. *Metropolitan Council grading criteria for metropolitan lakes*

Grade	Total Phosphorus (µg/l)	Chlorophyll a (µg/l)	Secchi Disc (ft)
A	<23	<10	>10.0
B	23-32	10-20	7.25-10.0
C	32-68	20-48	4.0-7.25
D	68-152	48-77	2.3-4.0
F	>152	>77	<2.3

The Met Council's grading scale is useful in comparing the water quality of the many lakes in the Upper Cannon River Lobe. Unfortunately, most of the Upper Cannon's lakes have grades of "C" or below, with many lakes having a grade of "F". Table 7 shows the Met Council rating for each lake in the Upper Cannon River Lobe. Additional monitoring data for the Upper Cannon Lobe's lakes and streams is included in Appendix E. Analysis of whether the lakes and streams are improving can be found in Appendix A, Appendix C, and Appendix E.

Table 7. *Met Council grades for Upper Cannon River lobe lakes*

Lake (Years observed)	Met Council Secchi rating (m)	Met Council TP rating (ug/L)	Met Council Chlorophyll-A rating (ug/L)
Cannon ('03-09)	D	F	D
Caron ('02-08)	F	F	F
Cedar ('80-09)	D	D	C
Charles* (2007)	C	B	B
Diamond ('07-08)	F	D	B
Dora ('07-08)	D	F	F
Dudley ('99-08)	C	B	B
Fish ('07-08)	A	A	A
Frances ('80-07)	F	C	B
French ('79-08)	C	D	D
German ('56-09)	F	C	C
Gorman ('89-08)	C	F	C
Horseshoe ('81-08)	F	D	D
Hunt ('07-08)	D	D	D
East Jefferson ('56-09)	F	D	C
Middle Jefferson ('79-09)	F	F	D
West Jefferson ('90-05)	F	D	D
Jefferson (Swede's Bay) ('93-09)	F	F	C
Kelly ('80-08)	C	C	A
Lower Sakatah ('03-07)	B	F	C
Mabel ('07-08)	D	D	F
Perch* (2008)	B	A	A
Reeds ('81-08)	C	C	C
Rice-LeSueur* (2007)	A	F	A
Roberds ('80-07)	D	F	F
Roemhildts ('08-10)	A	A	A
Round* (2008)	F	D	D
Sabre ('07-08)	C	F	B
Shields Lake ('80-07)	D	F	C
Silver ('08-10)	C	D	C
Sunfish ('80-08)	D	C	C
Tetonka ('55-07)	C	F	C
Toners ('08-10)	F	F	D
Tustin ('96-08)	F	F	F
Upper Sakatah ('07-08)	C	F	C
Volney ('81-07)	D	C	C
Wells ('99-08)	F	F	D

* Indicates only one year of WQ data collected, 2 years required to be "fully assessed".
Years observed is the range in which lake data was derived

Management Strategy: Priority Management Zones and Concepts

The Priority Management Zones and Priority Management Concepts in this strategy are meant to be for the next three to five years. Chapter 6 provides an explanation of PMZs and PMCs and a description of the process that was used to select the priority management zones and concepts for each lobe. The table summarizing information from the "list of assets" for each lake and stream in the lobe is included as Appendix F. The "list of assets" for the Upper Cannon River Lobe can be found in the Watershed Library on the Cannon River Watershed Partnership's website (www.crwp.net). The PMZs and PMCs selected by local water resource professionals and citizens leaders are listed below *(not in order of priority)*:

1. Protection of the Lakes with Good Water Quality: Roemhildts Lake, Fish Lake, Kelly-Dudley, Perch Lake, and Charles Lake.
2. Shields Lake: Phosphorus loading reduction.
3. Lake Volney: Phosphorus loading reduction.
4. Whitewater and Waterville Creek watersheds: Phosphorus, sediment, and *E. coli* bacteria loading reductions.
5. Buffers: 50 foot perennial buffer installation on public waters using existing inventory and one-rod (16.5 foot) perennial buffer installation on all public ditches.
6. Upper Cannon River Green Corridor: Increase land protected and improve wildlife habitat.

Protection of the Lakes with Good Water Quality

Most of the Upper Cannon's lakes have grades of "C" or below on the Met Council's grading criteria, with many lakes having a grade of "F". However, five lakes have grades of "B". The five lakes are Roemhildts Lake, Fish Lake, Kelly-Dudley, Perch Lake, and Charles Lake. Table 6 shows each lake's grade. These lakes are a priority because there are few lakes in the Cannon River watershed that are not impaired and in relatively good condition. It is much easier to protect these lakes now, so that we do not have to restore them later.

Actions

1. Preserve the natural and undisturbed shoreline.
2. Create zoning overlay to limit or manage development to limit impact to water quality.
3. Implement aquatic invasive species prevention education.
4. For Kelly-Dudley, use mass balance, terrain analysis, and ditch/stream surveys to understand pollutant loading. Use data gathered to proactively work with landowners/operators to implement possible BMPs.
5. Continue to monitor lakes to detect signs of degradation.

Shields Lake: Phosphorus loading reduction

Shields Lake is located in Western Rice County and is the headwaters of the Cannon River. According to a Minnesota Department of Natural Resources survey (2006), the shoreline and riparian zone, spawning habitat (for largemouth bass and bluegill), and the aquatic plant community are in relatively good condition in the lake. These assets will be important protection priorities.

The water quality and clarity of Shields Lake are not in good condition (See Table 6). In 1972 a study of Rice County lakes stated, "Shields Lake is in that group of lakes with intermediate water quality" (National Biocentric, Inc., 1972, p. 31). Unfortunately, a follow-up study of Rice County lakes in 1986 found that, "Shields Lake has experienced a slow, steady decline in transparency and fluctuation in nutrient concentrations since 1972" (National Biocentric, Inc., 1986, p. 47).

Actions

1. Increase the natural and undisturbed shoreline from the amount found in the 2006 DNR lake survey. McCullough Park is a good candidate for a future shoreland restoration project once Irwin Path is relocated away from the lake.
2. Protect the aquatic plant community and spawning habitat present in the lake.
3. Conduct a phosphorus mass balance study and use terrain analysis and ditch and stream surveys to determine phosphorus sources to the lake.
4. Implement erosion control and water retention projects, buffers, and wetland restoration projects to reduce phosphorus entering the lake.
5. Achieve 100% compliant septic systems.

Lake Volney: Phosphorus loading reduction

Historically, Lake Volney has been a treasured recreational lake in Le Sueur County. Many longtime residents of the area have fond memories of swimming at the Lake Volney Beach. Beginning in the 1980s, water clarity began to decrease, and algal blooms became a nuisance.

Lake Volney is probably the most studied lake in the Cannon River Watershed. It was the first lake in the watershed to be assessed by the MPCA's Lake Assessment Program in 1987 and was studied extensively in the 1990s by Le Sueur County through the Clean Water Partnership program.

With the assistance of the Clean Water Partnership Program, Le Sueur County and the Lake Volney Association have put extensive resources into restoring Lake Volney since the mid-1990s. Water clarity has begun to improve, and algal blooms have been decreasing in the last ten years. Many local water resource professionals expressed the sentiment that Lake Volney is nearly ready to "flip" back to its former condition.

The Draft Upper Cannon Lakes TMDL for Excess Nutrients (Phosphorus) and a draft implementation plan have been submitted by Minnesota State-Mankato Water Resources Center to the MPCA. The action items below have been taken from the draft implementation plan. Detailed tasks for each action are listed in the implementation plan.

Actions (Minnesota State-Mankato Water Resources Center, 2011)

1. Reduce loading from monitoring location V2 (which drains large wetland complex NE of Lake Volney).
2. Reduce loading from monitoring location V3 (located on the west side of Lake Volney).
3. Reduce loading from agricultural land uses.
4. Reduce loading from developed land uses
5. In-Lake/Near Shore Source Reduction/Enhancement of Biological Integrity

Whitewater and Waterville Creek Watershed: Phosphorus, sediment, and E. coli bacteria loading reductions

The Whitewater Creek watershed is an approximately 22,000 acre watershed on the southern end of the City of Waterville. It is made up of two streams – Whitewater Creek and Waterville Creek that join in the City of Waterville. The majority of the land in the watershed is cultivated crops. This subwatershed was part of the Upper Cannon Assessment Project from 2007-2009. Water samples and flow data indicate this watershed had the highest loading for Total Suspended Solids (TSS), Nitrate-Nitrite-N, and E. coli bacteria of the five subwatersheds studied.

The watershed is small and implementation actions will be focused on one-on-one meetings and work with landowners and operators of livestock. A nutrient management specialist, who does not have enforcement duties, should be employed who can provide education, planning and implementation assistance. This approached has worked well in southeast Minnesota and should be attempted in this area.

Actions

1. Achieve 100% compliance with Open Lot Agreement and County feedlot rules.
2. Restrict access for livestock from streams.
3. Work with producers to improve manure and nutrient management.
4. Install buffers along all public streams and ditches.
5. Achieve 100% compliant septic systems.
6. Implement wetland restoration projects in the upland areas of Waseca County.

Buffers: 50 foot perennial buffer installation on public waters using existing inventory and one rod (16.5 foot) perennial buffer installation on all public ditches

Water draining over land carries with it sediment, bacteria, phosphorus and other pollutants. A perennial vegetative buffer helps to separate land from the surface water. In doing so, a shoreland buffer can reduce pollutants in runoff, as well as provide economic opportunities, wildlife habitat, and other benefits. Since 2008 work has gone on to educate elected officials and inform county staff regarding the shoreland buffer rule requirements for agricultural land as well as to map the land in the Cannon River watershed to understand the current status of buffers. Table 8 shows the acres of land in each county that should have a 50 foot perennial buffer but do not based on GIS evaluations.

Table 8. *Number of acres that should have a 50 foot perennial buffer*

County	Acres in Cropland	Percent of Total
Goodhue	276	4.4%
Dakota	NA	NA
Le Sueur	304	8.78%
Rice	402	9.11%
Steele	44	3.08%
Waseca	368	11.83%

As this table illustrates, the problem of lack of buffers does exist throughout the counties of the Cannon River watershed. In 2010 a four county project, funded by Clean Water Fund dollars, began to encourage landowners to enroll this land into buffers. They were paid a small amount to do so. Efforts have begun in Dakota and Goodhue Counties to enforce this rule as of the spring of 2011.

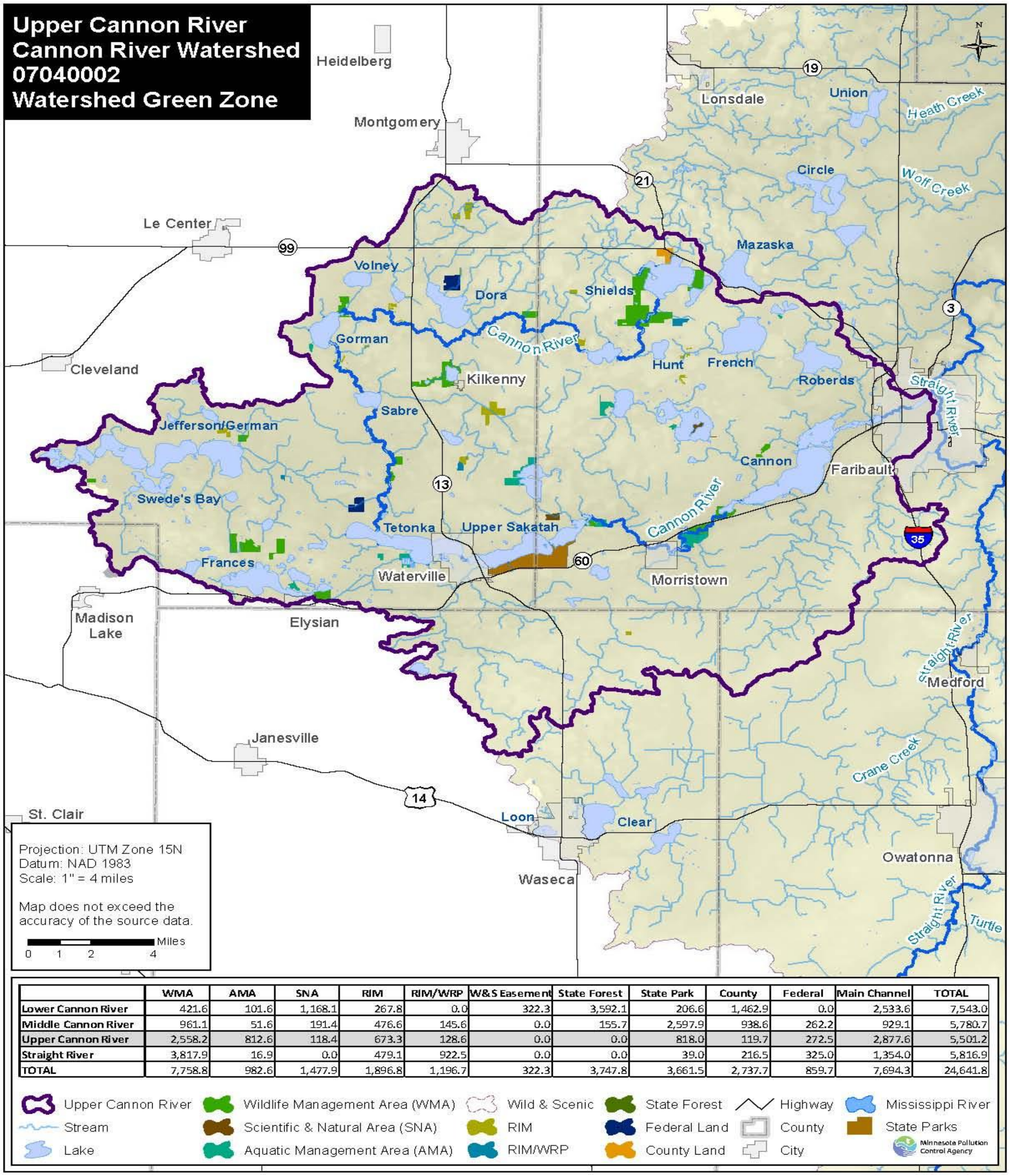
Along with the public waters, there is a need for buffers on ditches – both public and private. The ditch systems are old and in many cases they have not had benefits of the system reviewed since they were installed. Redetermination of benefits will trigger the requirement for a one rod (16.5 feet) buffer to be installed along the public ditches. Landowners on a ditch system can petition the county for redetermination of benefits.

Actions

1. All counties conduct active agricultural shoreland buffer rule enforcement.
2. Install at minimum 50 foot perennial buffers along all public waters.
3. Install at minimum one-rod (16.5 foot) buffer along all public ditches.
4. Conduct public education campaign about the benefits of buffers – make it a cultural norm that buffers should be in place.
5. Work with NRCS to make haying of buffers an accepted practice for land enrolled in their programs.
6. Work with landowners/operators to improve the quality of buffers that have problem areas.
7. Provide education on buffer installation and maintenance.
8. Re-evaluate status of buffers in 3 years to determine progress.

Upper Cannon River Green Corridor: Increase land protected along the Cannon River

The riparian zone along a river serves many important functions. It provides habitat for wildlife, reduces sediment, bacteria, and phosphorus entering the river, preserves the floodplain, and provides for a beautiful recreational experience for outdoor enthusiasts. In the Upper Cannon River Lobe much of the Cannon River's riparian zone has been permanently preserved through land acquisition by the DNR and other conservation groups, or in other conservation programs such as RIM to create a "green corridor". Figure 11 shows the locations of the protected lands and the acreage protected in various conservation programs.



	WMA	AMA	SNA	RIM	RIM/WRP	W&S Easement	State Forest	State Park	County	Federal	Main Channel	TOTAL
Lower Cannon River	421.6	101.6	1,168.1	267.8	0.0	322.3	3,592.1	206.6	1,462.9	0.0	2,533.6	7,543.0
Middle Cannon River	961.1	51.6	191.4	476.6	145.6	0.0	155.7	2,597.9	938.6	262.2	929.1	5,780.7
Upper Cannon River	2,558.2	812.6	118.4	673.3	128.6	0.0	0.0	818.0	119.7	272.5	2,877.6	5,501.2
Straight River	3,817.9	16.9	0.0	479.1	922.5	0.0	0.0	39.0	216.5	325.0	1,354.0	5,816.9
TOTAL	7,758.8	982.6	1,477.9	1,896.8	1,196.7	322.3	3,747.8	3,661.5	2,737.7	859.7	7,694.3	24,641.8

Figure 11. Upper Cannon River green corridor

Actions

1. Identify priority parcels for inclusion in the Cannon River Green Corridor using aerial photos, fieldwork, already completed planning processes or assessments such as county biological surveys, ecological assessments, natural resource inventories, or floodplain maps.
2. Conduct outreach to landowners of unprotected land along the Cannon River about protecting their land as part of the Cannon River Green Corridor.
3. Promote the Cannon River Green Corridor concept to the general public and outdoor enthusiasts.
4. On lands already protected, restore and enhance habitat and natural communities.

Monitoring Strategy

Short-term (0-3 years) and long-term (5-10 years) monitoring strategies were determined utilizing past, current, and future water quality monitoring data. These short and long-term monitoring strategies are discussed in further detail below.

Short-term (0-3 years)

1.) Review all water quality and physical data collected.

Currently, water quality data focuses on assessment and has been limited to two consecutive funding year cycles because state grants were the main funding source. This has lead to the water quality data to be inconsistent on a yearly basis. Making it difficult to determine surface water impairments and pollutant sources because it does not account for seasonal variability; changes in agricultural practices, crop rotations, and can result in sample bias. Based on the limited water quality data collected in this lobe, six recommended chemical parameters (associated surface water problems) were identified to assist in evaluating the surface water impairments and they are: total suspended solids (erosion/sedimentation/turbidity), total phosphorus (eutrophication), ortho-phosphorus (eutrophication), chlorophyll-a (eutrophication), nitrate-nitrogen (eutrophication), and E. coli bacteria (public health risk). In addition, it is important to re-evaluate “what we know” as it pertains to water quality information within each lobe of the watershed. Many different agencies, educational institutions, and organizations have water quality information being collected. It is essential to regularly update the water quality database to stay current on the health of the surface water resources of the lobe and watershed.

2.) Assess water quality condition for stream reaches with incomplete or no water quality data.

Chemical parameters to be analyzed would be total phosphorus, nitrate nitrogen, E. coli bacteria, and total suspended solids. In comparison to the other three lobes of the watershed, the Upper Cannon lobe can be characterized as having a lack of long-term stage data, flow discharge measurements, and limited in the water quality sample numbers and type of water quality chemical parameters analyzed. There are numerous intermittent or perennial streams, ditch systems, lake inlet/outlets, and wetland outlets within this lobe that have not been evaluated and could represent a significant source of pollutants leading to many of the surface water impairment listings (*e.g.,* county ditch 59 & 46, Tustin lake outlet, Shield lake inlet, and Weinberger lake outlet). Identifying these priority pollutant areas would be beneficial for future restoration activities, Best Management Practices (BMP), and educational outreach opportunities.

3.) Assess water quality condition for all the lakes within the lobe

The Upper Cannon lobe contains the majority of the lakes within the Cannon River watershed. There are lakes that have no water quality data; lakes with water quality data older than ten years, and those lakes that have an incomplete data set to be considered completely "assessed" by EPA standards (*i.e.* Perch, Round, Rice, and Charles Lake). These are the lakes were monitoring efforts should be focused. Some of these lakes have proven difficult to collect water quality data due to restricted lake access (*e.g.,* Bossuot, Toners, and Sasse Lake). Generally, most of these lakes with no water quality data are small and the shoreline is privately owned. We have encountered landowners not willing to provide access for water quality sample collection. However, future restoration activities and upcoming Total Maximum Daily Load (TMDL) studies will increase our ability to contact local landowners resulting in more water quality information being collected on lakes with no water quality sampling history.

4.) Develop and implement field stream assessments throughout the lobe

This stream corridor component would comprise of six distinct components which are: Bank Erosion Hazard Index (BEHI), Near-Bank Stress (NBS), stream discharge measurements, stream dimension surveys, stream habitat assessments, and invertebrate surveys. An example of this stream corridor assessment could be applying BEHI and NBS estimation tools, which involves evaluating bank characteristics and flow distribution along river reaches and mapping various risk ratings commensurate with bank and channel changes. An estimate of erosion rate is made, and then multiplied times the bank height times the length of bank of a similar condition, providing an estimate of cubic yards and/or tons of sediment/year. This information can be compared to the sediment yield data to apportion the amount of sediment potentially contributed by stream banks. Along with the other components mentioned, this field stream assessment toolbox should provide an abundance of information relating to stream condition, channel evolution, and overall stream health. This information would also assist in identifying priority areas where restoration activities need to be focused to address impairment issues. In addition, it enables the researcher to monitor the stream's condition over-time in a subjective manner.

Long-term (5-10 years)

1.) Establish two dedicated year-round monitoring stations along the Cannon River before joining with the Straight River in Faribault.

Currently, no long-term flow data is being recorded in the region. Ideally, one station would be placed in the upper portion of the lobe and the other station at the outlet point in Faribault, MN. Monitoring may not be necessary at all times of the year, but it is particularly important to understand the hydrology of the water body, in order to predict when important changes in chemical and biological patterns are expected. These monitoring stations could answer some important questions such as: Is your watershed/water system perennial, intermittent, or ephemeral? Is the pollutant of concern primarily transported during base flow (when the system may be more dominated by groundwater) or during snow melt or storm events? This information is vital in determining overall lobe flow, lobe response to seasonal changes and storm flow effects, percentage of Cannon River overall flow is derived from upper lobe, and pollutant load allocations. At a minimum, you can consider: watershed lobe response time, predictable seasonal changes, daily changes, and storm event impacts.

2.) Establish flow discharge rating curves for five major tributaries within the Upper Cannon lobe.

Tentatively, these locations would be McKenzie, Whitewater, Waterville, and Devil's creek. In addition to the four creek locations, County Ditch 59 would also have flow discharge curves established. Past water quality projects have avoided monitoring this ditch due to low flows, but one source of the ditch water is flow from an impaired lake (German Lake). Generally, these selected locations have year-round flow, but may become dry during low precipitation years. These sites were selected based on accessibility, drainage area, sustained year-round flow, and past monitoring data. It is important to note that this lobe of the watershed has limited discharge rating curve data for the larger tributaries.

3.) Establish four long-term sites where biological and physical stream metrics can be collected and observed.

These stations will collect biological and physical metrics used to establish long-term stream health trends. These locations will be determined in the future and will be dependent on funding availability, location, and utilization of trained citizen volunteers interested in this subject matter. After the MPCA concludes their 2011 intensive watershed monitoring project in the Cannon River watershed, information will be available to determine which locations would be the best suited for long-term stream health observation. By collecting this information, stream health trends, stream channel morphology, channel evolution, and long-term trends can be monitored and developed. Thus, allowing us to determine if the stream condition/health are improving or degrading over time.

4.) Utilization of a hydrological model to indicate were restoration efforts should be focused.

One such model that may be able to assist is the GSSHA model. The principal purpose of the GSSHA model is to correctly identify and realistically simulate the hydrologic processes in a watershed. The model is intended to simulate different types of runoff and determine the controlling physical processes in watersheds (*i.e.,* infiltration excess, saturated source areas, and groundwater discharge). The GSSHA model ability to simulate saturated and unsaturated groundwater allows for the model to be used in a variety of climates and watersheds. This new model formulation represents advancement in state-of-the-art physically based watershed scale hydrologic modeling because it incorporates the latest technology and is verifiable at both the process and watershed scales. This model has been used for flash flood modeling, soil moisture predictions, sediment loading to receiving water bodies, tidal and hurricane storm surge, engineering design, hydrology education, and hydrologic research.

5.) Conduct BMP effectiveness monitoring after implementation projects have been completed.

Another long-term monitoring benchmark is to conduct BMP effectiveness monitoring after implementation projects have been completed. Dramatic changes in nutrient and sediment concentrations often occur naturally, so it is important to understand this natural variability in your system. In BMP effectiveness monitoring, the objective is to assess and/or demonstrate the impact of the BMP on addressing the water quality issue of concern. The ease with which this is done will depend on the magnitude of this impact relative to background conditions. The range of natural variability in the system must also be taken into consideration because this variability may mask any changes resulting from the BMP implementation. As a general rule, more samples are needed in a highly variable system, but by targeting sampling timing it may be possible to greatly improve the monitoring program. In the case of the Straight River lobe, the flow pattern has been greatly modified due to increased subsurface drainage and loss of wetland habitat. By conducting BMP effectiveness monitoring, it allows for evaluation of how well a technique or method will reduce pollutants and flow volume from entering surface water systems.

6). Determine if water quality goals are being achieved

These goals will be based on past water quality results and the 303(d) impaired waters list determined by the EPA. Water quality standards serve as the foundation for the water-quality based approach to pollution control and are a fundamental component of watershed management. Water quality standards are State law that: define the water quality goals of a water body, or segment thereof, by designating the use or uses to be made of the water; criteria necessary to protect the uses; and protect water quality through anti-degradation provisions. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Act. This means that water quality standards should: 1) include provisions for restoring and maintaining chemical, physical, and biological integrity of State waters, 2) provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water ("fishable/swimmable"), and 3) consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agricultural and industrial purposes, and navigation. Based on the 2010 impaired waters draft list and water quality data collected from the Upper Cannon River Watershed Assessment Project (MPCA, 2010)(1), there are four streams with *E. coli* bacteria impairments. However, there are 26 lakes in the Upper Cannon lobe that are impaired for nutrients. Of these 26 lakes, Cedar Lake is the only lake with a nutrient and mercury impairment listing. Due to these numerous nutrient and mercury impairment listings, water quality goals should focus on reducing nutrient source contributions to these surface water systems through management strategies, initiatives promoting land conservation, conservation easements, and nutrient BMP's. An example of a water quality goal in the Upper Cannon lobe is to reduce *E. coli* bacteria concentrations in the four previously mentioned impaired streams by 20%.

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