

# FISH HABITAT PLAN:

A STRATEGIC GUIDANCE DOCUMENT



MINNESOTA DEPARTMENT OF NATURAL RESOURCES  
SECTION OF FISHERIES





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# EXECUTIVE SUMMARY

Minnesota has 5,400 fishing lakes and 15,000 miles of fishable rivers and streams. Maintaining abundant populations of fishes in these waters requires high quality aquatic habitat and healthy ecosystems.

The goal of this plan is to guide efforts by the Section of Fisheries to protect and restore fish habitats in lakes and streams of Minnesota. The Section of Fisheries will strive to direct approximately 60% of habitat management resources towards protection and 40% towards restoration. Central to the success of this plan is increased coordination between the Section of Fisheries and a variety of partners, both within and external to the DNR. The plan draws together a portfolio of existing plans and reports that provide strategic direction, guidance, and performance measures regarding Minnesota's aquatic resources. Fish habitat objectives include defining landscape level work areas, prioritizing lakes within the work areas, choosing projects, engaging partners, education and outreach, tracking results, influencing natural resource policy, and learning and adapting the implementation process. A suite of implementation strategies has been developed for each objective.

Past habitat management activities have focused on nearshore physical habitat (aquatic plant removal permitting), riparian stewardship (acquiring land and restoring shoreline), and stream channel improvement. In addition to these successful traditional practices, this plan recognizes the importance of watershed management to fish habitats, and suggests that the Section of Fisheries strategically interacts with the Division of Ecological and Water Resources and other agencies, local governments, lake associations, and other non-government organizations to advocate for fish and their habitats through watershed management.

Habitat frameworks are presented for both lakes and streams. The lakes framework is based on stresses to the lake from nearshore disturbance and land use in the watershed. The stream framework centers around an index of biotic integrity (IBI) and land use. Pieces of both frameworks are still being developed. These frameworks will help define and prioritize areas of aquatic habitat protection and restoration.

Staffing recommendations are made at several functional scales. Two landscape level fish habitat consultants, one for forested regions and one for agricultural zones, will develop policy and deliver fish habitat expertise. These coordinators will primarily define landscape level work areas, coordinate with partners, and affect natural resource policy. Several sub-regional fish habitat specialists will work with local partners to prioritize project areas, identify projects, track results, and provide habitat education. Each Fisheries Area will devote an additional 1/3 equivalent staff time to local fish habitat issues.

The Section of Fisheries is faced with emerging and increasingly urgent decisions that will affect future spending and staffing patterns. As agency budgets improve, either through revitalization of the Game and Fish Fund or through active pursuit of outside sources such as Legacy Funds or the National Fish Habitat Partnership, the Section has opportunity to enhance programmatic capacity for fish habitat management. This enhancement should not only include increased internal habitat project work, but also increased coordination with habitat partners both inside and outside of the DNR. Choices made by the Section of Fisheries will influence the structure, scope, and function of fish habitat work implemented across the state for decades to come.

# BACKGROUND

“Practical fisherman and others devoted to a more wholesome outdoor life should realize that there is no other starting point for further development of the “contemplative art of angling” than by building forest areas and still more forest areas.”

Charles Reittel, 1925  
*Fins, Feathers and Fur:*  
*Official Bulletin of the*  
*Minnesota Game and*  
*Fish Department*

## Why Do We Need a Fish Habitat Plan?

Minnesota has a wide diversity of lakes and rivers which comprise some of the state’s most valuable ecological, scenic, and economic assets. Among these, 5,400 fishing lakes range from shallow prairie lakes of the southwest to large, deep lakes on our northern border. There are also 15,000 miles of fishable rivers and streams, from small cold-water trout streams in southeast and northeast Minnesota to the large rivers that host world class walleye, catfish, lake sturgeon, and other fisheries.

Maintaining and enhancing high quality aquatic habitat and healthy ecosystems are essential for sustaining the populations of fish that are safe to eat, support a multi-billion dollar angling economy, and contribute to the quality of life we enjoy. Each waterbody is an asset to the local wildlife and human communities. Each waterbody is also a reflection of the land use within its watershed and on its shoreline. Changing land use and population growth threaten aquatic habitats in Minnesota. In the face of these and other pressures, sustaining Minnesota’s excellent fishing is not guaranteed and cannot be taken for granted.

A Fish Habitat Plan is necessary to maximize our ability to protect, enhance, and restore habitats in the face of limited budgets and staff. The most cost effective way to achieve healthy aquatic habitats is to protect areas that are still functionally intact.<sup>1</sup> Protection was also the top priority in the habitat section of the Minnesota Statewide Conservation and Preservation Plan<sup>2</sup> and the USDA Watershed Condition

Framework.<sup>3</sup> Recognizing that restoration of degraded habitats is also worthwhile, the Section of Fisheries will strive to direct approximately 60% of habitat management resources towards protection and 40% towards restoration. The first step in a restoration project may often be the protection of the remaining functional components before actual restoration work begins.

## Watershed Protection

While land in much of the forested portion of the state is under public ownership, a considerable amount is owned by private individuals and companies. These private parcels are increasingly being split up and sold for development. Private forest conservation easements, allowing sustainable timber harvest but no development, are a promising tool for preventing the detrimental ecological consequences of forest parcelization and development. Influencing partners to target forest easements within the watersheds of high water quality lakes will provide the permanent protection necessary to sustain the important ecological services that these systems provide to the citizens of Minnesota.

<sup>1</sup> Corson, A., P. Blanchard, and P. Calvert. 2010. Strategies for watershed management. Missouri Department of Conservation, Jefferson City.

<sup>2</sup> Legislative Citizen Commission on Minnesota Resources (LCCMR). 2008. Minnesota statewide conservation and preservation plan: final plan—phase 2.

<sup>3</sup> USDA. 2011. USDA Watershed Condition Framework. United States Department of Agriculture, United States Forest Service, FS-977. 24 pp.

## What Factors Affect Fish Habitat?

Fish habitat in lakes is largely affected by shoreline disturbance and water quality. Shoreline disturbances reduce physical habitat including the submersed and emergent vegetation, woody structure, and bottom substrates that fish and other aquatic animals need for food production, spawning substrate, and cover from predation. Water quality is largely determined by the size of and land use within the watershed, as well as riparian practices.<sup>4</sup> Poor water quality is associated with reductions in clarity, oxygen levels, and submerged vegetation and increases in algae and abundances of tolerant fish species, such

### Shoreline Protection

Demand for shoreline property is high, and shorelands are rapidly being developed. DNR's acquisition of riparian shoreline parcels called Aquatic Management Areas (AMAs) ensures that critical fish and wildlife habitat are conserved, public access to water resources will always be available, and habitat can be restored on previously disturbed areas. The Section of Fisheries administers more than 899 AMA shoreland miles across Minnesota. Fisheries recently partnered with the Trust for Public Lands to use Outdoor Heritage Fund monies to acquire over 200 acres of land on a peninsula on Dead Lake, an important migratory waterfowl lake in Ottertail County. This parcel included a variety of terrestrial habitats, protected over 4 miles of shoreline, and added to the existing Dead Lake WMA.

as common carp and black bullhead. The integration of water and land use planning has been identified as one of five essential actions to sustain water quality in Minnesota,<sup>5</sup> and has been recognized as important to fish as early as 1925.<sup>6</sup>

For lakes, water quality is affected by point and non-point pollution sources in the watershed.<sup>2</sup> Agricultural and urban run-off contribute oxygen-depleting pollutants, which are especially harmful to sensitive species such as cisco. Careless lakeshore development also decreases a lake's ability to function as a healthy ecosystem, not only by allowing increased runoff, but also through physical habitat alteration by lakeshore owners. Aquatic vegetation and large woody structure are often removed to satisfy urban senses of aesthetics.<sup>7</sup>

Fish habitat in streams and rivers is more complex and is influenced by a variety of factors.<sup>8</sup> Hydrology controls the source, amount, and rate of flow within the stream channel. Wetland drainage, road building, field tiling, and withdrawal of water affect the hydrologic cycle within the watershed. Physical barriers such as dams and flow reductions from water withdrawals disrupt system connectivity and interfere with movement of fishes and other aquatic species. The biota of a stream includes the mosaic of terrestrial and riparian plants and animals living along the channel and in the flood plain and



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<sup>4</sup> Burnett, K.M., G.H. Reeves, D.J. Miller, S. Clarke, K. Vance-Borland, and K. Christianson. 2007. Distribution of salmon-habitat potential relative to landscape characteristics and implications for conservation. *Ecological Applications* 17: 66-80.

<sup>5</sup> Swackhamer, D.L., J. Coleman, and M. Hoff. 2011. *Minnesota Water Sustainability Framework*. University of Minnesota Water Resources Center. St. Paul. 139 pp.

<sup>6</sup> Reittel, C. 1925. More forests, better fishing. Fins, feathers and fur: official bulletin of the Minnesota Game and Fish Department. 41: 21-30.

<sup>7</sup> Payton, M. and D. Fulton. 2004. A study of landowner perceptions and opinions of aquatic plant management in Minnesota lakes. U.S. Geological Survey. Minnesota Cooperative Fish and Wildlife Unit. University of Minnesota, Department of Fisheries, Wildlife, and Conservation Biology. St. Paul.

<sup>8</sup> DNR's Watershed Assessment Framework at [http://www.dnr.state.mn.us/watershed\\_tool/promo.html](http://www.dnr.state.mn.us/watershed_tool/promo.html)

“The scope of the Plan includes coordination, acquisitions, projects, and assessment to protect and restore aquatic habitat. . . New to this plan are the formal recognition of the role land use plays in affecting fish habitat and setting priority work areas, and the increased coordination required to influence land use decisions for the benefit of fish.”

watershed. Geomorphology is the combination of landscape topography, soil type, and stream flow patterns that sets the foundation for the shape and stability of the stream channel and flood plain. Water quality is the chemical and physical nature of water in the stream. These elements interact dynamically with each other to determine the habitat of stream fishes. Sediment load, nutrient concentrations, and water temperature determine stream suitability for different fish species. As with lakes, water quality in streams is a direct reflection of land use in a watershed.

This plan stresses a holistic approach to fish habitat management. It considers influences of watersheds, shorelines, and physical aquatic components on fish habitat, and presents a framework by which the Section of Fisheries can work with a number of partners in various roles to protect and restore fish habitat in lakes and streams across Minnesota. In some instances, the Section of Fisheries will be the lead, while in other instances the Section's role will be to provide technical or financial support. The Section of Fisheries does not intend to duplicate efforts or compete for limited funds, but seeks to provide assistance where appropriate, and lead where required.

### Purpose and Scope

The purpose of the Fish Habitat Plan is to guide the Section of Fisheries and our conservation partners in fish habitat protection, enhancement, and restoration efforts in managed fish waters across the state. This planning process was stimulated by large, new funding opportunities created by passage of a state constitutional amendment dedicating a portion of the state sales tax for clean water and fish and wildlife habitat, and federal fish habitat initiatives currently being organized under the National Fish Habitat Partnership.

The scope of the Plan includes coordination, acquisitions, projects, and assessment to protect and restore aquatic habitat. The Plan draws in a portfolio of existing plans and reports (Appendix 1) that provide strategic direction, guidance, and performance measures regarding Minnesota's aquatic resources. These existing plans have already guided quality habitat protection and restoration for the Section of Fisheries (Appendix 2). New to this plan are the formal recognition of the role land use plays in affecting fish habitat and setting priority work areas, and the increased coordination required to influence land use decisions for the benefit of fish.

The Section of Fisheries Fish Habitat Plan will eventually be folded into a broader Department aquatic habitat plan which is yet to be developed. This plan will encompass other flora, fauna, and human priorities within other DNR disciplines. We will also work toward a comprehensive Minnesota aquatic habitat plan that involves multiple agencies and stakeholder partners

### Restoration

Healthy shorelines are critical for water quality, aquatic plants, and fish and wildlife. DNR provides education, technical assistance, and grants to citizens, conservation organizations, and local governments to restore altered shoreline habitat in order to increase the diversity of native aquatic plants, improve and protect shoreline habitat, and enhance and protect water quality. Since 1998, the DNR Shoreline Habitat Program has helped restore shoreland on over 513 sites, comprising more than 29 miles of shoreland habitat. Shoreland restoration efforts can be accelerated through coordination with additional partners.

interested in aquatic habitat.

The Plan is a living document, focused on adaptive management. Data gathered and information learned from programs and projects will be used to update the Plan regularly with the best available scientific information.

## Authority to Act

The responsibilities of the Department of Natural Resources to conserve and enhance natural resources are codified for fish and wildlife MN Statute Chapter 84.941 and water resources MN Statute Chapter 114D. Protection and restoration of fish habitats is also consistent with the Department and Section of Fisheries mission statements.



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**DNR Mission:** "... To work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial use of natural resources in a way that creates a sustainable quality of life."

**Section of Fisheries Mission:** "To conserve and manage Minnesota's aquatic resources and associated fish communities for their intrinsic values and long-term ecological, economic, and recreational benefits to the people of Minnesota."

The values in this plan are also embedded in the *DNR Senior Management Team's four-year plan* "Conservation that Works."<sup>9</sup> Although "Conservation that Works" was created as a four year plan, the conservation values of that plan imply a long-term vision that transcends short-term planning processes.

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<sup>9</sup>MN DNR. 2011. DNR Senior Management Team four-year priorities: "Conservation that works." Minnesota Department of Natural Resources. St. Paul, MN.  
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**THE VISION of the MN DNR Section of Fisheries** is to achieve healthy, resilient aquatic ecosystems throughout the state that provide sustainable fishing and diverse, native fish communities. This vision will be realized through active collaboration with our partners to protect, enhance, and restore aquatic habitat in order to insure our multi-billion dollar angling economy.

## GUIDING PRINCIPLES

*High-quality aquatic habitats must be protected.* Losses of aquatic habitat for fish are occurring at a rapid pace because of land use changes in watersheds, development along shorelands, aquatic invasive species, climate change, and a widening societal disconnect with healthy, natural systems. While many of our

aquatic resources are still of outstanding quality, they are under increasing ecological stress. The generally acknowledged statement that it is “cheaper to protect than to restore” will guide the Section of Fisheries to identify high-quality lakes and streams and prioritize them for protection.

*Healthy watersheds are fundamental to clean water and fish habitat.* Fish are indicators of the ecosystem health of the lakes and streams in which they live. Improving watershed conditions and sustaining ecosystem services improves fish habitat and benefits a multitude of other aquatic and terrestrial organisms.

*Partnerships are critical for improving aquatic habitat.* The experience, knowledge, and skills of Fisheries staff must be leveraged with that of our

partners to improve aquatic habitat. The Section of Fisheries will partner with federal and state agencies, local governments, non-governmental organizations, sporting groups, lake associations, and others. These strong partnerships will enable us to capitalize on the expertise and fiscal resources that maximize the delivery of habitat protection and restoration programs and policies.

*A key partner will be the integrated Division of Ecological and Water Resources (EWR).* The vision of the new EWR division is “Healthy Watersheds throughout Minnesota.”<sup>10</sup> Because healthy watersheds are fundamental to clean water and fish habitat, EWR and Fisheries share some common goals. The extensive, field-based network of biological expertise at Fisheries area offices will enable the Section of Fisheries to assist EWR with local aquatic habitat issues and resource monitoring.

*Section of Fisheries procedures and staffing patterns will focus on habitat management activities.* Increased focus on aquatic habitat requires strategic changes in how the Section of Fisheries conducts business. This will shift how we gather habitat data, recruit staff, allocate budget resources, develop and implement habitat projects, and acquire Aquatic Management Areas. The Section will communicate this shift in focus with our stakeholders and engage them in this important work.



Eric Engbretson

<sup>10</sup>MN DNR. 2010. Healthy watersheds throughout Minnesota: Designing a new division within the Department of Natural Resources to manage water, biodiversity, and ecosystem service. Minnesota Department of Natural Resources, Division of Ecological and Water Resources. St. Paul, MN. 35 pp.

*Aquatic habitat management is implemented within a strategic framework that maximizes habitat benefit for the amount of resources allotted.* The Section's strategies for prioritizing habitat work will be based on ecologically sound, scientific principles that maximize protection, enhancement, and restoration of aquatic habitat. This strategic framework will be particularly important as large funding sources, such as the Outdoor Heritage Fund, Clean Water Fund, National Fish Habitat Partnership, and the Minnesota Environmental and Natural Resources Trust Fund, base their funding decisions on how proposed habitat actions maximize benefits and outcomes.

*Protection, enhancement, and restoration goals will be tailored to specific ecoregions.* Aquatic resources are exposed to different stressors across the state. Therefore, organizing aquatic habitat management actions around ecoregions and watershed boundaries will facilitate development of geographically appropriate strategies.

*The Section of Fisheries will support research and programs that increase public understanding, acceptance, and practice of aquatic habitat stewardship.* The DNR has done a creative and effective job of fostering near-shore stewardship through programs such as MinnAqua and the Shoreland Habitat Restoration Program. Our educational initiatives must expand to include the importance of watershed to aquatic habitat health, and stewardship solutions to protecting and restoring healthy watersheds. The Section will initiate internal research projects or contract with research institutions to gather critical human dimensions data from which to develop or adapt programs.

*Habitat management actions will result in measureable restoration and protection of aquatic systems.* Cost-effective monitoring and evaluation tools will be developed to measure success. These tools will build upon our existing lake and stream survey programs and be coordinated with monitoring programs within other DNR divisions, state agencies, and other partners.



Pete Jacobson



Eric Engbretson

# AQUATIC HABITAT CONSERVATION GOALS AND OBJECTIVES

The goal of this plan is to guide efforts by DNR Section of Fisheries to protect, enhance and restore fish habitats in lakes and streams of Minnesota.

## Goal

The goal of this plan is to guide efforts by DNR Section of Fisheries to protect, enhance and restore fish habitats in lakes and streams of Minnesota. These efforts will include nearshore projects (e.g. aquatic plant and woody habitat in lakes and within-channel habitat projects in streams), riparian projects (e.g. restoration and protection of lakeshores and stream floodplains), and watershed scale projects that protect and restore watersheds of high fishery value lakes and streams. The Section of Fisheries contributions will include physical project work, policy recommendations at local, state, and federal levels, and technical assistance to conservation partners. It is not the intent of DNR Section of Fisheries to duplicate efforts of partners, but rather to advocate for fish habitat protection, enhancement and restoration within the context of each partner's authority and scope of work.

The goal, objectives, and progress of this plan will be evaluated minimally every five years, with more thorough review and updates of the entire plan every ten years.

## Objectives

**1. Establish Landscape Scale Conservation Zones.** These zones will form the basis for establishing partnerships with other agencies and conservation groups.

**Strategy 1.** For lakes, zones will be based on the habitat framework for lakes discussed in the next section. Lakes within a zone will often have similar watershed and shoreline characteristics and disturbances, and so may benefit from similar conservation strategies. Zones may or may not correspond with other ecological or administrative boundaries. For example,

lake zones in need of protection would include western shield lakes and Mississippi River headwaters, while a zone requiring restoration might include lakes in the Ottertail River system and several other adjacent watersheds near Detroit Lakes and Alexandria. Most lakes in the southwest agricultural zone could be considered for partial restoration.

**Strategy 2.** Stream conservation zones will be based on the habitat framework for rivers and streams discussed in the next section. Adjacent major watersheds with similar types of disturbances may be combined into larger conservation zones. For example, the southeast trout streams include seven major watersheds which can be combined into one stream conservation zone.

### On the Right Track

BWSR examined trends in water chemistry in some Aitkin County lakes, and found that two lakes, Cedar and Farm Island, showed similar declines in water quality. DNR Fisheries surveys showed that cisco were once present in both lakes, but were no longer found in Farm Island Lake. BWSR used these data to demonstrate that protection was needed for Cedar Lake to stop the water quality decline and preserve cisco habitat. Aitkin County SWCD moved forward with this information to obtain \$50,000 in Clean Water grants for Cedar Lake habitat projects including conservation easements, forest stewardship planning, and shoreline restoration. In this example, Fisheries simply provided information that other entities used to influence where Clean Water money was applied.

**Strategy 3.** Conservation zones can be created directly from declared work areas of potential partners, such as the Leech Lake Area Watershed Foundation or the Mississippi Headwaters Board.

**2. Engage Partners.** Working with partners will be essential to the success of this plan. While the Section of Fisheries has demonstrated experience in working with physical habitats, the water quality component will require that we collaborate with others who have resources and authority extending up into the watersheds. Under this model, the Section of Fisheries obtains or supports funding for organizations or LGUs that include fish habitat values in project design and implementation.

**Strategy 1.** Invite partners to team with DNR to protect, enhance and restore watersheds identified in Objective 1. While Fisheries might not be the lead of these workgroups, such groups would provide a framework for many partners to come together and package larger projects for greater impacts and broader appeal. Where such groups already exist, staff will work directly with the group and represent Fisheries interests.

**Strategy 2.** Equip Fisheries staff to be familiar with mission and abilities of other state agencies, local government units, and private organizations, ranging from larger organizations such as The Nature Conservancy to smaller groups such as lake associations and sporting clubs.

**Strategy 3.** Support partners in grant requests and work plan modifications that benefit fish habitat. Support could range from moving a proposed project from an area where it would not benefit fish habitat to a higher priority area, to working with counties and local organizations to create zoning rules that

protect fish habitat, to encouraging conservation easements and forestry stewardship plans, to writing supporting documents for Clean Water or Outdoor Heritage grants, to aiding in acquisition of parcels. The Section of Fisheries may also take the lead in grant writing, and seek supporting documents from partners.

**3. Prioritize Project Areas.** Within each conservation zone, individual projects will need to be identified and prioritized.

**Strategy 1.** Define high-quality aquatic habitat for each conservation zone.

**Strategy 2.** Prioritize lake and stream watersheds for habitat work. Key considerations could include: degree of protection and disturbance, presence of critical habitat, water quality data, status of fish and aquatic plant communities, threat of development, importance of the resource, and degree of local support.

**Strategy 3.** Take advantage of sponsored conservation opportunities. Employ the concept of informed opportunism<sup>11</sup> which allows that work might be done in some areas that are not the highest priority if partners have already developed momentum and capacity for completing projects that benefit aquatic habitats. Such projects must explicitly acknowledge the trade-offs associated with delaying work on the areas of highest priority.

**Strategy 4.** Consider social, economic, and political factors that will help make project choices palatable to the public and other audiences.<sup>12</sup>



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<sup>11</sup> Noss, R. F., C. Carroll, K. Vance-Borland, and G. Wuerther. 2002. A multicriteria assessment of the irreplaceability and vulnerability of sites in the Greater Yellowstone Ecosystem. *Conservation Biology* 16: 895-908.

<sup>12</sup> Knight, A. T., and R. M. Cowling. 2007. Embracing opportunism in the selection of priority conservation areas. *Conservation Biology* 21: 1124-1126.

## Major Watershed Restoration and Protection Strategies (MWRAPS)

MWRAPS is a Pollution Control Agency potential plan to bring together information and recommendations from a number of stakeholders and package them into a single watershed management plan at the HUC 08 level. The restoration component will largely be driven by TMDL implementation plans, while the protection component will be driven by interests of stakeholders and identification of critical habitats. Clean Water implementation funds will be available to local government units through the MN Board of Water and Soil Resources. Additional protection can be achieved through partners using Outdoor Heritage Fund dollars.

**4. Project Identification and Tool Selection.** Section of Fisheries staff working on habitat issues must be informed and aware of the relative status of different watersheds, as well as aware of the kinds of work being carried out by different entities. Once a water body and its associated watershed are considered for protection and/or restoration, specific goals need to be identified. Habitat staff must then make specific decisions on projects that can be supported and projects that can be initiated. Without constraining all future projects, many projects will include one or more of the following strategies:

**Strategy 1.** Permanently protect high quality aquatic habitats and watersheds through conservation easements, special protection of designated areas by local units of government, and some fee title acquisition.



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**Strategy 2.** Leverage other land protection programs through grant support and by sharing Section priorities for watershed protection and restoration with EWR, MPCA, BWSR, and other partners.

**Strategy 3.** Identify and restore impaired systems where possible, coordinating with partners as needed.

**Strategy 4.** Provide technical assistance at state and county levels to include mechanisms for minimizing impacts to the watershed from new development and reducing the impacts of existing development.

**Strategy 5.** Apply for or assist with applications for federal, state, or other funding to support SWCD and other staff working at the watershed level in targeted areas to enroll riparian or other key land in conservation programs and to complete wetland and shoreline restorations.

**Strategy 6.** Once decisions are made as to what kind of project is desired for a specific watershed, work with appropriate partners to choose the right tools. Tools may include:

Watershed Level: conservation easements, land acquisition (including wildlife management areas, scientific and natural areas, and conservation land trusts), education, zoning proposals, local ordinance support.

Riparian Level: sensitive shoreland identification and protection (aquatic management areas), shoreland restoration, resident outreach, septic system compliance, bank stabilization, streamside buffers.

Aquatic Level: Physical habitat enhancement (e.g., large woody structure, plant restoration), water level management, connectivity, chemical rehabilitation, lake aeration, aquatic invasive species.

**5. Track Results.** The outcomes of habitat project activity should be quantifiable. As lake shorelines and watersheds are progressively protected, and as disturbances are reduced, water quality will be preserved or improved.

**Strategy 1.** A suite of graphs should be selected to portray projected and observed changes in land use, shoreland use, water quality and physical habitat. This suite may include plots from the lake and stream habitat frameworks, time series of water quality parameters, IBI scores, etc.

**Strategy 2.** Past, present, and targeted future status of individual waters and associated watershed should be plotted, and compared to observed changes resulting from cooperative management efforts.

**Strategy 3.** Long-term monitoring is needed to observe effects of habitat protection or restoration of fish populations. Lakes in the “Sustaining Lakes in a Changing Environment” program (SLICE) and demonstration watersheds may provide model systems to monitor for anticipated changes (or stability) in fish populations.

### An Education Observation

Central Lakes College students presented presentations on anticipated changes in lake trophic status for several major Brainerd Area lakes based on proposed zoning changes and projected population increases (December 2011). Lake association members were invited to hear about their lakes. After hearing how changes away from the lake were going to impact the lake, most shoreland owners responded with typical nearshore solutions, such as shoreland restoration or improved septic compliance. Educators have successfully supplied the public with some protection and restoration tools. Now they must broaden stakeholder understandings to include the ties between watershed health and water quality.

**6. Education.** Work within the DNR and with partners to expand education efforts to encourage both lakeshore and non-riparian landowner participation in planning and implementing habitat projects. The DNR and other agencies have done an excellent job conveying the importance of shoreland restoration, buffer strips, and compliant septic systems. With growing recognition of the importance of watershed management to water quality and fish habitat, education programs must be broadened to include the importance of stewardship and land management outside of riparian areas.

**Strategy 1.** Develop materials showing the history and projected future states of lakes of interest. Information would include history of disturbances, changes in trophic state, potential disturbances related to proposed zoning, expected impacts of proposed changes, and impacts of complete development of unprotected lands. These materials may be used to convey the urgency of watershed and shoreline habitat projects, and the consequences of inaction or inappropriate action.

**Strategy 2.** Discuss connections between watershed use and water quality at meetings with lake associations. Reach non-riparian owners through state and county fairs, local environmental forums, State Park interpretive talks, routine public interactions, and other opportunities.

**Strategy 3.** Work with MinnAqua to take this message to schools and other venues. Support efforts to expand adult stewardship education.

**Strategy 4.** Discuss or distribute materials with all AIS and APM permits.



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**Strategy 5.** Initiate internal research projects or contract with research institutions to gather critical human dimensions data from which to develop or adapt programs. An example would be to learn more about values guiding personal choice in private property stewardship decisions.

#### ***7. Affect Changes in Natural Resource Policy.***

Past land-use policies were often established without consideration to their effects on water quality and aquatic habitats, although this situation has improved in recent decades. With this habitat plan, the Section of Fisheries has the opportunity to reframe land-use policy questions and advocate for policy changes that would increase protection and restoration of aquatic habitats.

**Strategy 1.** Influence DNR internal policies.

Examples: Incorporate water quality considerations into work on private lands, sale of public lands, permitting, streamlining project planning and funding procedures.

**Strategy 2.** Influence policy at local government unit level.

Examples: township and county level planning and zoning, perceptions about public ownership, watershed district management. Proactively engage local government units concerning high value waterbodies.

**Strategy 3.** Influence policy at State level. Examples: management of School Trust lands, shoreland rules, stewardship incentives, ditch laws.

**Strategy 4.** Influence policy at Federal level. For example, make policy recommendations for federal Farm Bill and National Fish Habitat Conservation Act legislation that would positively influence aquatic habitat.

**8. Learn and Adapt.** With the large number of potential partners comes a large number of potentially successful pathways toward protecting, enhancing and restoring fish habitats. Some pathways may prove to be more effective than others, and some may not merit repeating. Careful record keeping and information sharing will be important tools to keep the Section moving forward efficiently. A reporting format will need to be developed that not only records project status, but also contains notes on the shortcuts and shortfalls experienced on different conservation pathways.

**Strategy 1.** Develop a “habitat manual” to guide habitat staff and other conservation practitioners through aspects of habitat assessment, prioritization, reporting, and evaluation. Also guide users through funding complexities and working with partners. Refine manual as learning occurs after reviewing successes and failures.

**Strategy 2.** Make reports available online to habitat personnel, other DNR staff, and the public.

**Strategy 3.** Section of Fisheries habitat staff should meet annually to evaluate methods.

**Strategy 4.** Identify and work within demonstration watersheds with USDA, MPCA, and BWSR where benefits of watershed BMPs can be documented.

**Strategy 5.** Habitat staff should seek feedback from partners.

**Strategy 6.** Periodically evaluate Section staffing priorities to determine effectiveness and continued relevancy.

# TOWARDS IMPLEMENTATION: SUPPLEMENTAL INFORMATION

Frameworks for Establishing Conservation Zones



Bill Lindner Photography

## Habitat Framework for Lakes

The lakes framework is based on the habitat condition plot (Figure 1) which simultaneously looks at the status of a lake's shoreline disturbance and watershed disturbance as surrogate measures of physical habitat and water quality, respectively. Lakes in the lower left quadrant have relatively undisturbed watersheds with good water quality and good physical habitats. Efforts should be made to protect these conditions. Lakes in the upper left quadrant still have good physical habitats, but may be suffering from lowered water quality due to watershed disturbances. These lakes will require watershed level restoration while protecting the shorelines. Lakes in the lower right quadrant have disturbed physical habitats but good water quality, and require shoreline restoration coupled with watershed level protection. Finally, lakes in the upper right quadrant have degraded physical habitats and water quality, and require restoration at both watershed and shoreline levels. Projects that can simultaneously reduce shoreline and watershed disturbances could yield the greatest conservation return for these highly altered systems.

## Watershed Disturbance and Water Quality

A landscape analysis of watershed condition in lakes across the state has suggested key geographic areas for water quality protection and restoration. Modeling by DNR Fisheries Research staff suggests that total phosphorus concentrations

increase significantly over natural concentrations in lakes with watershed land use disturbances greater than roughly 25%. Disturbed land includes urban development, agriculture, and mining, and may contribute up to 15 times more phosphorus to surface waters than undisturbed lands. Additional phosphorus can increase algal production, which can decrease



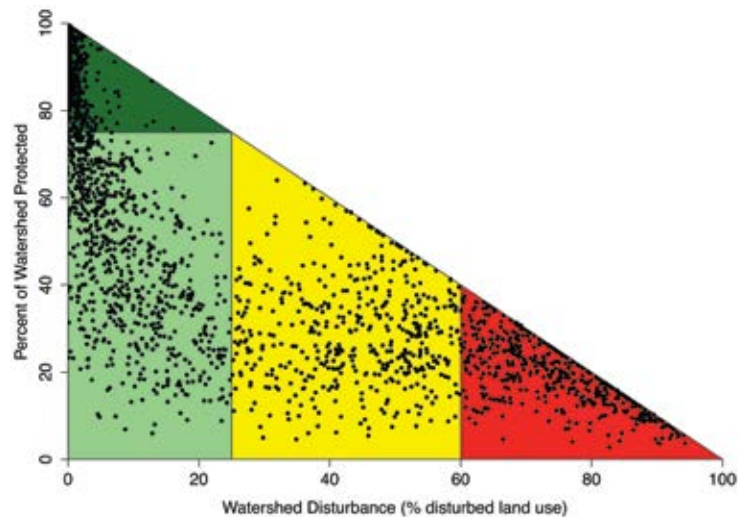
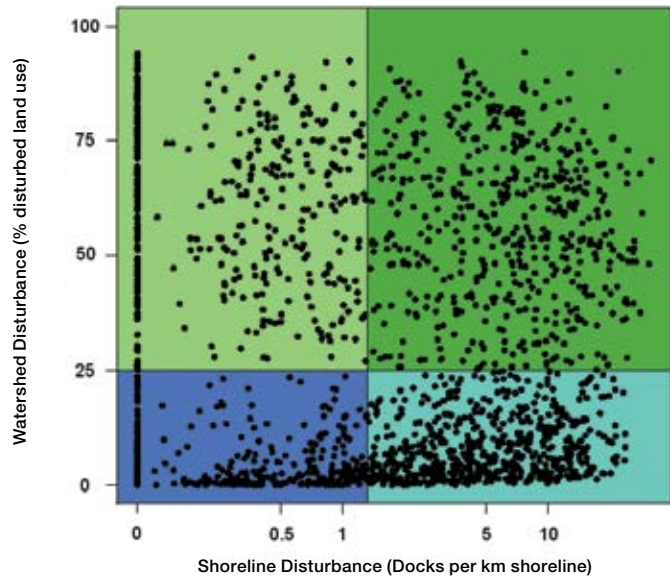
USDA Photo

plant growth, water clarity, and recreational value of the lake. By plotting the watershed disturbance level against a protected land variable (percent of land publicly owned or protected by conservation easement in 2008 Minnesota GAP Ownership data) for each lake's true watershed, a watershed condition plot was created (Figure 2). The condition of each watershed can then be projected onto a lakes watershed condition map (Figure 3).

The watershed condition plot and watershed condition map provide some general direction for the types of habitat work that may be most appropriate for each watershed. Watersheds with at least 75% of their area in protected status are reasonably protected from future disturbances at the watershed level (dark green in Figures 2 and 3). Maintenance of land protection is the primary goal within those watersheds and the suggested management approach is vigilance. Similarly, lakes with watersheds that are less than 25% disturbed but also less than 75% protected need additional protection to avoid future water quality degradation (light green). Lakes with more than 25% disturbance would benefit from watershed-level restoration. Restoration of lakes with intensive urbanization and agriculture in their watersheds (>60% disturbance) will be very expensive and difficult (red). The suggested approach for these lakes is partial restoration, likely focused on restoration of riparian habitats or particularly significant discrete watershed disturbances. Lakes with watersheds that have moderate levels of disturbance (25–60%) have a more realistic chance for full restoration of water quality (yellow).

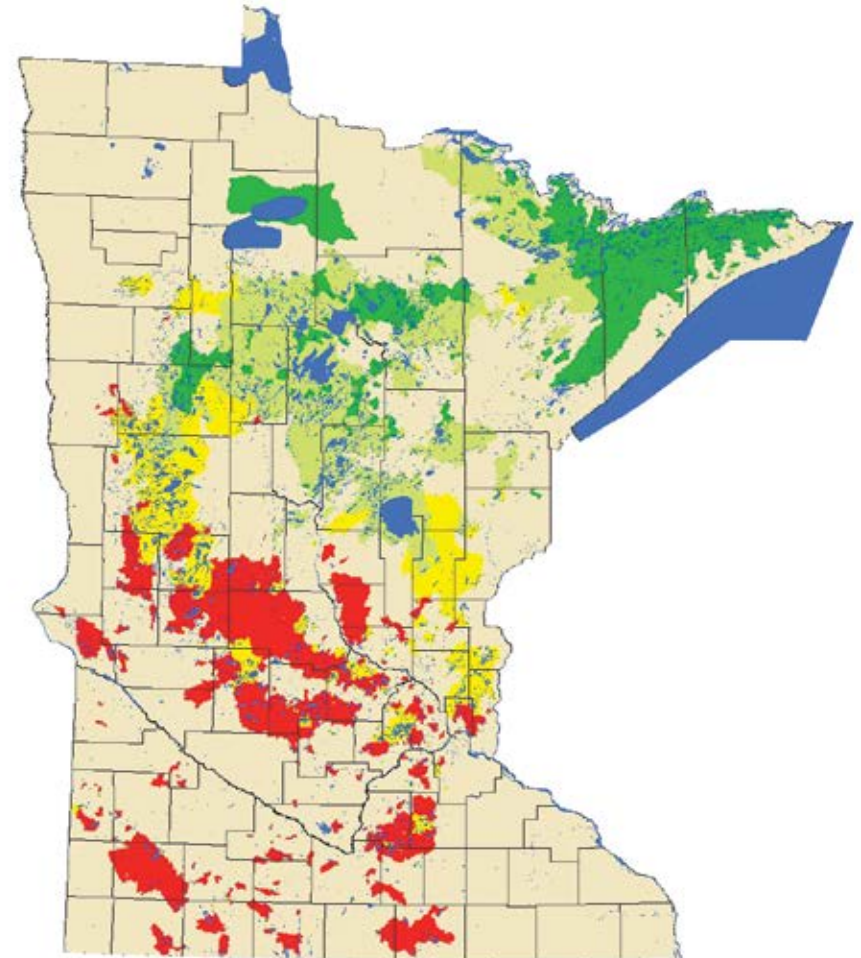
The distribution of lakes that fall in these categories is not uniform (Figure 3). Lakes with watersheds requiring vigilance tend to be in the northeast where extensive public land holdings exist in the form of national, state, and county administered forests. Lakes that would benefit from additional watershed protection are mostly found in the north central part of the state and the western edge of the Canadian Shield. Many of these

Figure 1. The Lakes Habitat Condition Plot. Distribution of Minnesota lakes based on the percentage of disturbed land in the watershed and the degree of shoreline disturbance. The shoreline disturbance threshold is provided as an arbitrary threshold until further refinements are made.



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Figure 3. Lakes Watershed Condition Map. This map roughly describes the distribution of watersheds in need of varying levels of protection and restoration. Dark green generally represents vigilance, light green indicates additional protection needed, yellow indicates potential for full restoration.



lakes still have excellent water quality and are great candidates for protection efforts. Full restoration areas (yellow) are mostly in transitions zones between forests and agriculture where watershed disturbance is moderate. Many lakes in southwestern Minnesota have watersheds largely committed to agriculture and are unlikely to be fully restorable. However, these turbid lakes are so nutrient-rich that they may benefit from watershed restoration efforts that at least bring nutrient concentrations down to the point where rooted macrophytes can grow (partial restoration).

#### Application Considerations:

- The watershed condition plot and associated map do not provide complete descriptions of condition. Local context was not considered in this broad assessment of disturbance. For example, some agricultural practices, such as row cropping, have greater effects on water quality than practices like grazing on permanent grasslands. In addition, precisely targeted best-management practices can mitigate the effects of land use disturbance, but do not appear in the generalized land disturbance model. Detailed modeling at the individual lake watershed scale will be necessary to quantify these effects and is a necessary step before

implementing specific water quality management actions.

- School Trust lands are included among protected lands via public ownership. However, their function is to generate income for the School Trust Fund. Future development of these lands for mining or other revenue producing disturbances may occur.



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- The threshold of 25% is not an invitation to develop lake watersheds to that level. All watershed disturbances lead to increased phosphorus which will increase algae and decrease water clarity. As part of its water quality standards, the U.S. Environmental Protection Agency has issued an antidegradation policy under the Clean Water Act that allows water quality to be lowered only in certain classifications of lakes, and only following state implementation procedures. These antidegradation policies should be applied to our high water quality, low disturbance lakes.

### Shoreline Disturbance and Physical Habitats

Shoreline disturbance, which includes agricultural practices and urbanization in riparian zones, often results in changes to the physical habitats of a lake or stream. Examples of shoreland disturbance effects on aquatic habitat include sedimentation from erosion that can reduce water clarity and blanket spawning substrates, and removal of plants and woody structure by riparian property owners.

A lakes shoreline condition plot is being developed similar to the lakes watershed condition plot. Actual shoreline disturbance is intensive to measure directly and only limited data exist. Remote sensing of shoreline disturbance is being explored as a way to evaluate shoreline habitat condition in lakes statewide. However, there are complications because tree canopies often obscure lawns, houses, and impervious roads in photographs used to assess disturbance. A proxy based on dock counts shows promise as an estimator of shoreland disturbance. Other measures of near shore habitat disturbance are also being considered. Condition maps and plots will be developed as those analyses are completed.

Management of physical habitats will be done in a more holistic fashion. For example, aquatic plant removal activity is regulated at the site level. While permitting will always be at the site level,

each site must be considered within the context of the entire lake. Regulations for plant removal may need to be indexed on the available habitat in the lake and risks to that habitat based on the level of development. Efforts are also needed to promote coarse woody habitat, which can supply spawning cover, nursery habitat, and feeding substrates for a variety of fish species. Protection and restoration of coarse woody habitat is promoted through education, stewardship, enhancement projects, and acquisition of wooded AMAs.

## Habitat Framework for Streams and Rivers

The streams framework is based on the relationship between standardized Index of Biotic Integrity (IBI) scores measured by the Minnesota Pollution Control Agency (MPCA), and watershed disturbances as summarized in a database provided by the National Fish Habitat Partnership (NFHP).

IBI scores generally decreased with increased watershed disturbances (Figure 4), presumably a result of habitat degradation associated with disturbance. Mean IBI scores were above impairment thresholds when the Watershed Disturbance Index (WDI) was less than 2.0. However, many sites with  $WDI < 2$  had IBI scores indicative of impairment. Some of these locations may be naturally depauperate of fish, or fish communities may be influenced by local effects not captured in the disturbance index. As disturbances increased above 2.0, mean IBI scores fell below impairment thresholds. Yet streams with high biotic integrity exist in areas of high disturbance, which demonstrates some natural resistance of the system that is not measured by this disturbance index. The statewide stream condition map, based solely on disturbance levels, shows similar trends to the lakes condition map (Figure 5). Watersheds nearer to agricultural and urban areas in southern and western parts of the state experience higher watershed disturbances resulting in poorer water quality, while watersheds further north and east are less disturbed and would benefit from protection

efforts. Improvements to this framework could be achieved by including local riparian effects and considering the protection status of individual parcels. These are areas for further development.

For sites with IBI scores, further refinements can be made to the streams framework. Standardized IBI scores can be combined with watershed disturbance scores to create an alternative strategy for categorizing regions of the IBI-disturbance plot (Figure 6). This graph, the streams watershed condition plot, is similar to the lakes watershed condition plot. Sites with standardized IBI scores greater than one are considered unimpaired, although it is apparent that some may be impacted by habitat disturbances. These sites may require vigilance or added protection, and as disturbance is increased, the component of restoration must also increase. For impaired waters (standardized  $IBI < 1$ ), restoration is essential to restore biotic integrity, although protection of remaining undisturbed features will be important to maintain progress achieved through restoration. Impaired waters at sites of low disturbance are likely areas of naturally limited biological potential, and would be low priority areas for restoration. However, the low IBI may be the result of unmeasured local disturbances, so these sites should not be discarded too readily. Moderately to highly disturbed, impaired waters may benefit from restoration of disturbed areas and protection of intact places. Highly disturbed impaired waters may be lower priority because of the amount of resources it would take to make substantial change. However, all sites near their impairment threshold are worthy of consideration. Costs

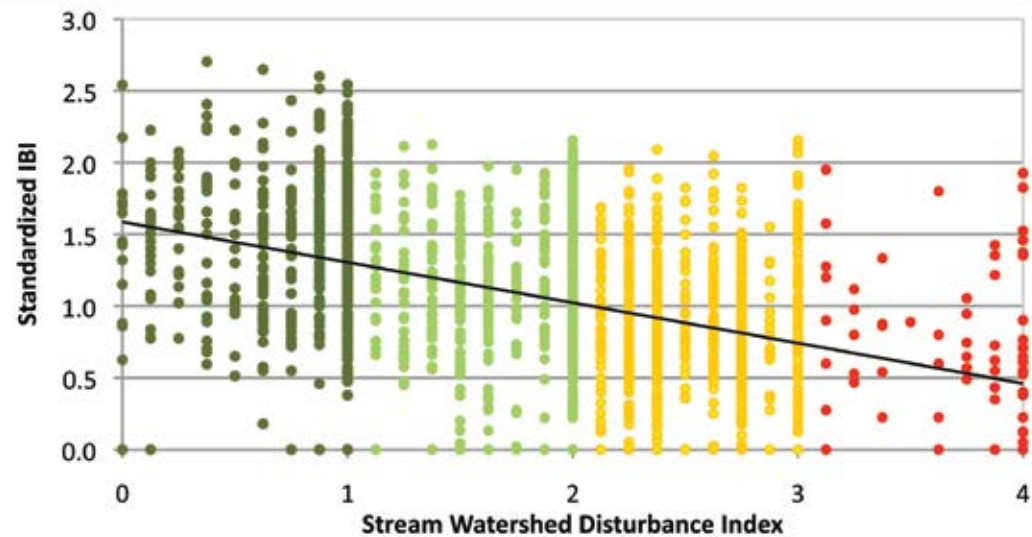


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to prevent impairment or restore slightly impaired systems may be small compared to costs associated with conducting TMDL studies and developing and implementing pollution reduction and restoration plans. The categories from this graph were transferred back to the local watersheds from which IBI scores were collected to create the Streams Watershed Condition Map (Figure 8), which is analogous to the Lakes Watershed Condition Map. Over time, as IBI scores are determined for more locations by PCA or others, enough sites may be sampled to create a stream condition map based on biotic responses rather than just disturbance level.

The utility of this model is the ability to pull geographically similar reaches together and highlight them within this framework. For example, North Shore tributaries to Lake Superior generally fall out as low disturbance and high IBI (Figure 7). There are some exceptions to this rule, however. A few streams are very highly disturbed and have IBI indicative of impairment. Two of these streams are in the city of Duluth, where high disturbance is expected and restoration may be difficult. However, one of these streams is near Two Harbors, where disturbances would be expected to be less, and some degree of restoration may be possible.

Figure 4. Standardized IBI scores plotted against a stream watershed disturbance index (WDI). In most cases, streams with IBI scores > 1 are considered unimpaired, while streams with IBI scores < 1 are considered impaired. Colors correspond to Figure 5.



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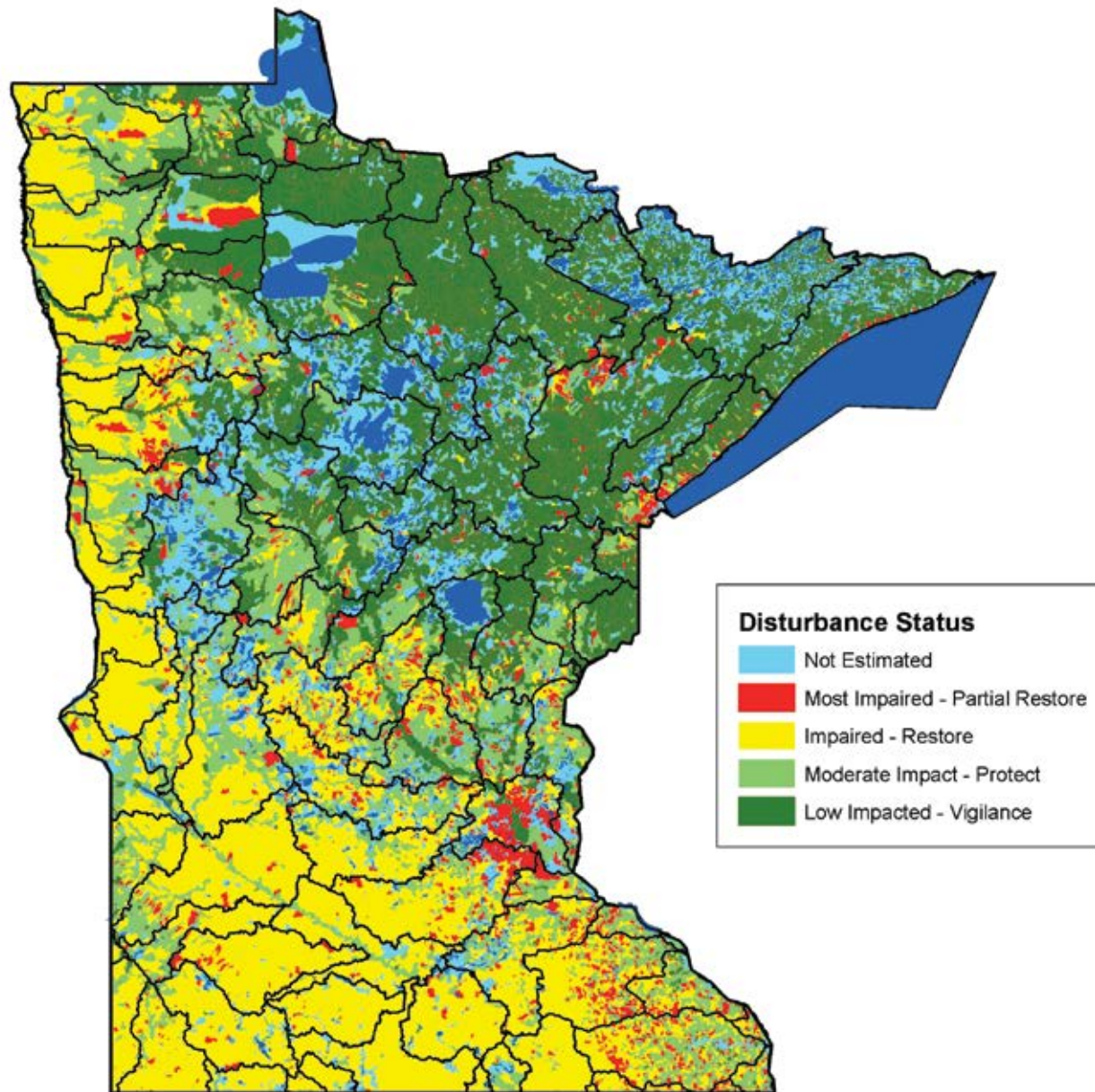


Figure 6. Streams Watershed Condition Plot. This plot is roughly analogous to the Lakes Watershed Condition Plot. The red band represents sites slightly above or below their impairment thresholds.

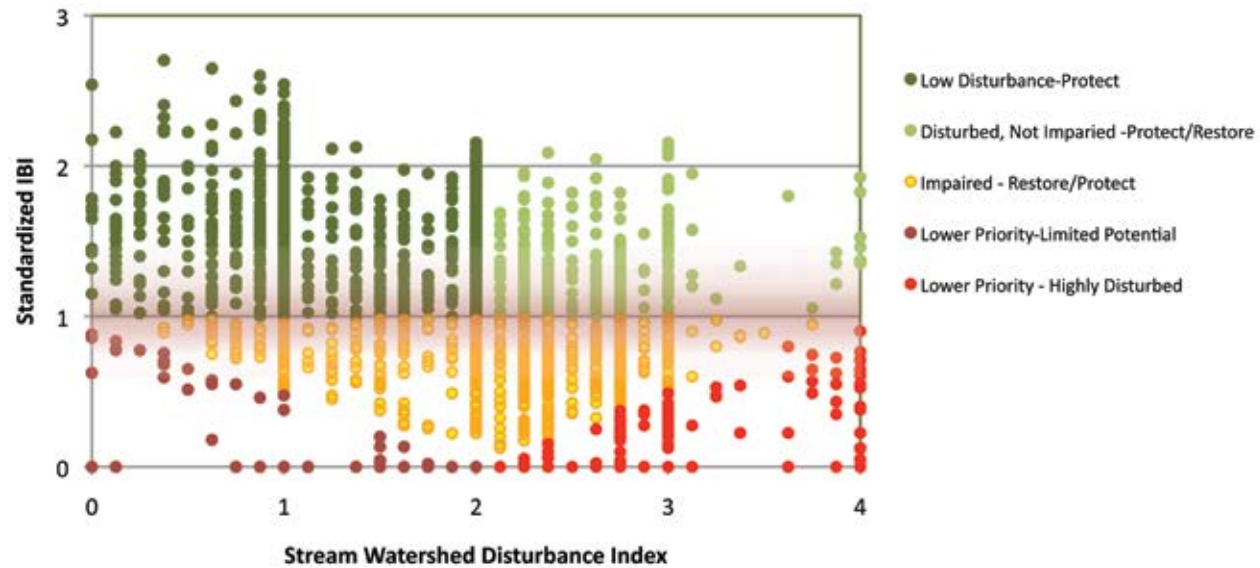
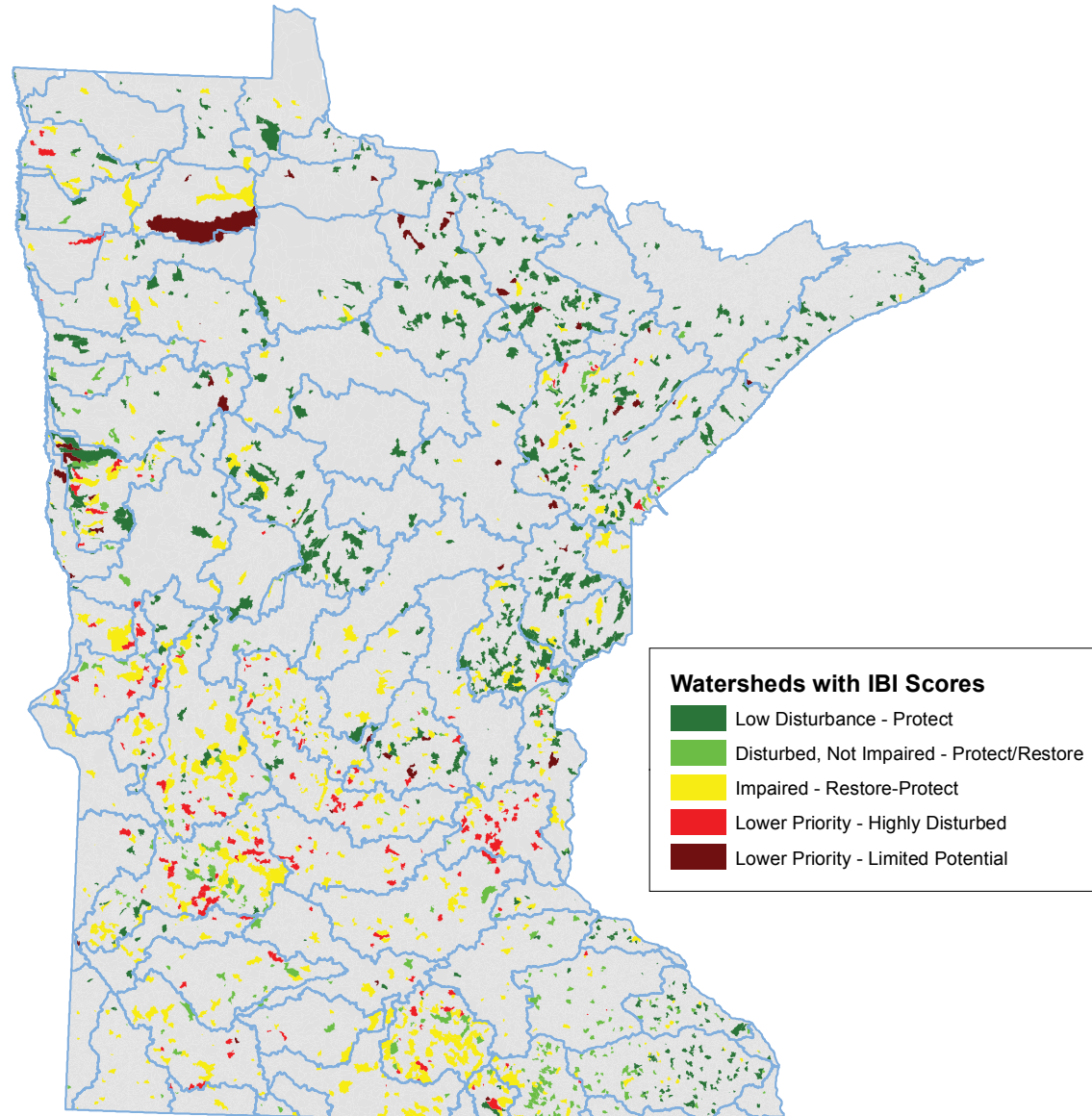


Figure 8. Streams Watershed Condition Map. This uses the Streams Watershed Condition Plot to assign protection or restoration efforts to streams. It is analogous to the Lakes Watershed Condition Map.



## Recommended Staffing

The amount of resources the Section of Fisheries can pursue, obtain, administer, spend, or influence in favor of fish habitats will be directly affected by the choices made to support habitat work. Several bottlenecks have been identified that limit the Section's capacity for habitat coordination and implementation. First, coordination with partners is becoming more complex. Yet this coordination was identified in surveys of Fisheries staff as something that should be done more often, even though current capacity is limited. Second, some Fisheries Area offices are heavily engaged in management of projects initiated by partners (e.g. southeast trout stream restoration, fish passage projects in the Red and Minnesota rivers). Third, increasing complexity in prioritizing, developing, and managing acquisition and conservation easement projects is limiting Area office capacity. To relieve these bottlenecks, the Section of Fisheries will build towards the following fish habitat positions. These positions represent new capacity for habitat work in Fisheries, and will not be replacing or substituting for other established habitat positions (see Appendix 3 for job duties of proposed and current habitat staff; see Appendix 5 for 2012 habitat staffing).



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### Landscape Level Fish Habitat Consultants

—The Section will develop forest and prairie policy and coordination positions within the Central Office framework. These two landscape level fish habitat consultants will have large work areas, and will focus on establishing conservation zones that result in natural partnerships with other agencies and conservation organizations. They will work with the partners to build consensus on priority conservation areas, find

money for conservation, and influence spending of conservation dollars to maximize ecological benefits. These coordinators will also be habitat policy experts for their respective landscapes, and will seek to influence natural resource policies for the benefit of fish habitats. These positions are critical to successful implementation of OBJECTIVES (1) establish conservation zones, (2) engage partners, (7) affect natural resource policy, and (8) learn and adapt.

**Sub-regional Fish Habitat Specialists**—Six sub-regional fish habitat specialist positions are proposed and will have a geographical focus at the regional level. Habitat priorities for the positions will be guided by the respective Regional Managers. These specialists will work with local partners to manage or assist with watershed level projects, which could range in scope from a single local watershed to several major watersheds. As project managers, they will be responsible for defining projects, selecting or developing appropriate tools, evaluating success, and reporting results. Sub-regional specialists will have ample opportunity to educate the public as they build partnerships and communicate about projects. These positions are critical to successful implementation of OBJECTIVES (2) engage partners, (3) prioritize project areas, (4) project identification and tool selection, (5) track results, (6) education, and (8) learn and adapt.

**Area Fish Habitat Capacity**—Fisheries Area offices have been requested to contribute the equivalent of  $\frac{1}{3}$  of one position to habitat-related work, with a geographical focus at the Area office level. Assignment of these positions is extremely flexible to accommodate unique needs and staff skills at and/or between area offices. Habitat priorities will be determined by Area Supervisors. Scope of work could range from lakeshore habitat improvement or single reach projects up to watershed level work. Area level work fulfills the same objectives as the Sub-regional specialists, but at a local scale defined by discrete projects.

**Options for the Future**—Habitat work throughout the Section of Fisheries will require periodic internal review. As protection or restoration projects near completion, regional and Area priorities will be reexamined to guide continuation or redirection of future work.

## Role of Partners

Although it is not the role of this document to tell partners how to do habitat conservation, several partners have requested more information on what they can do now to work with the Section of Fisheries to conserve fish habitat. How each partner can do the most for fish habitat and where those efforts are best applied will ultimately be determined through interactions with Fish Habitat Consultants and detailed examinations of potential work areas. In the meantime, non-DNR habitat practitioners that wish to consider fish in their conservation delivery can try to shift watershed protection projects to areas of Minnesota that are within “protection” areas (light green) on the habitat framework maps. Within these areas, cisco lakes and their watersheds are of particularly high value, and will benefit from any protection efforts. Restoration efforts may be shifted to “restoration” (yellow) areas on the same maps, perhaps with emphasis on headwater reaches and smaller watersheds. Restoration in the “partial restoration” (red) areas requires more nuanced consideration. The recommended approach for partners interested in partial restoration projects is to discuss opportunities with local Area Fisheries offices.

## Prioritization of Project Areas

Section of Fisheries will develop prioritization algorithms to aid in the prioritization of project areas. Project areas may range in size from small stretches of shoreline to major watersheds, depending on the scope of the project. While these procedures for setting priorities will be objective, there will always be room in the prioritization process for local subjective input.

Measures that may be considered could include watershed size, percentage of sensitive shoreline, a riparian disturbance metric, status of managed gamefish, fish and plant IBI scores, a measure of intolerant species, future development plans, and an index of local importance (i.e. is the lake an important recreation lake, are property taxes significant to local governments, etc.). Separate prioritization algorithms will need to be defined for lakes and streams, and whether the lake or stream is being considered for protection or restoration.

Project areas with motivated private interests, such as lake associations or interested fishing or conservation groups may receive special consideration, especially if the local group has already secured funding for a specific type of habitat work.

## Funding Challenges and Opportunities

Resources for protecting, enhancing, and restoring aquatic habitat are limited. Therefore it is critical that we identify criteria to prioritize areas for habitat project implementation and carefully evaluate our successes and failures. It is also important for us to work closely with existing partners and engage new partners who can bring additional resources and expertise to this challenge.

Project and acquisition money for aquatic habitat conservation work by the Section of Fisheries is vulnerable to changes in fishing license revenues and legislative appropriations. Traditional funding mechanisms will not achieve the protection, restoration, and enhancement of aquatic habitats necessary to maintain sustainable fishing opportunities in the state; however, other funding is available to protect and restore aquatic habitat.



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Beginning in 2003, a new federal fish habitat initiative began to develop a federal program that would provide long-term sustainable funding for partnership-driven, landscape-scale investments to protect and restore aquatic habitats nationwide. The National Fish Habitat Partnership (NFHP) seeks to conduct national aquatic habitat assessments and promote implementation of habitat projects within a strategic framework that focuses on system function. Minnesota is included in five NFHP partnerships: Midwest Glacial Lakes, Fishers and Farmers, Great Lakes Basin, Great Plains, and Driftless Area Restoration Effort partnerships. Several aquatic habitat projects have been funded in Minnesota through NFHP partnerships.

In addition, in November 2008, the voters of Minnesota passed a constitutional amendment which added 3/8th of one-percent to the existing state sales tax. Two-thirds of the revenue from the increased tax is dedicated for "... the benefit of Minnesotans, ... to restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife; ... to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater from degradation..." This funding creates

### **The National Fish Habitat Partnership,**

through its regional framework, has funded several aquatic habitat projects in Minnesota including \$31,300 for stream protection and ravine stabilization in the Seven Mile Creek watershed, a trout stream in south-central Minnesota; \$200,000 to hire staff who will acquire conservation easements adjacent to trout streams that are tributaries to Lake Superior; and \$20,000 to record donated conservation easements on Cass County lakeshore deemed sensitive aquatic habitat. In addition, the National Fish Habitat Partnerships recently released a national assessment of river and stream habitat conditions. The assessment provides valuable guidance to partners working on the ground to conserve priority aquatic areas.

### **Outdoor Heritage Funds...**

are appropriated annually by the legislature with recommendations from the Lessard-Sams Outdoor Heritage Council. In fiscal years 2010 - 2013, \$19 million was appropriated to DNR for aquatic habitat work. DNR aquatic programs receiving funding included: \$14.5 million for AMAs, \$2.2 million for stream restoration, \$568 thousand for shoreline habitat, \$328 thousand for dam maintenance, \$910 thousand for coldwater streams, and \$506 thousand for warmwater habitat. These funds have been used to protect, enhance, and restore critical aquatic habitat. Some examples include permanent conservation easements on nearly 300 acres and 6,000 shoreline feet of a YMCA camp located on Sturgeon Lake in Pine County, enhancing shorelines with native vegetation on Keller Lake, trout stream easement corridor maintenance in SE Minnesota, and a trout stream restoration project on West Beaver Creek in Houston County.

25 years of new opportunities for habitat and water quality initiatives at a larger scale of impact than has ever been possible in the past. In the first three funding cycles, several excellent projects and acquisitions were completed with funding generated by the Clean Water, Land and Legacy Amendment as appropriated through the Outdoor Heritage Fund and Clean Water Fund.

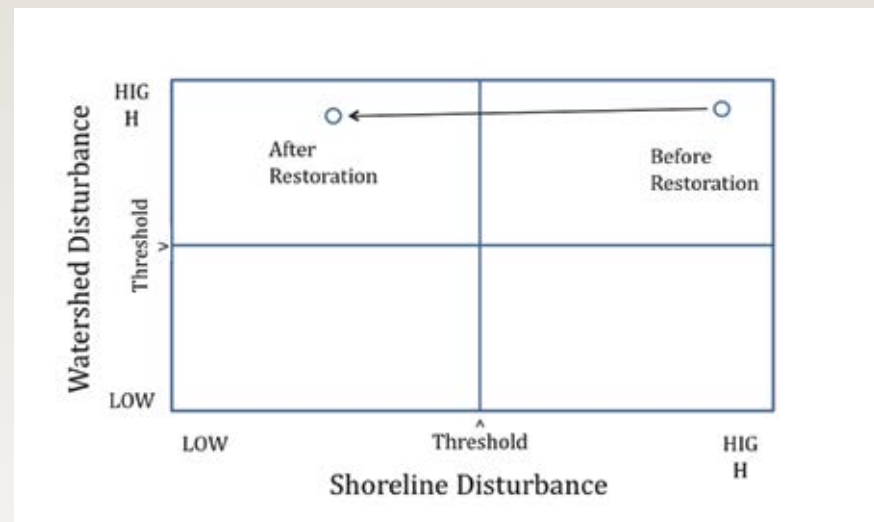
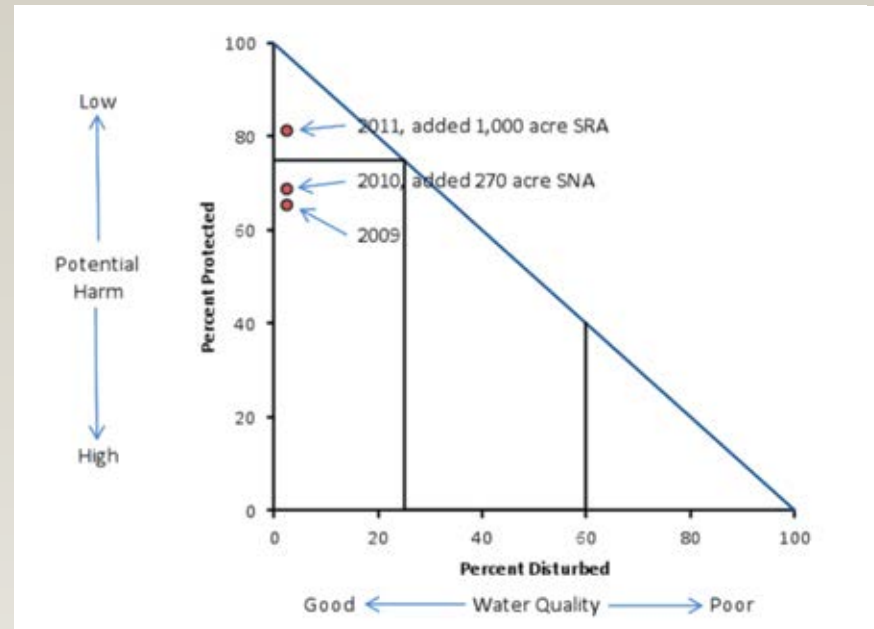
Other funding for this important work may come from a variety of sources including: Minnesota State Bonding, Environment and Natural Resource Trust Fund (state lottery) allocated by the Legislative-Citizen Commission on Minnesota Resources, Reinvest In Minnesota Critical Habitat Match, Game and Fish Fund, Federal Aid in Sport Fish Restoration Act (Dingell-Johnson and Wallop-Breaux funds), Federal Energy Regulatory Commission, federal grants (e.g. fish passage), and General Fund.

## Tracking Results

Two examples are presented to highlight how the lakes habitat framework can be used to track changes made to lakes.

The first example follows watershed protection efforts in the watershed of LaSalle Lake in Hubbard County. In 2009, the status of the LaSalle Lake watershed was 2.3% disturbed and 65% protected. The additions of a 270 acre Scientific and Natural Area in 2010 and a 1,000 acre State Recreation Area in 2011 increased the level of protection to 81%. Since lakes with more than 75% of their watershed in protected status are essentially protected from adverse water quality disturbances, LaSalle Lake has changed from a lake with a watershed in need of protection to a lake with a sufficiently protected watershed.

The second example conceptually demonstrates the benefits of shoreline restoration in a real lake in the Twin Cities metropolitan area. Lake Phalen is surrounded by suburban housing developments and a golf course. It is unrealistic to fully restore water quality in the lake to pre-disturbance levels by restoring the watershed. However, there are realistic opportunities to restore the shoreline component of fish habitat. For this lake, there is a five-year plan to improve over 65% of the three-mile shoreline. Although shoreline improvements are expected to only minimally reduce phosphorus inputs from stormwater runoff, improving shoreline related habitat will benefit the fish in the lake.



# GLOSSARY

**Adaptive Management**—Adaptive management is a monitoring-based management framework that simultaneously seeks to meet management objectives while collecting information needed to inform future management decisions.

**AIS—Aquatic Invasive Species.** A non-native species that causes ecological or economic problems. For more details see <http://www.dnr.state.mn.us/invasives/faq.html>

**AMA—Aquatic Management Area.** AMAs are established “to protect, develop, and manage lakes, rivers, streams, and adjacent wetlands and lands that are critical for fish and other aquatic life, for water quality, and for their intrinsic biological value, public fishing, and other compatible outdoor recreation uses.” Minnesota Statute 86A.05 subd 14. View the AMA Acquisition Plan at <http://files.dnr.state.mn.us/aboutdnr/reports/strategic-documents/ama-acquisition-report.pdf>

**APM—Aquatic Plant Management.** The DNR Aquatic Plant Management Program protects native vegetation and the aquatic environment from unnecessary harm while allowing lakeshore homeowners to control some aquatic vegetation for water access. Details of the program are discussed at <http://www.dnr.state.mn.us/eco/apm/index.html>

**BMP—Best Management Practice.** A compromise management strategy that spatially or temporally limits ecologically risky activities for the purpose of maximizing ecological protection. For examples, BMPs for riparian property owners are presented at <http://www.extension.umn.edu/distribution/naturalresources/DD6946.html>

**Buffer Strip**—A strip of undeveloped land separating developed land from an ecologically sensitive area, such as a lakeshore or stream.

**BWSR—Minnesota Board of Water and Soil Resources:** <http://www.bwsr.state.mn.us/>

**Clean Water Funds**—“Thirty-three percent of the sales tax revenue from the Legacy amendment is allocated to the Clean Water Fund. Those funds may only be spent to protect, enhance, and restore water quality in lakes, rivers, and streams and to protect groundwater from degradation. At least five percent of the clean water fund must be spent to protect drinking water sources.” <http://www.legacy.leg.mn/funds/clean-water-fund>

**Conservation Easement**—A landowner agrees to surrender certain land management rights to protect specific conservation attributes.

Conservation easements are generally perpetual. Defined in statute as “a nonpossessory interest of a holder in real property imposing limitations or affirmative obligations the purposes of which include retaining or protecting natural, scenic, or open-space use, protecting natural resources, maintaining or enhancing air quality, or preserving the historical, architectural, archeological, or cultural aspects of real property” (Minn Statute 84C.01, Subd.1).

**Conservation Zones**—Collections of contiguous watersheds in similar disturbance condition or subject to similar disturbance pressures such that the entire zone can be considered as one large homogeneous block. A given conservation zone may be subject to protection, restoration, or a combination of both.

**DNR—Minnesota Department of Natural Resources.** <http://www.dnr.state.mn.us/index.html>

**EWR—Minnesota DNR Division of Ecological and Water Resources.** <http://www.dnr.state.mn.us/eco/index.html>

**EPA—United States Environmental Protection Agency.** [www.epa.gov/](http://www.epa.gov/)

**GIS—Global Information System.** A global information system analyzes and displays data that is geographically referenced. It makes it possible to visualize and interpret relationships and patterns, often through the presentation of maps, which are relatively easily understood.

**Human Dimensions**—A social science that recognizes the importance of social attitudes and human behaviors in natural resource management. <http://www.human-dimensions.org/>

**HUC-12—Hydrologic Unit Code 12.** Hydrologic unit codes designate watersheds throughout the United States. As the watershed divisions become finer, the code becomes longer. HUC-12 watersheds are also referred to as 12-digit HUCs, referring to the length of their code.

**IBI—Index of Biotic Integrity.** A summary score created to describe the response at a sampling site of a biotic community to disturbances. Several different measurements related to species diversity, richness, and species tolerance are summed to produce the final IBI score. More details can be found at [http://www.epa.gov/bioiweb1/html/ibi\\_history.html](http://www.epa.gov/bioiweb1/html/ibi_history.html). A standardized IBI score is the score for a stream sampling site divided by the impairment threshold for that type of stream.

**Impairment Threshold.** The magnitude of a measurement which separates impaired and unimpaired systems. For example, the impairment threshold for standardized IBI scores is 1.0. Scores higher than one occur in systems that are considered unimpaired, and scores less than one indicate impairment.

**LCCMR—Legislative-Citizen Commission on Minnesota**

**Resources.** “The function of the LCCMR is to make funding recommendations to the legislature for special environment and natural resource projects, primarily from the Environment and Natural Resources Trust Fund.” <http://www.lccmr.leg.mn/>

**Macrophytes.** Aquatic rooted vascular plants making up the conspicuous plant communities in lakes and streams.

**MinnAqua.** “MinnAqua is a statewide education program designed to teach angling recreation and stewardship as well as the ecology and conservation of aquatic habitats.” <http://www.dnr.state.mn.us/minnaqua/index.html>

**MPCA—Minnesota Pollution Control Agency.**

<http://www.pca.state.mn.us/>

**Outdoor Heritage Fund.** Thirty-three percent of the sales tax revenue from the Legacy amendment is allocated to the outdoor heritage Fund. These funds are allocated to projects that “directly relate to the restoration, protection, and enhancement of wetlands, prairies, forests, and habitat for fish, game, and wildlife, and that prevent forest fragmentation, encourage forest consolidation, and expand restored native prairie.” <http://www.isohe.leg.mn/>

**NFHP—National Fish Habitat Partnership.** <http://fishhabitat.org/>

**Riparian Zone**—land immediately adjacent to stream and lake shorelines, sometimes referring only to the land-water interface, but also sometimes referring to terrestrial zones close to the water. The boundary of the riparian zone is generally established by changes in vegetation.

**SNA—Scientific and Natural Area.** “The Scientific & Natural Areas (SNA) program preserves natural features and rare resources of exceptional scientific and educational value.” <http://www.dnr.state.mn.us/snas/index.html>

**SRA—State Recreation Area.** Lands managed through Minnesota State Parks that are open to public recreation, usually including hiking, wildlife viewing, fishing, hunting and trapping.

**SLICE—Sustaining Lakes in a Changing Environment.** A DNR-led collaborative effort to identify and understand environmental stressors in order to develop management approaches that can mitigate or minimize negative impacts caused by residential development, agriculture, aquatic plant removal, invasive species and climate change. <http://www.dnr.state.mn.us/fisheries/slice/index.html>

**TMDL—Total Maximum Daily Load.** The maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

**Trophic State.** The trophic state of a lake is a description of the amount of nutrients in the lake, primarily phosphorus and nitrogen. It can be measured chemically using phosphorus, physically using the depth of light penetration, or biologically measuring chlorophyll levels from algae. For more information, refer to <http://www.epa.gov/bioiweb1/aquatic/carlson.html>

**USDA—United States Department of Agriculture.**

<http://www.usda.gov>

**Watershed.** An area of land where surface runoff converges at a single point where the waters join another waterbody. A drainage basin.

**WDI—Watershed Disturbance Index.** A single disturbance score derived from the combination of many distinct measurements of disturbance. The WDI in this plan includes various disturbance measures relating to agriculture, urbanization, mining, roads, dams, pollution sites, and population density.

**WMA—Wildlife Management Area.** State-owned parcels of land managed for the benefit of wildlife species and open to public wildlife viewing and hunting.

# APPENDICES

## *Appendix 1. Existing plans and reports that provide strategic direction, guidance and performance measures for fish habitat planning.*

- Blann, K. and M. Cornett. *Identifying lake conservation priorities for The Nature Conservancy in Minnesota, North Dakota and South Dakota, Volume 1: A portfolio for Minnesota*. The Nature Conservancy.
- Legislative Citizen Commission on Minnesota Resources (LCCMR). 2008. *Minnesota statewide conservation and preservation plan: final plan—phase 2*. 290 pp.
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*Appendix 2: Table of Fisheries Habitat Program accomplishments FY06-10.*

Activity	FY06	FY07	FY08	FY09	FY10	5 year Average*
Acquisition:						
Number on coldwater streams	9	6	10	11	9	9
Miles	5.45	2.67	3.96	5.43	3.62	4.23
Acres	265.5	98.7	136.2	162.4	85.3	149.6
Number of all other AMAs	17	17	13	26	13	17
Miles	6.17	5.33	4.46	12.39	8.94	7.46
Acres	329.3	457.1	205.9	1121.7	731.8	569.2
Development:						
Coldwater						
Number streams developed**	6	4	7	6	6	5.8
Miles	70.9	2.5	7.8	8.3	8.9	19.68
Number streams maintained***	46	29	20	24	26	29
Miles	348.8	183.5	173.2	210.7	182.9	219.82
Warmwater						
Number streams developed**	8	3	1	1	0	2.6
Miles	108.8	60	7.5	10	0	37.26
Number streams maintained***	0	2	4	3	3	2.4
Miles	0	1	161.5	20.7	90	54.64
Number walleye spawning areas developed	0	1	1	0	1	0.6
Number lakes rehabilitated	1	0	1	2	2	1.2
Aeration systems installed	3	0	4	1	1	1.8
Aquatic Plant Restoration						
Number of sites - public	11	13	10	15	9	11.6
Acres	7.72	3.67	3.95	11.2	2.41	5.79
Shoreline feet	8677	6135	6889	6300	3200	6240
Number of sites - private	17	17	29	49	58	34
Acres	2.9	2.94	4.13	4.06	5.54	3.91
Shoreline feet	4414	4525	7024	6140	7718	5964

\* Numeric objectives that indicate a percent increase are based on the annual average from Fiscal Year 2006-2010. Note that several funding sources vary annually based on legislative, LCCMR, and LSOHC appropriations, therefore the number and scope of acquisitions and projects can vary dramatically year to year.

\*\* Stream development projects are defined as activities that create a new or different habitat on a stream reach (e.g. remove a section of stream, addition of cross vanes).

\*\*\* Stream maintenance projects are defined as activities that improve existing conditions (e.g. beaver dam removal, vegetation control). The number of miles indicated is the number of miles where the activity was applied (e.g. for beaver control, the number of miles of stream contracted for impediment removal).

*Appendix 3. Description of duties, required knowledge, skills and abilities, and relationship to others for positions corresponding to DRAFT habitat staffing plan.*

Position	Duties	Knowledge, Skills, Abilities	Relationships
Habitat Program Manager	Provides overall program direction, budget, and resource allocation; habitat program expert provides testimony to legislature or other high visibility bodies; key liaison on agency panels and commissions relating to aquatic habitat	Knowledge of Fisheries programs and interrelationship with other DNR, state, and federal programs; ability to prepare and manage budgets; ability to supervise high performing staff; ability to develop policy recommendations; ability to implement legislative directives; ability to provide guidance to Section Chief and Division Director on rapidly emerging habitat policy issues	Fisheries management team; Division management team; DNR habitat program managers; state and federal habitat program leaders; legislators; LCCMR and LSOHC staff
Landscape Level Fish Habitat Consultant	Overall landscape expert for aquatic habitat program activities in either forested or prairie zones; recommends policy initiatives; provides statewide coordination of internal habitat program activities; coordinates habitat program activities with other agencies; compiles requests and manages habitat budget; provides oversight of administrative procedures for grants, contracts, and work agreements; manages special funds, accounting, and reporting; produces outcome reports and other accountability documents; serves on inter-divisional work groups to positively influence decisions affecting aquatic habitat	Knowledge of Fisheries programs and interrelationships with other DNR, state, local, and federal programs; knowledge of landscape-specific habitat programs and stakeholders;	<u>Prairies</u> : Mn Dept of Agriculture; NRCS Farm Bill program staff; USFWS program staff; MPCA feedlot and TMDL program staff; Private Lands Program supervisor; other Division and Dept. prairie program staff; TNC; Great Plains FHP manager; Fishers & Farmers FHP manager <u>Forests</u> : DNR Div of Forestry; Forests for the Future program; other Division and Dept forest program staff; Lands & Minerals staff; USDA Forest Service; Mn Forest Resources Council; Arrowhead Region Economic Development Authority; TNC; Mn Land Trust; Trust for Public Lands <u>Urban</u> : MPCA stormwater and TMDL program staff; watershed district managers; Metropolitan Council; Great Lakes FHP manager; DARE FHP manager

Position	Duties	Knowledge, Skills, Abilities	Relationships
Sub-Regional Habitat Specialist	Technical expert for habitat project design and implementation; provides technical guidance to Area Fisheries staff; builds consensus for inter-disciplinary/partnership project activities focused around regional landscape priorities; issues and manages grants, contracts, and work agreements necessary to accomplish habitat project objectives; compiles reports on expenditures, accomplishments, and outcomes within work area; tracks program activities within the work area and provides evaluation of completed projects; meets with key stakeholders and local governments to promote habitat program goals and priorities; develops communications for distribution to internal and external customers	Knowledge of fiscal policies, procedures, and controls for issuing grants, contracts, and work agreements; knowledge of aquatic habitat strategic priorities; ability to inform and influence others; technical knowledge and demonstrated skill in the following: <ul style="list-style-type: none"> <li>• Rosgen stream hydrology</li> <li>• Shoreline restoration</li> <li>• Fee title and conservation easement acquisition</li> <li>• TMDL</li> <li>• Forest management</li> <li>• USDA farm programs</li> <li>• Watershed science</li> </ul>	Regional Fisheries Managers; Area Fisheries Staff within the work area; other discipline regional managers and work teams; local SWCD staff; local conservation organization staff
Program Field Staff <ul style="list-style-type: none"> <li>• SHP</li> <li>• APM</li> <li>• Construction Crew</li> <li>• CW Stream Crew</li> <li>• AMA/asset mgmt crews</li> </ul>	Responsible for project needs assessment, implementation, and evaluation; may serve as lead worker for seasonal labor crews; operates equipment; meets with landowners and other project partners regarding implementation details	Assumed to meet KSAs for their respective existing classifications	Ranges from regional to local staff; internal and external; agencies, local governments, and NGOs
Area Habitat Specialists	Minimum 1/3 FTE equivalent at each Area Office dedicated to aquatic habitat management.	Locally determined but assumed to meet NR-Spec KSAs plus demonstrated skill at some or all aspects of aquatic habitat delivery	Locally determined but operating at the most grassroots level with local governments, conservationists, and other stakeholder groups

*Appendix 4. DNR Fisheries Habitat Program review summary table. A summary of staff and area supervisor surveys, work group products, and input from other divisions, agencies, and partners.*

Function	Core Programs, Services, and Products	How effective are we currently according to staff*?	What is our role?	Should we spend more, less, or the same amount of time?*	Other comments
Acquisition	<ul style="list-style-type: none"> <li>• AMA acquisition and conservation easements</li> <li>• Acquisition proposals for partners</li> </ul>	<ul style="list-style-type: none"> <li>• <u>More effective</u>: AMA</li> <li>• <u>Marginally effective</u>: Acquisition proposals for partners.**</li> </ul>	We are the lead agency for acquiring and managing AMAs. In an informal survey of other divisions, agencies, and partners several asked for our priorities.	<ul style="list-style-type: none"> <li>• <u>Do more</u>: AMA acquisition (63% of staff said do more).</li> <li>• In a survey of Supervisors and Program Staff***, 63% preferred focusing more effort on protection and 37% on restoration, though nearly all thought some effort should be devoted to each. Responses differed by eco-region.</li> </ul>	Regular check-in on strategic direction and coordination with partners, especially on LSOHC acquisitions is needed. Maintenance and development of new and existing AMAs is a particular challenge and we should begin explicitly exploring alternatives including contract use.
Aquatic Habitat Projects	<ul style="list-style-type: none"> <li>• Fish passage projects (dam removal/modifications and culverts)</li> <li>• AMA maintenance &amp; development</li> <li>• Stream HI: Stream habitat improvement and restoration and maintenance (beaver control and structures)</li> <li>• Shoreland Habitat Program projects (SHP)</li> <li>• Lake aeration</li> <li>• Lake reclamations</li> <li>• Water level management</li> </ul>	<ul style="list-style-type: none"> <li>• <u>More effective</u>: Stream HI.</li> <li>• <u>Marginally effective</u>: Fish passage projects, SHP, Aeration, Reclamations.</li> <li>• <u>Less effective</u>: AMA maintenance &amp; development**, Water level management**</li> </ul>	We function primarily as <u>lead agency</u> and also as a <u>partner</u> and/or <u>influence</u> for aquatic habitat projects. Most partners surveyed indicated that they relied on DNR Fisheries to lead on aquatic habitat projects, and that they had little funding or expertise to complete projects.	<ul style="list-style-type: none"> <li><u>Do more</u>: AMA &amp; SHP.</li> <li><u>Do more/same</u>: Fish passage projects &amp; Stream HI</li> <li><u>Do less/same</u>: Reclamations.</li> <li><u>Do less</u>: Aeration (70% of staff said less).</li> <li>• In a survey***, 57% preferred focusing most on nearshore activities and 43% on watershed activities, though nearly all thought some effort should be devoted to each. Responses differed by eco-region.</li> </ul>	Funding is primarily through LSOHC, CWL, LCCMR and other outside sources which come with extra logistical challenges. Taking on projects with existing Area staff is difficult given staffing cuts at Areas; therefore additional support is needed from Statewide and Regional staff trained in project management. The core habitat group felt we were more effective at dam removal/modification projects than at culvert projects.

Function	Core Programs, Services, and Products	How effective are we currently according to staff**?	What is our role?	Should we spend more, less, or the same amount of time?*	Other comments
Aquatic Habitat Coordination, Technical Guidance, Regulations, and Education	<ul style="list-style-type: none"> <li>• Coordination: Intra-agency, Interagency, with LGUs, and with external partners</li> <li>• Multi-state and national aquatic habitat initiatives (e.g., NFHAP, climate change)</li> <li>• TMDL activities</li> <li>• Review: Environmental review, DEWR permit review, FERC relicensing reviews, Land sale reviews and exchanges</li> <li>• Aquatic habitat policy development and support</li> <li>• APM permitting</li> <li>• Outreach: Educational materials, programs, and public information</li> <li>• Invasive species</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Marginally effective:</u> Outreach, APM permitting, Environmental review and FERC review</li> <li>• <u>Less effective:</u> Coordination, DEWR permit review, TMDL, Invasive species, Multi-state and national aquatic habitat initiatives**</li> </ul>	Our primary role is as a <u>partner or influence</u> . We provide guidance and educational materials to other planners and decision-makers that best protect aquatic habitat and fish, such as for forest management plans, local water plans and conservation plans in agricultural zones. In an informal survey of other divisions, agencies, and partners nearly all listed improved communication and targeted outreach with a clear message on how to protect and improve aquatic habitat as areas critical for success. Several also cited stricter regulations below the OHWL as a need.	<ul style="list-style-type: none"> <li>• <u>Do more:</u> Coordination &amp; Outreach.</li> <li>• <u>Do more/same:</u> Invasive species, DEWR permit review, TMDL, APM permitting, &amp; Environmental review</li> <li>• <u>Do same:</u> FERC</li> </ul>	Coordination was ranked as the number one activity we should do more of (by 73% of staff), despite staff believing we are currently less effective at coordination. Such a mixed result can be interpreted as a statement that the outcomes of the activity are positive, our perceived effectiveness is limited by our present level of investment, and effectiveness can be improved with more effort.
Assessment, Monitoring, and Evaluation of Aquatic Habitat	<ul style="list-style-type: none"> <li>• GIS/IT Programs for technical services</li> <li>• Habitat monitoring (SLICE/ Sentinel Lakes Program)</li> <li>• Habitat assessment (lake and stream surveys)</li> <li>• Habitat Research Group (including university research by contract and partnerships)</li> </ul>	<ul style="list-style-type: none"> <li>• <u>More effective:</u> assessment.</li> </ul>	We are the <u>lead agency</u> . We provide the information used by others to make ecologically-based decisions as it relates to aquatic habitat. Other Divisions, Agencies, lawmakers, recreational users, and citizens use our survey information. In an informal survey of other divisions, agencies, and partners many requested further information on sensitive shoreline areas and to know where our priorities lay. (Other partners including DEWR, PCA, and academic researchers also collect some aquatic habitat information).	<u>Do more/same</u> amount of assessment work.	A separate review of this function is ongoing.

\* For the most the comprehensive participation and ease of reporting, we used the full staff survey (2010) results where they were available. Participants of separate surveys included Fisheries Supervisors and the Habitat Core Team ranked some of these programs higher or lower than the full staff survey.

\*\* These programs were only ranked by Core Habitat Group Participants; therefore results reported are from a select number of survey participants.

\*\*\* An interactive survey was conducted during the Fall Area Supervisors Conference where participants were asked to respond to a series of questions regarding preferences for lake habitat management actions.

*Appendix 5. DNR Fisheries habitat staffing as of December 2012.*

Aquatic Plant Management			
Wayne Mueller	APM Specialist	Brainerd	
Kevin Martini	APM Specialist	Brainerd	
Audrey Kuchinski	APM Specialist	Little Falls	
Craig Soupir	APM Specialist	New Ulm	
Leslie George	APM Specialist	Glenwood	
Bob Ekstrom	APM Specialist	Bemidji	
Sean Sisler	APM Specialist	Metro	
Shane McBride	APM Specialist	Metro	
Rob Dodd	APM Specialist	Metro	
Shoreland Restoration and Protection			
Heather Baird	Shoreline Habitat Specialist	Brainerd	
Lindy Ekola	Shoreline Habitat Specialist	Glenwood	
Cory Netland	Shoreline Habitat Specialist	New Ulm	
Regional Habitat Coordinators			
Vacant	Red River Specialist	Bemidji	
John Lindgren	St. Louis Estuary Coordinator	Duluth	
Mark Nemeth	Trout Stream Habitat Specialist	Metro	
Aquatic Management Areas			
Jim Melander	AMA Acquisition Specialist	Lanesboro	
Emilee Nelson	AMA Acquisition Specialist	Lanesboro	
Rebecca Reiche	AMA Acquisition Specialist	Lake Superior	
Habitat Construction			
Jean-Paul Lipton + 3 others	Construction Crew	Detroit Lakes	
Steve Erickson + 3 seasonal	Coldwater Crew	Lanesboro	
Vacant	AMA Crew (north)	Brainerd	Tentative through LSOHC
Vacant	AMA Crew (south)	Hutchinson	Tentative through LSOHC
Statewide Habitat Coordination			
Vacant	Habitat Program Manager	St. Paul	
John Hiebert	Lakes Habitat Consultant	St. Paul	
Brian Nerbonne	Streams Habitat Consultant	St. Paul	
Steve Enger	APM Coordinator	St. Paul	
Michael Duval	Lakes Management Coordinator	Brainerd	
Vacant	LSOHC Project Manager	St. Paul	Tentative through LSOHC
Vacant	LSOHC Project Manager	TBD	Tentative through LSOHC
Katie Haws	Midwest Glacial Lakes Partnership	Brainerd	
Tom Jones	Habitat Planner	Brainerd	
Research			
Peter Jacobson	Research Supervisor, Habitat	Itasca State Park	
Donna Dustin	Research Biologist	Detroit Lakes	
Andy Carlson	Research Biologist	Brainerd	
Doug Dieterman	Research Biologist	Lake City	
Tim Cross	Research Biologist	Hutchinson	
Cindy Tomcko	Research Biologist	Grand Rapids	
Vacant	Research Biologist	East Metro	



