

Aquatic Ecosystem Protection Efforts in Minnesota's Snake River Watershed: Summary and Recommendations



Photo: Minnesota Pollution Control Agency

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1 Introduction

The Snake River Watershed, located in east-central Minnesota, supports a diverse range of aquatic species including fish and freshwater mussels, as well as a number of terrestrial threatened and endangered species (TNC 2009). The watershed is home to several outstanding resources such as the Mille Lacs Wildlife Management Area, the Solana State Forest, and the Rum River State Forest, which provide critical habitat for many species and support recreational activities such as hiking, fishing, and wildlife viewing. While the watershed supports a diverse species community and habitats, the health of the watershed is threatened by decreased water quality, invasive species, forest fragmentation, and increased flooding events. To protect the watershed's biodiversity and ecosystem services, state agencies, local governments, conservation groups, Soil and Water Conservation Districts (SWCD), and stakeholders have been working to assess water quality, understand species distribution, and implement best management practices (BMP). Building upon these efforts, the Minnesota Department of Natural Resources (DNR), the Board of Water and Soil Resources (BWSR), the Minnesota Pollution Control Agency (MPCA), The Nature Conservancy (TNC), the Snake River Watershed Management Board (SRWMB), SWCDs, and other stakeholders are working collaboratively to develop a restoration and protection plan for the watershed, termed the Snake River Watershed Restoration and Protection Strategies (WRAPS) report (MPCA 2010a).

The United States Environmental Protection Agency (EPA) contracted with The Cadmus Group, Inc. (Cadmus) to perform a review of protection efforts in the Snake River Watershed to assist the state and collaborators in long-term watershed protection efforts. The Snake River Watershed was selected by the project team¹ by evaluating three candidate watersheds (St. Croix-Snake River, Mississippi Headwaters-Leech Lake, and Upper Mississippi/Brainerd Lakes: Elk-Nokasippi) against a set of criteria, which included: TNC/State Priority, ecological capacity, protection and restoration opportunities, existence of a watershed protection plan (or evidence of willingness of jurisdictions to work together to develop a watershed plan), available watershed protection tools, local implementation capacity, local political readiness, community engagement, threats and vulnerability, ability to leverage federal and state sources of funding, predominant type of land ownership (public vs. private), projected population growth, and ecosystem services. Using these criteria, the project team deemed the Snake River Watershed as the best fit for this project.

The purpose of this report is to:

1. Provide an overview of existing protection efforts in the Snake River Watershed;
2. Identify gaps in existing protection efforts; and
3. Provide recommendations on how to enhance efforts to protect aquatic ecosystems including the functions and processes that support ecosystem health in the Snake River Watershed.

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2 Healthy Watersheds Initiative

EPA launched the Healthy Watersheds Initiative to protect and maintain our nation's remaining healthy watersheds having natural, intact aquatic ecosystems; prevent them from becoming impaired; and accelerate restoration successes. This Initiative is being implemented by promoting a strategic, systems approach to identify and protect healthy watersheds based on integrated assessments of landscape condition, hydrology, fluvial geomorphology, habitat, water chemistry, and biotic communities. This approach recognizes that aquatic ecosystems function as interconnected systems within a larger watershed, landscape, and temporal context. It also provides for a more comprehensive and coordinated approach to setting priorities for protection and restoration. Additionally, it will accelerate restoration, with the best chances of recovery likely to be in waters near existing healthy aquatic ecosystems (Sundermann et al. 2011).

A healthy watershed is defined as one in which natural land cover supports dynamic hydrologic and geomorphic processes within their natural range of variation; habitat of sufficient size and connectivity supports native aquatic and riparian species; and water quality supports healthy biological communities. Natural vegetative cover in the landscape, including the riparian zone, helps maintain the natural flow regime and fluctuations in water levels in lakes and wetlands. This in turn helps to maintain natural geomorphic processes, such as sediment storage and deposition, which form the basis of aquatic habitats. Connectivity of aquatic and riparian habitats, in the longitudinal, lateral, vertical, and temporal dimensions helps to ensure that biotic refugia are available during floods, droughts, and other extreme events.

Provided below is a brief description of each of the six healthy watersheds attributes. More detailed descriptions of each attribute are provided in EPA's technical document *Identifying and Protecting Healthy Watersheds: Concepts, Assessments, and Management Approaches* (EPA 2012). The technical document also provides examples of integrated assessment and management options to identify and protect healthy watersheds.

Landscape Condition

Natural vegetative land cover and riparian corridors serve as habitat for native species, provide soil stability and prevent erosion, regulate watershed hydrology and nutrient cycling, and filter runoff, protecting both surface water and ground water quality. Forested riparian areas provide shade, which maintains waterbody temperature. Leaves and woody debris, particularly in headwater streams, provide a food source and habitat for aquatic organisms. Interconnections among forest patches, wetlands, and riparian zones are also important. Threats such as urban development, agriculture production, and deforestation can fragment forested areas and riparian corridors. Fragmented landscapes disrupt species dispersal and movement from the aquatic to terrestrial landscape; species that rely on migration between aquatic habitats and upland areas may be particularly vulnerable. Fragmented watersheds are also more vulnerable to invasive species, which may out-compete native plant and animal species.

Habitat

A variety of aquatic habitat types exist in healthy watersheds including wetlands, floodplains, riparian habitat, and physical habitat in lakes and streams. The number and distribution of different habitat types and their connectivity influence species population health (Committee on Hydrologic Impacts of Forest Management, National Research Council, 2008). The quality of aquatic habitat is related to and influenced by hydrologic and fluvial geomorphic processes, as well as overall landscape condition and water quality, and can thus serve as an integrating indicator of watershed health.

Hydrology

Watershed hydrology is driven by landscape conditions (e.g., topography and geology), climate, and anthropogenic factors (e.g., water withdrawals and land use). The movement of water sustains ecosystem health by carrying nutrients, sediment, and biota through the watershed (Vannote 1980). Many native aquatic species depend on natural variation in the magnitude, timing, duration, frequency and rate of change of flow conditions (Poff et al. 1997). Urban development, land drainage, dam construction, water withdrawals, and alterations to waterbody structure can have significant impacts on a watershed's natural hydrologic processes.

Fluvial Geomorphology

Fluvial geomorphology refers to the shape and pattern of a stream as it moves through the landscape. Watershed inputs (water, sediment, and organic matter) and valley characteristics (valley slope and width, bedrock and surficial geology, soils, and vegetation) determine a river channel's form (pattern, profile, and dimension) (Vermont Department of Environmental Conservation, 2007). Anthropogenic factors that influence fluvial geomorphology include changes in land use/cover (e.g., urbanization or agriculture), floodplain and riparian encroachment, and flow alterations stemming from dam and culvert construction and/or water withdrawals. These factors also limit natural disturbances (e.g., flooding), which have a direct impact on ecosystem biodiversity and habitat availability.

Water Quality

Water sustains all life, and protecting water quality is essential to the health and viability of aquatic and terrestrial species, as well as to humans, which rely on clean water for drinking. Water quality can be impacted by chemical constituents (e.g., nutrients, organic matter, dissolved oxygen, pH, and various pollutants), and physical constituents (e.g., turbidity and stream temperature). Landscape condition, hydrology, and geomorphology all influence water quality. Water quality influences biological condition and ultimately the attainment of aquatic life and recreational beneficial uses. Maintaining water quality can also decrease drinking water treatment costs that would be needed to remove pollutants and sediment from degraded water.

Biological Condition

Maintaining biological condition within a watershed refers to supporting and maintaining a “balanced, integrated, and adaptive community with a biological diversity, composition, and functional organization comparable to those of natural aquatic ecosystems in the region” (Frey 1977, Karr and Dudley 1981, Karr et al. 1986, EPA 2012). The health of individual organisms, species, and entire communities is intricately linked to the availability and diversity of quality aquatic habitat. For example, many species rely on different ecosystem environments (e.g., streams and wetlands) at different periods of their lifecycle. Preserving the naturally diverse habitats available in watersheds helps ensure a healthy biological community.

3 Snake River Watershed Overview

The Snake River flows for approximately 90 miles from its headwaters in the Solana State Forest in Aitkin County to the St. Croix River, which is a tributary to the Mississippi River. Located in east-central Minnesota, the Snake River Watershed is a part of the larger St. Croix Watershed (Figure 1). The Snake River and its tributaries drain approximately 1,006 square miles within six counties: Kanabec (48.7%), Aitkin (20.4%), Pine (20.2%), Mille Lacs (9%), and small portions of Isanti (1.6%) and Chisago (0.1%). Land cover within the watershed is predominantly forested (48%) and agricultural (35%), though wetlands constitute 14% of the land cover in the watershed (TNC 2009). The watershed contains several state forests and wildlife management areas including the Snake River State Forest, the Chengwatana State Forest, the Rum River State Forest, and the Mille Lacs Wildlife Management Area (TNC 2009).

Primary residential areas within the basin include the Town of Mora (Kanabec County) and Pine City (Pine County), both of which have a population of less than 5,000, demonstrating the generally rural makeup of the watershed. However, population in the watershed is predicted to expand over the next 20 years (Figure 2). The greatest predicted population increases (up to 106.2%) are expected within the western central portion of the basin in the Ann River and Knife River subwatersheds (Sharon Pfeifer, DNR, personal communication, 04/18/2013). Approximately 25% of the watershed is under public ownership (see Figure 3 and Table 1). The highest proportions of publically owned land are within the Upper Snake River, the Ann River, and the Groundhouse River subwatersheds.

The Snake River is highly biodiverse and supports a minimum of 15 native freshwater mussel species and an estimated 65 fish species (TNC 2009). Terrestrial biodiversity is also high, with a number of threatened and endangered species and species of special concern within the watershed, such as osprey and Blanding’s turtle (TNC 2009). Given its high fish species richness, rare invertebrate species, and unique biological habitats, TNC has identified the St. Croix headwaters drainage area, which includes the Snake River, as an aquatic and terrestrial priority in its Superior Mixed Forest Ecoregion Conservation Plan (TNC 2002). The Snake River Watershed has also been identified as a priority watershed for aquatic habitat protection under the Midwest Glacial Lakes Partnership Strategic Plan, which is a fish habitat protection plan for glacial lakes throughout the Midwest, including Minnesota (MGLP 2009).

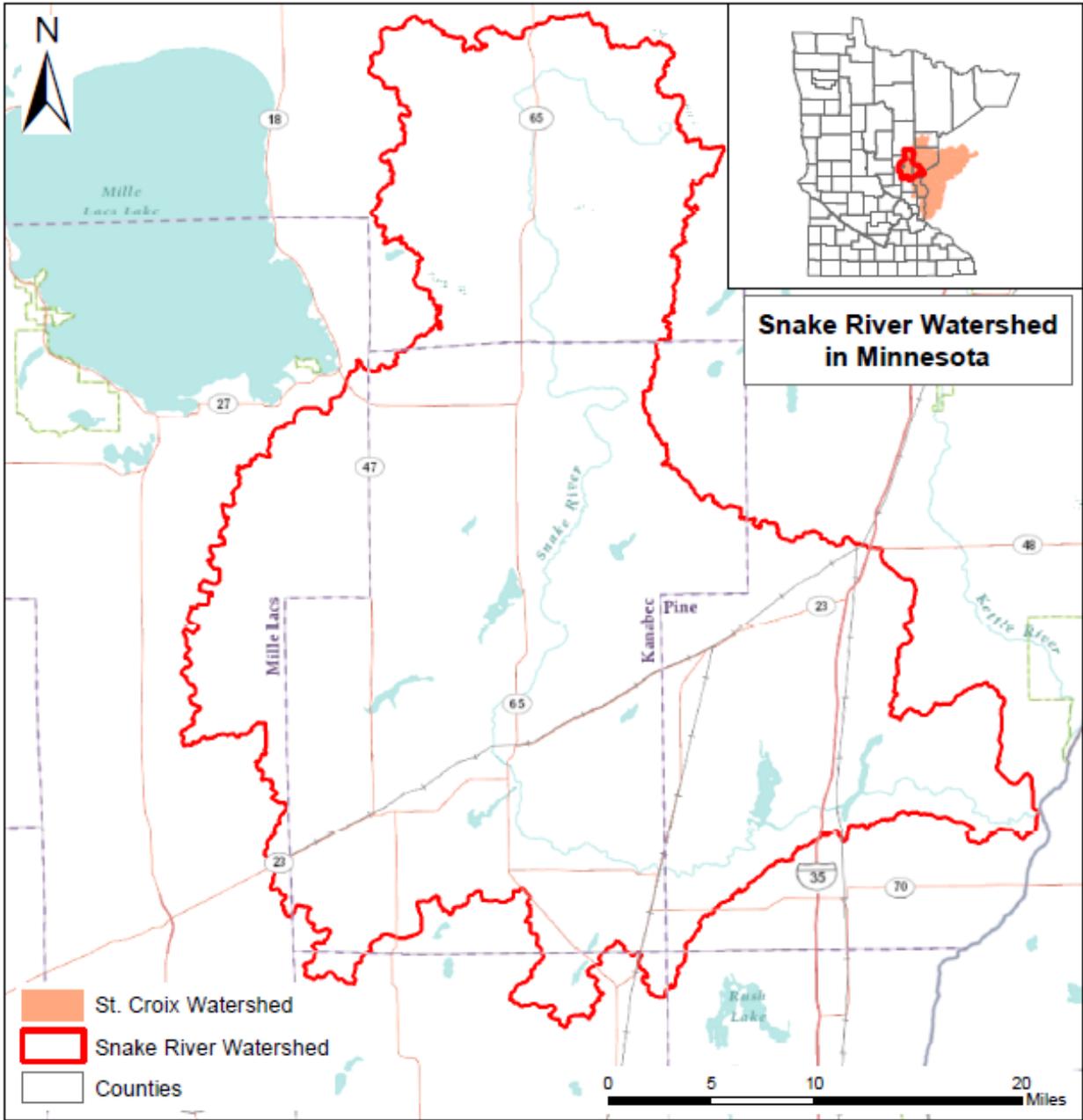


Figure 1. Map of the Snake River Watershed within the St. Croix Watershed in Minnesota.

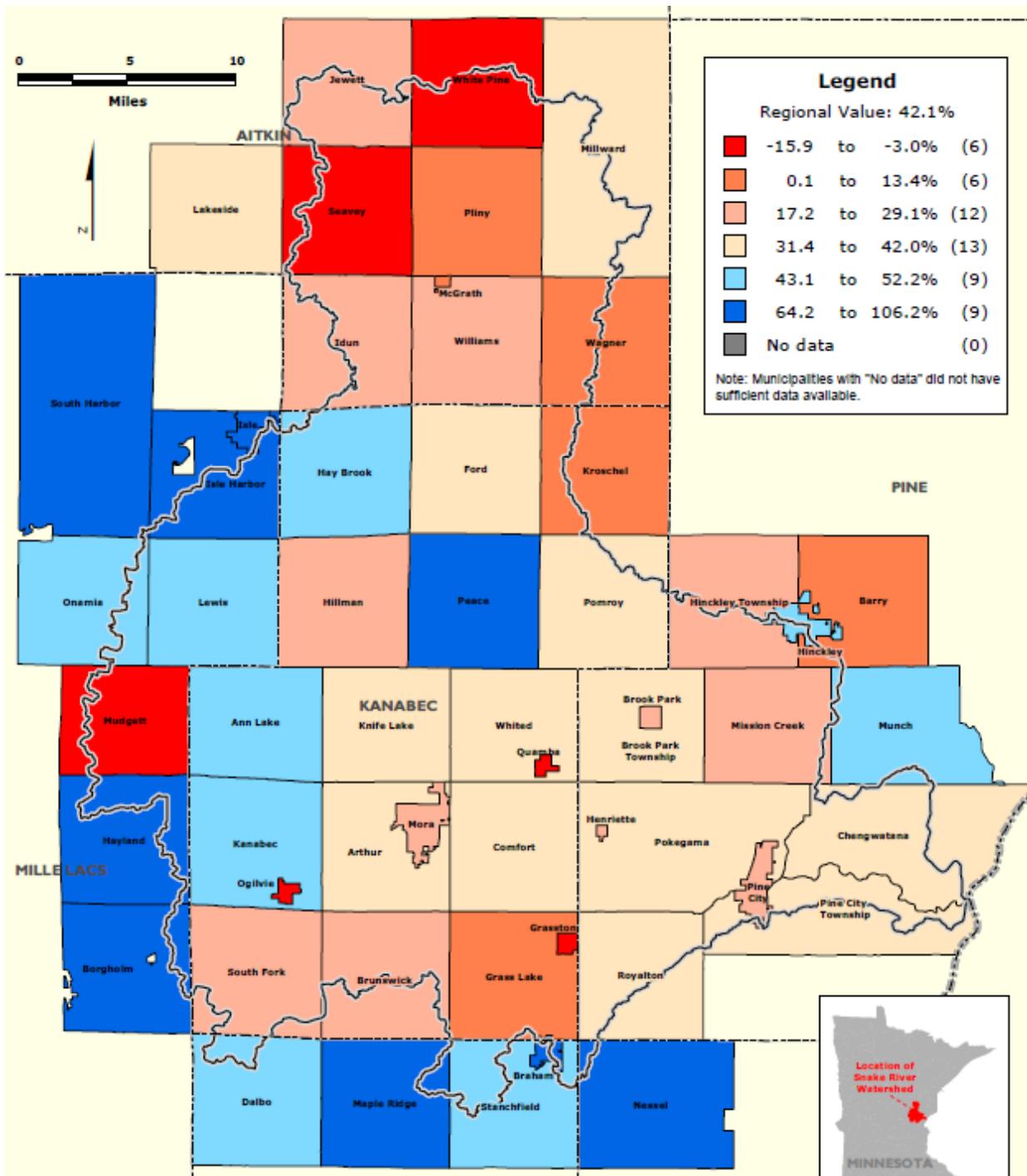


Figure 2. Projected population growth rates by municipality (2006-2035) in the Snake River Watershed. Source: Luce (2013).

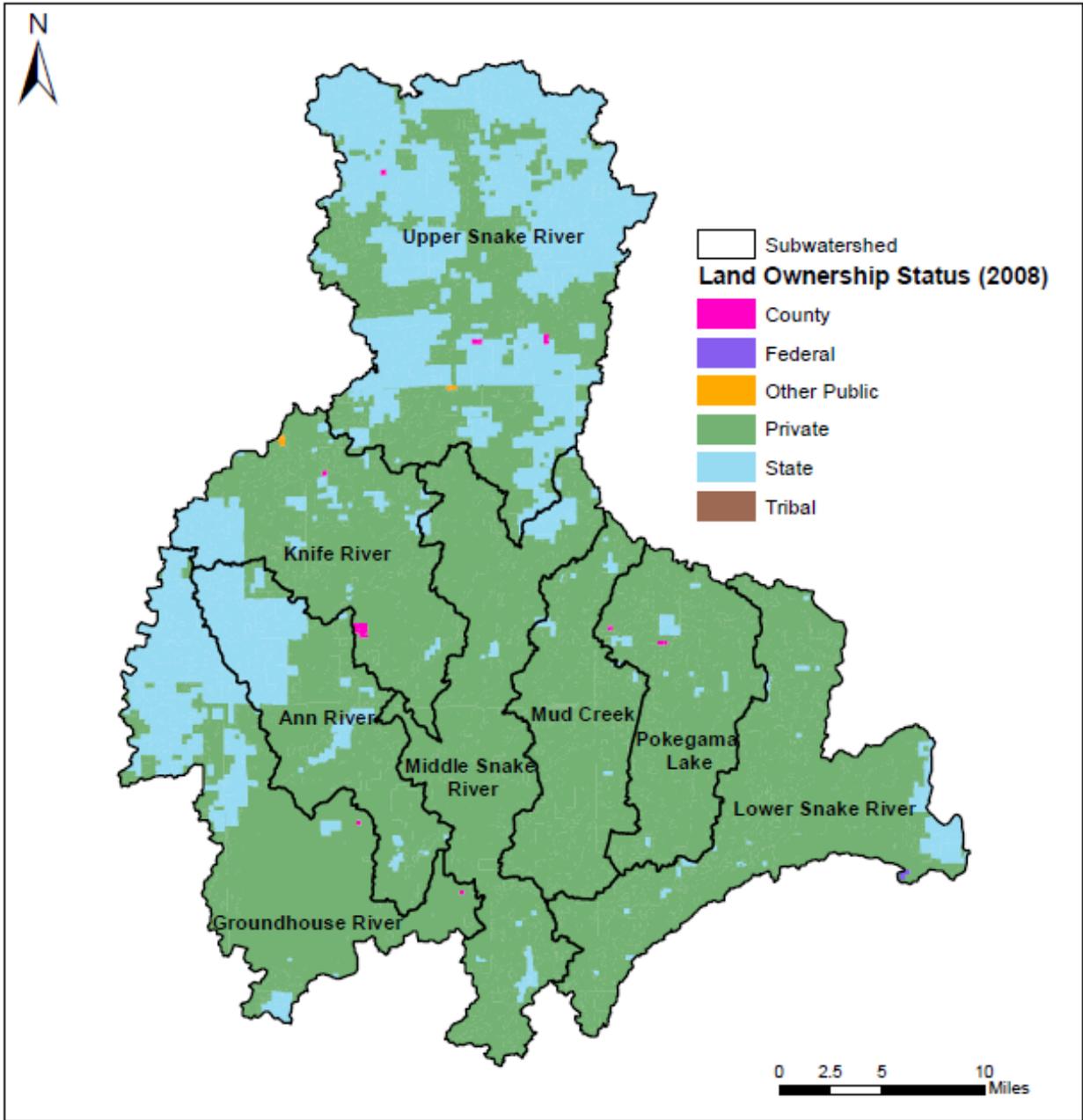


Figure 3. Ownership status of land parcels within the Snake River Watershed. Source: DNR Data Deli (2008).

Table 1. Land ownership in the Snake River Watershed as of 2008. Source: DNR Data Deli (2008).

Land Owner	Acres	% of Watershed
Federal	106	0.02%
State	160,478	25%
Tribal	3	0.00%
County	760	0.12%
Other Public	179	0.03%
Private	482,662	75%
Total	644,188	100%

4 Watershed Protection Efforts

Local and state level efforts to protect natural resources and restore ecological health within the Snake River Watershed are extensive. At the state level, MPCA, DNR, BWSR, and the Legislative-Citizen Commission on Minnesota Resources (LCCMR) provide funding for land protection, have developed tools to assist in identifying priority areas for protection, and have initiated land acquisition programs to protect natural areas. Additionally, the state’s water quality standards and Total Maximum Daily Load (TMDL) programs help to protect and restore water bodies. At the local level, SWCDs, counties, and a number of watershed groups, such as the Friends of the Snake River, the St. Croix Conservation Collaborative, and the St. Croix River Association, lead activities and assessments to promote protection of the watershed and its ecosystem services. In addition, the SRWMB develops and implements watershed protection and maintenance plans, and works to improve wildlife and recreational opportunities within the watershed. The SRWMB is a four county non-regulatory joint powers organization created in response to increasing water quality concerns and recreational and development pressures occurring in the Snake River Watershed.

An inventory of tools, assessments, and resources available to support efforts to protect the Snake River Watershed is provided in Table 2 as well as in the accompanying Microsoft Excel file *SRW_Protection_Inventory.xls*. A brief summary of each of the efforts/tools listed in Table 2 is provided in Appendix B. The following sections highlight just a few of the regulatory tools, funding opportunities, and initiatives that are and can be used to protect and restore ecosystem health within the Snake River Watershed. More detailed information on each program can be obtained from the sources of information cited in the accompanying Excel inventory.

Table 2. Inventory of protection efforts relevant to the Snake River Watershed. A “✓” indicates that the effort addresses one or more of the six Healthy Watersheds Initiative attributes. Further details on each effort are provided in Appendix B.

Program or Document Name	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology
National/Multi- State- Funding Opportunity						
Conservation Reserve Program	✓	✓			✓	
National/Multi-State- Non-Regulatory Efforts						
National Fish Habitat Action Plan		✓				✓
North American Landbird Conservation Plan		✓				✓
North American Landbird Conservation Plan	✓	✓				✓
Projected Climate and Land Use Change Impacts on Aquatic Habitats		✓				✓
Strategic Plan for Fish Habitat Conservation in Midwest Glacial Lakes		✓			✓	✓
National/Multi-State- Technical Resources						
Midwestern Fish Habitat Assessment Models		✓				✓
Watershed Forest Management Information System	✓				✓	
State- Funding Opportunity						
Clean Water, Land and Legacy Amendment	✓	✓	✓	✓	✓	✓
Environment and Natural Resources Trust Fund	✓	✓	✓		✓	✓
Erosion Control and Water Management Program	✓	✓			✓	
MN Prairie Conservation	✓	✓				
State- Regulatory Efforts						
Snake River Watershed Restoration and Protection Strategy					✓	
Public Water Works Permit Program			✓			
MN Floodplain Management Act	✓	✓			✓	
MN Shoreland Management Act	✓	✓			✓	
MN Wetland Conservation Act		✓				
Source Water Protection					✓	
Water Quality Standards and TMDL Program	✓	✓			✓	✓
State- Non-Regulatory Efforts						
DNR Strategic Conservation Agenda	✓	✓	✓	✓	✓	✓
Livestock Environmental Quality Assurance Program					✓	
Managing MN's Shallow Lakes for Waterfowl and Wildlife	✓	✓			✓	
MN Conservation Apprenticeship Academy	✓	✓	✓	✓	✓	✓
MN Forests for the Future Program	✓	✓				
MN Water Availability Report			✓			

Program or Document Name	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology
MN Wildlife Action Plan	✓	✓				✓
Northeast MN Wetland Mitigation Inventory and Assessment		✓				
Scientific and Natural Areas Program	✓	✓				✓
Aquatic and Wildlife Management Areas	✓	✓				
MN Statewide Mussel Survey		✓				✓
Statewide Conservation and Preservation Plan	✓	✓	✓		✓	✓
Water Sustainability Framework	✓	✓	✓	✓	✓	✓
Woodland Stewardship Plan	✓	✓				
Clean Water Partnership and Section 319 Program	✓	✓	✓	✓	✓	✓
State- Technical Resources						
Ecological Ranking Tool	✓	✓			✓	
Forests, Water and People Analysis	✓	✓			✓	✓
MN Biological Survey		✓				✓
National Land Transformation Model	✓					
Precision Conservation Initiative	✓	✓	✓	✓	✓	
Upper Mississippi River Forest Partnership	✓	✓	✓		✓	
Watershed Health Assessment Framework	✓	✓	✓	✓	✓	✓
Watershed- Regulatory Effort						
County Shoreland Management Ordinance	✓	✓				
County Subdivision Ordinance	✓	✓			✓	
Watershed- Non-Regulatory Efforts						
County Water Management Plan	✓	✓	✓		✓	✓
Isanti County Parks Plan	✓	✓				
Snake River Riparian Corridor Protection Project	✓	✓				
Snake River Watershed Enhancement Project	✓				✓	
St. Croix Watershed Protection Project	✓	✓				
Snake River Watershed Conservation Action Plan	✓	✓			✓	✓
St. Croix River Watershed Conservation Priorities Report		✓				
St. Croix Shoreland Vegetation Restoration Project	✓	✓				
Watershed- Technical Resources						
Systematic Conservation Planning Using Zonation	✓	✓	✓	✓		✓
County Geologic Atlas Program					✓	
Grassland Bird Conservation Area	✓	✓				
Public Water Supply Map					✓	
Small Wetlands Acquisition Program		✓				

4.1 State Level Activities

This section highlights key funding opportunities and watershed protection tools and assessments that are available for the State of Minnesota (refer to Appendix B for a more detailed inventory). These resources are helpful for gaining an understanding of trends in overall ecosystem health and in identifying general areas in need of protection.

4.1.1 State: Funding Opportunities

Provided below is a summary of key sources of funding that have been used to support some of the larger protection activities within the Snake River Watershed. Additional funding opportunities (e.g., the Outdoor Heritage Fund, Conservation Partners Legacy Grants, Reinvest in Minnesota, the Conservation Reserve Program, etc.) are also available; these additional sources are of funding documented in Table 2 and Appendix B. Numerous federal programs also offer funding support through grants (e.g., the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service's Environmental Quality Incentive Program (EQIP)). This report does not include a summary of federal grant programs; however, these federal sources of funding may be available to support protection and restoration activities in the watershed.

Clean Water Partnership Program

Administered by MPCA, the Clean Water Partnership (CWP) Program provides funding to projects aimed at controlling nonpoint source pollution, thereby improving surface water and ground water quality. Funding is provided through loans, matching grants, and technical assistance to local governments. In Fiscal Year 2012, The CWP Program provided a \$201,892 grant award to the Kanabec Soil and Water Conservation District for a water resources protection project within the St. Croix, as well as a \$400,000 low-interest loan to SRWMB for a Snake River Watershed restoration protection project (MPCA 2012a). More information on the CWP Program, including how to apply for grants is available on MPCA's website.²

Clean Water Fund

The Clean Water Fund, which is part of the Clean Water, Land, and Legacy Amendment, was established in 2008. Under this Amendment, state sales tax was increased by three-eighths of one percent, and 33% of the tax (approximately \$85 million annually through 2034) is distributed to the Clean Water Fund. The remaining portions of the tax funds are distributed to the Outdoor Heritage Fund, the Arts and Cultural Heritage Fund, and the Parks and Trails Fund (see Appendix B). Financial assistance provided through the Clean Water Fund is dedicated to projects designed to protect and restore surface water and drinking water resources, conduct monitoring and assessments, and restore watershed health (The Minnesota State Legislature 2013). Information on how to apply for funding under the Clean Water Fund

²<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/water-nonpoint-source-issues/clean-water-partnership/more-about-the-clean-water-partnership-program.html>

is available on the Minnesota State Legislature’s website.³ The Clean Water Fund has been used to support such efforts as the Minnesota Water Sustainability Framework (see section 1.1.1), and is currently being used to help fund the Ann River Watershed TMDL for biota and bacteria, as well as the Snake River WRAPS (see section 4.2.1) (MPCA 2011).

Environment and Natural Resources Trust Fund

The Environment and Natural Resources Trust Fund (ENRTF) was established in 1988 and dedicates funding from the state’s lottery and investment income to natural resource protection projects. An estimated \$38.2 million will be dedicated to protection projects in 2013 (LCCMR 2013). ENRTF supported the development of the Minnesota Ecological Ranking Tool (section 1.1.1) and is currently supporting the St. Croix Watershed Protection Project (see section 4.2.2), which includes the Snake River Watershed. Information on how to apply for funding under ENRTF is available on LCCMR’s website.⁴

4.1.2 State: Regulatory Tools

Water Quality Standards and TMDL Program

Water quality standards define the goals for a waterbody by designating its uses; setting criteria to protect those uses and determine if they are being attained; and establishing provisions such as antidegradation (referred to as “nondegradation” in Minnesota) policies to protect high quality waterbodies. In Minnesota, MPCA derives and adopts water quality standards to protect the 13.1 million acres of lakes, rivers, and wetlands in the state from pollutants that degrade aquatic ecosystems (MPCA 2012b). MPCA also administers the state’s nondegradation program. MPCA is currently in the process of adopting changes to the nondegradation requirements of the state’s water quality standards to more effectively protect water quality through the application of the nondegradation rules. In addition, the state is working to incorporate a tiered aquatic life use (TALU) framework for rivers and streams into its water quality standards. Rather than implementing a “one-size-fits-all” approach to protecting aquatic life, a TALU framework protects each type of classified waterbody based on its biological potential. For example, additional levels of protection are afforded to waters designated as Class 2: Exceptional Use, which provides better protection to healthier waterbodies. Incorporating a TALU framework also enhances the state’s ability to identify stressors and develop and implement effective strategies to maintain or improve water quality. The state anticipates implementing the TALU-based assessments beginning in 2015. More information on Minnesota’s TALU framework can be found on MPCA’s website.⁵

Under the requirements of the Clean Water Act (CWA) the State of Minnesota assesses the health and condition of its waterbodies. If a waterbody is considered impaired, Section 303(d) of the CWA requires the development a TMDL that sets pollutant load reduction goals necessary to return the impaired

³<http://www.legacy.leg.mn/opportunities-funding>

⁴http://www.lccmr.leg.mn/funding_process/process_2012-2013.html

⁵<http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/tiered-aquatic-life-use-talu-framework.html>

waterbody to compliance with the applicable water quality standards. Water quality degradation in the Snake River Watershed is a top concern, as the state's 2010 impaired waters list included 264 miles of impaired streams within the Snake River Watershed (Figure 4) (MPCA 2010b). Two TMDLs have been completed within the Snake River Watershed: the final Groundhouse River subwatershed TMDL for biota (sediments) and bacteria (Tetra Tech 2009); and the draft final Ann River subwatershed TMDL for bacteria, nutrients, and biota (Wenck Associates, Inc. 2013).

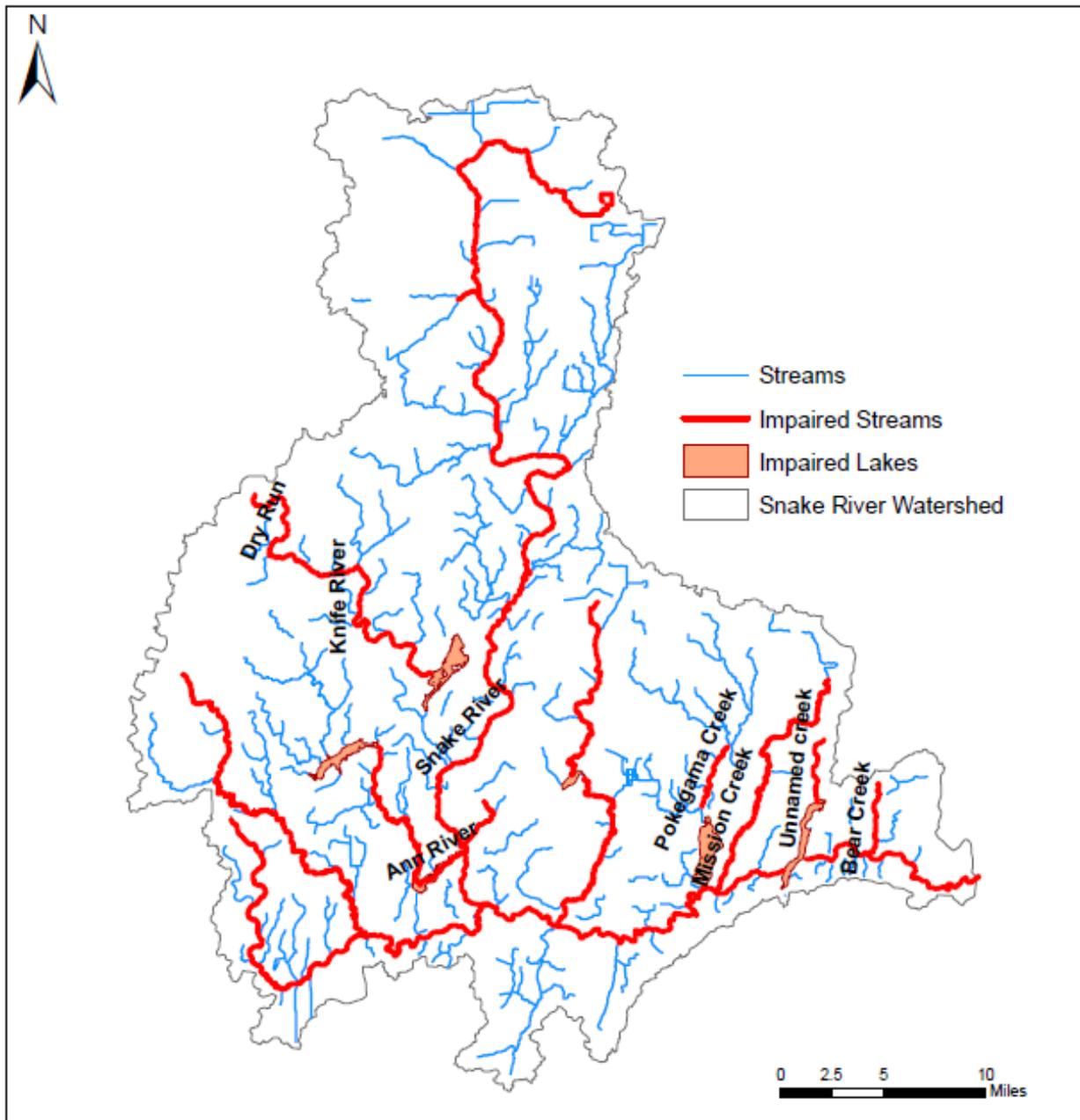


Figure 4. Streams and lakes listed as impaired under the state's 2010 impaired waterbodies list. Source: MPCA (2010b).

4.1.3 State: Non-Regulatory Protection Efforts and Resources

Minnesota Wildlife Action Plan

The DNR published the state's Wildlife Action Plan (WAP), *Tomorrow's Habitat for the Wild and Rare*, which evaluates state wildlife protection needs, with a focus on Species in Greatest Conservation Need (SGCN). SGCN are native animals whose populations are declining, rare, or vulnerable, and are below levels that ensure long-term stability and survival. General goals of the WAP are to protect SGCN populations within the state and expand public education and awareness of SGCN (DNR 2006). The WAP provides guidance for areas where funds and protection efforts should be targeted to have the greatest impact on SGCN and their habitats. The WAP also emphasized the importance of accelerating completion of Minnesota's Biological Survey under the State Wildlife Grants Program. Since 1987, the state has been conducting a systematic survey of rare plants and animals, and native plant communities in each county. At the time this document was developed, 81 of Minnesota's 87 counties, including most counties within the Snake River Watershed (with the exception of Pine and Aitkin), had been surveyed. Surveys are underway in the remaining six counties. Survey results can be viewed as Geographic Information System (GIS) shapefiles or PDFs to allow for targeting of resources to protect these communities.⁶

The Snake River Watershed is located largely in the Mille Lacs Uplands subsection of the Laurentian Mixed Forest Province (DNR 2006). The subsection is the most biodiverse area within the Province, supporting 128 SGCN, six of which are unique to the area (DNR 2006) (Figure 5). The WAP identifies nine distinct habitats within Mille Lacs, including: Forest-upland deciduous (hardwood), Forest-upland coniferous, shrub/woodland-upland, forest-lowland coniferous, wetland-nonforest, shoreline-dunes-cliff/talus, lake-deep, river- headwater to large, and river- very large. Because of the species diversity and prevalence of SGCN within the Mille Lacs, the WAP generally recommends targeting protection efforts in the Laurentian Mixed Forest Province and in the Mille Lacs Uplands subsection (see Figure 5) (DNR 2006). Examples of aquatic SGCN in Mille Lacs include southern brook lamprey, spotted salamander, mucket mussel, and the gilt darter. The gilt darter is endemic to the St. Croix River and its tributaries, including the Snake River (DNR 2006). Priority protection goals of the WAP for the Mille Lacs region include maintaining water quality, geomorphology, aquatic connectivity, and hydrology; protecting riparian corridors; and improving riparian terrestrial and aquatic habitats (DNR 2006).

⁶<http://www.dnr.state.mn.us/eco/mcbs/maps.html>

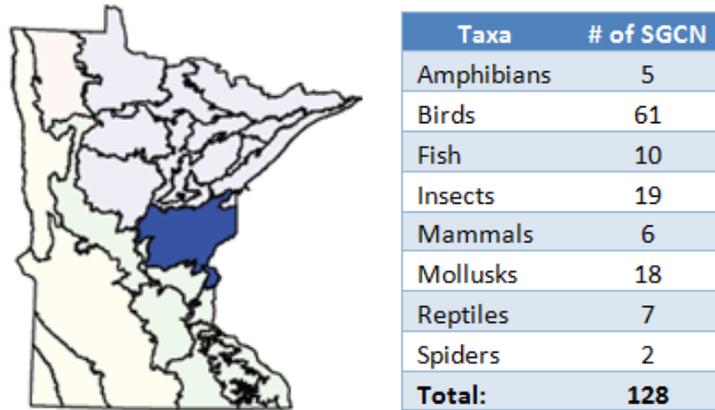


Figure 5. Location of the Mille Lacs subsection in Minnesota (dark blue), and the Species in Greatest Conservation Need (SGCN) organized by Taxa within Mille Lacs. Source: DNR (2006).

Minnesota Water Sustainability Framework

The Water Sustainability Framework was developed in 2011 by the University of Minnesota’s Water Resources Center and funded through Minnesota’s Clean Water Fund. The Framework provides a 25-year plan for restoring and maintaining sustainable water use in the state. Sustainable water use is defined as that which “does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs” (University of Minnesota 2011). The Framework details how sustainable water use may be achieved and provides recommendations for meeting key challenges.

Recognizing that ecosystem health is partly controlled by water flow through the landscape, a principal focus of the Framework is on maintaining ecological and hydrologic integrity. Threats to hydrologic integrity within Minnesota include dams, development along riparian habitats and shorelands, invasive species, and climate change. The Framework recommends the following actions to help restore and maintain ecosystem integrity:

1. Protect ecosystem benefits and services by enacting an Ecosystem Integrity Act. The Act should provide ecosystem protection, enforce penalties for invasive species introduction, and require that ecosystem economic value be considered during all policy and regulatory deliberations.
2. Minimize impacts from invasive species by developing statewide policies, targeting funding, and coordinating with surrounding states to prevent the introduction of, and manage existing, invasive species.
3. Develop an understanding of the effects of hydrologic alterations by applying a gridded surface/ subsurface hydrologic assessment model to assess watershed hydrologic characteristics and processes.

4. Maximize protection of marginal lands by using resources to keep existing lands in reserve and accelerating land easements throughout the state, and re-enrolling lands in conservation programs as their terms expire.

These recommendations may need to be carried out at the state policy level; however, a more detailed review of town and county policies and ordinances in the Snake River Watershed is needed to ensure sustainable water use within the watershed. In addition, an assessment of the presence and prevalence of invasive species within the Snake River Watershed may be advisable. Refer to section 6 for specific recommendations for the Snake River Watershed.

Aquatic and Wildlife Management Areas

The DNR's Aquatic Management Areas (AMA) program developed as part of the Outdoor Recreation Act in 1992, allows for the acquisition of critical aquatic habitat and stream access areas for protection. In addition to protecting high quality habitats, AMAs provide areas for education and research, and fishing opportunities, which account for a significant source of revenue for the state (DNR 2013a). There are six AMAs within the Snake River Watershed, three of which are in the Knife River subwatershed (Figure 6).

Similarly to AMAs, terrestrial habitat areas can be preserved through the Wildlife Management Areas (WMA) program. Protecting these areas provides wildlife habitat and opportunities for hunting, fishing, trapping, and other recreational uses. The WMA system was initiated under the state's "Save the Wetlands" program in 1951 (DNR 2013b). There are 21 WMAs in the Snake River Watershed, the largest of which is the Mille Lacs WMA in the Ann River, Knife River, and Groundhouse River subwatersheds (Figure 7).

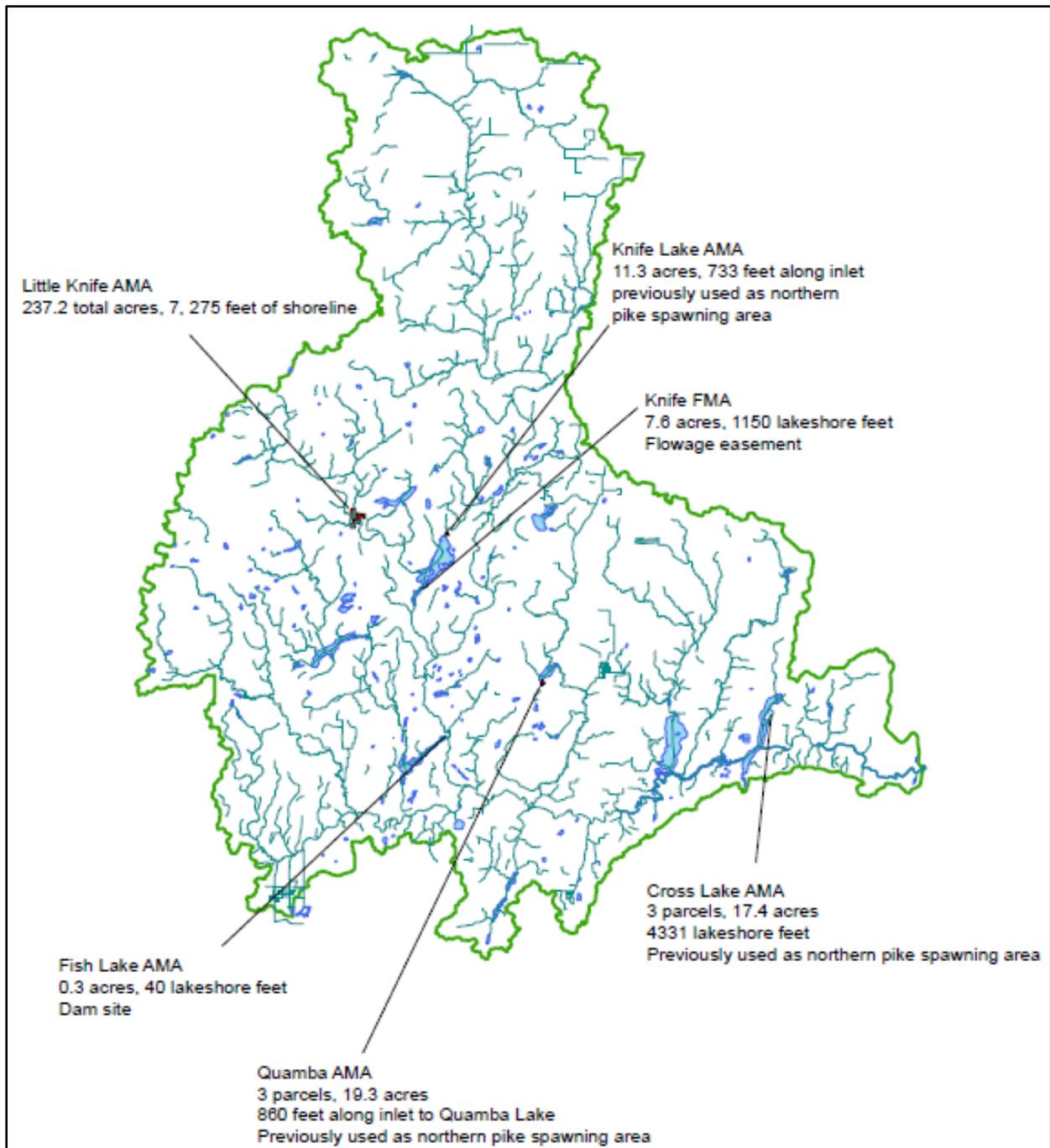


Figure 6. Aquatic Management Areas (AMA) within the Snake River Watershed. Source: DNR Data Deli (2004).

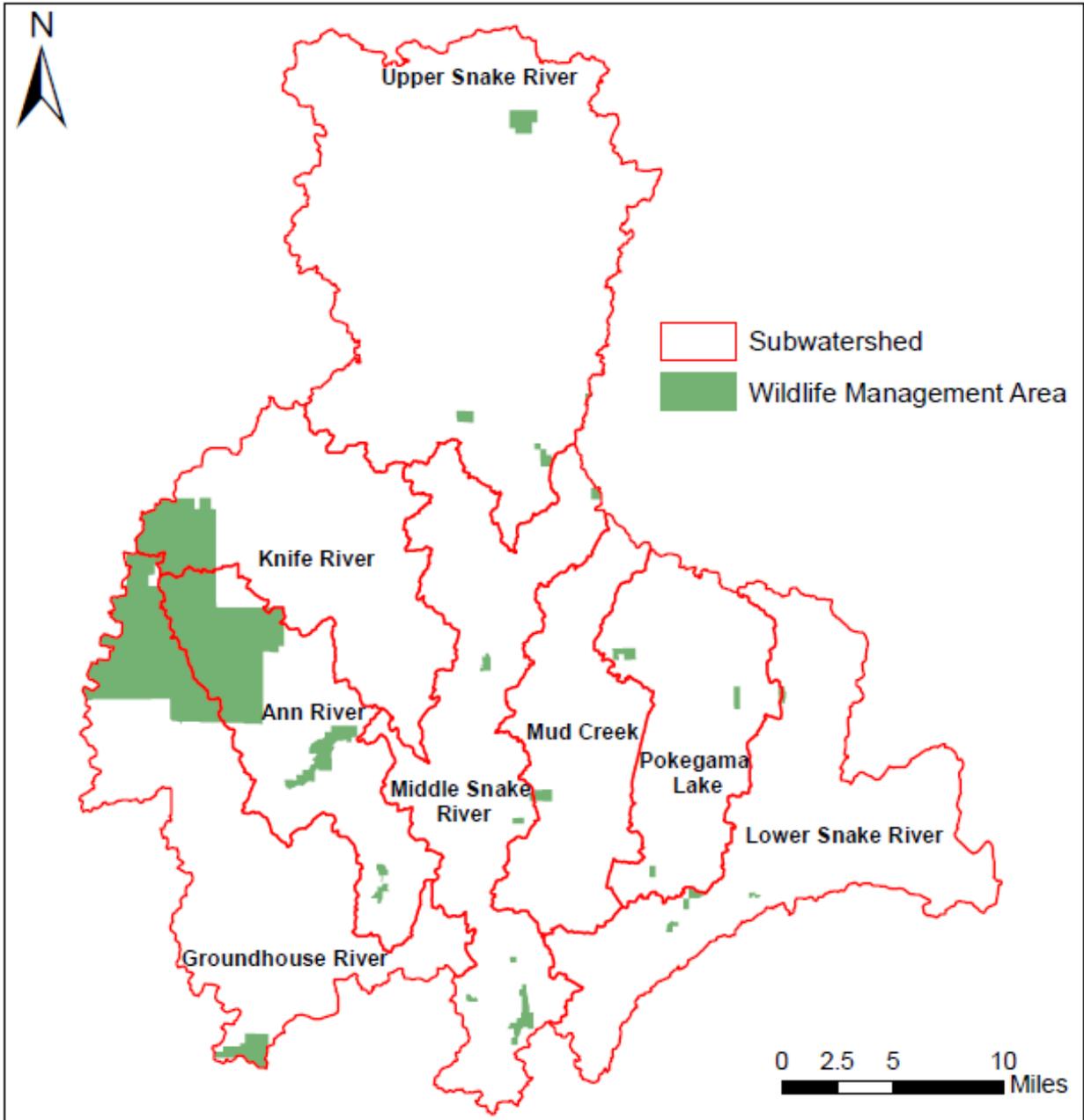


Figure 7. Wildlife Management Areas (WMA) within the Snake River Watershed. Source: DNR Data Deli (2006).

4.1.4 State: Technical Resources

Watershed Health Assessment Framework

The condition and health of Minnesota's watersheds were assessed by DNR using the Watershed Health Assessment Framework (WHAF). The WHAF utilizes an integrated approach to assessing watershed health. The WHAF uses a five-component framework for assessing hydrology, geomorphology, connectivity, biology, and water quality, and was used to produce 18 health index scores for each watershed in Minnesota (Figure 8). The 18 health indices used in the WHAF were selected based on discussions with subject matter experts and extensive literature reviews to understand ecological relationships and spatial data availability. Many of the 18 index values were compiled from underlying metrics that provide additional detail. An online map allows users to view the health scores for the five components and various individual indices. Each of the components and their ecosystem connections, as well as the methods used to calculate health indices are explained in detail on DNR's website.⁷

This generation of statewide scores allows for a comparison of watershed health across the state and at other spatial scales. Results from the health assessments were synthesized to provide an overall assessment of watershed health for each of Minnesota's major watersheds, including the Snake River Watershed. Results from the WHAF indicate that the Snake River Watershed is in good ecological health compared to other watersheds within the state (see Figure 9). The average health score among the indicators for the Snake River Watershed is 62 out of 100, with '0' being the highest risk and '100' being the most desirable condition (DNR 2011). For comparison, the highest mean health score within the state was 84 out of 100. For the Snake River Watershed, the hydrology component received the highest score, related partly to the relatively low impervious cover within the watershed, as well as the lower water withdrawal rates. However, it is noted that these are 8-digit Hydrologic Unit Code (HUC) watershed level values based on a comparative statewide scale. Reviewing subwatershed (catchment) level values will reveal local areas of concern that should be investigated. Connectivity received the lowest score, related to lower aquatic connectivity (e.g., high prevalence of physical structures, such as dams, within streams) and terrestrial connectivity. Poor terrestrial habitat quality is also noted as an area of concern for the watershed.

⁷http://www.dnr.state.mn.us/watershed_tool

HEALTH INDEX BY COMPONENT

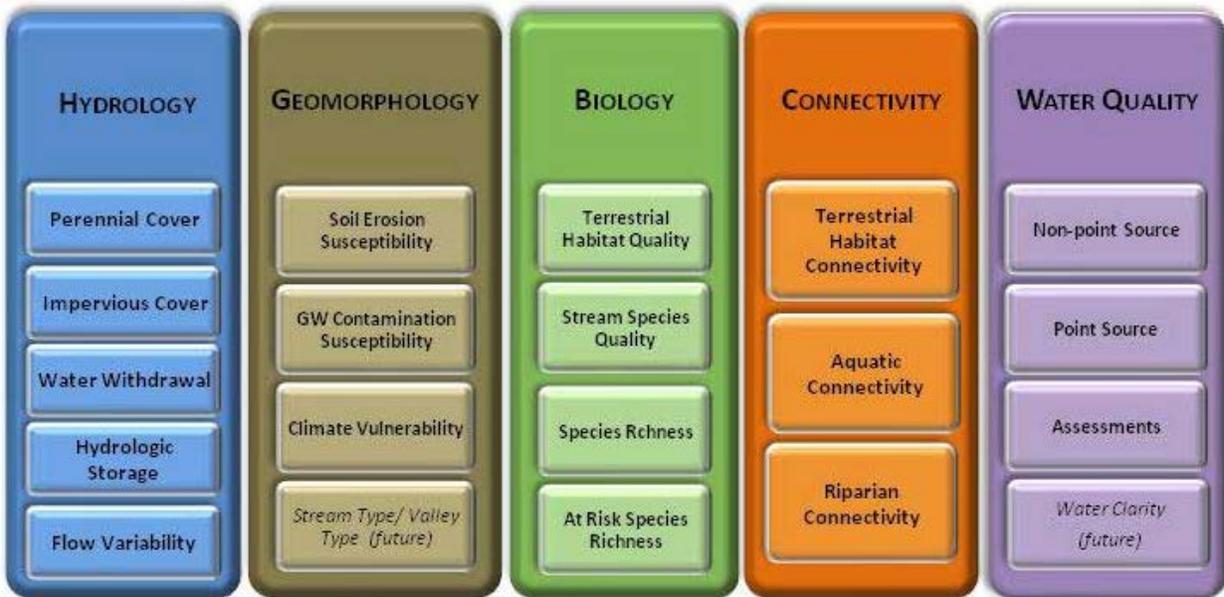


Figure 8. Watershed health indicators used by the Watershed Health Assessment Framework, for calculating watershed health scores. Source: DNR (2013c).

COMPONENT SCORES

 HYDROLOGY	 GEOMORPHOLOGY	 BIOLOGY	 CONNECTIVITY	 WATER QUALITY
Mean (Ave.) 83 Minimum Index 66	Mean (Ave.) 60 Minimum Index 48	Mean (Ave.) 59 Minimum Index 18	Mean (Ave.) 41 Minimum Index 10	Mean (Ave.) 69 Minimum Index 39
INDEX SCORES	INDEX SCORES	INDEX SCORES	INDEX SCORES	INDEX SCORES
Perennial Cover 87 Impervious Cover 91* Withdrawal 100* Storage 74 Flow Variability 66	Soil Erosion Susceptibility 79 Groundwater Susceptibility 53 Climate Vulnerability 48	Terrestrial Habitat Quality 18 Stream Species 76 Species Richness 78 At-Risk Species Richness 64	Terrestrial Habitat Connectivity 23 Aquatic Connectivity 10 Riparian Connectivity 91	Non-Point Source 72 Point Source 96* Assessments 39
Metric Sub-Scores Storage: Stream/Ditch Ratio 54 Surface storage 93			Metric Sub-Scores Aquatic Connectivity: Bridges/Culverts 14 Dams 5	Metric Sub-Scores Non-Point Source: Nutrient Application 94 Riparian Impervious 50

Figure 9. Watershed Health Assessment Framework scores for the Snake River Watershed. Source: DNR (2011).

Minnesota Ecological Ranking Tool

With funding provided through ENRTF, BWSR and the University of Minnesota worked collaboratively to develop the Ecological Ranking Tool. The Tool integrates spatial data for several ecosystem characteristics including aquatic and terrestrial habitat (e.g., SGCN habitat), surface water quality, erosion potential, and runoff potential to develop an Environmental Benefits Index (EBI). The EBI may be used to locate land parcels of high conservation value and may also be used in combination with an economic analysis for Conservation Reserve Program land parcels that are set to expire. Within the Snake River Watershed, the Tool has been used to identify and prioritize the top 10% of lands that impact water quality, have a high potential for erosion, and also provide high quality habitat. For each county (except Pine), the Tool was used to identify areas of cultivated land with high EBI scores. Users can view EBI scores, soil erosion risk, habitat quality, and water quality risk on an online map viewer on the University of Minnesota Duluth's website.⁸ Within the Snake River Watershed, the top 10% of EBI scores are located primarily in the upper portion of the watershed in Aitkin County (Figure 10), much of which is already protected under public land ownership (Figure 3).

The Ecological Ranking Tool is an example of a value-based model, which are commonly used for conservation prioritization. Such models can use a compilation of individual criteria (e.g., valuable landscape features, or heterogeneous content) and aggregated criteria (e.g., context and connections) with an objective function to prioritize locations within the landscape/watershed for conservation. Value models can be used in a public participation process, whereby participants can decide on what features are valued and the weights of those valued features. In addition, value models are easy to explain and apply at the local government scale. Value models, however, do not provide guidance on what practices should be implemented.

⁸<http://beaver.nrri.umn.edu/EcolRank/map-tool/>

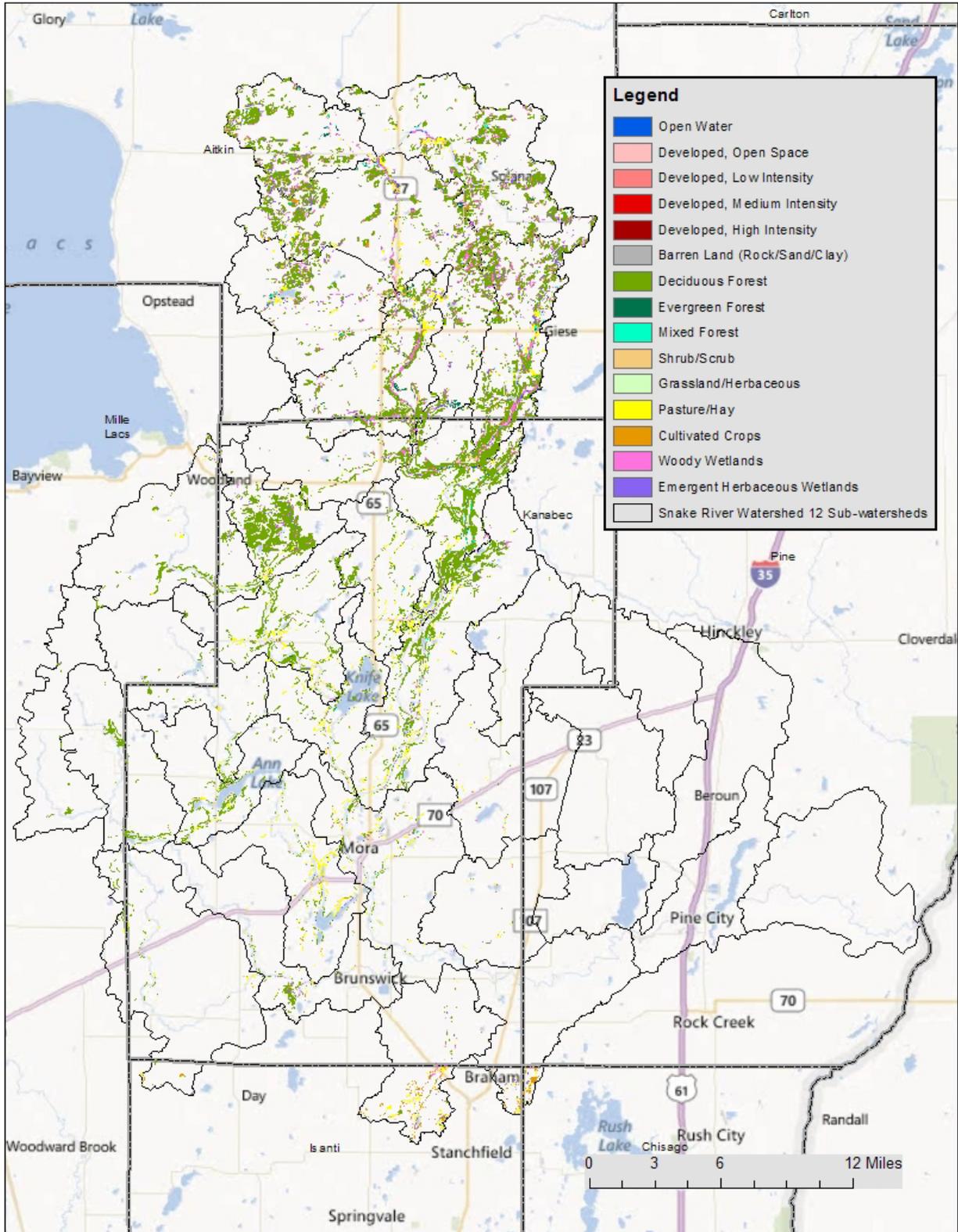


Figure 10. Environmental Benefits Index (EBI) for the Snake River Watershed calculated with the Ecological Ranking Tool. Figure displays the top 10% of EBI areas within the watershed using 2006 land cover data. Source: BWSR 2013a.

Systematic Conservation Planning Using Zonation

Zonation is a software framework for large-scale spatial conservation prioritization as well as a decision support tool for conservation planning. Zonation produces a hierarchical prioritization of the landscape based on the occurrence levels of features in sites (grid cells). It iteratively removes the least valuable remaining site, accounting for connectivity in the process. The output of Zonation can be imported into a GIS for further analysis. Zonation can be run on very large data sets (with up to ~50 million grid cells). The software allows balancing of alternative land uses, landscape condition and retention, and feature-specific connectivity responses. The software is freely available through Conservation Biology Informatics Group's website.⁹

A zonation analysis was performed for the Snake River Watershed by the DNR as part of the St. Croix Watershed Protection Project (see section 4.2.2). The goal of the analysis was to optimize environmental benefits while minimizing protection work in those areas that were not likely to cause surface water quality problems (i.e., non-contributing basins). Biology, hydrology, water quality, geomorphology, and connectivity data were incorporated into the model. Weights were used within the model to identify each datasets value. The weights were based on local values obtained through a questionnaire administered to a group of individuals organized by the St. Croix River Association (SCRA) and Washington Conservation District.

The initial draft results from the zonation analysis for the Snake River Watershed revealed two key areas for protection (Figure 11): 1) The riparian areas of the Snake River main stem, particularly the broad middle reaches between the cities of Grasston and Mora; and 2) the stream riparian areas south and west of the Bean Dam Wildlife Management Area. Riparian corridors of continuous, generally intact, natural or "semi-natural" terrestrial and aquatic habitat are known to improve water quality, provide wildlife habitat, and enhance recreational value. The South Fork of the Groundhouse River catchment was also ranked as high priority areas. Despite fairly low soil erosion risk, this subwatershed was identified as a contributor to Snake River sediment and phosphorus loads.

⁹<http://cbig.it.helsinki.fi/software/zonation/>

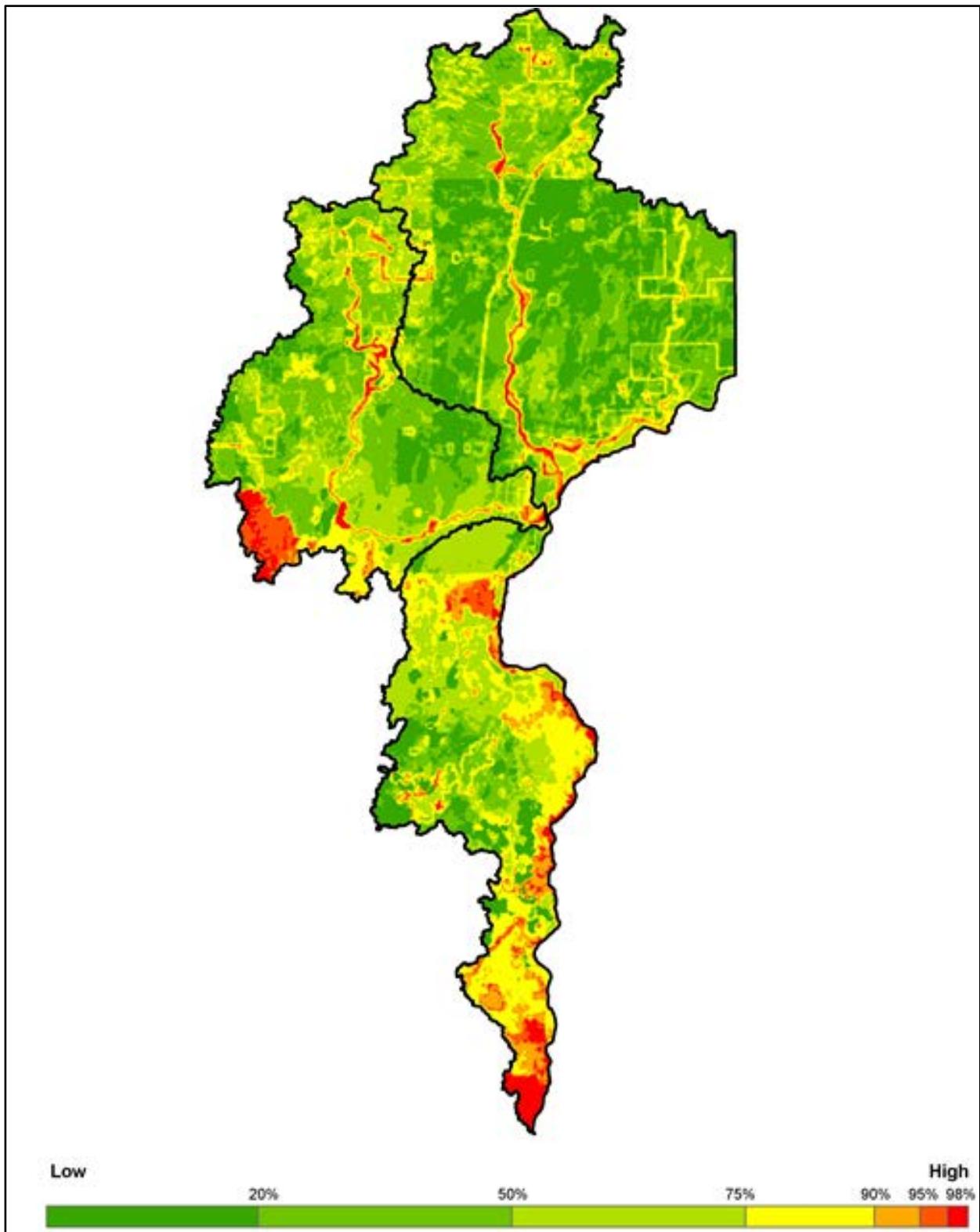


Figure 11. Draft priority protection areas within the St. Croix Watershed and the Snake River Watershed as identified through the zonation process. Red areas indicate higher priority areas for protection. Source: Paul Radomski, DNR, personal communication, 04/25/2013.

4.2 Watershed Level Activities

A variety of watershed-level tools and assessments are available to help guide protection efforts within the Snake River Watershed. Most of the efforts are focused on restoring water quality within the watershed, though more recent efforts from the SCRA are aimed at prioritizing areas for protection. Town and county ordinances are often an effective tool for protecting natural resources. While this project did not involve a detailed review of ordinances, a few key ordinances are included in the accompanying Excel inventory and described below.

4.2.1 Watershed: Regulatory Tools

Snake River Watershed Restoration and Protection Strategy

The state of Minnesota has adopted a “watershed approach” to address the state’s 81 HUC8 watersheds (Figure 12). The 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 water quality standards are listed as impaired, TMDL studies are performed, and a WRAPS report is developed. The watershed approach facilitates a more cost-effective and comprehensive characterization of multiple waterbodies 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. A WRAPS report summarizes past assessment and diagnostic work and outlines ways to prioritize actions and strategies for continued implementation. MPCA is currently collaborating with the DNR, BWSR, and SRWMB to develop a Snake River WRAPS report addressing biota, bacteria and phosphorus stressors. Further details on the watershed approach are provided on MPCA’s website.¹⁰

¹⁰<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/watershed-approach/index.html>



Figure 12. The five-step watershed approach, which includes developing Watershed Restoration and Protection Strategies.

County Level Ordinances

Town and county ordinances can be effective tools for expanding wetland and floodplain protections afforded by state laws, such as Minnesota’s Wetland Conservation Act, Shoreland Management Act, and Floodplain Management Act. In the Snake River Watershed, county wetland ordinances generally encourage avoiding or minimizing impacts to wetlands, but replacing wetland areas is an option and certain activities are exempt from the laws. The four main counties within the Snake River Watershed (Kanabec, Aitkin, Pine, and Mille Lacs) have more than 80% of their pre-settlement wetlands intact and in their natural state (BARR Engineering Company 2009). Figure 13 shows the proportion of land area in wetlands for each of the Snake River Watershed subbasins. The highest proportion of wetlands per subbasin area is near the Snake River headwaters in the Upper Snake River subwatershed.

Several programs, such as BWSR’s Permanent Wetland Preserve (PWP) and Wetland Preservation Areas (WPA) programs can be used to help incentivize wetland preservation. The purpose of the PWP program is to encourage SWCDs to prioritize wetlands for protection if they are: highly susceptible to development and alteration; wetlands with crop or farming history; not currently protected under federal laws; or are adjacent to land parcels that do not pose a significant risk to the wetland. Landowners receive varying rates of payments depending on the wetland type and location. Additional information on the PWP program can be found on BWSR’s website.¹¹

¹¹<http://www.bwsr.state.mn.us/easements/handbook/pwpeligibility.pdf>

Under the state's wetland protection program, landowners may also be incentivized to preserve wetlands on their property if a county chooses to designate wetlands and surrounding uplands as WPAs (BWSR 2013b). Of the four main counties within the Snake River Watershed, Kanabec and Aitkin counties have designated wetlands and surrounding uplands as WPAs (Kanabec County 2007, Aitkin County, no date). In addition, Aitkin County offers a Wetland Value Replacement Fund, which is designated for restoring and/or replacing the lost wetland functions. Funding may be distributed to projects aimed at preserving and restoring wetlands, controlling erosion, or purchasing conservation easements, for example (Aitkin County, no date).

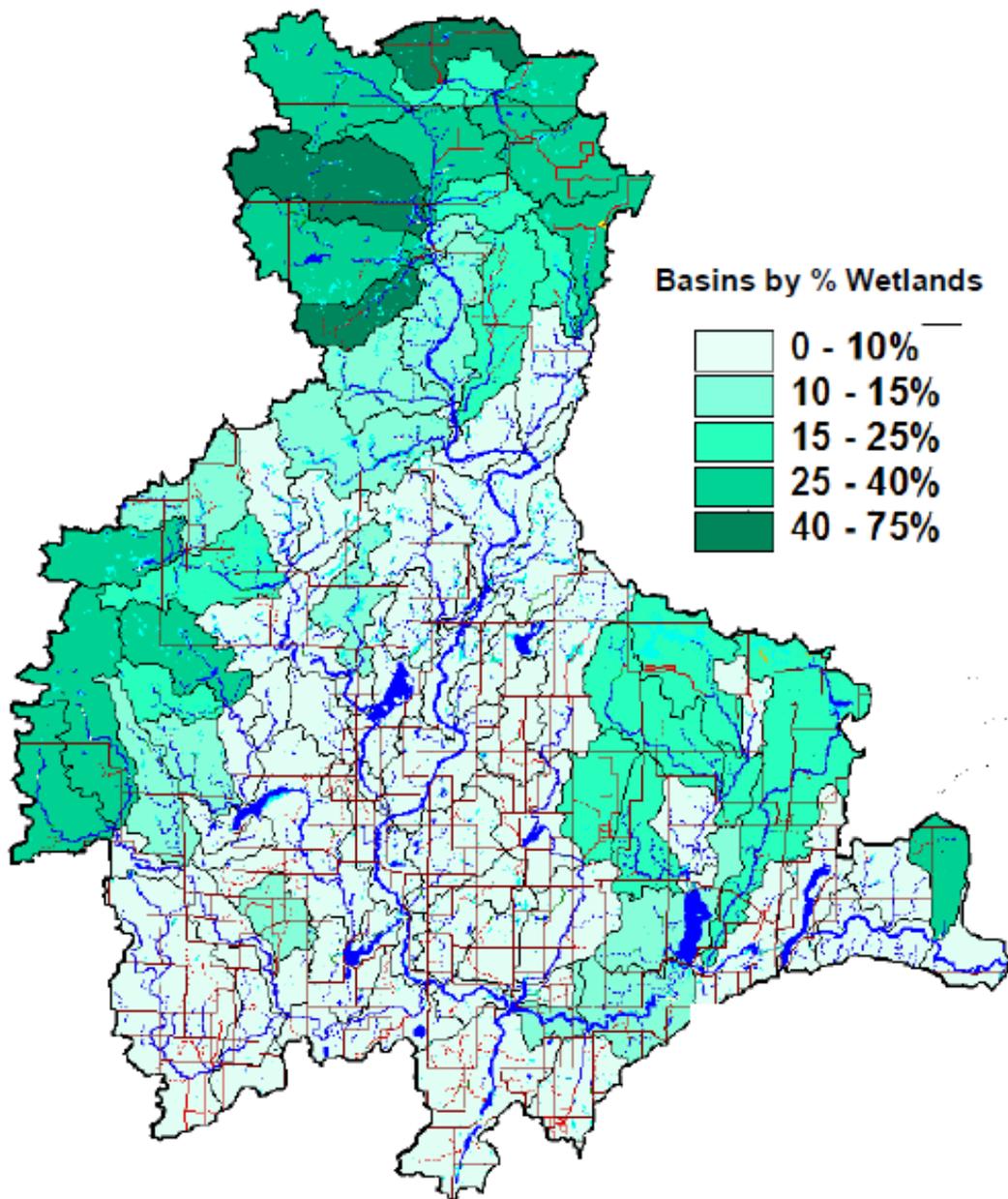


Figure 13. Percentage of minor subbasins in wetlands. Source: TNC 2009.

County Water Management Plans

All six counties within the Snake River Watershed have County Water Plans. These were voluntarily prepared by the county (for Kanabec, Mille Lacs, and Chisago), and by the SWCDs (for Pine, Aitkin, and Isanti counties). The Water Plans identify existing and potential future issues and opportunities for water resource protection, management, and development. Together, the Snake River Watershed WRAPS Strategy and County Water Plans can be used to prioritize areas within the watershed for protection and restoration.

Kanabec County's Water Plan is an example of a plan that involves a multi-pronged approach to protecting water resources within the county, with a particular focus on water quality (see Appendix B for brief summaries of other County Water Plans). During implementation of the previous version of Kanabec's Water Plan (2001-2006), the county conducted water quality monitoring and public education; inspected and repaired septic systems around lakes; provided technical assistance for animal feedlot improvements and manure management plans; and implemented cost sharing programs to control shoreline erosion through the use of natural vegetative buffers. Under the current Water Plan (2007-2016), the county plans to implement up to five feedlot and shoreland restoration projects annually; maintain drainage ditches to minimize excess highway runoff; replace up to 100 non-compliant septic systems; and continue water quality public education. Kanabec's Water Plan specifically identifies the middle and lower Snake River sub-watersheds as an area that should be targeted for BMP implementation related to its high intensity land uses and high quantity of rare and endangered animal and plant species. Importantly, the Kanabec Water Plan recognizes the value of coordinating efforts among all counties within the Snake River Watershed, and recommends that many of the proposed actions be conducted in each county (Kanabec County 2007). Refer to section 6 for recommendations on collaboration and coordination among watershed partners.

4.2.2 Watershed: Non-Regulatory Protection Efforts and Resources

St. Croix Watershed Protection Project

The SCRA and Washington Conservation District received financial assistance through ENRTF to conduct a detailed watershed assessment and prioritize areas for protection within the St. Croix Watershed. The project will involve a detailed review of SWCD comprehensive plans, county Water Plans, the National Park Service and DNR plans, municipal capital improvement plans, and nonprofit priorities. The review will assist in developing priority actions to improve habitat and water quality; expand recreational and tourism opportunities; and enhance local support for watershed protection. The project will also involve developing a prioritization protocol to identify three to seven priority conservation areas within the basin. For each priority area, the SCRA will identify stressors, prioritize areas for restoration, develop a list of protection and restoration strategies, and identify potential funding sources. Finally, subwatershed assessments will be conducted to identify 30 to 50 priority protection or restoration projects, seven of which will be implemented by SCRA in partnership with federal and state agencies, and landowners. The project proposal originally included a detailed analysis of town ordinances to identify areas that could be revised and strengthened to expand protections to surface water and

ground water resources and habitat areas. However, this analysis was removed from the final project plan due to limited funding availability. An in-depth analysis of ordinances would assist in identifying gaps in water resource and terrestrial habitat protections (see section 6).

In support of the St. Croix Watershed Protection Project, TNC conducted analyses to identify areas of high aquatic and terrestrial biodiversity within the Snake River Watershed. Results from the analyses indicate that the main stem of the Snake River and its headwaters provide habitat to a diverse range of aquatic species (Figure 14). Areas of high terrestrial biodiversity are scattered throughout the western and northern portions of the watershed, particularly in the Knife River subwatershed (Figure 15). Through discussions with stakeholders, counties, and state agencies, activities to protect the areas of higher biodiversity may be prioritized.

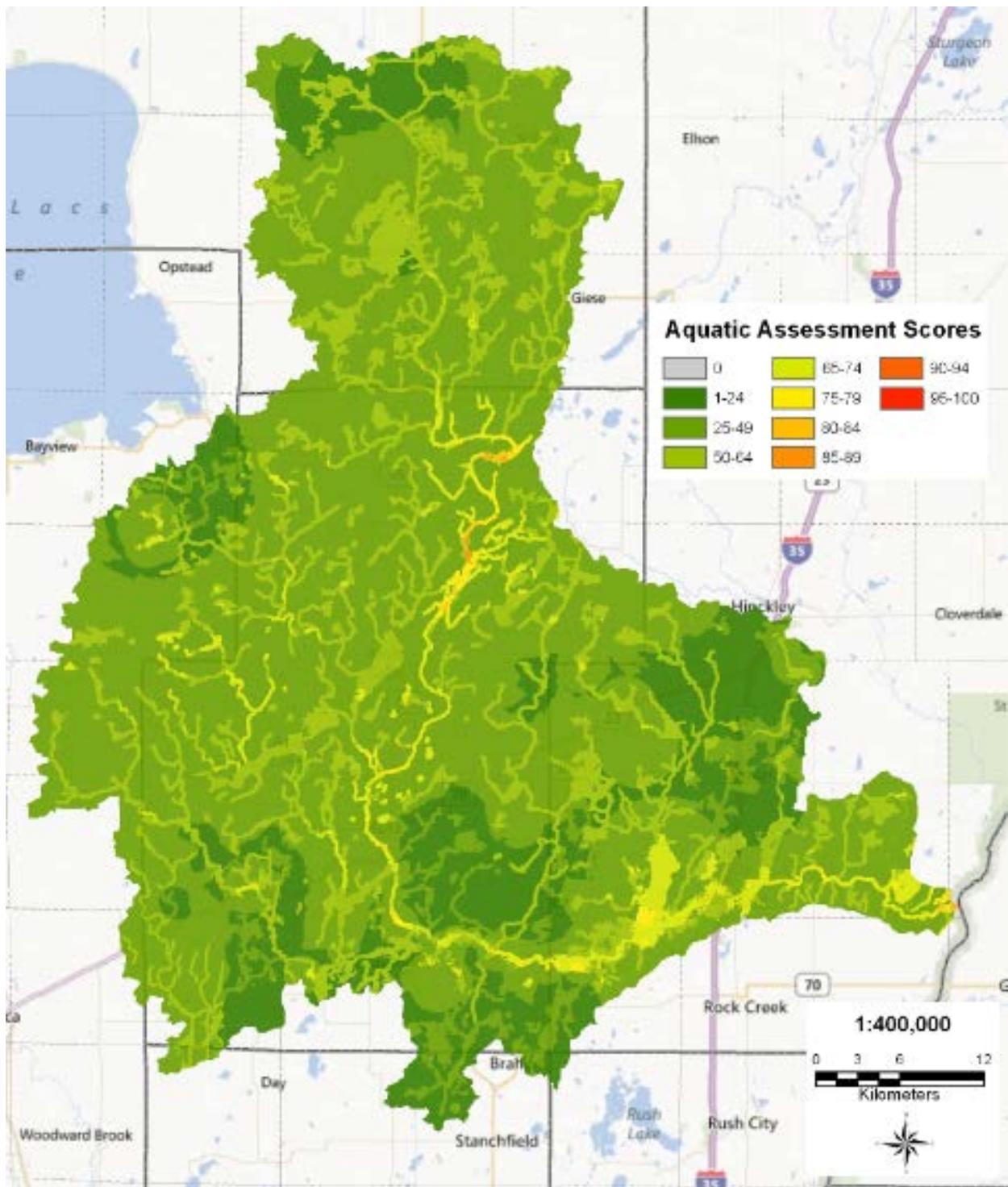


Figure 14. Aquatic biodiversity targets in the Snake River Watershed. Higher scores (red) indicate areas of higher aquatic biodiversity and may be prioritized for protection. Source: Johnson et al. (2013a).

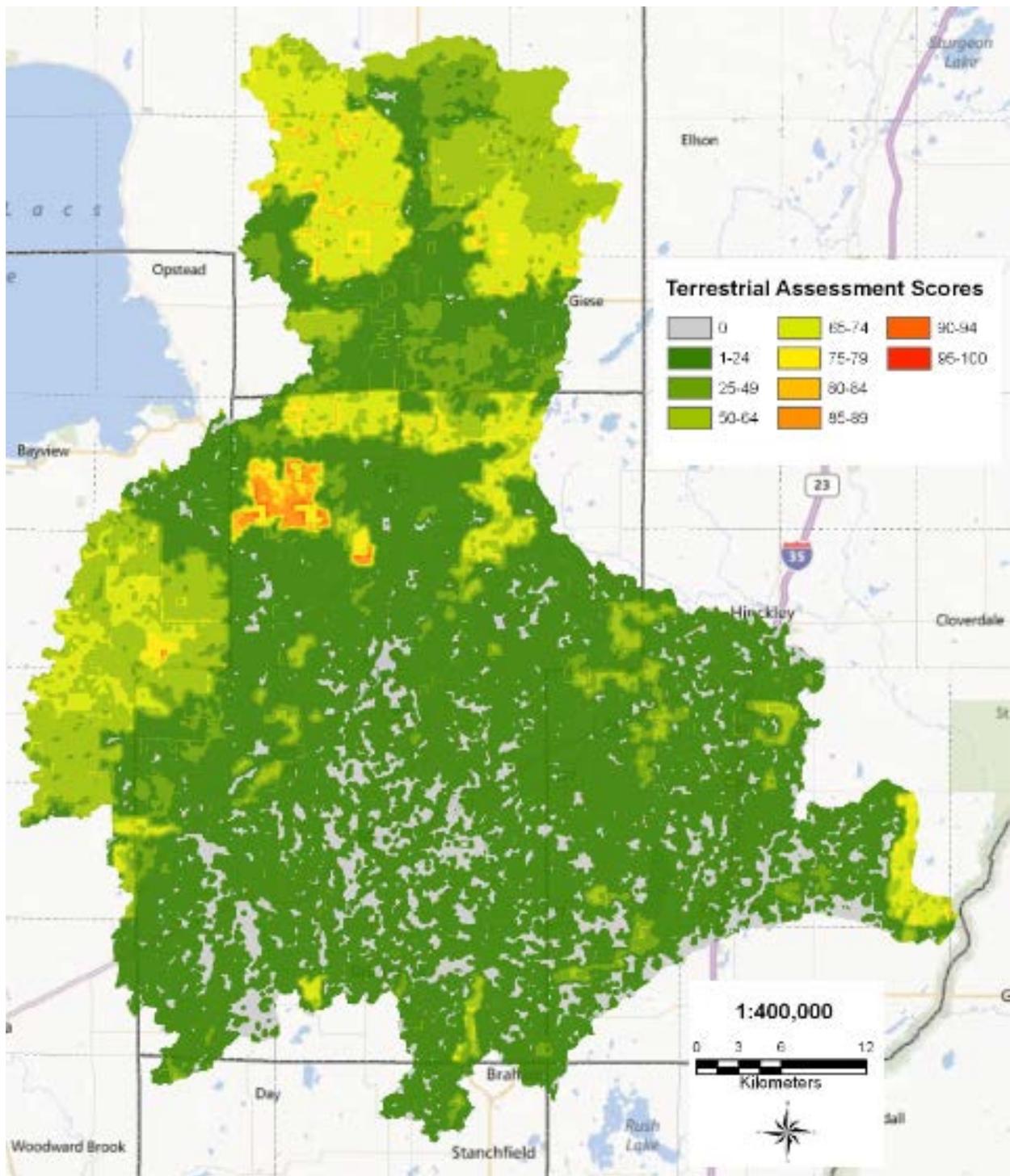


Figure 15. Terrestrial biodiversity targets in the Snake River Watershed. Higher scores (red) indicate areas of higher terrestrial biodiversity and may be prioritized for protection. Source: Johnson et al. (2013b).

Snake River Watershed Conservation Action Plan

In 2009, TNC prepared a Conservation Action Plan (CAP) for the Snake River Watershed. The CAP provides a complete assessment of terrestrial and aquatic ecosystems within the watershed, and identifies conservation targets and potential threats to those targets. The conservation targets are based on an ecoregional approach that TNC has used in more than 40 ecoregions, including in the Superior Mixed Forest ecoregion where the Snake River Watershed is located (TNC 2002, TNC 2009). As summarized in Table 3, TNC identified the greatest overall threats to the Snake River Watershed ecosystems as habitat alterations due to invasive species introduction, road and utility development, residential development, and climate change.

TNC's CAP (2009) emphasized the threat of invasive species on native aquatic and terrestrial species within the Snake River Watershed. According to TNC's analysis, Eurasian milfoil and curlyleaf pond weed, which can outcompete native vegetation and limit space for fish and other organisms, have been documented in nearly half of the deep lakes within the watershed. The common carp (*Cyprinus carpio*), which increases turbidity, thereby decreasing light availability to aquatic organisms, has also been introduced to deep lakes within the watershed. Buckthorns are pervasive in the watershed, outcompeting native plants for nutrients and light, and threatening forested and wetland ecosystems. Introduction of other invasive species may be eminent given their current presence in downstream reaches. For example, Asian carp have become established in the lower reaches of the upper Mississippi River and in the Illinois River. Zebra mussels spread quickly and, if introduced, would pose a significant threat to the unique freshwater mussel population provided in the Snake River Watershed.

Goals of the CAP include: maintaining lake sturgeon, nongame fish, and mussel communities in the Snake River main stem at or above 2009 levels through 2020; protecting shoreland habitat in priority areas along the Snake River main stem; expanding and improving the condition of the fire-dependent pine-oak forest and mature mesic hardwood forest ecosystems by 100%; and reducing phosphorus loading. To accomplish these goals, TNC outlined strategies such as supporting local land trusts and acquiring key buffer lands; expanding habitat corridors to improve connectivity of natural areas and shorelands; supporting the development of more protective shoreland management ordinances; and collaborating with stakeholders, landowners, and partners to prevent forestland fragmentation within the watershed (TNC 2009). Since the CAP was finalized, TNC has continued to engage as a partner and supporter of SCRA and the Washington County Watershed District in protection and planning efforts within the St. Croix Watershed, particularly in support of the St. Croix Watershed Protection Project (Kristen Blann, TNC, personal communication, 04/23/2013).

Table 3. Summary of ecosystem threats within the Snake River Watershed. Source: TNC (2009).

Threats Across Targets		Headwater streams	Small & med. river/ riparian systems	Inland lakes - deep/ stratifying	Shallow lakes/ open marshes	Peatland systems	Fire dependent forest systems	Wet forest/wet meadow systems	Mesic hardwood forest systems	Overall threat rank
Project-specific threats (Common taxonomy)		1	2	3	4	5	6	7	8	
1	Climate Change (Habitat Shifting & Alteration)	High	High	Med.	Low	Med.			Low	High
2	Development of roads or utilities (Roads & Railroads)	Med.	Low	High	Med.	Med.	Med.	Med.	Med.	High
3	Development: Second Home & Resort (Tourism & Recreation Areas)	Med.		High	Med.	Med.	Med.	Med.	Med.	High
4	Surface drainage modifications / Ditches & channelization (Other Ecosystem Modifications)	Med.	High	Low	Low	Med.		Low	Med.	Med.
5	Atmospheric Deposition (Air-Borne Pollutants)	High	Med.	Med.	Med.	Low				Med.
6	Land divestiture by industrial forest owners (Logging & Wood Harvesting)						High		Med.	Med.
7	Fire suppression (Fire & Fire Suppression)						High			Med.
8	Seed sources unavailable						High			Med.
9	Incompatible forestry practices (Logging & Wood Harvesting)	Med.				Med.	Med.	Med.		Med.
10	Incompatible recreational activities, e.g. ORV/ATV trail damage (Recreational Activities)	Low	Med.	Med.	Low	Med.		Low		Med.
11	Management of/for certain species		Med.	Med.	Low				Med.	Med.
12	Development: urban and suburban (Housing & Urban Areas)		Low	Med.	Low				Med.	Med.
13	Agricultural land use / runoff (Annual & Perennial Non-Timber Crops)	Med.	Med.							Med.

Threats Across Targets		Headwater streams	Small & med. river/riparian systems	Inland lakes - deep/stratifying	Shallow lakes/open marshes	Peatland systems	Fire dependent forest systems	Wet forest/wet meadow systems	Mesic hardwood forest systems	Overall threat rank
Project-specific threats (Common taxonomy)		1	2	3	4	5	6	7	8	
14	Introduced insect and disease (Invasive Non-Native/Alien Species)						Med.	Med.		Med.
15	Forestry Emphasis on Younger Growth Stages (Logging & Wood Harvesting)		Low	Low	Low				Med.	Low
16	Altered beaver populations (Hunting & Collecting Terrestrial Animals)	Low	Med.					Low		Low
17	Invasive/alien species (Invasive Non-Native/Alien Species)			Low		Med.				Low
18	Earthworm Introductions by Anglers (Invasive Non-Native/Alien Species)								Med.	Low
19	Forestry: Lack of Riparian Buffers (Logging & Wood Harvesting)		Low	Low	Low					Low
20	Sport fish stocking (Invasive Non-Native/Alien Species)	Low		Low						Low
21	Forestry: Emphasis on Stand level Management Driven by Ownership Boundaries (Logging & Wood Harvesting)								Low	Low
22	Mining: Sand, gravel, peat (Mining & Quarrying)						Low			Low
23	Operation of dams or reservoirs (Dams & Water Management/Use)	Low								Low
24	Removal of in-channel wood (Other Ecosystem Modifications)		Low							Low
25	Rusty crayfish (Problematic Native Species)	Low								Low
Threat Status for Targets and Project (Summary Rating)		High	High	High	Med.	Med.	High	Med.	Med.	High

St. Croix River Watershed Conservation Priorities Report

The St. Croix River Watershed Conservation Priorities Report (CPR) was developed by the St. Croix Conservation Collaborative, which is comprised of non-profit organizations, local units of government, state agencies from Minnesota and Wisconsin, and federal agencies. The CPR's approach was to compile all conservation efforts on a map of the St. Croix Watershed, and identify and prioritize conservation needs to guide future watershed conservation efforts. The CPR identified 28 general areas in need of protection, including the Snake River. Recommended protection strategies include: expanding land acquisitions and conservation easements in select areas; updating municipal land use plans to include a Natural and Cultural Resources component; coordinating protection efforts by developing a listserv for stakeholders to share information and provide project updates; and developing an online mapping tool of protection work. For the Snake River priority area, the CPR recommended restoring and maintaining water quality within the Snake River by implementing BMPs and acquiring land for protection (St. Croix Conservation Collaborative 2006). Importantly, the CPR recommendations for the Snake River are broad in scope and do not identify specific locations or types of BMPs to be implemented along the main stem.

Snake River Watershed Enhancement Project

The SRWMB recently published their final report on the Snake River Watershed Enhancement Project. One of the primary goals of the Enhancement Project is to protect the Snake River from sedimentation and pollutant loads, and to educate local communities about the importance of preserving their watershed. The Enhancement Project involved extensive BMP implementation, ranging from creating sediment basins, wetlands, and grass waterways; controlling erosion and farm runoff; developing manure management plans; installing rain gardens; repairing earthen dams; and building livestock exclusion fences (SRWMB 2012). See Figure 16 for the location of protection projects within the watershed. All BMPs were targeted toward areas contributing high pollutant loads to the Snake River. In addition to BMP implementation, the Enhancement Project has involved extensive monitoring and evaluation to estimate soil loss and nutrient load reductions. Primary sources of funding for the project were the Conservation Reserve Program, Reinvest in Minnesota, state cost share program for SWCDs, and EQIP.

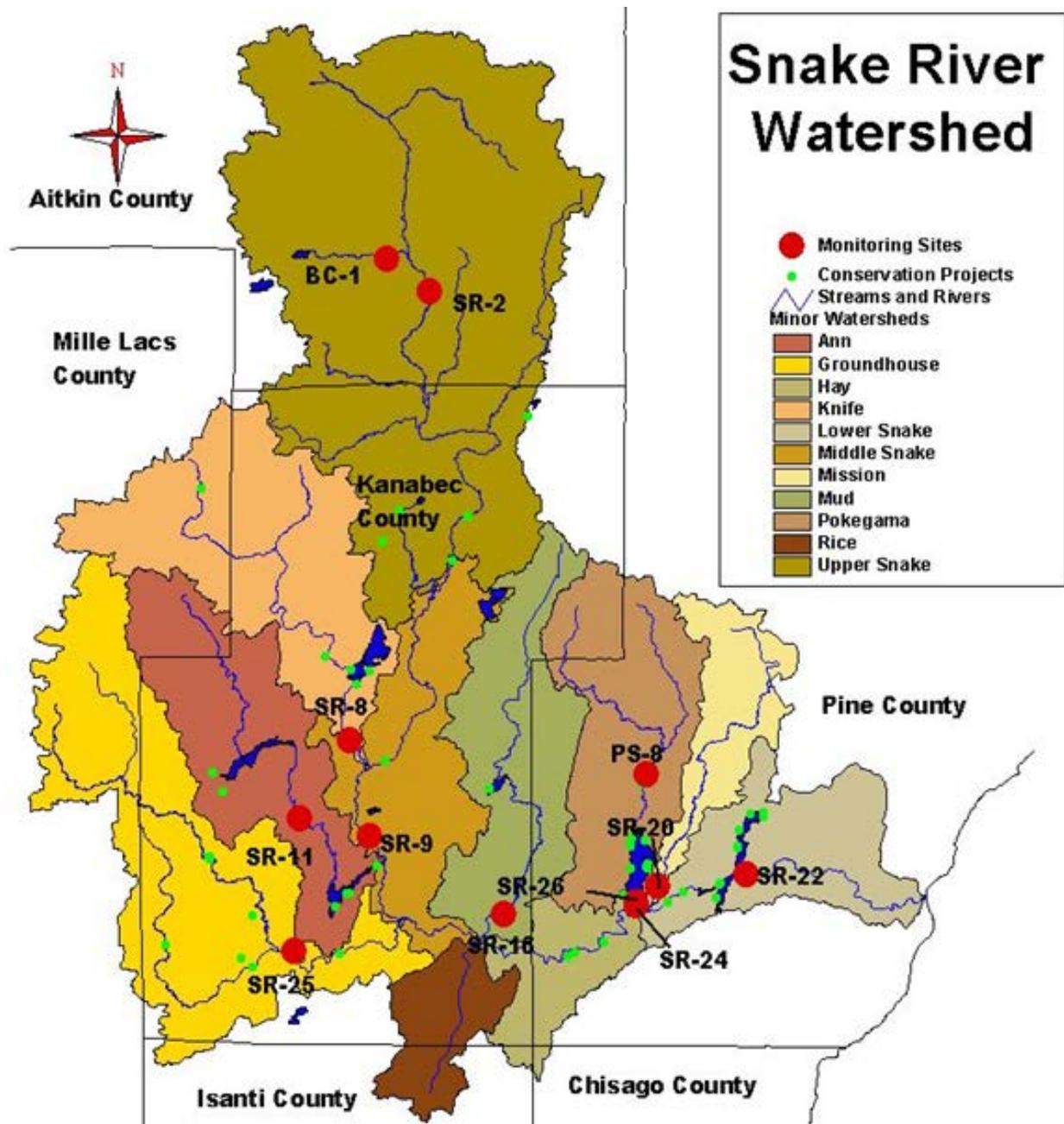


Figure 16. Locations of protection projects and best management practice implementation under the Snake River Enhancement Project. Source: SRWMB (2012).

4.2.3 Watershed: Technical Resources

Forest, Water and People Analysis

The U.S. Forest Service's Forest, Water and People Analysis identifies private forests that are most beneficial for drinking water supplies and that are in the most need of protection from development. The analysis involved integrating nine GIS data layers (forested land, agricultural land, riparian forest cover, road density, soil erodibility, 2000 housing density, change in housing density, surface water consumers, and private forests) to determine the ability of HUC-12 watersheds (30 m scale) to produce clean drinking water (USFS 2009). Results of the analysis indicate that the Snake River Watershed provides a moderate to high ability to produce clean water, with an overall score of 21 out of 40 in terms of development pressure on private forests that are important for drinking water supply protection. For comparison, the highest scoring watershed in the state is the Pine, receiving a score of 28 out of 40. As shown in Figure 17, areas within the Upper Snake River and Ann River subwatersheds have the highest probability of producing clean water within the Snake River Watershed. Some of the land within these two areas is publically owned (Figure 3), including a WMA in the upper Ann River subwatershed (Figure 7). In addition, many of the wetlands in these areas have been preserved (see Figure 13), which can filter pollutants from stormwater runoff and minimize sediment and nutrient runoff.

The focus of the Forest, Water and People Analysis was on surface water supply systems. However, maintaining intact forested ecosystems and protecting surface waters can also protect ground water drinking water supplies because the two systems are intricately linked in the hydrologic cycle. The Minnesota Department of Health (MDH) is the primary agency responsible for protecting Minnesota's ground water drinking water supplies, which are the primary source of drinking water within the Snake River Watershed. MDH collaborates with other state and federal agencies including the Minnesota Department of Agriculture (MDA), DNR, MPCA, EPA, and USGS to monitor and protect ground water sources of drinking water within the state (MDH 2013). In April, 2013, the Freshwater Society published a report on Minnesota's ground water use and availability (Freshwater Society 2013). The sixteen key ground water areas of concern within the state, as identified in the report, are located outside of the Snake River Watershed; however, towns and counties should be cognizant of ground water withdrawals and transfers to ensure long term sustainable use.

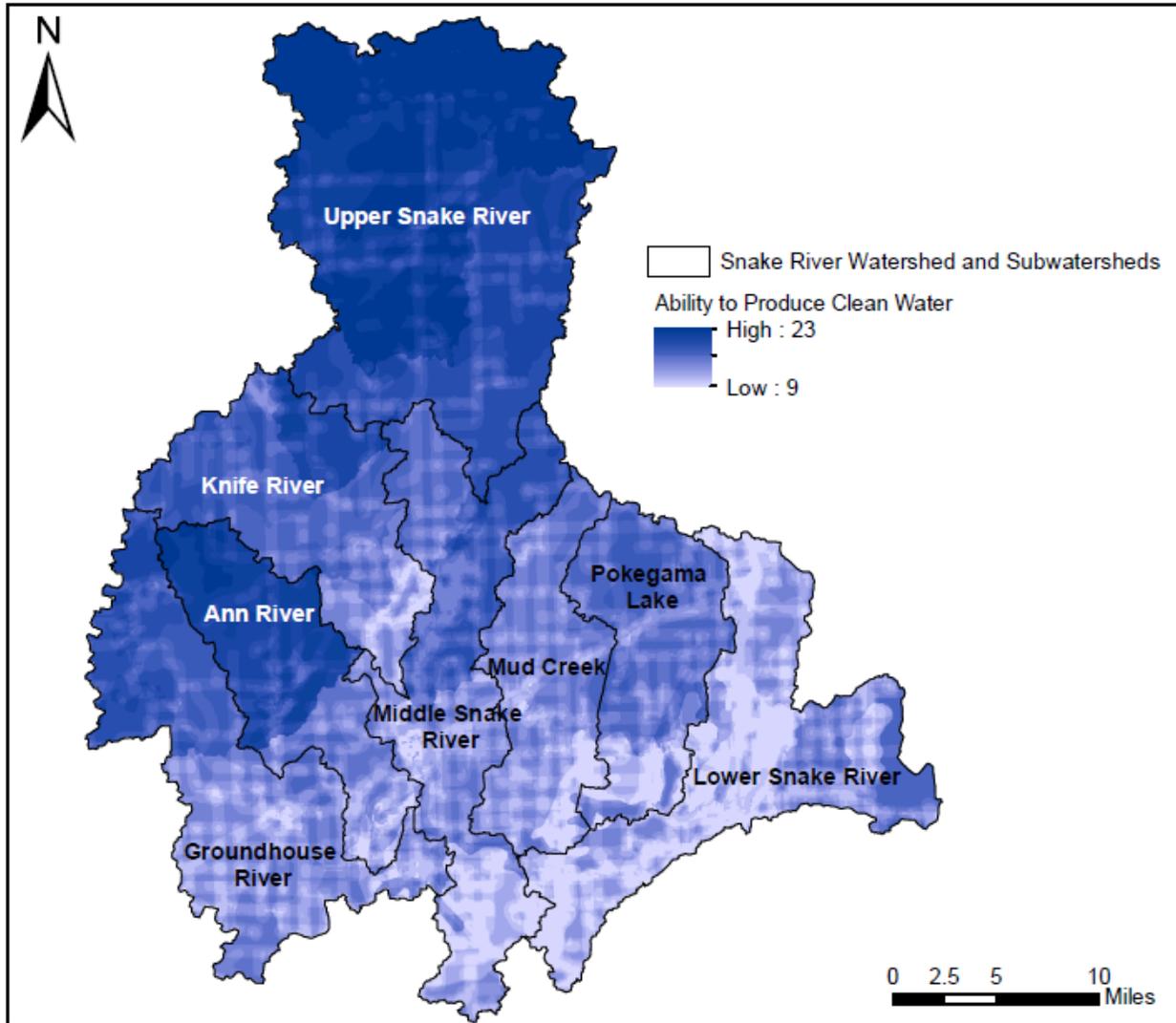


Figure 17. Results from the U.S. Forest Service’s Forest, Water and People Analysis for the Snake River Watershed indicating the ability of subwatersheds to produce clean water. Source: USFS (2009).

5 Summary of Existing Protection Efforts

The Snake River Watershed supports a number of outstanding resources, healthy biological communities, and a variety of habitats including forests and wetlands. These ecosystems and the services they provide are at risk due to threats such as development, landscape fragmentation, water quality degradation, invasive species, and climate change (TNC 2009). There have been several assessments conducted within the Snake River Watershed. The assessments can be characterized as (1) general natural resource assessments (e.g., the WAP, the WHAF, the St. Croix River Watershed CPR, and TNC’s CAP); (2) water quality focused assessments (e.g., SRWMB’s Snake River Enhancement Project, Kanabec County’s Water Plan, and the WRAPS); and (3) targeted analyses (e.g., Forest, Water and People Analysis, the Ecological Ranking Tool, and the St. Croix Watershed Protection Project). Together,

these assessments provide a good understanding of the types of habitats within the watershed; general areas of higher biodiversity; key stressors within the watershed; and stream segments in poor water quality health.

Most of the natural resource assessments have been conducted at the state or larger St. Croix Watershed scales. These assessments provide general protection recommendations, rather than identifying specific priority locations or strategies for protection. For example, the WAP, which focused on wildlife protection, recommended protecting riparian corridors and habitats; aquatic connectivity, hydrology, geomorphology; and water quality within the watershed. The WHAF used an integrated approach to assess watershed health at the state level and found that the hydrologic condition of the Snake River Watershed is relatively intact, though aquatic connectivity is impacted by physical structures such as dams and culverts within streams. The St. Croix River Watershed CPR identified the Snake River in general, as a priority area for protection. TNC's CAP provided slightly more targeted recommendations for protection within the watershed, including sustaining populations of several aquatic species, protecting certain forested ecosystems, maintaining shoreline habitat areas, and reducing phosphorus loading (TNC 2009). Each of these general assessments is helpful in guiding natural resource protection within the watershed, but don't identify specific areas in need of protection.

Several Snake River Watershed assessments focused on water quality. SRWMB's Snake River Enhancement Project involved implementation of BMPs throughout the watershed to reduce sediment and pollutant loading to surface waters (SRWMB 2012). A primary goal of SRWMB is water quality protection and restoration, and in addition to conducting long-term water quality monitoring, SRWMB provides water quality public education and outreach to communities and watershed groups. County Water Plans can be considered assessments given that the county prioritizes areas for protection. A primary focus of county Water Plans is surface water and ground water quality protection. For example, Kanabec County's Water Plan (and others- see Appendix B) targets BMP implementation in the Middle and Lower Snake River subwatersheds to protect water quality from development. The multi-agency WRAPS process also focused on protecting water quality within the watershed by synthesizing information and results from the state's watershed assessments and TMDLs. Restoring and maintaining water quality is critical to maintaining a healthy biological community. However integrated assessments that consider water quality, in addition to other watershed attributes such as landscape and habitat connectivity, hydrology, geomorphology and biological community are needed to fully protect watershed health.

Targeted natural resource analyses have also been conducted within the Snake River Watershed, though the findings and results from each assessment tend to differ depending on the organization's priorities and project goals. The Forest, Water and People Analysis focused on identifying priority forested areas to protect drinking water supplies. The analysis identified large forested lands in the western and northern portion of the watershed as priority protection areas. The primary focus of the Minnesota Ecological Ranking Tool was on protecting surface waters from soil erosion and sediment runoff. This Tool identified priority areas within the Upper Snake River subwatershed for protection. The currently ongoing St. Croix Watershed Protection Project will establish and implement a protocol for identifying priority areas for protection. Preliminary analyses conducted by TNC identify priority areas, but the

analyses were focused solely on protecting aquatic and terrestrial biodiversity. Finally, the zonation process implemented by DNR prioritized nearly the entire Snake River main stem as well as a large area within the southwestern portion of the basin.

6 Gaps in Protection Activities and Recommended Future Actions

The majority of protection efforts within the Snake River Watershed have focused on restoring water quality through BMP implementation or on identifying areas of high biodiversity. Water quality and viable populations of terrestrial and aquatic species are critical components of a healthy watershed; however, there are several ways in which existing protection efforts can be expanded upon. Collaborations between watershed partners and state agencies, and engaging the public in decision making processes can expand protections across jurisdictional boundaries and allow the public to be more aware of the importance of protecting their watershed. Also, town and county ordinances are powerful tools that can be applied to expand protections. Gaining a better understanding of the types of ordinances within the watershed would be a first step towards incorporating them into existing protection activities.

There are also several opportunities to help fill gaps in existing protection efforts. For example, the Snake River Watershed received a low score for aquatic connectivity in the WHAF assessment (DNR 2011); however efforts to date have not addressed culvert and dam restoration or removal to improve fish passage. Also, the threat of invasive species has been cited as a top concern within the watershed, threatening the viability of native aquatic and terrestrial species (TNC 2009, University of Minnesota 2011). While there is general knowledge of where certain invasive species have colonized within the watershed, there has been no detailed watershed scale assessment to understand their presence and prevalence, nor have extirpation and mitigation strategies been developed. Finally, many of the existing assessments have identified general areas, or large locations (i.e., the entire Snake River main stem) for protection. With limited resources available, protecting all of these areas is likely not feasible. Conducting a more detailed analysis that incorporates all attributes of a healthy watershed (i.e., landscape condition, habitat, hydrology, fluvial geomorphology, water quality, and biological condition) and identifies specific priority protection areas within the watershed will help watershed organizations and state agencies better target funding and activities. The following are recommendations for ways to enhance existing efforts and help fill gaps:

1. Conduct a detailed review of city, township, county, and state ordinances to identify opportunities to strengthen protections;
2. Encourage civic engagement and collaboration and coordination among state agencies, conservation groups, counties, and watershed organizations to strengthen watershed protection efforts;
3. Conduct a detailed systems-based analysis using existing datasets and tools to prioritize specific areas for protection;

4. Develop an inventory of culverts and dams within the watershed and prioritize them for restoration or removal to improve aquatic connectivity; and
5. Assess the presence and prevalence of invasive species within the Snake River Watershed.

More detailed descriptions of each of the recommendations are provided below. These recommendations are not listed in any particular order and implementation of each will likely depend on watershed priorities and availability of resources.

1. Conduct a detailed review of city, township, county, and state ordinances to identify opportunities to strengthen protections

City, township, county, and state ordinances and laws can be effective tools for protecting water resources and ecosystems from the impacts of development. For example, town ordinances often require a buffer between surface waters and development activities; such buffers may be extended for critical resource waters, areas of high quality habitat, or to maintain landscape connectivity. Wetland protection ordinances may be extended to protect isolated wetlands as well as potential and documented vernal pools. Cluster zoning or open space ordinances can be an effective means of preserving permanent open space. Cluster zoning laws allow for conservation of open space while simultaneously providing a mixture of housing types. For example, smaller and more compact residential areas may be approved for construction in order to conserve larger areas of adjacent open space.

Conducting a detailed review of ordinances within the Snake River Watershed will provide a greater understanding of what types of protections already exist, and where. This type of review will also allow conservation agencies and water resource managers to identify gaps or areas in which ordinances can be strengthened to expand natural resource protections. Conducting a detailed review will be greatly facilitated by working closely with members of city planning and zoning boards, which are familiar with the local laws and will also be knowledgeable of any upcoming revisions to current ordinances.

2. Encourage civic engagement and collaboration and coordination among state agencies, conservation groups, counties, and watershed organizations to strengthen watershed protection efforts

Collaboration among watershed partners and civic engagement are critical for long-term success in protecting ecosystem functions and processes in the Snake River Watershed. Coordinating efforts helps to ensure that all relevant data are identified and that experts are utilized effectively. The process also minimizes the potential for duplicating efforts and allows for more effective use of limited resources. Having multiple partners work in tandem to achieve a common goal provides the ability to strategically plan and prioritize protection efforts within the watershed.

Two prime examples of successful collaboration within the Snake River Watershed include SRWMB and the WRAPS process. SRWMB represents the needs and interests of four counties within the watershed, and has successfully conducted long term water quality monitoring and BMP implementation to protect water resources across jurisdictions. Because of their collaborative efforts, the activities implemented by

SRWMB extend beyond what can be provided solely through county-specific Water Plans. Another important collaborative effort is the WRAPS process. The WRAPS is led by MPCA, although DNR, BWSR, and SRWMB are active participants in its development and implementation. For example, MPCA and DNR work together to collect data to identify stressors and sources of pollution, conduct spatial analyses, construct models, and analyze model iterations for point and nonpoint sources of pollution. Local stakeholders and communities are involved in the development of the WRAPS by voicing priorities, and prioritizing and refining strategies for protection and restoration. Watershed protection activities can be enhanced through more collaborative efforts like these.

Opportunities for additional collaboration exist, particularly for DNR and BWSR. Both agencies have similar objectives and work on projects directly affecting natural resource protection within the Snake River Watershed. The agencies are collaborating on some efforts, such as prairie and grassland area preservation, though given the large protection focus within the Snake River Watershed, there is ample room for additional coordination and collaboration. A potential opportunity for collaboration is through Minnesota BWSR's Conservation Apprenticeship Academy (see Appendix B for further detail). The program recruits students from universities for apprenticeship positions to transfer natural resource conservation expertise and knowledge on to the next generation.

Another opportunity for collaboration is when counties update and implement their Water Plans. Water Plans present an opportunity for jurisdictions to evaluate their water resources, set goals for protection, and secure funding for protection projects. Given the interconnected nature of ecosystems, protection efforts throughout the Snake River Watershed may be enhanced if county Water Plans were developed in coordination with neighboring counties. For example, several county Water Plans set goals for protecting/restoring shorelines and controlling erosion (see Appendix B). Shoreline habitat should be prioritized based on size and habitat quality, and in many cases may cross county lines. Counties can secure and coordinate funding to target those areas rather than restoring small patches of isolated shoreland areas.

The public should also be involved in watershed protection decision making processes, where possible. Recognizing the importance of civic engagement in watershed projects, MPCA has a contract to conduct a pilot civic engagement study. The goal of the study is to organize a first-stage civic infrastructure pilot in Kanabec County, with membership from the remaining counties in the watershed and other organizations in the St. Croix Watershed. The work will be grounded in the need for sustainable citizen engagement in water quality management. Civic leaders participating in this project will build their own skills for community organizing and work in partnership with Kanabec County SWCD staff and the St. Croix Watershed Team to achieve water quality goals. The community organizing groups – Civic Organizing, Inc. and Citizens League – will lead the teaching process and will be intentional about establishing a clear relationship between civic practices they teach and achieving water quality goals. Outcomes of this project will be used to influence existing approaches to policy making for the purpose of achieving greater impact and sustainable results in watersheds within Kanabec County and the St. Croix Watershed and may be transferable statewide.

As recommended by the St. Croix CPR, general collaboration between watershed partners and engaging the public can be enhanced through communicational tools, such as a listserv and website as well as an online mapping tool of protection work. These and other communication mechanisms will allow for regular updates on watershed protection projects and enable users to showcase innovative restoration and protection strategies. The website would also simultaneously serve to educate the public about ongoing activities and ways in which they may become involved. Similar websites currently exist for each individual partner (e.g., SRWMB, Friends of the Snake River), but a more unified website would allow for better collaboration between partners.

3. Conduct a detailed systems-based analysis using existing datasets and tools to prioritize specific areas for protection

There are multiple opportunities for protection in any watershed. Narrowing down what practices to implement and where in the landscape to implement them can help to more effectively target efforts and apply limited resources. As described in section 5, a number of assessments have been conducted within the watershed, several of which have provided more general recommendations for protection activities. There is a need for a comprehensive analysis that uses existing assessments, data, and tools to identify specific locations within the watershed that provide the greatest contribution to watershed health. The analysis may produce a 'top ten' list of priority areas, for example, making protection more feasible. Importantly, such an analysis should consider all elements of a healthy watershed (i.e., landscape condition, hydrology, fluvial geomorphology, habitat, water chemistry, and biotic communities), rather than focusing on only one attribute, such as water quality or biodiversity preservation. The St. Croix Watershed Protection Project may provide this type of analysis, though it is unclear what type of information and data will ultimately be included in their assessment.

A GIS overlay analysis is one option that may be used to identify priority protection areas within the watershed. As described in this report and in the accompanying Excel inventory, a number of relevant spatial datasets already exist for the watershed. A few examples include the spatial datasets from the Forest, Water and People analysis, Minnesota's Ecological Ranking Tool, the Minnesota Biological Survey, Upper Mississippi River Forest Partnership's habitat maps, and state LiDAR data. Online webmaps are also available, such as those from the National Fish Habitat Action Plan, ENRTF, and Minnesota's Ecological Ranking Tool. Large areas of land are already receiving some degree of protection through public ownership, WMAs, and AMAs (spatial datasets available through DNR). Targeting protection efforts around these areas and within river corridors can increase aquatic and landscape connectivity, which allows for species migration and expands natural land areas that can be used for wildlife-related recreational activities. Ultimately, using a scientifically sound approach to identify a few key areas for protection will allow for more targeted use of funds and help to ensure that efforts are directed towards areas that have the greatest contribution to overall watershed health.

4. Develop an inventory of culverts and dams within the watershed and prioritize them for restoration or removal to improve aquatic connectivity

Results from the WHAF indicate that aquatic connectivity is an area of concern within the Snake River Watershed. Poorly designed and improperly functioning culverts and dams threaten the viability of native fish species, prevent fish passage during critical spawning seasons, and can block access to quality habitat areas (Martin and Apse 2011). They also can cause seasonal flooding, damaging roads and private property, and increasing pollutant runoff to local waterbodies during flooding events. A recommended approach for restoring aquatic connectivity and fish passage within the watershed is to develop an inventory and assess the condition of dams, culverts, and road-stream crossings in the watershed, and prioritize the structures for repair or removal. TNC established procedures for developing such an inventory as part of the Northeast Aquatic Connectivity Analysis (NACA) (Martin and Apse 2011). Similar approaches have been implemented on smaller scales, including in the 1,500 square mile Pine-Popple Watershed in Wisconsin (Diebel et al. 2010), and most recently in the Green Bay Watershed in Wisconsin (TNC 2012). Importantly, the DNR has already begun developing an inventory of potential road-stream crossings in the state and TNC previously initiated a similar effort within the St. Croix River Watershed (Kristen Blann, TNC, personal communication, 02/15/13). While the inventories may not be complete or have been ground-truthed, they can serve as the foundation for developing a fish passage barrier inventory for the Snake River Watershed.

The general approach for identifying fish passage barriers involves first compiling all relevant GIS datasets of dams, culverts, anadromous fish habitat, roads, railroads, and hydrography. The roads and railroads are then intersected with the hydrography stream network GIS layer to develop a preliminary inventory of probable road-stream crossings. A comprehensive survey may then be completed to verify the presence of the road-stream crossings and dams, and assess their condition. Factors that affect fish passage and should be evaluated during the survey include water velocity, length of the structure, presence/absence of natural substrate within the structure, whether the structure is perched above the stream, the ratio of the structure water depth to stream depth, and the presence of a scour pool downstream from the structure (Diebel et al. 2010). After assessing the condition of each structure, they may be prioritized based on local and state objectives.

Prioritizing structures for remediation or removal will require achieving a balance between identifying those structures that block access to quality habitat and spawning areas; the possible introduction of invasive species if the structure is removed; the cost-effectiveness and feasibility of restoration; the structure's effect on flooding and associated economic and water quality impacts; and future road construction activities. Detailed methods for prioritizing barriers can be found in Diebel et al. (2010) and Martin and Apse (2011). TNC has also developed a GIS-based application- the Barrier Analysis Tool- to facilitate the calculations. The tool is available for ArcGIS 9.3, but is currently being updated for a newer ArcGIS version (Erik Martin, TNC, personal communication, 01/17/2013).

The DNR has developed a preliminary database of potential road-stream crossings within Kanabec County in the Snake River Watershed, and is planning to conduct an on-the-ground assessment of the culverts (Craig Wills, DNR, personal communication, 02/22/2013). The inventory may be expanded to

portions of Mille Lacs County within the Snake River Watershed. In addition, DNR is looking into the possibility of developing a statewide inventory of culverts as part of their stream survey program (Karl Koller, DNR, personal communication, 02/21/2013). TNC also began developing an inventory of potential road-stream crossings within the St. Croix River Watershed, though the culverts have not been ground-truthed (Kristen Blann, TNC, personal communication, 02/15/2013). Any prioritizing of road-stream crossings within the Snake River Watershed should consider possible introduction or spread of invasive species, since allowing passage for native species can also facilitate passage of invasive species. Prioritization should also be coordinated with local Public Works departments to align road construction activities with culvert restoration and/or removal. Guidance should be provided prior to any construction activities in order to ensure proper culvert placement and sizing to retain fish passage. In addition, results from the culvert inventories should be incorporated into county Water Plans (if the counties develop the inventory) or supplied in DNR's comments and suggestions on county Water Plans (if DNR develops the inventory).

5. Assess the presence and prevalence of invasive species within the Snake River Watershed

TNC's CAP (2009) emphasized the threat of current and future establishment of invasive aquatic and terrestrial species in the Snake River Watershed. Species that have already colonized lakes and the terrestrial landscape within the watershed include Eurasian milfoil, curlyleaf pond weed, the common carp, and buckthorns. While not yet established, colonization of invasive species such as Asian carp and zebra mussels pose an eminent threat to the health of the Snake River Watershed (TNC 2009). Preventing the introduction of invasive species is critical because once introduced, these species are costly, if not nearly impossible, to eradicate. While invasive species have been documented as a concern, their presence within the watershed has not been thoroughly assessed and documented. It is recommended that a detailed assessment of the presence, prevalence, and potential threats of invasive aquatic and terrestrial species be conducted for the Snake River Watershed. Such an assessment should also evaluate for the potential introduction of invasive species from downstream waterbodies, including the St. Croix River and Mississippi River. In cases where invasive species are downstream from the Snake River Watershed, strategies should be developed and implemented to minimize the risk for introduction and colonization, where possible.

7 Summary and Conclusions

The Snake River Watershed supports healthy forested, wetland, and stream ecosystems that provide quality habitat to freshwater mussels and a number of SGCN and threatened and endangered species (DNR 2006, TNC 2009). Many of these natural land areas are important to the local economy, generating revenue from recreational activities such as fishing, wildlife viewing, hunting, and hiking. The health of the watershed is being threatened by stressors such as development, invasive species, and climate change. A statewide watershed health assessment (the WHAF) indicated that the Snake River Watershed is in relatively good ecological health and would be a good candidate for implementing EPA's Healthy Watersheds Initiative to protect its resources. The purpose of this project was to develop an

inventory of and review existing protection activities to identify gaps or opportunities to strengthen current protection efforts, and provide recommendations for future activities.

A review of assessments, tools, and datasets reveals that there has been a strong focus on assessing water quality and watershed biodiversity and identifying areas supporting high numbers of aquatic and terrestrial species. Implementation efforts have been focused on restoring water quality through BMPs, particularly in areas of intense development. These efforts are being conducted by multiple agencies and organizations simultaneously (e.g., TNC, DNR, SRWMB, etc.). To help strengthen current protection activities and fill gaps in existing protection activities, the following recommendations are made:

1. Conduct a detailed review of city, township, county, and state ordinances to identify opportunities to strengthen protections;
2. Encourage civic engagement and collaboration and coordination among state agencies, conservation groups, counties, and watershed organizations to strengthen watershed protection efforts;
3. Conduct a detailed analysis using existing datasets and tools to prioritize areas for protection;
4. Develop an inventory of culverts and dams within the watershed and prioritize them for restoration or removal to improve aquatic connectivity; and
5. Assess the presence and prevalence of invasive species within the Snake River Watershed.

Implementing the above recommendations will help accelerate efforts to protect the outstanding resources that the Snake River Watershed supports. The first two recommendations are targeted primarily for strengthening current and future efforts, while the later three will help fill gaps to protect all attributes of a healthy watershed, including landscape condition, habitat, hydrology, fluvial geomorphology, water quality, and biological condition.

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Appendix A. Acronyms

AMA	Aquatic Management Area
BMP	Best Management Practice
BWSR	Board of Water and Soil Resources
CAP	Conservation Action Plan
CRP	Conservation Reserve Program
DNR	Department of Natural Resources
DWSMA	Drinking Water Supply Management Areas
EBI	Environmental Benefits Index
ENRTF	Environment and Natural Resources Trust Fund
EPA	Environmental Protection Agency
GBCA	Grassland Bird Conservation Area
GIS	Geographic Information System
HAPET	Habitat and Population Evaluation Team
HUC	Hydrologic Unit Code
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MFA	Minnesota Forestry Association
MGLP	Midwest Glacial Lakes Partnership's
MPCA	Minnesota Pollution Control Agency
NACA	Northeast Aquatic Connectivity Analysis
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NPDES	National Pollutant Discharge Elimination System
PIF	Partners in Flight
PWS	Public Water Supply
SCRA	St. Croix River Association
SGCN	Species in Greatest Conservation Need

SNA	Scientific and Natural Area
SRWMB	Snake River Watershed Management Board
SWAP	Small Wetlands Acquisition Program
SWCD	Soil and Water Conservation District
TALU	Tiered Aquatic Life Use
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UMRFP	Upper Mississippi River Forest Partnership
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAP	Wildlife Action Plan
WFMIS	Watershed Forest Management Information System
WHAF	Watershed Health Assessment Framework
WHPA	Wellhead Protection Areas
WMA	Wildlife Management Area
WMD	Wetland Management District
WPA	Wetland Preservation Area
WRAPS	Watershed Restoration and Protection Strategy

Appendix B. Inventory of Protection Efforts

Provided in this appendix are summaries of national, multi-state, Minnesota, and watershed efforts that can be used to protect ecosystem functions and services within the Snake River Watershed. This report is accompanied by a Microsoft Excel inventory (*SRW_Protection_Inventory.xls*), which provides further information on each activity, including source information (e.g., websites and associated documents), and also identifies which of the six Healthy Watersheds Initiative components are directly influenced/impacted by each activity. Developing this inventory involved consultations with various watershed partners and an extensive review of federal, state, county, and local agencies and associations' websites to identify recent and ongoing protection activities that may directly influence the Snake River Watershed.

The 58 protection activities summarized in this appendix are organized by jurisdiction (e.g., national/multi-state, state, watershed) followed by type (e.g., funding opportunities, regulatory efforts, non-regulatory efforts, and technical resources). Each description follows the same format and includes a summary of the tool, program or effort as well as a description of the benefits of the effort in terms of the six Healthy Watersheds Initiative attributes. In most cases, one or more documents/products are associated with each protection effort (e.g., reports, GIS data, webmaps). These documents were downloaded and file names for each document are included in the "Associated Documents" subsection for each activity. Cases where "Associated Documents" is labeled as "None" indicates that the information is all available online and can be found at the project's website, which is provided in the accompanying Microsoft Excel inventory.

National/Multi-State Protection Efforts

Funding Opportunities

Conservation Reserve Program

Entity: U.S. Department of Agriculture

Jurisdiction: National

Summary: Through the voluntary Conservation Reserve Program (CRP), agricultural landowners may receive cost-share assistance and rental payments to establish long-term conservation practices on eligible farmland. Annual rental payments are based on the rental value of the land and provide up to 50% of the landowners costs for implementing the protection efforts. Each county within the Snake River Watershed has agricultural land enrolled in the CRP as of April 2011 (http://www.fsa.usda.gov/Internet/FSA_File/su41county.pdf):

- Aitkin- 671 acres
- Chisago- 650 acres
- Isanti- 1,018 acres
- Kanabec- 277 acres
- Mille Lacs- 757 acres
- Pine- 263 acres

Benefits: Agricultural activities can have adverse impacts on the local environment and water quality, most notably by contributing sediment and nutrient loads to water resources. Implementing conservation practices on agricultural land, such as protecting topsoil from erosion and reducing on-site

leaks and runoff, can protect surface and ground water quality. Furthermore, adding vegetated covers provides habitat for wildlife populations and can assimilate nutrients in runoff.

Associated Documents: None

Non-Regulatory Efforts

National Fish Habitat Action Plan

Entity: National Fish Habitat Partnership

Jurisdiction: State

Summary: The National Fish Habitat Partnership has developed an online mapping tool that allows the user to view the risk of current habitat degradation for stream and coastal fish habitats. Portions of the Upper Snake River subwatershed and western Groundhouse River Subwatershed are categorized as Low to Very Low risk for habitat degradation. The remaining portions of the watershed are at Moderate risk, with the exception of the eastern portions of the Groundhouse River, Ann River, and Middle Snake subwatersheds, which are at High risk for habitat degradation.

Benefits: Identifying the level of risk for fish habitat degradation can allow the state to effectively and more efficiently target their limited resources towards protecting and preserving “low” risk waters, and restoring “high” risk waters from degradation.

Associated Documents: Online mapping tool

North American Landbird Conservation Plan

Entity: Partners in Flight

Jurisdiction: National

Summary: Partners in Flight (PIF) is a multi-national cooperative effort between federal, state, and local government agencies, foundations, professional organizations, conservation groups, academics, industry, and private individuals seeking to protect and restore bird populations in North and South America. The cooperative has developed a Conservation Plan and a 2012 Strategic Action Plan which identifies broad goals and objectives for full life-cycle landbird conservation and specifically identifies tasks to be achieved within the next three years.

Benefits: The objectives and goals set in the Strategic Action Plan allow PIF to focus resources on improving landbird monitoring, research, inventory, management and educational programs. If implemented effectively, the Strategic Action Plan will provide much needed baseline data on landbird populations, which will prove useful when implementing full life-cycle landbird conservation activities.

Associated Documents: PIF_Landbird_ConservationPlan, PIF_ActionPlan_2012

North American Waterfowl Management Plan

Entity: U.S. Fish and Wildlife Service

Jurisdiction: National

Summary: The North American Waterfowl Management Plan (NAWMP) is a commitment between the U.S., Canada, and Mexico to restore and manage wetland ecosystems for waterfowl, conserve biological diversity, and to promote sustainable economic development and protection. The goal of the NAWMP is to return waterfowl populations to those of the 1970s. In 2005 the NAWMP Committee conducted an assessment of the Plan's efforts and accomplishments and published a final report in 2007. The assessment found that coordination between various waterfowl and wetland protection groups has improved, and that protection programs have influenced more than 13 million acres of breeding, wintering, and migration habitat. The assessment also provided a variety of recommendations to improve the NAWMP including:

- Conducting a more targeted effort in the Prairie Pothole Region (partially in Minnesota, but outside of the Snake River Watershed)
- Implement agricultural programs and policies that favor retention and improvements to grassland and wetland habitats over large prairie areas.
- Plan for long-term security of key habitat areas.

A similar plan- the North American Waterbird Conservation Plan (NAWCP)- was developed by Waterbird Conservation for the Americas and co-authored by representatives of the U.S. Fish and Wildlife Service (USFWS). The NAWCP provides a framework and guide for conserving waterbird populations. More information on the NAWCP is available here: <http://www.waterbirdconservation.org/nawcp.html>.

Benefits: The NAWMP has been successful in engaging stakeholders and conservation professionals in the public and private sectors, working with landowners to preserve and enhance private land for waterfowl habitat. Preserving waterfowl habitat for all stages of their life cycle is key to protecting not only waterfowl populations, but also other birds and wildlife that reside in those areas as well. Preserved habitat also provides tourism and bird watching opportunities.

Associated Documents: FWS_NAWMP_2011-12_Plan, FWS_NAWMP_Assessment2007

Projected Climate and Land Use Change Impacts on Aquatic Habitats

Entity: Fish Habitat, Climate, and Land use Change

Jurisdiction: Midwest

Summary: This project, which had not been completed by the time this report was finalized, will identify rivers within the Great Lakes Partnership region that are most vulnerable to climate and land use change impacts. The project involves modeling fish habitat responses to climate change and land use conditions through changes in flow and temperature, which directly correlate with fish assemblages in the region. Final products will include the following for all rivers in the Midwest: maps of predicted temperature and flow regime under current and projected conditions; maps predicting the distribution of major sport fish species; and potential vulnerability ranking and shifts in major sport fish species.

Benefits: If this project includes a vulnerability ranking, this would allow the state and local jurisdictions to target resources towards protecting river reaches that may be most severely impacted by climate change and development. Sport fishing is a key economic activity in Minnesota and understanding how

and where climate change and development may have the greatest impact on fish assemblages can help the state work to preserve these communities and mitigate potential impacts.

Associated Documents: None

Strategic Plan for Fish Habitat Conservation in Midwest Glacial Lakes

Entity: Midwest Glacial Lakes Partnership

Jurisdiction: Midwest

Summary: The Midwest Glacial Lakes Partnership's (MGLP) mission is to protect and enhance fish habitats in the glacial lakes region of the Midwest through habitat protection. Steering committee members represent Minnesota's DNR, TNC, USFWS, USFS, USGS, and other state natural resource agencies. Key goals of MGLP are to prevent fish habitat degradation, improve water quality, and support natural diversity within lake ecosystems. To achieve these goals, MGLP developed a Strategic Plan to protect 10,000 acres of healthy, intact lake habitats and 40,000 acres of healthy watersheds; restore natural variability in 1,000 lake acres; and reduce sedimentation and nutrient runoff to lake habitats.

Benefits: Preserving natural lakes and their habitat is key to protecting fish populations and other aquatic life. Lakes with healthy fish populations and ecological diversity provide recreational fishing opportunities and revenue for local areas. Additionally, preserving water quality by minimizing sedimentation and nutrient loads to surface waters improves water clarity, which can benefit lakeshore property values.

Associated Documents: MWGLP_FishHabitatGlacialLakes

Technical Resources

Midwestern Fish Habitat Assessment Models

Entity: National Fish Habitat Partnership and Downstream Strategies, LLC

Jurisdiction: Midwest

Summary: This project, which was not yet completed when this report was finalized, involves the development of a GIS conservation decision planning tool allowing aquatic scientists to estimate the probability of restoration success for specific species or aquatic community indicators. The user has the ability to manipulate the most significant anthropogenic contributors within the model to determine outcomes.

Benefits: Once completed, states and counties can use results from the model to target funding towards water resources that have the greatest potential for restoration success, allowing for more efficient use of limited funding. Furthermore, protection activities in these areas will have the most benefit in terms of restoring water quality and the aquatic community.

Associated Documents: None

Watershed Forest Management Information System

Entity: University of Massachusetts at Amherst

Jurisdiction: National

Summary: The Watershed Forest Management Information System (WFMIS) is a spatial decision support system that evaluates and assists in forest protection planning, minimizing nonpoint source pollution, planning forest road maintenance, and silviculture planning and operations. The tool uses available GIS data such as land cover and topography, combined with field measurements for road-stream crossings and harvest units.

Benefits: The WFMIS allows states, counties, and other local jurisdictions to identify land parcels that are most important in terms of their conservation value and are significant as a source of clean water. The tool can also aid forest management planning and protection activities, and assist conservation managers in identifying priority areas for conservation easements or land purchases.

Associated Documents: None

State Protection Efforts

Funding Opportunities

Clean Water, Land and Legacy Amendment

Entity: Clean Water Fund and Outdoor Heritage Fund

Jurisdiction: State

Summary: In 2008, Minnesota passed the Clean Water, Land and Legacy Amendment. The purpose of the Amendment is to protect drinking water sources; restore and enhance surface and ground water; protect and restore wetlands, forests, prairies and wildlife habitat; and support parks and trails, arts and culture. The Amendment increases state sales tax by three-eighths of one percent, 33% of which is distributed to the Clean Water Fund, and 33% is distributed to the Outdoor Heritage Fund. The remaining funds are distributed to the Arts and Cultural Heritage Fund and Parks and Trails Fund.

Approximately \$85 million will be distributed to the Clean Water Fund annually until 2034. The Clean Water Fund Performance Report details appropriations for (a) protection/restoration activities, (b) drinking water protection, (c) monitoring/assessment, and (d) watershed restoration and protection strategies. In fiscal year 2010/2011, approximately nine water erosion BMPs and one other protection project (not specified) were conducted in the Snake River Watershed.

The Outdoor Heritage Fund focuses on restoring, protecting, and enhancing forests, wetlands prairies, as well as habitat for fish, wildlife and game. Efforts help prevent forest fragmentation and encourage forest consolidation. Each county within the Snake River Watershed has been affected by several Outdoor Heritage Fund projects: Kanabec (n=7), Aitkin (n=10), Pine (n=4), Mille Lacs (n=3), Isanti (n=5), and Chisago (n=7).

Also included under the amendment is the Conservation Partners Legacy Grant Program, which awards funding to projects focused on restoring or protecting fish, game, and wildlife habitats in the state. During Fiscal Year 2013, approximately \$3.5 million was awarded to such projects throughout the state.

Benefits: Benefits of the Clean Water, Land and Legacy Amendment touch on each of the six Healthy Watersheds Initiative elements: landscape condition, habitat, hydrology, geomorphology, water quality and biological condition. Specific benefits include protecting and enhancing wildlife habitat by improving habitat connectivity and/or expanding forested areas and protecting wetlands and prairies; protecting the natural shoreline and geomorphology of rivers, which provides improved aquatic habitat and provides flood control; controlling invasive species populations, and restoring previously diminished stream flows. Together, these benefits provide tourism revenue for the Snake River Watershed area through improved opportunities for fishing, hunting, and wildlife watching. Protecting riparian areas also improves surface and ground water quality, which may be used for recreational and/or drinking water purposes.

Associated Documents: CleanWaterFund_PerformanceReport

Environment and Natural Resources Trust Fund

Entity: Legislative-Citizen Commission on Minnesota Resources (LCCMR)

Jurisdiction: State

Summary: This constitutional amendment approved in 1988, dedicates funding from the Minnesota State Lottery and investment income to state protection projects. The goal of the Fund is to “protect, conserve, preserve, and enhance Minnesota’s air, water, land, fish, wildlife, and other natural resources.” The Six-Year Strategic Plan for the Environment and Natural Resources Trust Fund (ENRTF) provides both short- and long-term goals for Fund expenditures. Priority areas include (but are not limited to):

- Reducing land and water habitat fragmentation, degradation, loss, and conversion
- Improving land use practices
- Controlling and reducing the spread of invasive species
- Supporting improved natural resource data management, research, planning, and demonstration projects that protect ecological integrity and water resources
- Supporting community-based protection planning
- Promoting natural resource and environmental education
- Promoting fishing, hunting, and outdoor recreation

The LCCMR website also includes an online interactive map allowing the user to identify conservation easement land acquisitions and ENRTF funded fee titles since 2005 (<http://www.gis.leg.mn/gis/geomoose-lccmr/htdocs/>).

Benefits: Protecting wildlife and fishery habitat as well as water quality provides local economic opportunities for hunting, angling, recreation and tourism. Reducing habitat fragmentation is essential to sustaining a healthy wildlife community. Improving land use practices can prevent erosion and runoff to surface waters, and protect habitat for native species.

Associated Documents: LCCMR_ENRTF_StrategicPlan

Erosion Control and Water Management Program

Entity: Minnesota Board of Water and Soil Resources

Jurisdiction: State

Summary: The Erosion Control and Water Management Program, or State Cost-Share Program, provides funding to local SWCDs to implement practices such as erosion and sedimentation control, and water quality improvements to preserve soil and water resources. Landowners may request financial and technical assistance from their SWCD to implement protection activities.

Benefits: The Cost-Share Program provides needed funding for landowners to implement BMPs and measures to protect habitat and preserve water quality.

Associated Documents: None

Minnesota Prairie Conservation Programs

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: Prairie habitat once covered one-third of the state, or 18 million acres, though only 2% of the original prairie remains today. Minnesota has taken several approaches to protecting prairies, including developing a prairie restoration handbook for landowners, and the Minnesota Prairie Landscape Plan aimed at restoring, enhancing, and protecting native prairies, grasslands, and wetlands over the next 25 years. Specific strategies include:

- Protecting native prairie, selected grasslands, wetlands, and stream and shallow lake riparian areas, through ownership or conservation easements.
- Restoring prairies by minimizing fragmentation and connecting and buffering native prairies and associated habitats. Restoration will also pertain to previously drained wetlands.
- Enhancing natural disturbance regimes, including grazing and fire, which are key components of the prairie system by expanding grazing management and prescribed fire burning.

Prairie land owners may also enroll their land in the Native Prairie Bank Program, which protects the prairie either permanently or temporarily through conservation easements. Briefly, the landowner receives a payment for their native prairie land as long as it is privately owned and not developed. Landowners who use the land for grazing, mowing for hay, or harvesting are also eligible for the program. Detailed information on how to apply and payment amounts are provided here: <http://www.dnr.state.mn.us/prairierestoration/prairiebank.html>.

Landowners of protected prairie land are also eligible for a property tax exemption on that parcel of land through the state's Native Prairie Tax Exemption Program. To be eligible for the program, the parcel must be dominated by native prairie vegetation with limited to no tree cover; not be used for pasture; be at least five acres; and never have been cultivated, plowed, reseeded, or severely altered. Further information is available here: <http://www.dnr.state.mn.us/prairierestoration/taxexemption.html>.

Benefits: Preserving prairie land protects grasslands and wetlands that provide essential habitat to native species. Protected land also provides economic and recreational benefits associated with tourism from wildlife watching, angling, and hunting. The plan also calls for expanding perennial crops, which

provide for sustainable and wildlife-friendly agriculture, and sustainable grazing and haying opportunities.

Associated Documents: DNR_NativePrairieMap, DNR_PrairieConservationPlan.

Regulatory Efforts

Snake River Watershed Restoration and Protection Strategy

Entity: Minnesota Pollution Control Agency

Jurisdiction: State

Summary: MPCA is currently collaborating with other state agencies and local organizations to develop the Snake River Watershed Restoration and Protection Strategy (WRAPS). A WRAPS is a technical document that incorporates results from the state's water quality assessment, watershed analysis, planning, implementation, and measurement of results into a 10-year timeframe that addresses both protection and restoration strategies for the watershed.

Benefits: The WRAPS will provide a visually-oriented document that can assist agencies, local governments, and watershed stakeholders in determining how and where to most effectively implement watershed protection and restoration activities. In addition, the WRAPS process is an example of an effort that involves collaboration between multiple state agencies.

Associated Documents: None

Public Water Works Permit Program

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The Public Water Works Permit Program regulates water development activities such as filling, shore protection, excavation, bridges and culverts, water level controls, dams, and dredging.

Benefits: The Public Works permitting process is a critical component of protecting water resources. The program helps to ensure proper placement and sizing of structures such as dams and culverts, which can impede fish passage. The program also helps to minimize impacts from filling and excavation activities on water resources.

Associated Documents: None

Minnesota Floodplain Management Act

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The Floodplain Management Act, enacted in 1969, promotes sound land use development in floodplains throughout the state. Individual communities which are prone to floods are required to

adopt floodplain management regulations. Similarly to the federal standards, the state standards identify the 100-year floodplain as the minimum area needed for regulation at the local level.

Benefits: Floodplains are dynamic systems, which, when preserved in their natural state, provide both environmental and economic benefits. Preserving floodplains allows for the native vegetation to assimilate nutrients and filter pollutants from runoff during heavy storm events. They also minimize flooding damage to local communities and provide rich nutrients to the waterbody after flooding events. Preserving the natural process is often less costly than building infrastructure to handle excessive stormwater, restore water quality, and minimize flooding. Floodplains are also scenic areas and provide for recreational activities including hunting and bird watching.

Associated Documents: None

Minnesota Shoreland Management Act

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: Minnesota has statewide shoreland management standards, which apply to all lakes that are greater than 25 acres and rivers that have a drainage area of more than 2 square miles. The standards apply to shoreland use and development including: minimum lot size and water frontage, land use, BMPs, shoreland alterations, sanitary code, and building setbacks, among others. All land within 1,000 feet of a lake and 300 feet of a river and its designated floodplain are regulated under the Act.

Benefits: Protecting shoreland preserves habitat for native species and reduces pollutant loading to recreational and drinking waters. The preserved shoreland and associated waterbodies also provide opportunities for fishing, hunting, and wildlife viewing.

Associated Documents: None

Minnesota Wetland Conservation Act

Entity: Minnesota Board of Water and Soil Resources

Jurisdiction: State

Summary: The Wetland Conservation Act is designed to maintain and protect wetlands and the ecological services they provide. The state's goal is a no-net-loss of wetlands and requires persons proposing to fill, drain, or excavate a wetland to minimize impact (if avoiding disturbance is not possible), and replace any lost wetland acres, functions, and values. Some projects with minimal impact may be exempted from the Act. The state legislature approved the Act in 1991, and it has since been amended on several occasions.

For counties that have greater than 80% of their pre-settlement wetlands still intact and in their natural state, the local SWCDs play a role in administering wetland rules. This applies to the following counties within the Snake River Watershed: Aitkin County (91.1% remaining), Kanabec County (87.0% remaining), Mille Lacs County (90.3% remaining), and Pine County (92.1% remaining). Below are links to each county's wetland rules:

Aitkin County- <http://www.co.aitkin.mn.us/Ordinances/WetlandOrdinanceFinalToRecorder.pdf>

Kanabec County- http://kanabeccounty.govoffice2.com/index.asp?Type=B_BASIC&SEC=%7B561C8625-88F5-4685-8835-B973ED8B1A0A%7D&DE=%7B7118B520-737B-4EF2-8862-FBB81004096D%7D

Mille Lacs County- http://www.co.mille-lacs.mn.us/index.asp?Type=B_BASIC&SEC=%7B7E63A77A-DD0B-4D0A-BA33-C616F2DEEAA0%7D

Pine County- http://www.co.pine.mn.us/index.asp?Type=B_BASIC&SEC=%7BDBB91E9C-CE83-4E61-A74E-96E3B232C325%7D

Benefits: Wetlands provide a variety of ecological services such as filtering pollutants, protecting shoreline, recharging ground water, and retaining storm water runoff to protect both surface water and ground water and minimize flooding. Wetlands can also have a strong nutrient assimilation capacity, reducing nutrient loading to downstream waters. Wetlands provide habitat for birds and other native terrestrial animals, and can provide recreational opportunities such as hunting, wildlife viewing, canoeing, birding, and angling.

Associated Documents: None

Source Water Protection

Entity: Minnesota Department of Health and local municipalities

Jurisdiction: State

Summary: Minnesota has a source water protection program, which includes wellhead protection, source water assessments, and surface water intake protection. The program is designed to protect drinking water supplies from potential contamination. The City of Mora, in Kanabec County, has developed Part I of a Wellhead Protection Plan and is in the process of developing Part II of the Plan. The Plan discusses delineating Wellhead Protection Areas (WHPA) and Drinking Water Supply Management Areas (DWSMA) to protect drinking water supplies. The Plan also provides an assessment of well and DWSMA vulnerability. For source water and wellhead protection efforts, all three municipal wells in Mora have been classified as vulnerable. The town of Hinckley has also developed a Wellhead Protection Plan, though the document is not currently available. The town of Ogilvie is in the process of developing their Wellhead Protection Plan.

Benefits: Delineating WHPAs and DWSMAs is one of the first steps towards protecting public drinking water supplies by managing sources of pollution within the area that supplies water to the well. Protecting public water supplies from contamination protects public health and also avoids potential expenses from treating polluted water or drilling new wells.

Associated Documents: Mora_WellheadProtection

State Water Quality Standards and TMDL Program

Entity: Minnesota Pollution Control Agency

Jurisdiction: State

Summary: Waterbodies throughout Minnesota are designated for particular uses (e.g., aquatic life, drinking water use), which establish water quality goals for those waterbodies. To protect those designated uses under the Clean Water Act, Minnesota derives and adopts water quality standards

which determine allowable levels of pollutants, and serve as the regulatory basis for management actions like attainment decisions (i.e., whether the waterbody is impaired), TMDLs, and National Pollutant Discharge Elimination System (NPDES) permit limits. Impaired waterbodies are restored through the development of TMDL's which set the maximum allowable pollutant concentration while still maintaining the designated use.

Benefits: Several segments within the Snake River Watershed are listed as impaired for various pollutants. Associated water quality standards and TMDLs will help restore those impaired waterbodies.

Associated Documents: None

Non-Regulatory Efforts

Department of Natural Resources' Strategic Conservation Agenda

Entity: MN Department of Natural Resources

Jurisdiction: State

Summary: The DNR's goals are to conserve and enhance Minnesota's water, natural resources and wildlife habitat, protect fish and wildlife populations, and provide for outdoor recreational activities. The Strategic Conservation Agenda outlines the DNR's goals and strategic directions. Broadly, these include: providing private and community land protection assistance, integrating approaches for managing private and public land, providing water and watershed protection, and mitigating and adapting to, climate change.

The DNR's water resource protection goals are to:

- Protect natural characteristics of wetlands, shorelands, and aquifers
- Restore previously disrupted stream flow where possible
- Control point and nonpoint source pollution
- Control invasive species
- Conserve water resources

The DNR's natural land and habitat goals are to:

- Ensure that wildlife habitats are connected by natural corridors
- Augment Minnesota's forested land area
- Protect native prairies, grasslands, and riparian forest through easements, donations, and purchases
- Restore degraded habitat
- Enroll marginal cropland in long-term conservation easement programs
- Create strong conservation partnerships to enhance fishing, hunting, wildlife viewing opportunities
- Enhance fish and wildlife populations and habitats

Benefits: Benefits of the DNR's Strategic Conservation Agenda touch on each of the six Healthy Watersheds Initiative elements: landscape condition, habitat, hydrology, geomorphology, water quality and biological condition. Creating partnerships across the private and public sector promotes protection activities that meet multiple needs such as improved hunting and fishing opportunities while simultaneously enhancing native species populations and their habitats. Restoring previously disrupted stream flow restores sediment and nutrient flow through the system; provides for natural fluctuations in flow which nourish floodplains and improve habitat viability; and improves fishery productivity thereby supporting sport and commercial fishing. Water resources are also protected under the plan, providing drinking water and general water quality protection.

Associated Documents: DNR_StrategicConservation

Livestock Environmental Quality Assurance Program

Entity: Minnesota Department of Agriculture (MDA)

Jurisdiction: State

Summary: The Livestock Environmental Quality Assurance Program helps livestock producers address water quality issues on their farms and achieve environmental goals. Farmers may enroll in the program and trained technicians develop an environmental assessment and identify financial assistance for improvement projects. Examples of farm aspects that are included in the assessment are: waterbody management, wildlife habitat, waste disposal, water run-on and runoff, feed and manure storage, and wildlife benefits of forested and wooded areas on the farm. Since 2010, 105 livestock producers voluntarily registered for the program. Assessments on the farms found 728 resource concerns, and protection activities were applied to 65% of them. Concerns ranged from manure storage and management, to stream buffer strips, to soil quality improvements. The program provides \$150,000 annually to livestock producers and is funded through the Clean Water Fund.

Benefits: Agricultural activities often represent a substantial portion of nonpoint source runoff to surface waters. The program protects recreational and drinking water quality and minimizes soil loss and runoff, which can impact water clarity and quality. Implementing protection activities also provides landowners with valuable marketing opportunities.

Associated Documents: MDA_LivestockEnvQA

Managing Minnesota's Shallow Lakes for Waterfowl and Wildlife

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The Shallow Lake Program Plan provides goals and objectives for managing Minnesota's shallow lakes, which provide key habitat for ducks. The goals are designed to help meet the objectives of the Long Range Duck Recovery Plan, which identifies a 50-year strategic approach to protect, manage, and restore Minnesota's duck breeding and migration population. The Shallow Lake Program Plan objectives include:

- Assessing shallow lake habitat conditions.

- Maximizing management of the 200 shallow lakes within the state's Wildlife Management Areas, federal Waterfowl Production Areas, National Wildlife Refuges, and state Designated Wildlife Management Lakes for optimal waterfowl habitat.
- Maximizing management of the 1,553 shallow lakes that are partially owned by the state, federal, or local entities, and designating an additional 30 lakes.
- Increasing wildlife management of the 201 shallow lakes that have public access, particularly those that are already designated as Migratory Waterfowl Feeding and Resting Areas or have wildlife habitat.
- Increasing public awareness of the natural resource, historic, and cultural benefits of wild rice and protecting lakes containing natural stands of wild rice.

Benefits: Preserving shallow lakes protects waterfowl breeding and migration habitat, preserves lake water quality, provides waterfowl hunting and watching opportunities, and preserves natural landscape conditions.

Associated Documents: DNR_shallowlakesplan

Minnesota Conservation Apprenticeship Academy

Entity: Minnesota Board of Water and Soil Resources (BWSR)

Jurisdiction: State

Summary: The Minnesota Conservation Apprenticeship Academy involves recruiting and training future conservationists from Minnesota universities. Through the program, conservation professionals work with students to transfer knowledge and experience to the next generation responsible for Minnesota's conservation. The program began in July 2010 and will end in June 2013.

Benefits: Training the future generation of conservationists is essential to the long-term preservation and conservation of Minnesota's forests, grasslands, prairies, and water resources. Additionally, cross-generational collaboration can stimulate the development of new ideas and methods to improve conservation efforts in the state.

Associated Documents: None

Minnesota Forests for the Future Program

Entity: MN Department of Natural Resources

Jurisdiction: State

Summary: The Forest Legacy Advisory Team was formed by the DNR to develop a strategy for protecting state forests and optimizing their value and use. The Team recommended creating the Minnesota Forests for the Future Program that would collaborate with the private and public sector to use conservation easements, among other tools, to retain the state's forests. Other recommendations include: focusing the Program on public forests that provide exceptional recreational access, timber production and other economic activities, and ecological values; applying easements, fee title acquisition, land exchanges, tax policies and cost-share programs to meet forest protection goals; and providing a reliable funding mechanism to maintain a forest easement stewardship program.

The Minnesota Forest Legacy Program is part of Forests for the Future, and uses state and federal funds to purchase permanent conservation easements to protect private forested areas in targeted areas of the state. While the land is designated for permanent protection, the landowner retains ownership and can continue to use the forested land for recreation and timber production.

Benefits: Retaining forests provides for sustainably produced timber products, public recreation opportunities, and wildlife habitat with reduced fragmentation. Preserving forests also improves soil health, as well as air and water quality. At the time this report was produced, forested areas within the northwestern portion of the watershed (Mille Lacs Lake Area) were considered Candidate Forest Legacy Areas, but no land areas within the watershed were Eligible Forest Legacy Areas (i.e., land parcels eligible for funding under the Forest Legacy Program). An area must be “activated” to be eligible for federal funds, but will still qualify for state funds. This program can be used to expand protections to forested areas, providing habitat and recreational opportunities.

Associated Documents: ForestsfortheFutureReport_2008

Minnesota Water Availability Assessment Report

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: Understanding water availability in the state of Minnesota depends upon anthropogenic impacts to water quality, water use and alterations to flow paths, and impacts from climate change and weather patterns. To determine long-term water availability and sustainability, the DNR developed an in-depth assessment based on current water resources relative to quantities and trends in water supplies. The report includes a variety of state-wide maps allowing for the evaluation of trends of climate, surface and ground water, and water use during the previous ten years compared to long-term historic trends.

Benefits: The report found that deeper aquifers in metropolitan areas are continuing to decline and that future water supply from such aquifers in the future will be limited if trends continue. Assessing water availability is critical to determining where and when to implement water conservation strategies.

Associated Documents: DNR_WaterAvailability

Minnesota Wildlife Action Plan

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: As required by Congress under the Conservation and Restoration Program and the State Wildlife Grants Program, each state, including Minnesota, has created a comprehensive wildlife protection strategy. Minnesota’s Wildlife Action Plan, “Tomorrow’s Habitat for the Wild and Rare,” evaluates state wildlife protection needs, particularly for species in greatest conservation need (SGCN), and details necessary action steps. SGCN are native animals whose populations are declining, rare, or vulnerable, and are below levels that ensure long-term stability and survival. The goals of the Plan are to: (1) stabilize and increase populations of SGCN; (2) improve knowledge about SGCN; and (3) enhance the general population’s appreciation for SGCN. Priority protection efforts that have been implemented include:

- Completing the Minnesota Biological Survey
- Conducting a statewide mussel survey and restoring rare mussel species populations
- Identifying sensitive shoreline, or shorelines that are important to rare species
- Restoring and enhancing of prairies- particularly those that support SGCN

Benefits: Conducting a complete biological resource survey allows the state to identify which species may be vulnerable to development pressures and in greatest need for protection. Identifying SGCN habitats allows the state to target resources towards protecting priority areas that will enhance species populations, reduce fragmentation, and also provide wildlife viewing opportunities for locals and tourists.

Associated Documents: DNR_WildlifeConservationPlan

Northeast Minnesota Wetland Mitigation Inventory and Assessment

Entity: Minnesota Board of Water and Soil Resources

Jurisdiction: Northeast Minnesota

Summary: The wetland mitigation inventory was developed to identify areas where wetlands may be replaced and still provide benefits such as stormwater retention, pollutant filtration, water quality protection, fish and wildlife habitat, and ground water recharge. The inventory assessment includes all counties in the Snake River Watershed except Chisago. An online mapping system allows users to identify locations of farmed, partially or fully drained wetlands, invasive species locations, trout streams, impaired waterbodies, and private and public lands.

Benefits: Developing an inventory of wetland mitigation sites can facilitate permit compliance by identifying where wetlands may be replaced. Wetlands provide vital ecosystem services such as stormwater retention, pollutant filtration, water quality protection, fish and wildlife habitat, and ground water recharge. Importantly, replacement wetlands may not always achieve full service and can require long-term monitoring and maintenance.

Associated Documents: BWSR_WetlandMitigation_2010

Scientific and Natural Areas Program

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The purpose of the Scientific and Natural Areas (SNA) Program is to protect Minnesota's ecological diversity, rare and endangered species, and natural landforms for public education and scientific study. The Program involves protecting land areas, promoting education and research, producing publications, and coordinating with private landowners to ensure protection of key areas. The SNA Program set a Long Range Plan in 2004, aimed at protecting through SNA designation "three locations per region of each rare species, plant or animal, and geological feature" and "five locations of plant communities known to occur in each landscape region." More than 40% of the potential SNAs are estimated to be in prairies, with the remaining potential SNAs in the deciduous and coniferous forest habitat areas. The SNA website includes an online interactive map which allows the user to identify SNAs

throughout the state. Kettle Lake, within the Snake River Watershed in Pine County is designated as an SNA.

Benefits: Designating areas as SNAs provides a wealth of scientific research and public education opportunities. The designated areas also provide extensive recreational opportunities such as hiking, wildlife watching and photography, snowshoeing, angling, hunting, dog walking, and canoeing. Protecting SNAs from development also protects wildlife habitat and reduced fragmentation.

Associated Documents: DNR_SNA_LongRangePlan

Aquatic and Wildlife Management Areas

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The Aquatic Management Area and Wildlife Management Area programs allow for the acquisition and protection of critical aquatic and terrestrial habitat. These areas are available for public use for educational purposes, wildlife viewing, hunting, fishing, and other recreational activities.

In 1991, the state legislature created the Aquatic Management Area program under the Outdoor Recreation Act. The Aquatic Management Area Acquisition Plan sets short-term (2008-2017) and long-term (2018-2032) goals and recommends that the state ultimately acquire for public ownership and protection, 72% of the 5,508 miles of coldwater stream habitat, and 39% of the 64,000 miles of lake and warmwater shorelands in the state.

Benefits: Preserving critical habitat areas through these programs helps sustain healthy biological communities while simultaneously providing economic revenue to the state and local area from tourism and recreational activities.

Associated Documents: DNR_AquaticAreaAcquisition

Minnesota Statewide Mussel Survey

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: DNR is conducting a statewide survey to document the mussel community in threatened and minimally-surveyed rivers in Minnesota. All data collected through the survey will be inventoried in DNR's Natural Heritage Information System. Data from the assessment will be used to protect the state's mussel species, educate the public about their importance to Minnesota's ecosystems, and identify watershed success stories.

Benefits: The Snake River Watershed provides quality habitat for freshwater mussel species and they are a critical component of the local ecosystem. The mussel populations within the Snake River Watershed are at risk due to impacts from development and the potential threat of invasive mussels, such as the zebra mussel. The statewide mussel survey will help document their location within watersheds and allow for more targeted use of resources to implement activities to protect these species.

Associated Documents: None

Statewide Conservation and Preservation Plan

Entity: Legislative-Citizen Commission on Minnesota Resources

Jurisdiction: State

Summary: The Statewide Conservation and Preservation Plan (2008) provides an inventory and assessment of Minnesota's natural resources and provides recommendations for land use, transportation, habitat, and energy production and use in the state. Developing the Plan involved integrating datasets to identify priority areas throughout the state in most need of protection or planning, which are discussed in the report and displayed on maps. Example maps include areas of critical and vulnerable habitat and biodiversity, erosion potential, and vehicle miles traveled to determine the need for transportation planning. The Plan also includes a cost-benefit analysis for various recommended conservation strategies, such as wetland restoration.

Benefits: The Plan will help direct expenditures from the Minnesota Environment and Natural Resources Trust Fund and also guide decision makers on short- and long-term conservation and planning policies. Implementing the conservation plan will preserve habitat for native species and reduce habitat degradation, fragmentation and loss.

Associated Documents: LCCMR_StatewideConservationPlan

Water Sustainability Framework

Entity: University of Minnesota's Water Resources Center

Jurisdiction: State

Summary: Funded by Minnesota's Clean Water Fund, the Water Sustainability Framework was developed to determine how to restore/maintain sustainable water use in the state. Sustainable water use is defined as that which "does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs." The final Framework report details how sustainable water use may be achieved and provides recommendations for meeting key challenges. Specifically, the Framework recommends five actions that must be taken in order to achieve water sustainability:

- Revise water appropriations permitting to include a sustainability threshold for extractions based on flow regimes, and model the state's water balance
- Comply with water quality standards through implementation plans for reducing pollutants and engage farmers in the process
- Address future contaminants (i.e., contaminants of emerging concern)
- Integrate water and land use planning
- Align water, energy, transportation, and land policies for sustainability

Benefits: Achieving sustainable water use will allow for adequate water availability for aquatic life, drinking water, agriculture and industrial uses, infrastructure needs, and mining. Sustainably managing water resources, such as stormwater, can prevent degradation of surface and ground waters, enhance water quality, and minimize stormwater treatment costs. Sustainable water use also provides for healthy and resilient ecosystems and adequate water supplies in aquifers.

Associated Documents: WaterSustainabilityFramework

Woodland Stewardship Plan

Entity: Minnesota Forestry Association (MFA)

Jurisdiction: State

Summary: To preserve forested habitat and terrestrial connectivity, the MFA encourages landowners to develop Woodland Stewardship Plans with the help of an expert in the field. The plans provide landowners with an assessment of available habitat and goals to retain ecological diversity, plant trees, and enhance habitat. The preparer of the plan can help the landowner in taking the next steps to implement the plan and educate the landowner about any available cost-share programs. Owners of 20 to 1,000 acres of land that are at least 10% wooded, as well as corporations whose stocks are not publicly traded, are eligible for a plan. The cost of the plan varies depending on the size of the lot but ranges from \$230 to \$1000.

Benefits: The Woodland Stewardship Plans educate landowners about the habitat on their land, the value of the timber, and identify areas at risk for soil erosion. Landowners with Plans have the ability to plant more trees where appropriate, build trails, prune high-value trees, increase their income through harvesting timber, maintain ecological diversity and enhance habitat for native species. Preserving the forested land also protects nearby surface water quality and ground water quality by reducing stormwater runoff and assimilating nutrients. Retaining forested areas along riparian zones prevents erosion and reduces the impacts of sedimentation.

Associated Documents: None

Clean Water Partnership and Section 319 Program

Entity: Minnesota Pollution Control Agency

Jurisdiction: State

Summary: The state's Clean Water Partnership and Section 319 Program offer state and federal funding, respectively, to address nonpoint source pollution. The funds may be used to implement TMDLs as well as to protect unimpaired waterbodies from degradation.

Benefits: Nonpoint sources of pollution represent the largest threat to water quality in Minnesota, and this program assists water resource managers in minimizing its impact.

Associated Documents: None

Technical Resources

Ecological Ranking Tool

Entity: Minnesota Board of Water and Soil Resources and the University of Minnesota

Jurisdiction: State

Summary: The Ecological Ranking Tool was funded by the Environment and Natural Resources Trust Fund. The Tool combines wildlife habitat, surface water quality, erosion potential and runoff potential GIS layers to create an Environmental Benefits Index (EBI). Within the Snake River Watershed, the Tool

has been used to identify and prioritize the top 5% and 10% of lands that impact water quality, have a high potential for erosion, and also have the greatest benefit for habitat. For each county, the Tool identifies areas of cultivated land with high EBI scores, allowing the state to better allocate resources.

A separate economic model for Conservation Reserve Program (CRP) parcels has also been developed. The economic model incorporates data such as soil productivity, current subsidies, and commodity prices to predict CRP re-enrollment. Specifically, the model helps determine which land owners of CRP parcels are likely to re-enroll in the program given current prices and costs.

Benefits: The Ecological Ranking Tool prioritizes surface water protection areas and key habitat zones, allowing the state to target resources and funds appropriately. Used in combination with ancillary data, the Tool can become more powerful in identifying specific areas that are of high risk but provide the most benefit. Prioritizing areas for protection ultimately saves state resources, enhances fish and wildlife habitat for recreational and tourism opportunities, and improves water quality for aquatic life and drinking water uses.

Associated Documents: BWSR_SnakeEBI, BWSR_EcoRankingTool, BWSR_EcologicalRanking_Report.

Forests, Water and People Analysis

Entity: U.S. Forest Service

Jurisdiction: State

Summary: The Forests, Water and People Analysis identifies private forests that are most beneficial for drinking water supplies and are in the most need of protection from development. Priority forests were identified by using nine GIS layers: forested land, agricultural land, riparian forest cover, road density, soil erodibility, 2000 housing density, change in housing density, surface water consumers, and private forests. The Snake River Watershed has a score of 21 of 40 in terms of development pressure on private forests that are important for drinking water supply protection. This ranks the Snake River Watershed as 264 of 540 watersheds in the state (note that because multiple watersheds have the same score, multiple watersheds also have the same rank order). A factsheet for Minnesota specifically, includes maps showing the ability of each watershed to produce clean drinking water, and also demonstrates development pressure on private forests in drinking water supply watersheds. The Snake River Watershed is considered to have a moderate to high (8 of 10 score) ability to produce clean water.

Benefits: The Forests, Water and People Analysis allows the state to target funds towards forested areas that are key to the preservation of surface and ground water drinking water resources. Protecting forested land in watersheds that provide drinking water provides a filtration mechanism for pollutants from runoff and atmospheric deposition, thereby improving water quality and minimizing treatment costs. Preserving large swaths of forests also retains connectivity, which is essential to wildlife viability.

Associated Documents: USFS_ForestsWaterPeople_MNfactsheet, USFS_ForestsWaterPeople_FinalReport2009.

Minnesota Biological Survey

Entity: Minnesota Department of Natural Resources

Jurisdiction: State

Summary: The Minnesota Biological Survey collects, interprets, and delivers baseline data on the distribution and ecology of rare animals and plants, native plant communities, and functional landscapes. GIS shapefiles and PDFs of native plant communities and rare species are available for Isanti and Chisago counties. Shapefiles only, are available for Mille Lacs and Kanabec counties.

Benefits: Identifying native plant communities and rare species habitats for each county allows the state and counties to allocate their conservation funds towards protecting these priority areas from development and degradation. These areas may also provide wildlife watching opportunities for residents and tourists.

Associated Documents: None

National Land Transformation Model

Entity: Dr. Bryan Pijanowski, Purdue University

Jurisdiction: State

Summary: The National Land Transformation Model was used to develop maps displaying projected urban and agricultural land use for the years 2010 to 2105 in five year increments. Land use estimates are based on the 2001 National Land Cover Dataset. Findings from the analysis were published in the Journal of Land Use Science paper “Hierarchical modeling of urban growth across the conterminous USA: developing meso-scale quantity drivers for the Land Transformation Model” and is available for purchase.

Benefits: Projecting land use and population growth across Minnesota can help the state account for population growth when implementing conservation activities and working towards protecting habitat through land acquisitions and easements.

Associated Documents: Each file is available online, though data for the year 2040 has been downloaded as the file: US_2040_UrbV1

Precision Conservation Initiative

Entity: Minnesota Department of Agriculture

Jurisdiction: State

Summary: The Precision Conservation Initiative disseminates conservation targeting tools, including digital terrain (Lidar) analysis techniques, to help conservation professionals target funding for priority areas to improve water quality. Using the digital terrain analysis provides information about hydrological, geomorphological, and biological features, and can significantly reduce the amount of time and resources needed to identify priority areas, or areas in critical need of protection, within the state.

Benefits: The tools developed by the initiative allow conservation professionals to direct funds towards implementing effective conservation practices in priority areas throughout the state. Using the Lidar data can help water resource professionals determine treatment needs and costs, more effectively and

efficiently apply funding, and improve project outcomes. Lidar data are currently available for Kanabec, Mille Lacs, and Isanti counties, within the Snake River Watershed.

Associated Documents: GIS layers are available online

Upper Mississippi River Forest Partnership

Entity: U.S. Geological Survey and U.S. Forest Service

Jurisdiction: Southeastern portion of Minnesota (Mississippi River Watershed)

Summary: The Upper Mississippi River Forest Partnership (UMRFP) is formed by state foresters from Minnesota, Illinois, Indiana, Iowa, Missouri, and Wisconsin. The purpose of the UMRFP is to promote sustainable forest management, and target tree and forest restoration and protection efforts. Bird habitat and water quality preservation is a key focus of the partnership and maps of priority forests for protection as well as bird habitat maps for bottomland, upland, grassland, and shrubland migratory birds, have been developed.

The UMRFP developed an Action Plan (2009-2013) to strengthen coordination among the organizations working on sustainable forestry. The UMRFP also plans to develop and implement pilot projects in target watersheds and provide public educational opportunities to address key watershed issues. The Action Plan contains an appendix of specific objectives and program accomplishments achieved during 2004-2008.

Benefits: Preserving habitat in the Upper Mississippi River Basin, which contains one of the largest expanses of flood plain native plant communities in the country, is synonymous with protecting birds and endangered species in the area. Efforts under the UMRFP allow for states to target their resources towards areas that provide essential bird habitat. Restoring and protecting the native bird community allows for bird-watching opportunities and recreational activities in forested or prairie land. Preserving forests and prairies provides natural filtration for runoff and atmospheric deposition, thereby protecting water quality that may be used for drinking water and recreational opportunities.

Associated Documents: USFS_UMRS_09-13ActionPlan, USFS_UMRS_BirdHabitat, USFS_UMRS_FloodplainBluffs, USFS_UMRS_MigratoryBird, USFS_UMRS_PriorityForests2007, USFS_UMRS_PriorityForests2009, USFS_UMRS_RiparianBuffers, USFS_UMRS_bottomlandBirdHabitat_Map, USFS_UMRS_GrasslandBirdHabitat_Map, USFS_UMRS_PriorityForests_Map, USFS_UMRS_ShrublandBirdHabitat_Map, USFS_UMRS_UplandBirdHabitat_Map, USFS_UMRS_UplandHabitat.

Watershed Health Assessment Framework

Entity: Minnesota Department of Natural Resources

Jurisdiction: Snake River Watershed (and state)

Summary: The Watershed Health Assessment Framework provides an overview of the ecological health of each of the state's major watersheds, including the Snake River Watershed. The Framework provides Watershed Health Scores for each of the state's watersheds based on a series of ecological health indicator variables including hydrology, geomorphology, biology, connectivity, and water quality. The Snake River Watershed has a mean score of 62 out of 100 (indicating a relatively minimally impacted watershed compared to others in the state), with the lowest scores received in the areas of aquatic and

terrestrial habitat connectivity. Importantly, the Framework uses the 2002 impaired waters list and other older data that are in need of updates.

Benefits: Determining the relative ecological health of watersheds across Minnesota, allows the state to identify watersheds that are minimally impacted and are in need of protection, versus watersheds that are severely impacted and may be resource-intensive to restore. Results from the Snake River Watershed assessment indicate that funds may be targeted towards activities that protect aquatic and terrestrial habitat connectivity, which impact a myriad of other ecological indicators such as water quality, water clarity, and native species viability.

Associated Documents: DNR_SRW_HealthAssessment

Watershed Protection Efforts

Regulatory Efforts

County Shoreland Management Ordinances

Entity: Soil and Water Conservation Districts for each county

Jurisdiction: Aitkin, Chisago, Isanti, Kanabec, Mille Lacs, and Pine counties.

Summary: Recognizing that shoreland development poses a threat to water quality, general welfare, and public health, each county within the Snake River Watershed has developed a shoreland protection ordinance. Shorelands are defined as the “land located within the following distances from public waters: 1,000 feet from the ordinary high water level of a lake, pond, or flowage; and 300 feet from a river or stream, or the landward extent of a floodplain designated by ordinance on a river or stream, whichever is greater.” The ordinances help to ensure more controlled use and development of shorelands and prevent water quality degradation. Note that the shoreland ordinance for Isanti County could not be located on the county’s website. However, references to this ordinance are made in the county’s water management plan (see document entitled “Isanti_WaterManagementPlan.”)

Benefits: Protecting shoreline areas helps prevent erosion and protects water quality. Importantly, protecting the vegetation around shorelines minimizes pollutant loading from runoff and provides shade which can help stabilize stream or lake temperature. Shade also limits light availability and may help control or minimize algae growth, particularly in shallow waterbodies. Protected shorelines have aesthetic benefits as well and may improve housing property values and increase local tourism revenue.

Documents: Aitkin_Ordinance_Shorelands, Chisago_Ordinance_Shorelands, Kanabec_Ordinance_Shorelands, Pine_Ordinance_Shorelands.

County Subdivision Ordinance

Entity: County Soil and Water Conservation District

Jurisdiction: Mille Lacs County

Summary: The Mille Lacs County subdivision ordinance recommends that, when necessary, buffer strips and conservation easements be created to protect the edges of wetlands. Other counties within the watershed also have subdivision-type ordinances, though a detailed review was not conducted.

Benefits: Vegetated areas along wetlands serve as natural filters for pollutants, including metals and nutrients, and prevent erosion. Preserving the riparian area of wetlands also helps ensure that the wetlands remain in-tact and can continue to provide habitat for wildlife and effectively filter pollutants from runoff. Retaining wetlands also minimizes stormwater runoff, which reduces pollutant loading to surface waters and minimizes stormwater treatment costs.

Associated Documents: MilleLacs_Subdivision

Non-Regulatory Efforts

County Water Management Plans

Entity: Soil and Water Conservation Districts for each county

Jurisdiction: Aitkin, Chisago, Isanti, Kanabec, Mille Lacs, and Pine counties.

Summary: Each of the six counties within the Snake River Watershed has a Water Management Plan. The plans identify existing and potential future issues and opportunities for water resource protection, management and development. Consistent among the plans are concerns regarding impaired waters and the cumulative impacts of development, as well as the need for continued public education and implementation of BMPs. Because nearly all of Kanabec County is within the Snake River Watershed, all of the objectives and goals apply to the Snake River Watershed. A summary of the goals and objectives for each county are below:

Aitkin (2009-2014)- Coordinate stormwater management plans among jurisdictions within the county; protect riparian areas by promoting no mow zones on waterfronts and wetlands and providing public workshops; seal abandoned wells to protect ground water quality; develop a plan for lake users to evaluate the presence/absence of endangered and invasive species.

Chisago (2010-2013)- Reduce phosphorus loadings to the St. Croix River from the county to help meet the 20% basin-wide goal; implement practices and projects recommended by TMDLs; seal abandoned wells to protect ground water quality; conduct public education and training on water quality in the county; require all septic system owners to register their systems with the county and empty their tanks every three years (per recommendations from the county's Waste Water Task Force).

Isanti (2006-2015)- Consider natural resources and habitat when guiding new development; promote BMPs and continue public education and compliance with stormwater rules to improve stormwater quality; preserve habitat areas and restore wetlands to help improve water clarity in county lakes and rivers; implement land use practices to minimize anthropogenic impacts on natural resources.

Kanabec (2007-2016)- Protect shorelands by implementing 4-5 feedlot/shoreland restoration projects annually; maintain drainage ditches on existing and new roads, which will involve developing an inventory of all ditches within the county; protect ground water quality by replacing up to 100 existing non-compliant septic systems, sealing between 10-20 wells, and funding 250 water tests for homes with newborns; continue to fund public education campaigns pertaining to hazardous and solid waste. Kanabec County also recently requested input on priority concerns and actions for their Water Management Plan update. Top concerns included: protecting ground water drinking water sources; sealing unused wells; and developing a local ground water quality database.

Mille Lacs (2006-2016)- Encourage development practices and patterns that maintain, protect, or enhance surface and ground water quality; support the SRWMB in encouraging BMP implementation to improve water quality; develop a GIS to assist in mapping development activities and natural resources

to better assess potential impacts; encourage use of wetland buffers; provide guidance to developers and communities to incorporate innovative waste treatment alternatives; encourage the use of low impact development technologies to improve stormwater quality; prioritize waters in need of TMDLs.

Pine (2010-2020)- improve impaired waters and maintain unimpaired waters; participate in the TMDL processes for waters within the county; improve forestry practices by conducting BMP education and better assessing forestry practices to determine impacts to water quality; secure funding for additional staff to write forest stewardship plans; encourage jurisdictions to adopt stormwater and shoreland ordinances and implement low impact development practices; protect riparian areas and apply for funding to be used as a tax break for residents who install buffers along shorelines.

Benefits: The specific accomplishments of the water plans will likely be detailed in the subsequent versions of each plan. However, expected benefits include:

- Protection, enhancement, and restoration of native habitat, including protection of contiguous habitat areas to improve connectivity.
- Improved recreational and drinking water quality through landscape protection and installation of riparian buffers.
- Protection and maintenance of land and aquatic habitat, which will provide fishing and hunting recreational opportunities, benefiting the local economy.
- Protection of ground water, which may be used for drinking water, and can also have a positive impact on the surface waters receiving the ground water through infiltration.

Documents: Aitkin_WaterManagementPlan, Chisago_WaterManagementPlan, Kanabec_WaterPlan, MilleLacs_WaterPlan, Pine_WaterManagementPlan, Isanti_WaterManagementPlan, Kanabec_PriorityConcerns2012.

Isanti County Parks and Recreation Plan

Entity: Isanti County Parks and Recreation Commission

Jurisdiction: Isanti County

Summary: Isanti County developed the Parks and Recreation Plan to improve recreational opportunities and preserve natural areas and ecosystems in the county. For each parcel of land acquired under the Plan, the county will develop a natural resource management plan and obtain baseline data of the vegetation and wildlife populations.

Benefits: Preserving ecosystems and natural areas protects habitat for mammals, birds, reptiles and amphibians from the pressures of development. The natural areas are also used for recreational activities, which provide health benefits for residents, tourism opportunities, and economic revenue for the area. Protecting these areas also helps to minimize habitat fragmentation, which is key to ensuring the viability of wildlife populations in the area. Preserving natural areas protects surface waters from sediment runoff and pollutants common in urban areas, which can improve water clarity and water quality. The property values may increase for local residents who live near the trails, open spaces and parks. Preserved forests and grasslands naturally filter stormwater and can help minimize flood damage and erosion, compared to urbanized areas with more impervious surface. Finally the natural areas provide an opportunity for public environmental education for the local community and schools.

Associated Documents: Isanti_ParksPlan

Snake River Riparian Corridor Protection Project

Entity: Minnesota Department of Natural Resources and The Nature Conservancy

Jurisdiction: Snake River Watershed

Summary: The DNR, in collaboration with TNC, has purchased 405 acres of land along the Snake River and Snake River State Forest for protection. With this purchase, a total of 14 miles of shoreline along the Snake River are now protected from urban and rural development. The property provides habitat to native species such as white-tailed deer, gray and red fox, black bears, beavers, and muskrats; the Snake River provides habitat for walleye, smallmouth bass, northern pike, catfish, and lake sturgeon. The land purchase was funded through the Re-Invest in Minnesota Critical Habitat Matching Program and the Outdoor Heritage Fund (see Fund description for Clean Water, Land and Legacy Amendment).

Benefits: Purchasing shoreline areas for protection helps preserve habitat for native species and improves connectivity between the Snake River and the Snake River State Forest. The land also provides economic revenue from recreational tourism, angling, hunting, and wildlife viewing. Protecting the shoreline from future development preserves and enhances water quality in the Snake River, as well as in the main receiving water- the Upper Mississippi River.

Associated Documents: None

Snake River Watershed Enhancement Project

Entity: Snake River Watershed Management Board

Jurisdiction: Snake River Watershed

Summary: The Snake River Watershed Enhancement Project (2008-2011), involved extensive BMP implementation, watershed monitoring and evaluation, and public education in the Snake River Watershed. Best management practices ranged from creating sediment basins, wetlands, and grass waterways, controlling erosion and farm runoff, developing manure management plans, installing rain gardens, repairing earthen dams, and building livestock exclusion fences. The voluntarily implemented BMPs were designed to target priority areas, or land parcels that contribute a significant portion of the pollutant load to the Snake River. The total cost for BMP implementation was \$405,000. The Project involved extensive monitoring and evaluation within the Snake River Watershed and assistance with developing the Groundhouse River TMDL. Public education involved delivering presentations to lake associations, community groups, governmental units, class rooms, and recreational groups.

Benefits: The Enhancement Project has been a significant step forward in protecting the Snake River from sedimentation and pollutant loads, and educating local communities about the importance of preserving their watershed. The Project detailed estimated soil loss and nutrient load reductions incurred from many of the BMPs that were implemented. By including water quality monitoring along with BMP implementation, the SRWMB may have sufficient data to quantify pollutant load reductions and determine if certain BMPs are more effective than others. Implementing BMPs can provide a marketing advantage for farmers or businesses implementing the practices, while simultaneously improving in-stream and downstream water quality and clarity for aquatic plant and animal species.

Associated Documents: SRWMB_EnhancementProject, SRWMB_EnhancementProject_Final

St. Croix Watershed Protection Project

Entity: St. Croix River Association

Jurisdiction: St. Croix River Watershed

Summary: The St. Croix River Association and Washington Conservation District received financial assistance through ENRTF to conduct a detailed watershed assessment and prioritize areas for protection within the St. Croix Watershed.

Benefits: While a number of state and watershed-scale natural resource assessments have been conducted, most provide general recommendations for protection activities. This project will assist in developing priority actions for specific locations within the basin to improve habitat and water quality; expand recreational and tourism opportunities; and enhance local support for watershed protection.

Associated Documents: None

Snake River Watershed Conservation Action Plan

Entity: The Nature Conservancy

Jurisdiction: Snake River Watershed

Summary: Recognizing the importance of enhancing protection activities in the Snake River Watershed, TNC developed the Conservation Action Plan (CAP) in 2009. The CAP includes baseline terrestrial and aquatic species information, land ownership within the watershed, natural disturbance regimes, hydrology and geomorphology data, water quality, ground water contamination susceptibility, and an assessment of key threats in the watershed. Threats in the watershed were prioritized based on the severity, scope, contribution, and irreversibility, and were detailed in an Excel spreadsheet. Using the baseline data, the CAP set the following goals and objectives:

- Meet or exceed a 20% phosphorus loading reduction by 2020.
- Preserve lake sturgeon, nongame fish, and mussel populations.
- Protect shorelands and associated habitats for 40% of the priority shorelands on lakes and river segments.
- Increase the total acreage of healthy fire-dependent pine-oak forest and mature mesic hardwood forests by 100%.

Various strategies will be implemented to achieve these goals, including:

- Supporting local land trusts in identifying and purchasing critical buffer lands.
- Expanding corridors.
- Supporting implementation of a lake sturgeon management plan.
- Identifying approaches to protect mussel communities.
- Supporting the development and implementation of an effective TMDL plan for Lake St. Croix and other impaired waterbodies.

- Promoting adoption of protective shoreland management standards and expansion of critical habitat designation.
- Supporting sustainable forest management to prevent fragmentation through easements, certifications, and outreach.

Benefits: The CAP sets high but attainable protection goals for the watershed and details the necessary steps and actions needed to achieve those goals. Collaboration with local partners including conservation professionals, public and private land owners, members of the SRWMB, and others is instrumental to effectively implementing the CAP while simultaneously increasing public awareness about how land activities impact the local environment.

Associated Documents: TNC_SnakeRiver_CAP, TNC_SRW_CAPworkbook

St. Croix River Watershed Conservation Priorities Report

Entity: St. Croix Conservation Collaborative

Jurisdiction: St. Croix Watershed

Summary: The Conservation Priorities Report was prepared by the St. Croix Conservation Collaborative, which consists of 29 partners in Wisconsin and Minnesota. The report identifies the Snake River as a priority area with the primary objective being to maintain and restore water quality through implementation of BMPs and public ownership. The report identifies development pressure as a key threat to the Snake River.

Benefits: By prioritizing areas for protection within the St. Croix watershed, the Collaborative allows the state and local organizations to more efficiently and effectively target their resources. Targeting BMPs and supporting public ownership of land in the Snake River Watershed will improve water quality, preserve habitat for native species, enhance fisheries, and provide for recreational opportunities.

Associated Documents: StCroix_ConservationPriorities

St. Croix Shoreland Vegetation Restoration Project

Entity: Kanabec County Soil and Water Conservation District

Jurisdiction: St. Croix Watershed

Summary: The St. Croix Shoreland Vegetation Restoration Project is designed to assist landowners and the public in restoring vegetation (particularly native vegetation), and implement erosion control and water quality improvement projects in the subwatersheds of the St. Croix. Under this project, an estimated 3,506 linear feet of shoreline buffer have been planted at a cost of \$59,859.

Benefits: The vegetative buffer has prevented an estimated 78.7 tons/yr of soil loss and 67 lbs/yr of phosphorus runoff to surface waters. Reducing nutrient and sediment runoff protects water quality and clarity, thereby improving aquatic habitat. Improved water clarity also has aesthetic benefits, potentially increasing local property values and allowing for recreational opportunities.

Associated Documents: St.Croix_ShorelandRestoration

Technical Resources

Systematic Conservation Planning Using Zonation

Entity: Minnesota Department of Natural Resources

Jurisdiction: St. Croix

Summary: For the St. Croix Watershed, DNR applied zonation software to prioritize land areas for protection. For the Snake River Watershed, the goal of the Zonation analysis was to optimize environmental benefits while minimizing protection work in those areas that were not likely to cause surface water quality problems (i.e., non-contributing basins). Seven features were used in the model and included elements of biology, hydrology, water quality, geomorphology, and connectivity. Weights were used to identify each feature's value within the model. The weights used reflected local values, having been obtained through a questionnaire administered to a group of individuals organized by the SCRA and Washington Conservation District.

Benefits: Zonation software provides a framework for large-scale spatial conservation prioritization as well as a decision support tool for conservation planning.

Associated Documents: None

County Geologic Atlas Program

Entity: Minnesota Geologic Survey

Jurisdiction: Chisago County

Summary: Counties may request a geologic atlas map from the Minnesota Geologic Survey. Currently, Chisago County is the only county within the Snake River Watershed that has a map. The maps define aquifer properties and boundaries and identify connections between aquifers to the land and surface waters. A range of geologic information is also provided for each county, including geology, mineral resources and natural history.

Benefits: The information provided in the geologic atlas maps can help counties manage ground water resources for water allocation, permitting, remediation, monitoring, and well construction.

Associated Documents: Online map

Grassland Bird Conservation Area

Entity: U.S. Fish and Wildlife Service (USFWS)

Jurisdiction: Chisago County

Summary: The USFWS has created a map that identifies Grassland Bird Conservation Areas (GBCA), or land areas which provide suitable habitat for grassland birds, and should be prioritized for protection. The map includes the Chisago County portion of the Snake River Watershed. To qualify as a GBCA, the land must be at least 95% grassland, 50 m or more from woody vegetation, and may contain up to 30% wetland habitat. The three types of GBCA (Types 1 to 3) differ based on the amount of grass on the landscape, size, width, and the types of wetlands. Type 1 GBCAs are larger and contain more grassland area, whereas Type 3 GBCAs are the smallest, and contain a smaller percentage of grassland area.

Benefits: The GBCA map allows the state to target resources towards protecting priority grassland bird habitat. Habitat protection, particularly for the larger, Type 1 GBCAs, minimizes habitat fragmentation, and can have positive impacts on soil and water quality.

Associated Documents: FWS_GrasslandBirds

Public Water Supply Map

Entity: Minnesota Department of Health

Jurisdiction: Snake River Watershed

Summary: Minnesota's Department of Health developed a map of all public water supplies and drinking water protection areas within the Snake River Watershed.

Benefits: The map can be used to identify where protection efforts may be targeted to protect public drinking water supplies. Protecting drinking water resources from potential contamination can protect public health and minimize costs associated with drinking water treatment and drilling new wells.

Associated Documents: MDH_PWS_SourceWaterProtection

Small Wetlands Acquisition Program

Entity: U.S. Fish and Wildlife Service

Jurisdiction: Chisago County

Summary: The Small Wetlands Acquisition Program (SWAP) was developed by USFWS' Habitat and Population Evaluation Team (HAPET) to preserve small wetlands and associated upland habitat for breeding waterfowl protection. HAPET developed tools to target Waterfowl Protection Areas and conservation easements. The tools allow conservation managers to assess the potential bird population benefits incurred by wetland and grassland restoration and protection within Minnesota's Wetland Management District (WMD). Benefits of wetland protection and restoration are based on the integrity of the wetland complex and predicted landscape-scale nest success; grassland protection and restoration is based on accessibility to upland nesting hens and the parcel's contribution to a Type 1 Grassland Bird Conservation Area (see description for Grassland Bird Conservation Area). HAPET distributed a Microsoft Excel file of the indices to each of Minnesota's WMDs, and created a map of the priority level for small wetlands in Minnesota. All of the wetland areas in Chisago County are low to moderate priority. Data are not available online but can be requested via email to HAPET.

Benefits: Conserving these wetlands and grasslands protects both breeding and migratory bird populations, as well as other wildlife native to the area. Preserving contiguous parcels provides habitat connectivity, which allows for more sustainable population breeding. Wetlands are valuable natural filtration systems and can minimize pollutant loading to surface and ground waters that may be used for recreational and drinking water purposes. They also provide flood control and reduce stormwater runoff. Finally, preserving these natural areas provides bird watching opportunities and other recreational opportunities for the local community and tourists.

Associated Documents: FWS_WetlandAcquisition

Program or Document Name	File Name	Entity	Short Description	Jurisdiction	File Type	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology	1 st URL	2 nd URL	Category	#
Conservation Reserve Program	Online	USDA	The Program allows agricultural landowners to receive cost-share assistance and rental payments for establishing long-term conservation practices on eligible farmland.	National	Online	Ü	Ü			Ü		http://www.fsa.usda.gov/FSA/webapp?area=home&subject=corp		Multi-State- Non-Regulatory Efforts	1
National Fish Habitat Action Plan	Online	NFHP	An online mapping tool allowing the user to view the risk of current habitat degradation for stream and coastal fish habitats.	National	Webmap		Ü				Ü	http://ecosystems.usgs.gov/fishhabitat/		Multi-State- Non-Regulatory Efforts	2
North American Landbird Conservation Plan	PIF_Landbird_ConservationPlan	PIF	This plan is a cooperative effort among agencies, foundations, and others interested in bird protection not covered by existing conservation initiatives.	National	Plan		Ü				Ü	http://www.partnersinflight.org/	http://www.partnersinflight.org/	Multi-State- Non-Regulatory Efforts	3
North American Landbird Conservation Plan	PIF_ActionPlan_2012	PIF	The strategic action plan identifies broad goals and objectives for landbird conservation, and specifically identifies tasks to be achieved within the next three years.	National	Report		Ü				Ü	http://www.partnersinflight.org/	http://www.partnersinflight.org/	Multi-State- Non-Regulatory Efforts	4
North American Waterfowl Management Plan	FWS_NAWMP_2011-12_Plan	USFWS	NAWMP is a commitment between the U.S., Canada, and Mexico aimed at recovering waterfowl populations by restoring and managing wetland ecosystems.	National	Plan	Ü	Ü				Ü	http://www.fws.gov/birdhabitat/	http://www.fws.gov/birdhabitat/	Multi-State- Non-Regulatory Efforts	5
North American Waterfowl Management Plan	FWS_NAWMP_Assessment2007	USFWS	An Assessment Steering Committee conducted a biological assessment of the NAWMP. This report provides a variety of recommendations to improve the plan and make it more effective.	National	Report	Ü	Ü				Ü	http://www.fws.gov/birdhabitat/	http://www.fws.gov/birdhabitat/	Multi-State- Non-Regulatory Efforts	6
Projected Climate and Land Use Change Impacts on Aquatic Habitats	Online	Fish Habitat, Climate, and Land Use Change	Project is not yet complete. Final products will include the following for all rivers in the Midwestern U.S.: maps of predicted temperature and flow regime under current and projected conditions; maps predicting the distribution of major sport fish species; and potential vulnerability ranking and shifts in major sport fish species.	Midwest	Online		Ü				Ü	http://fishhabclimate.org/Assessments/Regional/GreatLakes		Multi-State- Non-Regulatory Efforts	7
Strategic Plan for Fish Habitat Conservation in Midwest Glacial Lakes	MWGLP_FishHabitatGlacialLakes	MGLP	The purpose of the plan is to protect, restore, and enhance sustainable fish habitats in glacial lakes in the Midwest, including MN.	Midwest	Report		Ü				Ü	http://midwestglaciallakes.org/p	http://midwestglaciallakes.org	Multi-State- Non-Regulatory Efforts	8
Midwestern Fish Habitat Assessment Models	Online	NFHP and Downstream Strategies, LLC	Project is not yet complete. A GIS conservation decision planning tool allowing the user to estimate the probability of restoration success for specific species or aquatic community indicators by manipulating the most significant anthropogenic contributors to the models.	Midwest	Online		Ü				Ü	http://www.downstreamstrategies.com/gis.html		Multi-State- Technical Resources	9
Watershed Forest Management Information System	Online	U. Mass. Amherst	WFMS is a spatial decision support system developed to evaluate and plan (1) forest conservation and nonpoint source pollution mitigation, (2) forest road maintenance, and (3) silviculture operations. The WFMS is an extension of ArcGIS that can be added as a toolbar to an ArcGIS interface.	National	Online	Ü					Ü	http://www.forest-to-faucet.org/	http://www.forest-to-faucet.org/	Multi-State- Technical Resources	10
Clean Water, Land and Legacy Amendment	Online	Outdoor Heritage Fund	The Fund supports the protection, restoration, and enhancement of wildlife habitat, including forests, wetlands, and prairies.	State	Online	Ü	Ü	Ü	Ü	Ü	Ü	http://www.legacy.leg.mn/funds/	http://www.legacy.leg.mn/pro	State- Funding	11
Clean Water, Land and Legacy Amendment	CleanWaterFund_PerformanceReport	Clean Water Fund	The report clarifies connections between Clean Water Funds invested, actions taken, and outcomes achieved in FY2010-2011.	State	Report	Ü	Ü	Ü	Ü	Ü	Ü	http://www.legacy.leg.mn/sites/default/files/resource		State- Funding	12
ENRTF	LCCMR_ENRTF_StrategicPlan	LCCMR	This constitutionally dedicated fund provides long-term stable funding for activities that protect, conserve, and enhance MN's natural resources.	State	Plan	Ü	Ü	Ü			Ü	http://www.lccmr.leg.mn/Strate	http://www.lccmr.leg.mn/	State- Funding	13
ENRTF	Online	LCCMR	This online mapping tool for ENRTF identifies conservation easement land acquisitions and parcel information.	State	Webmap	Ü						http://www.gis.leg.mn/gis/geomoose-lccmr/htdco/		State- Funding	14
Erosion Control and Water Management Program	Online	BWSR	Through the State Cost-Share Program, landowners or occupiers can request financial and technical assistance from their local SWCD to implement state-approved conservation practices.	State	Online	Ü	Ü				Ü	http://www.bwsr.state.mn.us/cs/	http://www.pineswcd.com/ind	State- Funding	15
MN Prairie Conservation Programs	DNR_NativePrairieMap	DNR	Map of the native prairie area in MN recorded between 1847 and 1908 compared to the area mapped between 1987 and 2011.	State	Map	Ü	Ü					http://files.dnr.state.mn.us/eco/mcbs/prairie_map.pdf		State- Funding	16
MN Prairie Conservation	Online	DNR	Native Prairie Bank Program enables landowners to protect native prairie on their property through a conservation easement with DNR.	State	Online	Ü	Ü					http://www.dnr.state.mn.us/prairierestoration/prairiebank.html		State- Funding	17
MN Prairie Conservation	Online	DNR	The Native Prairie Tax Exemption Program provides financial incentives for landowners to preserve their native prairie.	State	Online	Ü	Ü					http://www.dnr.state.mn.us/prairierestoration/taxexemption.ht		State- Funding	18
MN Prairie Conservation	DNR_PrairieConservationPlan	DNR	The Plan is aimed at protecting, restoring, and enhancing prairies in the state over the next 25 years.	State	Plan	Ü	Ü					http://files.dnr.state.mn.us/eco/	http://www.dnr.state.mn.us/p	State- Funding	19
Snake River Watershed Restoration and Protection (WRAP) Strategy	Online	MPCA	A WRAP is being developed for the Snake River Watershed, which will integrate findings from the state's water quality assessments and TMDL. The WRAP will also identify strategies for restoration and protection within the watershed.	State	Online						Ü	http://www.pca.state.mn.us/index.php/water/water-types-and-s		State- Regulatory Efforts	20
Public Water Works Permit Program	Online	DNR	The Public Water Works Permit Program regulates water development activities such as filling, shore protection, excavation, bridges and culverts, water level controls, dams, and dredging.	State	Online			Ü				http://www.dnr.state.mn.us/waters/watermgmt_section/pwper		State- Regulatory Efforts	21
Minnesota Floodplain Management Act	Online	BWSR	The Floodplain Management Act promotes sound land use development in floodplains throughout the state.	State	Online	Ü	Ü				Ü	http://www.dnr.state.mn.us/wat	http://www.dnr.state.mn.us/w	State- Regulatory Efforts	22
Minnesota Shoreland Management Act	Online	DNR	The purpose of the Shoreland Management Act is to protect shoreland areas from degradation, and sets standards for development.	State	Online	Ü	Ü				Ü	http://www.dnr.state.mn.us/sho	http://www.dnr.state.mn.us/w	State- Regulatory Efforts	23
Minnesota Wetland Conservation Act	Online	BWSR	The purpose of the act is to protect MN wetlands, with a goal of achieving no net-loss of wetlands in the state.	State	Online		Ü					http://www.bwsr.state.mn.us/w	http://www.bwsr.state.mn.us/	State- Regulatory Efforts	24
Source Water Protection	Mora_WellheadProtection	Minnesota Department of Health and local municipalities	Minnesota has a source water protection program, which includes wellhead protection, source water assessments, and surface water intake protection.	State	Plan					Ü		http://www.health.state.mn.us/d	http://cl.mora.mn.us/index.asp	State- Regulatory Efforts	25
State Water Quality Standards and TMDL Program	N/A	MPCA	The state derives water quality standards for pollutants to protect waterbody designated uses, such as aquatic life, drinking water and fish consumption. Impaired waterbodies are restored through the development of TMDL's which set the maximum allowable pollutant concentration while still maintaining the designated use.	State	Online	Ü					Ü	http://www.pca.state.mn.us/ind	http://www.pca.state.mn.us/in	State- Regulatory Efforts	26
DNR Strategic Conservation Agenda	DNR_StrategicConservation	DNR	The Strategic Conservation Agenda describes trends, goals, and directions for DNR. The report also highlights over 90 performance indicators and conservation targets DNR uses to measure and communicate progress.	State	Report	Ü	Ü	Ü	Ü	Ü	Ü	http://www.dnr.state.mn.us/con	http://www.dnr.state.mn.us/st	State- Non-Regulatory Efforts	27
Livestock Environmental Quality Assurance Program	MDA_LivestockEQVA	MDA	The program provides assessment and water quality assurance frameworks to farming operations across MN. The \$150,000 annual grant assists livestock owners in developing resource management plans and implementation plans, and annual reporting of WQ assessments.	State	Report						Ü	http://www.mda.state.mn.us/ne	http://www.legacy.leg.mn/pro	State- Non-Regulatory Efforts	28
Managing MN's Shallow Lakes for Waterfowl and Wildlife	DNR_shallowlakesplan	DNR	The plan is designed to manage and protect shallow lakes to meet the objectives of the Long Range Duck Recovery Plan.	State	Online	Ü	Ü					http://files.dnr.state.mn.us/recre	http://www.dnr.state.mn.us/s	State- Non-Regulatory Efforts	29
MN Conservation Apprenticeship Academy	Online	BWSR	The program approached universities to recruit students for apprenticeship positions during the 2011 and 2012 summers. Conservation professionals worked with students to transfer knowledge and experience to the next generation responsible for MN's conservation.	State	Online	Ü	Ü	Ü	Ü	Ü	Ü	http://www.legacy.leg.mn/projects/minnesota-conservation-app		State- Non-Regulatory Efforts	30

Program or Document Name	File Name	Entity	Short Description	Jurisdiction	File Type	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology	1 st URL	2 nd URL	Category	#
MN Forests for the Future Program	ForestsfortheFutureReport_2008	DNR	The program works with partners to use conservation easements and other tools to retain MN's healthy, working forests.	State	Report	Ü	Ü					http://files.dnr.state.mn.us/assiss	http://www.dnr.state.mn.us/assiss	State- Non-Regulatory Efforts	31
MN Water Availability Report	DNR_WaterAvailability	DNR	The report provides an assessment of water availability based on current water use, quantities and trends in water supplies.	State	Report			Ü				http://files.dnr.state.mn.us/aboutdnr/reports/legislative/2010_w		State- Non-Regulatory Efforts	32
MN Wildlife Action Plan	DNR_WildlifeConservationPlan	DNR	Tomorrow's Habitat provides an opportunity for collaboration between conservationists to identify MN's wildlife species and their habitats, and stabilize and increase populations of species of greatest conservation need.	State	Plan	Ü	Ü				Ü	http://www.dnr.state.mn.us/cwcs/index.html		State- Non-Regulatory Efforts	33
Northeast Minnesota Wetland Mitigation Inventory and Assessment	BWSR_WetlandMitigation_2010	BWSR	The final report describes results from the wetland stinging analysis, including recommendations for future actions.	State- NE MN	Report		Ü					http://www.bwsr.state.mn.us/wetlands/wca/NE_Assessment_Ph		State- Non-Regulatory Efforts	34
Northeast Minnesota Wetland Mitigation Inventory and Assessment	Online	BWSR	This interactive map and GIS database identifies potential wetland mitigation sites in Northeast MN.	State- NE MN	Webmap		Ü					http://www.bwsr.state.mn.us/wetlands/wca/NE_mitigation.htm		State- Non-Regulatory Efforts	35
Scientific and Natural Areas Program	DNR_SNA_LongRangePlan	DNR	The purpose of the SNA Long Range Plan is to protect an acreage base of SNA's sufficient to ensure the maintenance and continued existence of the state's remaining natural elements. Because of the magnitude of species, the plan establishes a classification system that serves as a filter for plant communities and individual species or natural features.	State	Plan	Ü	Ü				Ü	http://files.dnr.state.mn.us/aboutdnr/sna/	http://www.dnr.state.mn.us/sna/	State- Non-Regulatory Efforts	36
Aquatic and Wildlife Management Areas	DNR_AquaticAreaAcquisition	DNR	The Aquatic Management Area and Wildlife Management Area programs allow for the acquisition and protection of critical aquatic and terrestrial habitat. These areas are available to the public for recreational use.	State	Online	Ü	Ü					http://www.dnr.state.mn.us/wmas/index.html	http://files.dnr.state.mn.us/wmas/	State- Non-Regulatory Efforts	37
Minnesota Statewide Mussel Survey	Online	DNR	DNR is conducting a statewide survey to document the mussel community in threatened or minimally-surveyed rivers in Minnesota.	State	Online		Ü				Ü	http://www.dnr.state.mn.us/eco/nhrnp/mussel_survey/index.htm		State- Non-Regulatory Efforts	38
Statewide Conservation and Preservation Plan	LCCMR_StatewideConservationPlan	LCCMR	The state-wide conservation plan includes recommendations for land use, transportation, habitat, and energy production and use (available in PowerPoint's online). The plan evaluates and assesses costs and benefits of conservation strategies, such as wetland restoration/protection.	State	Plan	Ü	Ü	Ü		Ü	Ü	http://www.lccmr.leg.mn/statewide	http://www.lccmr.leg.mn/statewide	State- Non-Regulatory Efforts	39
Water Sustainability Framework	WaterSustainabilityFramework	U. Minnesota Water Resources Center	The framework provides a roadmap toward water sustainability, identifying issues and proposing solutions and next steps based on science and best practices.	State	Report	Ü	Ü	Ü	Ü	Ü	Ü	http://wrc.umn.edu/prod/groups/cfans/@pub/@cfans/@wrc/docs		State- Non-Regulatory Efforts	40
Woodland Stewardship Plan	Online	MFA	The MFA encourages owners of >20 acres to develop woodland stewardship plans with the help of an expert in the field. The plans provide landowners with an assessment of available habitat and goals to retain ecological diversity, plant trees, and enhance habitat.	State	Online	Ü	Ü					http://www.minnesotaforestry.org/stewardship-plan		State- Non-Regulatory Efforts	41
Clean Water Partnership and Section 319 Program	Online	MPCA	The Clean Water Act Section 319 program offers funding to water resource managers and others to implement programs/strategies to address nonpoint source pollution.	State	Online	Ü	Ü	Ü	Ü	Ü	Ü	http://www.pca.state.mn.us/index.php/water/water-types-and-s		State- Non-Regulatory Efforts	42
Ecological Ranking Tool	Online	BWSR/U. of MN	Downloadable GIS layers for EBI, soil erosion risk, WO risk, and wildlife habitat quality.	State	GIS Layers	Ü	Ü	Ü	Ü	Ü	Ü	http://www.bwsr.state.mn.us/ecological_ranking/		State- Technical Resources	43
Ecological Ranking Tool	BWSR_SnakeEBI	BWSR/U. of MN	Map of the top 5% and 10% of lands that impact WO, have the highest potential for erosion, and greatest benefit for habitat.	SRW	Map	Ü	Ü	Ü	Ü	Ü	Ü			State- Technical Resources	44
Ecological Ranking Tool	Online	BWSR/U. of MN	The Economic Model for CRP Parcels predicts CRP re-enrollment vs. cropping based on soil productivity, current subsidies, and commodity prices.	State	Online	Ü	Ü	Ü	Ü	Ü	Ü	http://www.bwsr.state.mn.us/ecological_ranking/		State- Technical Resources	45
Ecological Ranking Tool	BWSR_EcoRankingTool	BWSR/U. of MN	PowerPoint summarizing the Ecological Ranking Tool	State	PowerPoint	Ü	Ü	Ü	Ü	Ü	Ü			State- Technical Resources	46
Ecological Ranking Tool	BWSR_EcologicalRanking_Report	BWSR/U. of MN	This report describes results from the Ecological Ranking Tool and Economic Model for CRP parcels.	State	Report	Ü	Ü	Ü	Ü	Ü	Ü	http://www.bwsr.state.mn.us/ecological_ranking/Ecological_Ran		State- Technical Resources	47
Ecological Ranking Tool	Online	BWSR/U. of MN	This tool identifies areas that are of high habitat quality and at risk for soil erosion and runoff to surface waters.	State	Webmap	Ü	Ü	Ü	Ü	Ü	Ü	http://beaver.nrri.umn.edu/Ecol	http://beaver.nrri.umn.edu/Ecol	State- Technical Resources	48
Forests, Water and People Analysis	USFS_ForestsWaterPeople_MNFact sheet	USFS	This GIS-based analysis for 540 watersheds (including SRW) produced maps showing the ability of the watersheds to produce (a) drinking water and (b) clean drinking water. This factsheet provides analysis results for MN.	State	Factsheet	Ü	Ü	Ü	Ü	Ü	Ü	http://na.fs.fed.us/watershed/factsheet	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	49
Forests, Water and People Analysis	Online	USFS	Final GIS datasets containing: % forest land, % agricultural land, % riparian forest cover, road density, soil erodibility, housing density, ability to produce clean water, watershed data, etc.	State	GIS Layers	Ü	Ü	Ü	Ü	Ü	Ü	http://na.fs.fed.us/watershed/factsheet	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	50
Forests, Water and People Analysis	USFS_ForestsWaterPeople_FinalReport2009	USFS	Final report for the Forests, Water and People analysis for all states in the Great Lakes Region.	State	Report	Ü	Ü	Ü	Ü	Ü	Ü	http://na.fs.fed.us/pubs/misc/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	51
Minnesota Biological Survey	Online	DNR	The MBS collects, interprets, and delivers baseline data on the distribution and ecology of rare animals and plants, native plant communities, and functional landscapes. The website contains maps of areas of biodiversity significant, and maps of amphibian, reptile and bird distributions. This is part of DNR's Scientific and Natural Areas Program.	State	GIS Layers		Ü				Ü	http://www.dnr.state.mn.us/eco/	http://www.dnr.state.mn.us/eco/	State- Technical Resources	52
National Land Transformation Model	US_2040_Urbiv1	Bryan Pijanowski	The model was used to develop maps displaying projected urban and agricultural land use for the years 2010 to 2105 in five year increments.	State	Online	Ü	Ü	Ü	Ü	Ü	Ü	http://lm.agriculture.purdue.edu/usgs.htm		State- Technical Resources	53
Precision Conservation Initiative	Online	MDA	The Initiative disseminates digital terrain (Lidar) analysis techniques to help conservation professionals target funding for priority areas to improve WO.	State	GIS Layers	Ü	Ü	Ü	Ü	Ü	Ü	http://www.mda.state.mn.us/en/	http://www.mngeo.state.mn.us/	State- Technical Resources	54
UMRFP	USFS_UMRS_MigratoryBird	USGS/USFS	Ten grants were awarded addressing bird habitat conservation needs in the Upper Mississippi watershed. The projects ranged from surveying forested areas as potential Important Bird Areas to landowner workshops.	State- SE MN	Factsheet	Ü	Ü	Ü	Ü	Ü	Ü	http://na.fs.fed.us/ss/06/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	55
UMRFP	USFS_UMRS_RiparianBuffers	USGS/USFS	Using the more detailed SSURGO soils data, a methodology was developed to identify where riparian buffers could be the most effective at stopping soil and nutrients from reaching water bodies. Those watersheds where it was important to maintain forest cover were identified.	State- SE MN	Factsheet		Ü			Ü	Ü	http://na.fs.fed.us/ss/06/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	56
UMRFP	USFS_UMRS_BirdHabitat	USGS/USFS	Grant for conserving bird habitat in flood plain forest on private lands in MN and IA. Pilot project to promote flood plain forest management to private landowners in and adjacent to its highest-priority IBAs along the UMR.	State- SE MN	Grant		Ü	Ü	Ü	Ü	Ü	http://www.na.fs.fed.us/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	57
UMRFP	USFS_UMRS_FloodplainBluffs	USGS/USFS	Restoration of the Lower St. Croix floodplain and bluffs.	State- SE MN	Grant	Ü	Ü	Ü	Ü	Ü	Ü	http://www.na.fs.fed.us/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	58
UMRFP	USFS_UMRS_UplandHabitat	USGS/USFS	Restoration of the Mississippi-St. Croix upland habitat	State- SE MN	Grant		Ü			Ü	Ü	http://www.na.fs.fed.us/watershed	http://na.fs.fed.us/watershed/factsheet	State- Technical Resources	59
UMRFP	USFS_UMRS_bottomlandBirdHabitat_Map	USGS/USFS	Map of bottomland migratory bird habitat	State- SE MN	Map		Ü					http://www.na.fs.fed.us/watershed/upper_mississippi_partners		State- Technical Resources	60
UMRFP	USFS_UMRS_GrasslandBirdHabitat_Map	USGS/USFS	Map of grassland migratory bird habitat	State- SE MN	Map		Ü					http://www.na.fs.fed.us/watershed/upper_mississippi_partners		State- Technical Resources	61
UMRFP	USFS_UMRS_PriorityForests_Map	USGS/USFS	Map of priority forests for conservation	State- SE MN	Map	Ü	Ü	Ü	Ü	Ü	Ü	http://www.na.fs.fed.us/watershed/upper_mississippi_partners		State- Technical Resources	62

Program or Document Name	File Name	Entity	Short Description	Jurisdiction	File Type	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology	1 st URL	2 nd URL	Category	#
UMRFP	USFS_UMRS_ShrublandBirdHabitat_Map	USGS/USFS	Map of shrubland migratory bird habitat	State- SE MN	Map		U					http://www.na.fs.fed.us/watershed/upper_mississippi_partners		State- Technical Resources	63
UMRFP	USFS_UMRS_UplandBirdHabitat_Map	USGS/USFS	Map of upland migratory bird habitat	State- SE MN	Map		U					http://www.na.fs.fed.us/watershed/upper_mississippi_partners		State- Technical Resources	64
UMRFP	USFS_UMRS_09-13ActionPlan	USGS/USFS	Outlines goals for sustainable forests, WO, migratory bird habitat, and other habitat restoration.	State- SE MN	Plan		U			U		http://na.fs.fed.us/watershed/upper_mississippi_partnership/pd		State- Technical Resources	65
UMRFP	USFS_UMRS_PriorityForests2007	USGS/USFS	Priority forests for conservation model. This document summarizes the results of a GIS analysis that identified forests where allocation of resources would make the most difference.	State- SE MN	Report		U					http://na.fs.fed.us/pubs/watershed/uppermiss_summary_Is.pdf		State- Technical Resources	66
UMRFP	USFS_UMRS_PriorityForests2009	USGS/USFS	Priority forests for conservation model. The UMRFP focuses activities, demonstration projects, and cooperative programs on key watershed forestry issues in the UMR Basin: water pollution, loss of migratory bird habitat, and forest loss and fragmentation.	State- SE MN	Report		U					http://na.fs.fed.us/watershed/up	http://www.na.fs.fed.us/water	State- Technical Resources	67
Watershed Health Assessment Framework	DNR_SRW_HealthAssessment	DNR	The framework uses five components to describe watershed health: hydrology, geomorphology, biology, connectivity, and WO.	State	Report		U	U	U	U	U	http://files.dnr.state.mn.us/natu	http://www.dnr.state.mn.us/v	State- Technical Resources	68
County Shoreland Management Ordinance	Online	Mille Lacs SWCD	Mille Lacs County has regulations to protect wetlands and shorelands. Limited information is available online.	Mille Lacs	Online		U					http://www.co.mille-lacs.mn.us/	http://www.co.mille-lacs.mn.us/	Watershed-Regulatory Effort	69
County Shoreland Management Ordinance	Aitkin_Ordinance_Shorelands	Aitkin SWCD	The ordinance controls the use of shorelands in Aitkin County, providing wise subdivision, use, and development of shorelands of public waters.	Aitkin	Ordinance		U					http://www.co.aitkin.mn.us/Ordinances/shoreland2012amend		Watershed-Regulatory Effort	70
County Shoreland Management Ordinance	Chisago_Ordinance_Shorelands	Chisago SWCD	The ordinance controls the use of shorelands in Chisago County, providing wise subdivision, use, and development of shorelands of public waters.	Chisago	Ordinance		U					http://www.co.chisago.mn.us/fileupload/library/shorelandmanag		Watershed-Regulatory Effort	71
County Shoreland Management Ordinance	Kanabec_Ordinance_Shorelands	Kanabec SWCD	The ordinance controls the use of shorelands in Kanabec County, providing wise subdivision, use, and development of shorelands of public waters.	Kanabec	Ordinance		U					http://kanabecounty.govoffice2	http://kanabecounty.govoffice2	Watershed-Regulatory Effort	72
County Shoreland Management Ordinance	Pine_Ordinance_Shorelands	Pine SWCD	The ordinance controls the use of shorelands in Pine County providing wise subdivision, use, and development of shorelands of public waters.	Pine	Ordinance		U					http://www.co.pine.mn.us/verti	http://www.co.pine.mn.us/nd	Watershed-Regulatory Effort	73
County Subdivision Ordinance	MilleLacs_Subdivision	Mille Lacs County	The ordinance controls the use of shorelands in Mille Lacs County providing wise subdivision, use, and development of shorelands of public waters. The Mille Lacs County subdivision ordinance recommends the use of conservation easements, buffer strips, and other restricted areas when necessary to protect wetland edges. Other counties within the watershed also have subdivision-type ordinances, though a detailed review was not conducted.	Mille Lacs	Ordinance		U					http://www.co.mille-lacs.mn.us/	http://www.co.mille-lacs.mn.us/	Watershed-Regulatory Effort	74
County Water Management Plan	Aitkin_WaterManagementPlan	Aitkin SWCD	Water management plan for Aitkin County	Aitkin	Plan		U	U		U	U	http://aitkincountyswcd.org/PDF-Docs/WaterPlan6-24-09.pdf		Watershed- Non-Regulatory Efforts	75
County Water Management Plan	Chisago_WaterManagementPlan	Chisago SWCD	Water Management plan for Chisago County	Chisago	Plan		U	U		U	U	http://www.co.chisago.mn.us/Fl	http://www.co.chisago.mn.us/	Watershed- Non-Regulatory Efforts	76
County Water Management Plan	Isanti_WaterManagementPlan	Isanti SWCD	Water Management plan for Isanti County	Isanti	Plan		U	U		U	U	http://www.co.isanti.mn.us/zoning/complocalwater/Isanti%20Co		Watershed- Non-Regulatory Efforts	77
County Water Management Plan	Kanabec_WaterPlan	Kanabec SWCD	The plan identifies existing and potential challenges or opportunities for the protection, management, and development of water resources and related land resources. The purpose is to achieve effective environmental protection of Kanabec County's water and land resources.	Kanabec	Plan		U	U			U	http://kanabecounty.govoffice2.com/index.asp?Type=B_BASIC		Watershed- Non-Regulatory Efforts	78
County Water Management Plan	MilleLacs_WaterPlan	Mille Lacs SWCD	Local water resource plan for Mille Lacs County	Mille Lacs	Plan		U	U		U	U	http://www.millelacs.swcd.org/water_plan.htm		Watershed- Non-Regulatory Efforts	79
County Water Management Plan	Pine_WaterManagementPlan	Pine SWCD	Water management plan for Pine County	Pine	Plan		U	U		U	U	http://www.co.pine.mn.us/verti	http://pineswcd.com/index.asp	Watershed- Non-Regulatory Efforts	80
County Water Management Plan	Kanabec_PriorityConcerns2012	Kanabec SWCD	Kanabec County recently (July 2012) requested input on priority concerns and actions for their Water Management Plan update. Top concerns included: protecting ground water drinking water sources; sealing unused wells; and developing a local ground water quality database.	Kanabec	Plan					U				Watershed- Non-Regulatory Efforts	81
Isanti County Parks Plan	Isanti_ParksPlan	Isanti County Parks and Recreation Commission	The Parks Plan discusses natural resource management, maintenance and protection.	Isanti	Plan		U					http://www.co.isanti.mn.us/parksrecfiles/parkpdfs/31408ParkP		Watershed- Non-Regulatory Efforts	82
Snake River Land Purchase	Online	DNR/TNC	The DNR purchased 405 acres of land within the Snake River watershed between the Snake River and the Snake River State Forest. The purchase allows for protection of 1.8 miles of shoreline.	SRW	Online		U					http://news.dnr.state.mn.us/201		Watershed- Non-Regulatory Efforts	83
Snake River Watershed Enhancement Project	SRWMB_EnhancementProject	SRWMB	While this report is primarily a WO assessment, it includes priority management areas within the SRW and associated best management practices to reduce pollutant loading. The practices will be tracked and monitored to measure effectiveness.	SRW	Report		U					http://kanabecounty.govoffice2		Watershed- Non-Regulatory Efforts	84
Snake River Watershed Enhancement Project	SRWMB_EnhancementProject_Final	SRWMB	This final report details the accomplishments/ outcomes of the enhancement project.	SRW	Report		U					http://kanabecounty.govoffice2		Watershed- Non-Regulatory Efforts	85
St. Croix Watershed Protection Project	N/A	SCRA	SCRA and the Washington Conservation District received financial assistance through ENRTF to conduct a detailed watershed assessment and prioritize areas for protection within the St. Croix Watershed.	St. Croix	None		U							Watershed- Non-Regulatory Efforts	86
SRW CAP	TNC_SRW_CAPWorkbook	TNC	Workbook for the SRW CAP.	SRW	Data File		U			U	U	https://www.box.com/shared/fhwo3pgc7sggf5jzh		Watershed- Non-Regulatory Efforts	87
SRW CAP	TNC_SnakeRiverCAP	TNC	The CAP identifies conservation targets and potential threats to those targets in the SRW.	SRW	Report		U			U	U	https://www.box.com/shared/fhwo3pgc7sggf5jzh		Watershed- Non-Regulatory Efforts	88
St. Croix River Watershed Conservation Priorities Report	StCroix_ConservationPriorities	St. Croix Conservation Collaborative	The report contains information about ongoing conservation work in the St. Croix watershed and identifies priority areas in need of conservation.	St. Croix	Report		U					http://basineducation.uwex.edu/	http://basineducation.uwex.edu/	Watershed- Non-Regulatory Efforts	89
St. Croix Shoreland Vegetation Restoration Project	St.Croix_ShorelandRestoration	Kanabec SWCD	The report outlines conservation costs and practices implemented including planting native vegetation buffers in the St. Croix watershed.	St. Croix	Report		U					http://kanabecounty.govoffice2.com/vertical/Sites/%78DF6C19		Watershed- Non-Regulatory Efforts	90
Systematic Conservation Planning Using Zonation	N/A	DNR	For the St. Croix Watershed, DNR applied zonation software to prioritize land areas for protection. For the Snake River Watershed, the goal of the Zonation analysis was to optimize environmental benefits while minimizing protection work in those areas that were not likely to cause surface water quality problems (i.e., non-contributing basins).	St. Croix	None		U	U	U		U			Watershed- Technical Resources	91
County Geologic Atlas Program	Online	MGS	MGS County geologic atlases for improved water management. MGS provides comprehensive geologic mapping essential to effective and efficient management of surface and ground water resources.	Chisago	Webmap					U		http://www.mn.gov/mgs	http://www.arcgis.com/home/	Watershed- Technical Resources	92
Grassland Bird Conservation Area	FWS_GrasslandBirds	USFWS	Map identifying GBCAs, which are treeless, large patches with minimal edge (round or square shapes), that provide habitat for grassland nesting birds.	Chisago	Map		U					http://www.fws.gov/midwest/ha	http://www.fws.gov/midwest/	Watershed- Technical Resources	93
Public Water Supply Map	MDH_PWS_SourceWaterProtection	MDH	A map identifying public water supplies and protection areas within the SRW.	SRW	Map					U				Watershed- Technical Resources	94
Small Wetlands Acquisition Program	FWS_WetlandAcquisition	USFWS	The purpose of the SWAP is the conservation of small wetlands and associated upland habitats in the conservation of breeding waterfowl. The map shows the level of priority for each SWAP.	Chisago	Map		U					http://www.fws.gov/midwest/ha	http://www.fws.gov/midwest/	Watershed- Technical Resources	95

Acronym	Name
BWSR	Board of Water and Soil Resources
CAP	Conservation Action Plan
CRP	Conservation Reserve Program
DNR	Minnesota Department of Natural Resources
EBI	Environmental Benefits Index
ENRTF	Environment and Natural Resources Trust Fund
FOTSCH	Friends of the St. Croix Headwaters
GBCA	Grassland Bird Conservation Area
GIS	Geographic Information Systems
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MBS	Minnesota Biological Survey
MCBS	Minnesota County Biological Survey
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MFA	Minnesota Forestry Association
MGLP	Midwest Glacial Lakes Partnership
MGS	Minnesota Geological Survey
MN	Minnesota
MPCA	Minnesota Pollution Control Agency
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NFHP	National Fish Habitat Partnership
PIF	Partners in Flight
PRRILCS	Prairie Pothole Region Integrated Landscape Conservation Strategy
RSEA	Regionally Significant Ecological Areas
SCRA	St. Croix River Association
SNA	Scientific and Natural Areas
SRWMB	Snake River Watershed Management Board
SWAP	Small Wetlands Acquisition Program
SWCD	Soil & Water Conservation District
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UMRFP	Upper Mississippi River Forest Partnership
USDA	U.S. Department of Agriculture
WFMIS	Watershed Forest Management Information System
WQ	Water quality
WRAP	Watershed Restoration and Protection study

Program or Document Name	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology
National/Multi- State- Funding Opportunity						
Conservation Reserve Program	ü	ü			ü	
National/Multi-State- Non-Regulatory Efforts						
National Fish Habitat Action Plan		ü				ü
North American Landbird Conservation Plan		ü				ü
North American Landbird Conservation Plan	ü	ü				ü
Projected Climate and Land Use Change Impacts on Aquatic Habitats		ü				ü
Strategic Plan for Fish Habitat Conservation in Midwest Glacial Lakes		ü			ü	ü
National/Multi-State- Technical Resources						
Midwestern Fish Habitat Assessment Models		ü				ü
Watershed Forest Management Information System	ü				ü	
State- Funding Opportunity						
Clean Water, Land and Legacy Amendment	ü	ü	ü	ü	ü	ü
Environment and Natural Resources Trust Fund	ü	ü	ü		ü	ü
Erosion Control and Water Management Program	ü	ü			ü	
MN Prairie Conservation	ü	ü				
State- Regulatory Efforts						
Snake River Watershed Restoration and Protection Strategy					ü	
Public Water Works Permit Program			ü			
MN Floodplain Management Act	ü	ü			ü	
MN Shoreland Management Act	ü	ü			ü	
MN Wetland Conservation Act		ü				
Source Water Protection					ü	
State Water Quality Standards and TMDL Program	ü	ü			ü	ü
State- Non-Regulatory Efforts						
DNR Strategic Conservation Agenda	ü	ü	ü	ü	ü	ü
Livestock Environmental Quality Assurance Program					ü	
Managing MN's Shallow Lakes for Waterfowl and Wildlife	ü	ü			ü	
MN Conservation Apprenticeship Academy	ü	ü	ü	ü	ü	ü
MN Forests for the Future Program	ü	ü				
MN Water Availability Report			ü			
MN Wildlife Action Plan	ü	ü				ü
Northeast MN Wetland Mitigation Inventory and Assessment		ü				
Scientific and Natural Areas Program	ü	ü				ü
Aquatic and Wildlife Management Areas	ü	ü				
MN Statewide Mussel Survey		ü				ü
Statewide Conservation and Preservation Plan	ü	ü	ü		ü	ü
Water Sustainability Framework	ü	ü	ü	ü	ü	ü
Woodland Stewardship Plan	ü	ü				
Clean Water Partnership and Section 319 Program	ü	ü	ü	ü	ü	ü
State- Technical Resources						
Ecological Ranking Tool	ü	ü			ü	
Forests, Water and People Analysis	ü	ü			ü	ü
MN Biological Survey		ü				ü
National Land Transformation Model	ü					
Precision Conservation Initiative	ü	ü	ü	ü	ü	
Upper Mississippi River Forest Partnership	ü	ü	ü		ü	
Watershed Health Assessment Framework	ü	ü	ü	ü	ü	ü
Watershed- Regulatory Effort						
County Shoreland Management Ordinance	ü	ü				
County Subdivision Ordinance	ü	ü			ü	

Program or Document Name	Landscape	Habitat	Hydrology	Geomorphology	Water Quality	Biology
Watershed- Non-Regulatory Efforts						
County Water Management Plan	ü	ü	ü		ü	ü
Isanti County Parks Plan	ü	ü				
Snake River Riparian Corridor Protection Project	ü	ü				
Snake River Watershed Enhancement Project	ü				ü	
St. Croix Watershed Protection Project	ü	ü				
Snake River Watershed Conservation Action Plan	ü	ü			ü	ü
St. Croix River Watershed Conservation Priorities Report		ü				
St. Croix Shoreland Vegetation Restoration Project	ü	ü				
Watershed- Technical Resources						
Systematic Conservation Planning Using Zonation	ü	ü	ü	ü		ü
County Geologic Atlas Program					ü	
Grassland Bird Conservation Area	ü	ü				
Public Water Supply Map					ü	
Small Wetlands Acquisition Program		ü				