

Wolf River Basin

Biotic Inventory and Analysis

A Baseline Inventory and Analysis of Natural Communities, Rare Plants and Animals, and other Selected Features.

Primary Authors: Eric Epstein, William Smith, Craig Anderson, Elizabeth Spencer, John Lyons, and Drew Feldkirchner

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**Wisconsin's
Natural Heritage Inventory Program**

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Primary Authors: Eric Epstein, William Smith, Craig Anderson, Elizabeth Spencer, John Lyons, and Drew Feldkirchner

Data Management: Julie Bleser

GIS/Graphics Development: Julie Bleser, Nicole Merryfield, Terrell Hyde

Report Coordination: Drew Feldkirchner, Andrew Galvin

Contributors: This project would not have been possible without the efforts and expertise of many people. The following are those individuals who contributed to the study:

- Andréa Anderson: aquatic invertebrate sampling
- Andrew Galvin: planning, report coordination
- Andy Clark: natural communities, botany
- Angela Ives: site file development
- Anne Forbes, Partners In Place: Experts Workshop facilitation
- Betty Les: administration
- Chris Brennan: aquatic invertebrate sampling
- Craig Anderson: botany, rare plants
- Dan Spuhler: community ecology, birds
- Dennis Kuecherer: birds
- Dick Bautz: small mammals
- Drew Feldkirchner: report coordination
- Elizabeth Spencer: ecology, data processing
- Emmet Judziewicz: ecology, data processing
- Eric Epstein: planning, community ecology, birds
- Eric Wild: herptiles
- Fred Clark, Clark Forestry, Inc.: Coarse Filter Screening
- Jamie Denninger: aquatic invertebrate sampling
- Janel Pike: GIS
- Jason Tanck: aquatic invertebrate sampling
- Jim Burnham: zoology, data processing
- John Lyons: fish
- Josh Acker: general field support
- Julie Bleser: GIS, data management
- Kathy Kirk: terrestrial invertebrates

- Kristin Westad: botany, data processing
- Kurt Schmude: aquatic invertebrates
- Matthew Brust: terrestrial invertebrates
- Nicole Merryfield: GIS, Experts Workshop
- Sumner Matteson: birds
- Terrell Hyde: zoology, data processing and analysis
- Tim Cooke: administrative assistance
- Tim Larsen: administrative assistance, data entry
- Todd Miller: birds
- William Smith: planning, zoology, aquatic invertebrates

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INTRODUCTION



Figure 1. The Wolf River Basin

The Wisconsin Department of Natural Resources (WDNR), through the Natural Heritage Inventory (NHI) Section of the Bureau of Endangered Resources (BER) recently conducted an integrated land and water biotic inventory of the Wolf River Basin. This report represents the results of a three-year project.

The Wolf River Basin inventory effort was initiated in January of 1999 with the purpose of gathering data on natural communities, rare plants and animals, aquatic invertebrates, and other selected natural features for the entire basin. The information developed will be used to support various planning efforts to enhance the protection of the basin's ecologically significant natural resources. In particular, the inventory data will assist existing WDNR planning efforts, including the Lower Wolf River Bottomlands Natural Resources Area (NRA) and the Wolf River Basin plan. Additional planning efforts will benefit peripherally from this work, including

those of the Wolf River Partnership Team, Fish and Wildlife Integrated Planning, county and local government natural resources planning efforts, and private conservation planning. The biotic inventory information presented in this report is intended to be used alongside other information gathered for planning to develop a complete picture for the Basin.

BER has conducted biotic inventories for lands and waters throughout the State of Wisconsin, focusing on rare species, natural communities, and other elements of biodiversity. Most recently, BER completed detailed inventories for the Brule River and Northern Highland-American Legion State Forests and a broader inventory of the Lake Superior Basin wetlands. Three factors combined to create a challenging climate for the Wolf River Basin inventory: 1) the immense size of the basin, which includes approximately 3,670 square miles within portions of 11 counties and 8 ecological landscapes, 2) the large amount of private land ownership, an indicator of limited existing inventory information in state records, and 3) an immediate need to supply information for current planning projects in the Wolf River Basin. These factors represented a unique challenge and prompted BER to investigate alternative approaches for completing a comprehensive inventory of the entire Wolf River Basin.

BER developed a four-part approach for work conducted during the first field season. This work provided the necessary information required by the various planning projects above and set a solid foundation for which the remaining inventory efforts would be built upon. Although this plan represents a deviation from our typical inventory process (see Appendix A), it involved a number of pilot projects that, after future evaluation, may enhance the overall inventory process. The four inventory elements were as follows:

1. Analyze the existing data within the Wisconsin NHI Biological and Conservation Data (BCD) system on the status and presence of natural communities and rare plants and animals.
2. Conduct *coarse filter screening* (see Appendix A) on the Wolf River Basin to identify potential inventory areas for the ensuing inventory years.

3. Conduct an *Experts Workshop* for the Wolf River Basin to gather information on ecologically significant sites from individuals who have specialized and/or site-specific knowledge on the resources within the basin.
4. Conduct *fine filter inventory* (see Appendix A) on specific areas and selected taxa focusing on the southeastern portion of the Wolf River Basin to support the Lower Wolf River Bottomlands Natural Resources Area.

Fine filter inventory efforts were continued during 2000 and 2001 to include several additional taxa. Also, inventory efforts were broadened to include additional survey site locations throughout the basin.

This report summarizes work completed to date with an emphasis on:

1. analyzing results and providing ecological information for the Lower Wolf River Bottomlands NRA effort
2. summarizing inventory sites in the upper portion of the Wolf River Basin
3. suggesting potential NHI inventory needs for the future.

Organization of the Report

An interim report (WDNR 2000) was released in 2000, summarizing results from the 1999 inventory efforts to support master planning for the NRA. This report builds upon the interim report and summarizes overall findings of the inventory efforts to date. Part 1 contains general ecological information on the geology, hydrology, vegetation, and land use of the Wolf River Basin and methods used to conduct this project. Part 2 of the report summarizes inventory results for the Lower Wolf River Bottomlands Natural Resources Area (NRA). Part 3 briefly discusses inventory efforts implemented for the remainder of the basin, including the southern half of the Wolf River basin outside of the NRA and the northern half of the basin. Part 4 identifies key management issues and considerations related to the Natural Resources Area master planning effort. Part 5 identifies important conservation needs and priorities within the NRA. The appendices are meant to provide more detailed background materials and describe individual inventory efforts and results. The reports included in the appendices contain information on the objectives, methodologies, and results of each of the various inventory tasks. The majority of the detail relating to inventories will be found in these appendices. The appendices also contain additional detail about the majority of the Wolf River basin that was studied outside of the NRA.

PART 1: WOLF RIVER BASIN BIOTIC INVENTORY OVERVIEW

Description of Study Area

The Wolf Basin is 3671 sq. miles, or 6.6% of Wisconsin's land base. All of Waupaca county, and parts of Forest, Langlade, Marathon, Menominee, Oneida, Outagamie, Portage, Shawano, Waushara and Winnebago counties are located within the basin. The Wolf River originates in Pine Lake of southern Forest County and flows south, following the slope of the granite bedrock. It eventually drains into Lake Winnebago, after joining the Upper Fox River below Lake Poygan. The majority of the basin area extends westward from the Wolf River across Langlade, Shawano and Waupaca counties and the Menominee Reservation, with major tributaries flowing southeastward. These tributaries include the Red, Embarrass, Little Wolf and Waupaca Rivers. The Shioc River joins the Wolf from the East in central Outagamie County.

Geology

Many types of glacial landforms created by the Green Bay lobe of the Wisconsin Glaciation occur in the Wolf River Basin and influence the pattern of present land uses. Ground moraine and an extinct glacial lakebed extend across the southeast portion of the basin, creating a broad, level plain. Agriculture is the principal land use in this region. To the north and west, end and ground moraines surrounded by pitted outwash cover the majority of the landscape. Numerous small kettles containing lakes and peat bogs are embedded within these landforms. Due to the climate and the hilly morainal topography in the northern and western portions of the basin, forest cover is greater than in the southeast, and forestry gains in importance relative to agriculture.



Figure 2. Tension zone (adapted from Curtis 1959).

Vegetation

The northern and southern portions of the basin are roughly divided by the tension zone, a narrow region extending from northwest to southeast across Wisconsin, approximating an s-shape (Fig. 2). The tension zone separates the northern hardwood and prairie floristic provinces (Curtis 1959) and contains species associated with both provinces where many occur at the extent of their respective ranges. Highway 29 is used as a practical break between the north and south portions of the basin in this report, as it roughly coincides with the northern limit of the tension zone.

The pre-settlement vegetation of the basin was diverse and included floodplain forest, extensive wetland and swamp forest complexes, mesic (tallgrass) prairie, oak savanna, jack pine-scrub oak barren, maple-beech forest, red and white pine forest, and extensive hemlock hardwood/northern hardwood forest in the north. The plant communities throughout the basin formed a complex mosaic, resulting from complicated drainage patterns and landforms created by glacial deposits, edaphic factors, and recurrent natural disturbances such as windstorms, wildfires, floods, droughts, and insect infestations.

Only in the northern-most part of the basin (Forest and Langlade Counties, and to a lesser extent Menominee County) did a single community type prevail (sugar maple-hemlock-beech). The central and southern parts of the basin contained marshes, sedge meadows, swamp conifers (white cedar, black spruce and tamarack), lowland hardwoods (willow, soft maple, ash, elm and cottonwood), maple and beech forests, hemlock-hardwood forests, pine forests (white and red pine) and jack pine-scrub oak barrens. The pine-oak barrens were confined to small areas of sandy outwash located on the present day Menominee Reservation. The lowland hardwood, marsh and sedge communities present before settlement were largely concentrated along the Wolf River's lower-most reaches, below present-day Shawano south to Lake Poygan. The southwest corner of the basin (Waupaca, Portage and Waushara Counties) also included oak forest (red, white and black oak) and scattered areas of oak openings, oak barrens, and prairie (Finley 1976).

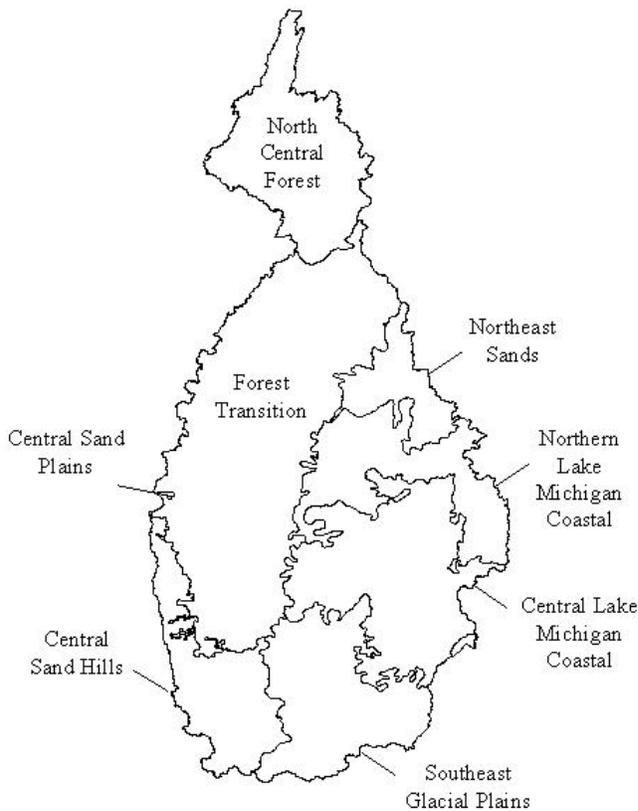


Figure 3: Ecological Landscapes of the Wolf River Basin

Ecological Landscapes

The Wisconsin DNR has mapped Wisconsin into areas of similar ecological potential and geography into units known as Ecological Landscapes. This classification is based on aggregations of subsections from the National Hierarchical Framework of Ecological Units (NHFEU) (Avers et al. 1994). The NHFEU and the Ecological Landscape systems delineate landscapes of similar ecological pattern and potential across the state in a way that is meaningful and useful to resource managers.

The Wolf River Basin is ecologically diverse on a landscape scale and is the point of convergence for half of the 16 Ecological Landscape types that occur in Wisconsin. Brief descriptions of the Ecological Landscapes that are represented within the Wolf River Basin are described below. Greatly expanded descriptions will be available shortly in the "Wisconsin Ecological Landscapes Handbook" (2002).

North Central Forest

The North Central forest landscape is characterized by gently rolling topography and silt loam soils. The forest cover is similar to the Northeast Hills, however the more

subdued topography results in somewhat fewer lakes and wetlands, and somewhat more homogenous forest coverage. This landscape comprises approximately 13% of the basin.

Forest Transition

The Forest Transition Ecological Landscape has the largest representation of any landscape within the Wolf River Basin. This landscape lies along the northern border of Wisconsin's Tension Zone, through the central and western part of the state, and supports both northern forests and agricultural areas. The eastern portion of the Ecological Landscape differs from the rest of the area in that it remains primarily

forested, and includes some extensive ecologically significant areas. Throughout this Ecological Landscape, small areas of conifer swamp are found near the headwaters of streams, and associated with lakes in kettle depressions on moraines. Ground flora show characteristics of both northern and southern Wisconsin, as this Ecological Landscape lies along the Tension Zone. This landscape comprises approximately 34% of the basin.

Northeast Sands

The Northeast Sands Ecological Landscape is still forested in many areas and contains several important river systems as well as extensive wetlands. Historically, extensive oak/jack pine barrens and jack pine forests were found in the outwash sand portions of this Ecological Landscape. Moraines supported forests of hardwoods, red pine and white pine. Outwash plains often contained pitted depressions, resulting in numerous wetlands and kettle lakes. Current forest vegetation is predominantly aspen, followed by northern hardwoods. Jack pine remains on the outwash plains along with northern pin oak. There are several important occurrences of jack pine/oak barren communities. A small percentage of this Ecological Landscape contains spruce-fir-cedar forest and lowland hardwood forest. The largest river is the Menominee, located on the Michigan-Wisconsin border. Several additional wild rivers within this Ecological Landscape are the Wolf, Pine, Popple, and Pike. This landscape comprises only 5% of the basin.

Northern Lake Michigan Coastal

The Northern Lake Michigan Coastal landscape is quite diverse, extending from the west shore of Lake Michigan to its westernmost extent within the Wolf River Basin. Historic vegetation included maple-basswood-beech forest, hemlock-hardwood forest, northern white-cedar swamp, hardwood-conifer swamp, and wet meadows. The major forest type is maple-basswood, with smaller amounts of lowland hardwoods, aspen-birch, lowland conifer, white-red-jack pine, and oak-hickory. This landscape comprises approximately 10% of the basin.

Central Sand Plains

The Central Sand Plains landscape makes up less than 1% of the Wolf River Basin, so it will not be discussed here.

Central Lake Michigan Coastal

The Central Lake Michigan Coastal landscape stretches from southwestern Door County, west across Green Bay to the Wolf River drainage and central Waupaca County, then southeast to Manitowoc County, and southward in a narrow strip along Lake Michigan to central Milwaukee County. The terrain is rolling where the surface is underlain by ground moraine, variable over areas of outwash, and nearly level where lacustrine deposits are significant. Historically, hardwood forests of sugar maple, basswood, beech, white ash, and red oak covered most of this landscape. White pine was locally important. Areas of poorly drained glacial lakeplain supported extensive wet forests of tamarack, white cedar, black ash, red maple, and elm, while the Wolf and Embarrass Rivers flowed through extensive floodplain forests of silver maple, green ash, and swamp white oak. Today approximately 84% of this Ecological Landscape is non-forested. The remaining forest consists mainly of mesic maple-basswood or maple-beech types or lowland hardwoods such as soft maples and ashes. Fragmentation of upland habitats is now severe throughout this landscape, and invasive plants have become a major concern, especially reed canary grass, giant reed, purple loosestrife, garlic mustard, common buckthorn, and honeysuckles. The waters of the Wolf-Embarrass River corridors provide seasonally critical habitat for numerous animals. Invasive species are a problem in many of the aquatic systems in this landscape. This landscape comprises approximately 17% of the basin.

Central Sand Hills

This area of end and recessional moraines includes rolling topography with sandy soils and is dominated by dairy (and small farm) agriculture interspersed with oak/pine forests. Historically, oak and pine barrens, sand prairies, and xeric pine-oak forests were widespread. Oak barrens and dry sand prairie remnants with management/restoration potential are still present. The concentration of cold headwater streams emanating from the moraines is significant. Remnant patches of natural vegetation are frequent, but the vegetation pattern is highly fragmented with few large patches intact. This landscape comprises approximately 9% of the basin.

Southeast Glacial Plains

These level to gently rolling plains in the SE portion of the basin are dominated by farmland interspersed with extensive wetland complexes and small hardwood forest/patches. Most of the area is underlain by rich silt loam or organic soils from glacio-lacustrine deposits and supports communities with high nutrient affinities. Wetlands include marshes, sedge meadows, prairies, hardwood swamps and limited tamarack/conifer swamps. Upland forests are primarily maple/beech/basswood cover types. This landscape comprises approximately 13% of the basin.

Importance of the Wolf River to Ecoregional Planning

The Nature Conservancy (TNC) is currently developing ecoregional plans for each of the major ecoregions in the United States. In Wisconsin, TNC has nearly completed the plan for the Great Lakes Ecoregion (TNC 2000) which includes the Wolf River Basin. TNC's ecoregional planning designs a portfolio of sites that collectively conserve viable natural community types, globally rare native species, and other selected features. Within each site, TNC anticipates working with their partners to conserve, or where necessary restore, the ecosystem patterns and processes that sustain the elements for which that site was selected (TNC 1997).

Map 1 shows the preliminary aquatic portfolio sites that were identified within the Wolf River Basin. Portions of the Wolf River main stem, the lower Embarrass River, and the Crystal/Waupaca River fall within the master plan inventory area. These sites have been identified because of their ecoregional significance and, as priorities, are in need of conservation activities to ensure protection of the diversity of the aquatic species found here.

Methods

Coarse Filter Screening

Recognizing that the large size of the Wolf River Basin presented a difficult challenge for detailed field studies, BER used various methods of compiling information on ecologically significant lands that was scientifically accurate and resource efficient. By combining knowledge of WISCLAND landcover data and aerial photo interpretation, BER intended to identify potentially important sites. In addition, BER hoped to develop a Coarse Filter Screening process that could be easily adapted for use in other large geographic areas throughout the state of Wisconsin.

Clark Forestry, Inc. was contracted by BER to conduct the coarse filter screening in 1999. The purpose of the screening was to identify sites with high potential for occurrences of threatened, endangered and special concern species, significant natural communities, or sites of otherwise high conservation value. The primary emphasis was on the identification of potential, high quality natural communities. A related goal was to create a cost-effective, and easily replicated process to identify sites using GIS, aerial

photography, and existing information sources, and compare the results of such a process to the recommendations obtained from basin experts. Further details of the coarse screening process can be found in Appendix K.

Budget and time constraints did not allow for ground truthing or fieldwork throughout the basin to support the coarse filter process in 1999. It was assumed that the methods used in this process would result in missing many small areas and areas whose attributes could not be captured using existing information sources (see results and recommendations in Appendix K).

Wolf River Basin Experts Workshop

In an effort to meet the immediate needs for inventory information, BER began to search for an inventory approach that would be more time and cost efficient. Recognizing the wealth of information that is available from local experts in the region, BER set out to develop a workshop process that would gather information from individuals with specialized knowledge of the resources in the area. Working with the assistance of a Design Team of Regional DNR staff, BER designed a workshop approach that would take advantage of information from this valuable source:

- ◆ Inventory information compiled from many different individuals (called *experts*) who have first-hand knowledge of ecologically significant sites “on-the-ground” (called *Expert Sites*). Table L-1 in Appendix L includes a full list of the Expert Sites and other relevant site information.

NHI believed that the Experts would provide insight into the effectiveness of the coarse filter work and provide additional fine scale information not obtainable from the general coarse-filter screening. Coarse filter screening and expert sites are illustrated on Map 2. At the workshop, participants worked together to compare the information from the two different inventory approaches and discuss priorities for future field inventory and resource conservation. The collaborative effort represented by this approach took advantage of many sources of expert information and supported long-term awareness of the basin and its conservation needs and set a precedent for what BER hopes will be more pro-active approaches to basin-wide inventory in the future. Details of the purposes and results of the experts workshop can be found in Appendix L.

Map 3 illustrates the final result of the Workshop: Sites with High Potential for Conservation and Inventory. Thirty-nine sites were identified from the list of Coarse Filter and Expert sites that represent the prioritization of sites by Experts based on their personal knowledge and information on hand at the Workshop. This information was used to support basin planning and to identify inventory needs for the 2000 field season.

The sites of high potential are distributed among most of the eight ecological landscapes represented within the basin. There are 10 high potential sites (based on the location of their center point) in the North Central Forest, 10 in the Forest Transition, 1 in the Northern Lake Michigan Coastal, 7 in the Central Lake Michigan Coastal, 5 in the Central Sand Hills, and 6 in the Southeast Glacial Plains. There are no high potential sites located in the Central Sand Plains or the Northeast Sands landscapes. Some sites span more than one landscape.

Fine Filter Inventory Methods

Appendix A contains provides an overview of the NHI program and describes methodology used. All fieldwork was conducted between May of 1999 and September 2001. Fieldwork was designed to target the following: natural communities, aquatic invertebrates, terrestrial invertebrates, small mammals, fishes, birds, and herptiles. In addition, rare plant records were added during the course of the natural community inventory work. Map 4 depicts the inventory locations for each of the surveys. The inventory

methods utilized, as well as results, for each of the above groups are included here as separate appendices (Table 1).

Table 1: Field survey types, primary authors, and location of survey information within this report.

Taxa / Inventory Type	Contributing Author(s)	Appendix (Appendices)
Aquatic Invertebrates	Kurt Schmude	C, E.1, E.2
Priority Stream Segment Descriptions	Compilation of all inventory efforts with emphasis on aquatic systems; Bill Smith, John Lyons	C
Birds	Todd Miller, Dennis Kuecherer, Eric Epstein	I
Fishes	John Lyons	C,J
Herptiles	Erik R. Wild	C,H
Natural Communities	Elizabeth Spencer, Eric Epstein, and Andy Clark, Emmet Judziewicz	N.1, N.2
Plants	Craig Anderson, Eric Epstein, Bill Smith, and Andy Clark	O
Small Mammals	Richard Bautz	F.1, F.2
Terrestrial Invertebrates	Kathy Kirk and Matt Brust	G
Priority Site Descriptions	Compilation of all inventory efforts with emphasis on natural communities and rare taxa; Eric Epstein, Andy Clark, Bill Smith, Craig Anderson, Elizabeth Spencer	B
Upper Wolf River Basin	Compilation of all inventory efforts with emphasis on primary inventory sites (natural communities); Eric Epstein and Elizabeth Spencer	D

Inventory locations within the NRA were surveyed at the highest intensity and for each of the taxa groups listed above. Several ecologically important priority sites and stream segments were identified within the NRA based on inventory results to support WDNR master planning (see Part 2 of this report regarding inventory within the NRA and Appendices B and C that describe priority sites and stream segments, respectively within the NRA). Additional sampling was performed at numerous locations outside of the basin, as resources allowed. Part 3 of this report gives a brief description of the areas outside of the NRA, and Appendix D describes primary inventory sites sampled within the northern portion of the Wolf River Basin.

A significant portion of the upper basin (Menominee County) was not surveyed as part of this project due to logistical considerations. Menominee County has Federal Reservation status, is a sovereign nation, and is rich in natural communities typical of a forested landscape. These considerations provide unique challenges and opportunities for a state government-coordinated resource inventory project, and because of the master planning needs of the Lower Wolf Bottomlands Natural Resource Area, it was thought best to focus our limited basin inventory efforts in the lower Basin. There is great interest in working with the Menominee in the near future on a comprehensive biotic inventory project on Tribal lands.

Future Inventory Needs

Additional comprehensive inventory work has not been scheduled specifically for the Wolf River Basin at this time. However, due to the vastness and ecological importance of the basin, there are several areas that could benefit from additional inventory efforts. The priorities for future inventory work include the following:

1. More thoroughly examine sites identified as having high potential for conservation and inventory
2. Complete comprehensive survey work in the northern half of the Wolf River Basin
3. More thoroughly examine the southwestern portion of the basin, focusing on natural communities such as prairies, savannas, dry forests, and seepage lakes, plus birds, herptiles, and rare plants.
4. Conduct additional inventory to fill data gaps and provide more detailed information on selected taxa within the NRA. Examples could include marsh birds such as rails and bitterns, forest interior birds, and certain herptiles.

PART 2: LOWER WOLF RIVER BOTTOMLANDS NATURAL RESOURCES AREA SUMMARY

Introduction

In 1999, the WDNR initiated master planning for various state-owned properties located along the Wolf River from the Shawano Dam in Shawano County downstream to Lake Poygan in Winnebago County. Recently (March 2002) a Feasibility Study (WDNR 2002) was approved, officially establishing the Lower Wolf River Bottomlands Natural Resources Area (NRA). The NRA is about 335 square miles and includes parts of Waupaca, Outagamie, Shawano, and Winnebago counties.

Map 5 depicts the NRA and the many existing state wildlife areas, fisheries areas, and state natural areas (see inset) that are set within a larger context of private lands. The area includes a wealth of wildlife and natural resources that are influenced by diverse interests. Property master planning involves the public in a process that will determine the use and management of state lands according to the many interests, needs, and opportunities that exist.

Lower Wolf River Bottomlands Master Plan Properties:	
1.	Deer Creek SWA
2.	DeWolfe SWA
3.	Hortonville Bog SNA
4.	Wolf River Bottoms SWA -LaSage Unit
5.	Mack SWA
6.	Maine SWA
7.	Mukwa SWA
8.	Navarino SWA
9.	Outagamie SWA
10.	Rat River SWA
11.	Shaky Lake SNA
12.	Wolf River Bottoms SWA – K & S Unit
13.	Wolf River SFA
14.	Wolf River SWA
15.	Wolf River Fisheries Remnants

Geology and Vegetation

The Lower Wolf River Bottomlands NRA is contained entirely within the Central Lake Michigan Coastal and Southeast Glacial Plains Ecological Landscapes. See Part 1 for a description of these landscapes, as well as others occurring within the basin.

Summary of NHI Data from the Endangered Resources Program for the NRA

Following is information on the significant natural communities, rare plants, animals, and other significant ecological features that are known to exist within the NRA. This information is from the NHI's Biological and Conservation Data (BCD) system. The most recent information added to the BCD is from the 2001 field season. Map 6 depicts the location of element occurrences (EOs) within the Wolf River Basin, and highlights those EO's documented from 1999-2001 (including, but not limited to, those identified as a result of 1999-2001 fieldwork). Appendices N.1, N.2, O, and P provide a full listing of all the known elements that occur within the entire basin and include descriptions and management considerations for each.

Inventory Sites

During the 1999 field season, surveys of natural communities were confined to the southeastern portion of the basin. Fieldwork in 2000 and 2001 expanded the scope of this effort, geographically, and included lands in other ownerships for which the DNR has secured permission to conduct surveys.

Surveys documented 64 stands of natural communities at 24 major sites. Fourteen of these sites are state-owned, with Wildlife Management, Fish Management, and Endangered Resources the primary programs involved. The remaining ten properties are privately-owned.

BER Priority Inventory Sites located within the NRA are listed below. Sites are numbered from north to south as they occur within the NRA. Site descriptions and a map containing all surveyed sites (Map 10) are included in Appendix B.

- | | |
|--|--|
| 1. Navarino State Wildlife Area | 14. Mosquito Hill / Liberty Bottoms |
| 2. Leeman Bottoms | 15. Wolf River State Fishery Area |
| 3. Deer Creek State Wildlife Area | 16. Mukwa Bottoms |
| 4. Embarrass River - CTH XX to CTH F | 17. Wolf River Corridor -Shaw's Landing to Fremont |
| 5. Maine State Wildlife Area | 18. Shaky Lake |
| 6. Maine Bottoms | 19. Rat River |
| 7. Wolf River Wetlands | 20. Lower Wolf River Marshes |
| 8. Outagamie Bottoms | 21. Winchester Meadows |
| 9. Mack State Wildlife Area | 22. Piacenza Marsh |
| 10. Lower Embarrass River Bottoms | 23. Clark's Point |
| 11. Hortonville Bog State Natural Area | 24. Poygan Islands |
| 12. LaSage Bottoms | |
| 13. S&M Bottoms | |

In addition to the 24 Priority Sites shown above, BER identified four ecologically important stream segments within the NRA. These were selected based on analysis of inventory data, especially mussel, macroinvertebrate, and stream surveys. Homogeneous stream segments harboring large numbers of taxa, rare taxa, and/or regionally significant populations were identified as Priority Stream Segments.

Priority Stream Segments located within the NRA are listed below. Site descriptions and a map containing all surveyed sites (Map 11) are included in Appendix C.

1. Wolf River Corridor – Shawano to CTH CCC
2. Wolf River Corridor – CTH CCC to Lake Poygan
3. Lower Embarrass River Corridor
4. Little Wolf River Corridor

Natural Communities

Brief descriptions of all natural communities surveyed within the NRA to date can be found in Appendix N.1. The following is a list of those natural community types known to occur within the NRA that have local or regional significance.

Natural community types of especially high significance because of their extent, quality or condition within the master plan area include:

- **Emergent Aquatic** (cattail-bulrush-bur-reed-arrowhead)
- **Emergent Aquatic** (wild rice)
- **Submergent Aquatic** (pondweeds-wild celery-waterweed-water-milfoil)
- **Southern Sedge Meadow** (tussock sedge-Canada bluejoint grass)
- **Floodplain Forest** (silver maple-green ash-swamp white oak)
- **Southern Hardwood Swamp** (red maple-elms-ashes)

Natural community types which are not extensive within the NRA but are significant because of their rarity statewide, their quality and condition, and/or because they provide habitat for locally or regionally rare species include:

- **Southern Mesic Forest** (maple-basswood or maple-beech forests on terraces just above the Wolf River floodplain).
- **Northern Dry-mesic Forest** (white pine-red oak-red maple)
- **Northern Wet-mesic Forest** (white cedar)
- **Northern Mesic Forest** (sugar maple – hemlock – beech – basswood)
- **Northern Sedge Meadow** (*Carex* spp.-Canada bluejoint grass)
- **Tamarack Swamp** (tamarack-Labrador tea-sedges-mosses)
- **Open Bog** (sphagnum mosses-leatherleaf)
- **Muskeg** (sphagnum mosses-ericaceous shrubs-black spruce-tamarack)
- **Wet Prairie** (prairie cordgrass-Canada bluejoint grass)
- **Wet-mesic Prairie** (big bluestem-prairie dock)
- **Sand Prairie** (little bluestem-junegrass)

Other habitats that were occasionally surveyed within the NRA that either represent cover types not included under the concept of natural communities by NHI at this time or are highly altered or degraded. Any of these types can sometimes provide important habitat for sensitive species or perform important functions such as buffering or increasing effective habitat area.

- **Restored Prairie**
- **Reed canary grass meadow**
- **Aspen forest**
- **Pine plantation**
- **Old field**

Aquatic Habitats

As used here aquatic habitats are somewhat homogeneous segments of streams or lakes that are similar in physical characteristics such as landform geology, surficial geology, local physiology, size, shape, and network position. These “macrohabitat” types are thought to correspond to a coarse level of biological community organization or sometimes to actual species assemblages. Aquatic macrohabitats may be further split out into habitat units based on water depth, light penetration, velocity, and substrate. These

units are thought to correspond to actual species assemblages (most often animals) or indicator taxa. This physically based hierarchical classification framework is in contrast to that used in the Priority Sites section in this report (Appendix B) which are typically defined by repeating plant assemblages. See [Classification Framework for Freshwater Communities](#), published by The Nature Conservancy (TNC 1997), for more details of this approach. The current NHI aquatic classification system has some similarities to the TNC system described above in that it is physically based, but it recognizes fewer variables and tends to classify an entire stream or lake as one type. NHI will be integrating the current system with TNC's system in the near future. Towards this revision of the NHI aquatic classification system a GIS based database has been developed which describes the physical stream resources at the macrohabitat level for the entire state. Maps 7-9, in addition to the summaries presented below at the macrohabitat level for the lower Wolf River Basin, are derived from this database. A similar lake classification system will likely be developed in the next few years.

Explanation of Maps 7, 8, and 9. Three stream variables are represented for each homogeneous segment, i.e. (1) hydrologic source (Map 7) (2) stream size (Map 8), and (3) gradient (Map 9). Each of these variables is a continuum, and they have been arbitrarily divided into three to five classes.

- *Hydrologic source* (Map 7) could be represented as any one of five classes describing dominant water source including (1) artificial/unknown, (2) high runoff, (3) high runoff/low groundwater, (4) low runoff/high groundwater, and (5) high groundwater.
- *Stream size* (Map 8) is determined by the number of first order (headwater) streams upstream with the classes being 1, 2-10, 11-50, 51-200, and 200+. On this map, size is represented by the width of the line.
- *Gradient* (Map 9) (change in elevation divided by segment length) is represented by three groups, slope of 0-.002 (slow flat water), slope of .002-.019 (medium flow rate), and slope greater than .002 (high flow rate). The number of classes actually represented in a particular area like the Lower Wolf River Basin will generally be fewer than those for the entire state.

Rare Plants

The Wisconsin Natural Heritage Inventory lists 11 rare plant species in the Lower Wolf River Bottomlands NRA (Table 2). These include 2 State Threatened species, and 7 State Special Concern species. No federally listed plant species have been found in the NRA.

Table 2. Rare Plants of the Lower Wolf River Bottomlands Master Plan Inventory Area

Scientific Name	Common Name	Observation Date	WI State Status	Federal Status
<i>Arabis missouriensis var deamii</i>	Deam's rockcress	1959	SC	
<i>Cardamine pratensis</i>	Cuckooflower	2001	SC	
<i>Carex formosa</i>	Handsome sedge	2001	THR	
<i>Carex gynocrates</i>	Northern bog sedge	2000	SC	
<i>Cypripedium reginae</i>	Showy lady's-slipper	2000	SC	
<i>Medeola virginiana</i>	Indian cucumber-root	2001	SC	
<i>Phegopteris hexagonoptera</i>	Broad beech fern	2001	SC	
<i>Platanthera dilatata</i>	Leafy white orchis	1931	SC	
<i>Platanthera orbiculata</i>	Large roundleaf orchid	1931	SC	
<i>Triglochin maritima</i>	Common bog arrow-grass	2001	SC	
<i>Valeriana sitchensis ssp uliginosa</i>	Marsh valerian	1944	THR	

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

Half of the rare plants in the Lower Wolf River Bottomlands NRA are associated with wetland communities. Four species grow in some type of calcareous wetlands. The remaining species grow in hardwood, conifer-hardwood, or conifer forests.

Of the 21 rare plant populations documented in the Lower Wolf River Bottomlands NRA, 9 grow in State Wildlife Areas and 3 grow on State Natural Areas. Those state-managed populations account for 4 of the 11 rare plant species known from the area. Any future survey work may reveal a larger proportion of these species on state-managed lands.

Botanical surveys in the Lower Wolf River Bottomlands NRA updated or revealed 17 populations of 7 species. Despite repeated surveys in the 1980's, no one had documented handsome sedge (*Carex formosa*), a Threatened species in Wisconsin, growing in the Wolf River Basin since the 1940s. In 1999, Andy Clark found a population on Wolf River Bottoms SWA - LaSage Unit and another just outside Mukwa State Wildlife Area. Additional records were added for this species in 2000 and 2001.

The occurrences for three species in the NRA, Deam's rockcress, leafy white orchis, and marsh valerian, are known only from historical records. The location information associated with these records is imprecise, and these occurrences might have actually been in the NRA. Further inventory in or near the NRA could locate new occurrences for these species. Leafy white orchis and marsh valerian have been found more recently elsewhere in the Wolf River Basin outside of the NRA. Deam's rockcress hasn't been documented in the Basin since 1965.

A discussion of all known rare vascular plants within the Wolf River Basin is provided in Appendix O.

Rare Animals

The Wisconsin Natural Heritage Inventory lists 115 rare animals in the Lower Wolf River Bottomlands Master Plan inventory area (Table 3). These include 4 WI Endangered species, 18 WI Threatened species, and 93 Special Concern species. Twelve animal species are considered rare or local throughout their range (G3). The remaining rare species are considered secure (G4-G5) or their global status is unknown. From the perspective of the state of Wisconsin, 12 species from the basin are critically imperiled (S1), 46 species are imperiled (S2), and 50 species are rare or uncommon (S3). The remaining 7 species are either secure (S4), of unknown status (SU) or extirpated (SX).

Aquatic habitats are even more important in the southeastern portion of the basin than in the basin as a whole and are considered critical for 62 percent of the rare species found in the Master Plan inventory area. Other important habitats for rare species in the basin are wetlands, harboring 14 percent of the taxa, pine/oak barrens with 10 percent, southern forests with 10 percent, northern forests with 7 percent, grasslands with 4 percent and oak savanna with one percent.

Significant occurrences of aquatic animals in the NRA are further described in Appendix P. Terrestrial animals of particular importance are the concentrations of Red-shouldered Hawk (threatened), Cerulean Warbler (threatened), Prothonary Warbler (special concern), and a number of more common floodplain forest birds. Regionally significant habitats for these species occur here, especially in larger connected patches of mature forest. In addition, wetland birds, including nesting colonies of Common and Forster's Tern (both endangered), as well as several special concern species including Black Tern, Least Bittern, American Bittern, Common Moorhen, and Northern Harrier are concentrated within the lowermost portion of the NRA. In addition, King Rail and Yellow Rail (both state threatened) were found here recently. Blanding's turtles (threatened) use the NRA in good numbers. Sandy openings in the Navarino State Wildlife Area support a number of rare insects not found elsewhere in the NRA. The few bogs in the NRA harbor a number of rare wetland insects including beetles and lepidoptera species. Old field

habitats adjoining some of the larger marshes and meadows support many grassland birds, including special concern species such as Upland Sandpiper, Dickcissel, and Grasshopper Sparrow.

Table 3. Rare Animals of the Lower Wolf River Bottomlands Master Plan Inventory Area

Scientific Name	Common Name	Observation Date	WI State Status	Federal Status
<i>Acipenser fulvescens</i>	Lake sturgeon	2001	SC/H	
<i>Acris crepitans blanchardi</i>	Blanchard's cricket frog	1991	END	
<i>Agabetes aceductus</i>	A hydrophylid beetle	2000	SC/N	
<i>Agabus bicolor</i>	A predaceous diving beetle	1999	SC/N	
<i>Agabus inscriptus</i>	A predaceous diving beetle	1999	SC/N	
<i>Agabus wasastjernaee</i>	Predaceous diving beetle	2000	SC/N	
<i>Alasmidonta marginata</i>	Elktoe	1995	SC/H	
<i>Alasmidonta viridis</i>	Slippershell mussel	1991	THR	
<i>Ammodramus henslowii</i>	Henslow's sparrow	2000	THR	
<i>Ardea herodias</i>	Great blue heron	2000	SC/M	
<i>Baetisca obesa</i>	A mayfly	1999	SC/N	
<i>Botaurus lentiginosus</i>	American bittern	2001	SC/M	
<i>Brachycercus prudens</i>	A caenid mayfly	1999	SC/N	
<i>Buteo lineatus</i>	Red-shouldered hawk	2000	THR	
<i>Celina hubbelli</i>	A predaceous diving beetle	1999	SC/N	
<i>Chlidonias niger</i>	Black tern	2001	SC/M	
<i>Chlosyne gorgone</i>	Gorgone checker spot	1991	SC/N	
<i>Cicindela lepida</i>	Little white tiger beetle	2000	SC/N	
<i>Cicindela patruela huberi</i>	A tiger beetle	2000	SC/N	
<i>Cicindela patruela patruela</i>	A tiger beetle	2000	SC/N	
<i>Clemmys insculpta</i>	Wood turtle	2000	THR	
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	1984	SC/M	
<i>Copelatus glyphicus</i>	Predaceous diving beetle	2000	SC/N	
<i>Cymbiodyta acuminata</i>	A water scavenger beetle	1999	SC/N	
<i>Cymbiodyta minima</i>	A water scavenging beetle	1999	SC/N	
<i>Dendroica cerulea</i>	Cerulean warbler	2000	THR	
<i>Dubiraphia bivittata</i>	A dubiraphia riffle beetle	2000	SC/N	
<i>Empidonax vireescens</i>	Acadian flycatcher	2000	THR	
<i>Emydoidea blandingii</i>	Blanding's turtle	2001	THR	
<i>Enochrus consortus</i>	A water scavenging beetle	2000	SC/N	
<i>Enochrus perplexus</i>	A water scavenger beetle	2000	SC/N	
<i>Enochrus sayi</i>	A water scavenging beetle	1999	SC/N	
<i>Epioblasma triquetra</i>	Snuffbox	1995	END	
<i>Erimyzon sucetta</i>	Lake chubsucker	1981	SC/N	
<i>Erynnis lucilius</i>	Columbine dusky wing	1991	SC/N	
<i>Etheostoma clarum</i>	Western sand darter	2001	SC/N	
<i>Euphyes bimacula</i>	Two-spotted skipper	1989	SC/N	
<i>Euphyes dion</i>	Dion skipper	2000	SC/N	
<i>Fundulus diaphanus</i>	Banded killifish	1974	SC/N	
<i>Gallinula chloropus</i>	Common moorhen	2001	SC/M	
<i>Gomphurus externus</i>	Plains clubtail	1999	SC/N	
<i>Gomphurus ventricosus</i>	Skillet clubtail	1999	SC/N	
<i>Gomphus viridifrons</i>	Green-faced clubtail	1999	SC/N	
<i>Graphoderus manitobensis</i>	A predaceous diving beetle	1999	SC/N	
<i>Haliaeetus leucocephalus</i>	Bald eagle	1989	SC/FL	LT,PD
<i>Haliplus canadensis</i>	A crawling water beetle	1999	SC/N	
<i>Haliplus pantherinus</i>	A crawling water beetle	1999	SC/N	
<i>Hebrus buenoi</i>	A velvet waterbug	2000	SC/N	
<i>Hebrus burmeisteri</i>	A velvet waterbug	1999	SC/N	
<i>Helocombus bifidus</i>	A water scavenging beetle	1999	SC/N	
<i>Hesperia leonardus leonardus</i>	Leonard's skipper	2000	SC/N	
<i>Hesperocorixa semilucida</i>	A water boatman	2000	SC/N	
<i>Hetaerina titia</i>	Dark rubyspot	1999	SC/N	
<i>Hydrochara leechi</i>	A water scavenger beetle	1999	SC/N	
<i>Hydrochara spangleri</i>	A water scavenger beetle	2000	SC/N	

Scientific Name	Common Name	Observation Date	WI State Status	Federal Status
<i>Hydrometra martini</i>	A water measurer	2000	SC/N	
<i>Hydroporus badiellus</i>	A predaceous diving beetle	1999	SC/N	
<i>Hydropsyche bidens</i>	A caddisfly	1999	SC/N	
<i>Ilybius discedens</i>	A predaceous diving beetle	1999	SC/N	
<i>Ilybius ignarus</i>	Diving beetle	2000	SC/N	
<i>Ilybius incarinatus</i>	A predacious diving beetle	2000	SC/N	
<i>Isoperla bilineata</i>	A perlid stonefly	1999	SC/N	
<i>Isoperla marlynia</i>	A perlid stonefly	1999	SC/N	
<i>Ixobrychus exilis</i>	Least bittern	2000	SC/M	
<i>Laccobius agilis</i>	A water scavenging beetle	1999	SC/N	
<i>Lepomis megalotis</i>	Longear sunfish	1926	THR	
<i>Lestes inaequalis</i>	Elegant spreadwing	2000	SC/N	
<i>Liodessus cantralli</i>	Cantrall's bog beetle	1999	SC/N	
<i>Liodessus flavicollis</i>	A predacious diving beetle	2000	SC/N	
<i>Lioporeus triangularis</i>	A predaceous diving beetle	1999	SC/N	
<i>Luxilus chrysocephalus</i>	Striped shiner	UNK	END	
<i>Lythrurus umbratilis</i>	Redfin shiner	1926	THR	
<i>Macrhybopsis aestivalis</i>	Shoal chub	2000	THR	
<i>Matus bicarinatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	1984	SC/M	
<i>Meropleon ambifuscum</i>	Newman's brocade	1994	SC/N	
<i>Moxostoma carinatum</i>	River redhorse	2000	THR	
<i>Moxostoma valenciennesi</i>	Greater redhorse	2000	THR	
<i>Neoscutopterus hornii</i>	A predaceous diving beetle	1999	SC/N	
<i>Nepa apiculata</i>	A water scorpion	2000	SC/N	
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	1999	SC/N	
<i>Notropis anogenus</i>	Pugnose shiner	1963	THR	
<i>Notropis texanus</i>	Weed shiner	2001	SC/N	
<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	1984	THR	
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	2001	SC/M	
<i>Ophiogomphus howei</i>	Pygmy snaketail	1999	THR	
<i>Opsopoeodus emiliae</i>	Pugnose minnow	2000	SC/N	
<i>Palaemonetes kadiakensis</i>	Mississippi grass shrimp	2001	SC/N	
<i>Pandion haliaetus</i>	Osprey	2001	THR	
<i>Paracloeodes minutus</i>	A small minnow mayfly	1992	SC/N	
<i>Parameletus chelifera</i>	A primitive minnow mayfly	1993	SC/N	
<i>Pelocoris femorata</i>	A creeping water bug	1999	SC/N	
<i>Pentagenia vittigera</i>	An ephemerid mayfly	1992	SC/N	
<i>Plauditus cestus</i>	A small minnow mayfly	1999	SC/N	
<i>Pleurobema sintoxia</i>	Round pigtoe	1995	SC/H	
<i>Poanes massasoit</i>	Mulberry wing	2000	SC/N	
<i>Poanes viator</i>	Broad-winged skipper	2000	SC/N	
<i>Procambarus acutus</i>	White river crawfish	2000	SC/N	
<i>Protonotaria citrea</i>	Prothonotary warbler	2000	SC/M	
<i>Pseudiron centralis</i>	A heptageniid mayfly	1999	SC/N	
<i>Rallus elegans</i>	King rail	2000	SC/M	
<i>Ranatra nigra</i>	A water scorpion	2000	SC/N	
<i>Rhantus sinuatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Simpsonaias ambigua</i>	Salamander mussel	1991	THR	
<i>Sorex arcticus</i>	Arctic shrew	1999	SC/N	
<i>Sperchopsis tessellatus</i>	A water scavenging beetle	1999	SC/N	
<i>Spharagemon marmorata</i>	Northern marbled locust	1999	SC/N	
<i>Stenelmis antennalis</i>	A riffle beetle	1999	SC/N	
<i>Stenelmis bicarinata</i>	A riffle beetle	1999	SC/N	
<i>Stenelmis fuscata</i>	A riffle beetle	1999	SC/N	
<i>Sterna forsteri</i>	Forster's tern	2000	END	
<i>Stylurus notatus</i>	Elusive clubtail	2000	SC/N	
<i>Trachyrhachys kiowa</i>	Ash-brown grasshopper	1999	SC/N	
<i>Triaenodes nox</i>	A caddisfly	2000	SC/N	
<i>Tritogonia verrucosa</i>	Buckhorn	1995	THR	

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened; LELT = listed endangered in part of its range, threatened in another part; PE = proposed endangered; PT = proposed threatened; PEPT = proposed endangered in part of its range threatened in another. **Group Name:** ^ = aquatic species. (See Appendix Q for the complete NHI Working list)

As with the entire basin, inventory coverage in the Lower Wolf River Bottomlands Master Plan inventory area has been uneven in terms of species or species groups surveyed, chronology, and geography. The Lower Wolf River and several major tributaries have been systematically sampled for mussels, fish and aquatic insects, but few other groups of animals have such systematic coverage. A number of invertebrates (mostly aquatic insects) were added to the NHI working list as a result of inventory work conducted during the 1999-2001 field seasons, as well as subsequent literature review.

A discussion of all known rare animals within the Wolf River Basin is provided in Appendix P.

PART 3: WOLF RIVER BASIN OUTSIDE OF THE NRA

Geology and Vegetation

In the northern and western part of the Wolf River basin, end and ground moraines surrounded by pitted outwash cover the majority of the landscape. Numerous small kettles containing lakes and peat bogs are embedded within these landforms. Due to the climate and the hilly, morainal topography in the northern and western portions of the basin, forest cover is greater than in the southeast, and forestry gains in importance relative to agriculture. Ecological Landscapes represented in these portions of the basin are described in Part 1.

Summary of NHI Data from the Endangered Resources Program

Following is information on the significant natural communities and rare plants and animals that are known to exist within the Wolf River Basin outside of the NRA. This information is summarized from NHI's Biological and Conservation Data (BCD) system and includes information added to the BCD from the 2001 field inventories. Map 6 depicts the location of element occurrences (EOs) within the Wolf River Basin, and highlights those EOs resulting from 1999-2001 fieldwork. Appendices N.1, N.2, O, and P provide a full listing of all the known elements that occur within the entire basin, and include descriptions and management considerations for each.

Natural Communities

Brief descriptions of all natural communities, aquatic features, and other habitats surveyed within the basin but outside of the NRA to date can be found in Appendix N.2. The following is a list of those natural community types known to occur within the basin but outside of the NRA that have local or regional significance.

Natural community types of especially high significance because of their extent, quality or condition within the basin but outside of the NRA include:

- **Emergent Aquatic** (cattail-bulrush-bur-reed-arrowhead)
- **Emergent Aquatic** - Wild Rice
- **Submergent Aquatic** (pondweeds-wild celery-waterweed-water-milfoil)
- **Southern Sedge Meadow** (tussock sedge-Canada bluejoint grass)
- **Southern Hardwood Swamp** (red maple-elms-ashes)
- **Northern Hardwood Swamp** (black ash-red maple-yellow birch)
- **Floodplain Forest** (silver maple-green ash-swamp white oak)
- **Northern Mesic Forest** (sugar maple-hemlock-yellow birch-beech-white pine)

Natural community types which are not extensive within the basin but are significant because of their rarity statewide, their quality and condition, and/or because they provide habitat for locally or regionally rare species include:

- **Northern Wet-mesic Forest** (white cedar)
- **Oak Barrens (oaks-prairie grasses and forbs)**
- **Pine Barrens (jack pine-oaks-prairie grasses and forbs)**
- **Southern Mesic Forest** (maple-basswood terraces just above the floodplain of the Wolf River)
- **Southern Dry Forest** (white oak-black oak)
- **Northern Dry-mesic Forest** (white pine-red oak-red maple)
- **Northern Sedge Meadow** (*Carex* spp.-Canada bluejoint grass)
- **Tamarack Swamp** (tamarack-Labrador tea-sedges-mosses)
- **Open Bog** (sphagnum mosses-leatherleaf)
- **Muskeg** (sphagnum mosses-ericaceous shrubs-black spruce-tamarack)
- **Wet Prairie** (prairie cordgrass-Canada bluejoint grass)
- **Wet-mesic Prairie** (big bluestem-prairie dock)
- **Sand Prairie** (little bluestem-junegrass)

Other habitats that were occasionally surveyed that either represent cover types not included under the concept of natural communities by NHI at this time or are highly altered or degraded. Any of these types can sometimes provide important habitat for sensitive species or perform important functions such as buffering or increasing effective habitat area.

- **Restored prairie**
- **Reed canary grass meadow**
- **Aspen forest**
- **Conifer plantation**
- **Intensively managed northern hardwoods**
- **Old field**

Aquatic Communities

See Part 2 for a discussion of aquatic communities, as well as maps 7-9.

Rare Plants

The Wisconsin Natural Heritage Inventory lists 66 rare plant species in the Wolf River Basin (Table 4), outside of the NRA. Nine of the species occur also within the NRA. The species include 8 that are State Endangered, 11 that are State Threatened species, and 47 that are State Special Concern.

Two of the Wisconsin Endangered plant species, the prairie white fringed orchid and Fassett's locoweed, are listed as threatened by the federal government. Both species were documented in 2000 by botanists in the Wolf River Basin outside of the NRA. Except for squarestem spikerush, the other Wisconsin Endangered plants (purple milkweed, little goblin moonwort, small yellow water crowfoot, dwarf huckleberry, and mountain cranberry) have been documented in the Wolf River Basin in the last twenty years.

Fassett's locoweed is considered to be a globally critically imperiled species due to the small number of known populations and the fragility of its habitat. The prairie white-fringed orchid is a globally imperiled (G2) species, and the little goblin moonwort and ram's-head lady's-slipper are considered rare throughout their ranges (G3). The remaining 62 tracked plant species are considered globally secure (G4, G5).

Table 4. Rare Plants of the Wolf River Basin Inventory Area Outside of the NRA

<i>Scientific Name</i>	Common Name	Lastobs Year	State Status	Federal Status
<i>Adlumia fungosa</i>	Climbing fumitory	1963	SC	
<i>Amerorchis rotundifolia</i>	Round-leaved orchis	1998	THR	
<i>Arabis missouriensis</i> var <i>deamii</i> *	Deam's rockcress	1965	SC	
<i>Arethusa bulbosa</i>	Swamp-pink	1995	SC	
<i>Asclepias ovalifolia</i>	Dwarf milkweed	2000	THR	
<i>Asclepias purpurascens</i>	Purple milkweed	1984	END	
<i>Bartonia virginica</i>	Yellow screwstem	1916	SC	
<i>Botrychium mormo</i>	Little goblin moonwort	2001	END	
<i>Botrychium oneidense</i>	Blunt-lobe grape-fern	1994	SC	
<i>Calylophus serrulatus</i>	Yellow evening primrose	1915	SC	
<i>Calypso bulbosa</i>	Fairy slipper	1994	THR	
<i>Cardamine pratensis</i> *	Cuckooflower	2001	SC	
<i>Carex assiniboensis</i>	Assiniboine sedge	2001	SC	
<i>Carex gynocrates</i> *	Northern bog sedge	2000	SC	
<i>Carex sychnocephala</i>	Many-headed sedge	2000	SC	
<i>Carex tenuiflora</i>	Sparse-flowered sedge	2000	SC	
<i>Carex vaginata</i>	Sheathed sedge	1994	SC	
<i>Ceratophyllum echinatum</i>	Prickly hornwort	1982	SC	
<i>Corallorhiza odontorhiza</i>	Autumn coral-root	2000	SC	
<i>Cypripedium arietinum</i>	Ram's-head lady's-slipper	2001	THR	
<i>Cypripedium candidum</i>	Small white lady's-slipper	1992	THR	
<i>Cypripedium parviflorum</i>	Small yellow lady's-slipper	2001	SC	
<i>Cypripedium reginae</i> *	Showy lady's-slipper	2000	SC	
<i>Deschampsia cespitosa</i>	Tufted hairgrass	1940	SC	
<i>Diplazium pycnocarpon</i>	Glade fern	2001	SC	
<i>Elatine triandra</i>	Longstem water-wort	1994	SC	
<i>Eleocharis olivacea</i>	Capitate spikerush	1977	SC	
<i>Eleocharis quadrangulata</i>	Squarestem spikerush	Unknown	END	
<i>Eleocharis quinqueflora</i>	Few-flower spikerush	1977	SC	
<i>Eleocharis robbinsii</i>	Robbins spikerush	1982	SC	
<i>Epilobium palustre</i>	Marsh willow-herb	1994	SC	
<i>Equisetum palustre</i>	Marsh horsetail	1994	SC	
<i>Equisetum variegatum</i>	Variiegated horsetail	1994	SC	
<i>Glycyrrhiza lepidota</i>	Wild licorice	1915	SC	
<i>Juncus vaseyi</i>	Vasey's rush	1916	SC	
<i>Liatris spicata</i>	Marsh blazing star	2000	SC	
<i>Lithospermum latifolium</i>	American gromwell	2000	SC	
<i>Littorella americana</i>	American shore-grass	1931	SC	
<i>Malaxis brachypoda</i>	White adder's-mouth	2000	SC	
<i>Medeola virginiana</i> *	Indian cucumber-root	2001	SC	
<i>Minuartia dawsonensis</i>	Rock stitchwort	1965	SC	

Scientific Name	Common Name	Lastobs Year	State Status	Federal Status
<i>Opuntia fragilis</i>	Brittle prickly-pear	2000	THR	
<i>Oxytropis campestris var chartacea</i>	Fassett's locoweed	2000	END	LT
<i>Penstemon pallidus</i>	Pale beardtongue	1965	SC	
<i>Platanthera dilatata*</i>	Leafy white orchis	1995	SC	
<i>Platanthera flava var herbiola</i>	Pale green orchid	1970	THR	
<i>Platanthera hookeri</i>	Hooker's orchis	1916	SC	
<i>Platanthera leucophaea</i>	Prairie white-fringed orchid	2000	END	LT
<i>Platanthera orbiculata*</i>	Large roundleaf orchid	1931	SC	
<i>Potamogeton confervoides</i>	Algae-like pondweed	1994	THR	
<i>Psilocarya scirpoides</i>	Long-beaked baldrush	2000	THR	
<i>Ranunculus gmelinii</i>	Small yellow water crowfoot	1994	END	
<i>Ribes hudsonianum</i>	Northern black currant	2001	SC	
<i>Scirpus torreyi</i>	Torrey's bulrush	1994	SC	
<i>Talinum rugospermum</i>	Prairie fame-flower	2000	SC	
<i>Thalictrum revolutum</i>	Waxleaf meadowrue	2000	SC	
<i>Trillium nivale</i>	Snow trillium	2000	THR	
<i>Triglochin maritima*</i>	Common bog arrow-grass	2001	SC	
<i>Utricularia purpurea</i>	Purple bladderwort	1982	SC	
<i>Utricularia resupinata</i>	Northeastern bladderwort	1994	SC	
<i>Vaccinium cespitosum</i>	Dwarf huckleberry	1994	END	
<i>Vaccinium vitis-idaea ssp minus</i>	Mountain cranberry	1994	END	
<i>Valeriana sitchensis ssp uliginosa*</i>	Marsh valerian	2000	THR	
<i>Verbena simplex</i>	Narrow-leaved vervain	1979	SC	
<i>Viburnum cassinoides</i>	Northern wild-raisin	1973	SC	
<i>Viola rostrata</i>	Long-spur violet	1979	SC	

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened.

*Species for which there occurrences both within and outside of the NRA

Many of the rare plants in the Wolf River Basin are associated with wetland communities. The others grow in a number of different forest communities, in prairies, on cliffs, on lakeshores, or are aquatic plants.

Of the rare plant populations documented in the Wolf River Basin, 24 grow on public lands including state wildlife areas and national forest. Of those 24, 13 rare species have been documented on state natural areas. Any future survey work may reveal a larger proportion of these species on state-managed lands.

Occurrences of two species, yellow evening primrose and tufted hairgrass, are historical and new records haven't been recently documented in the Wolf River Basin. The location data from these old records is imprecise, and the occurrences might not have been within the Basin. Additional inventory work in the vicinity of the original records would help clarify the status of these two species in the Wolf River Basin.

Botanical surveys in the Wolf River Basin updated or newly documented 56 populations of rare plants. These occurrences include, among others, records for the snow trillium, several species of orchids, a variety of sedges, 2 fern species, and cuckooflower.

A discussion of all known rare vascular plants within the Wolf River Basin is provided in Appendix O.

Rare Animals

The Wisconsin Natural Heritage Inventory lists 117 rare animals within the Wolf River Basin but outside of the NRA (Table 5). These include 9 WI Endangered species, 15 WI Threatened species, and 93 Special Concern species. Only one animal, a land snail (*Catinella gelida*) considered imperiled globally (G2), was found within the inventory area, although another 13 species are considered rare or local throughout their range (G3) were also present. The remaining rare species are considered secure (G4-G5) or their global status is unknown. From the perspective of the state of Wisconsin, 15 species from the basin are critically imperiled (S1), 49 species are imperiled (S2), and 47 species are rare or uncommon (S3). The remaining 6 species are either secure (S4), of unknown status (SU) or extirpated (SX).

In the Upper Basin, there are significant occurrences of several species and taxa. For example, the only record of the state endangered dragonfly *Somatochlora incurvata* outside of the central sands region of the state is here. Significant butterfly and moth species and numbers were found at Norrie Bog.

Inventory coverage throughout the basin has been uneven in terms of species or species groups surveyed, chronology, and geography. The Lower Wolf River and several major tributaries have been systematically sampled for mussels, fish and aquatic insects, but few other groups of animals have such systematic coverage. A number of invertebrates (mostly aquatic insects) were added to the NHI working list as a result of inventory work conducted during the 1999-2001 field seasons, as well as subsequent literature review.

A discussion of all known rare animals within the Wolf River Basin is provided in Appendix P. The methods for the fieldwork completed by each of the above scientists is included in their respective taxa reports. It is anticipated that additional surveys will be needed to fill gaps in phenology, to more thoroughly cover selected sites, to survey additional taxa (e.g., birds and rare flora), and to include additional sites identified at the Experts Workshop. Thus, these reports should be viewed as preliminary findings.

Table 5. Rare Animals within the Wolf River Basin outside of the NRA

Scientific Name	Common name	Lastobs Year	State Status	Federal Status
<i>Accipiter gentilis</i>	Northern goshawk	2000	SC/M	
<i>Acipenser fulvescens</i>	Lake sturgeon	1991	SC/H	
<i>Acris crepitans blanchardi</i>	Blanchard's cricket frog	1983	END	
<i>Aeshna tuberculifera</i>	Black-tipped darner	2000	SC/N	
<i>Aeshna verticalis</i>	Green-striped darner	1985	SC/N	
<i>Alasmidonta marginata</i>	Elktoe	1995	SC/H	
<i>Alasmidonta viridis</i>	Slippershell mussel	1991	THR	
<i>Aphredoderus sayanus</i>	Pirate perch	1970	SC/N	
<i>Ardea herodias</i>	Great blue heron	2001	SC/M	
<i>Baetisca obesa</i>	A mayfly	1999	SC/N	
<i>Boloria eunomia</i>	Bog fritillary	2000	SC/N	
<i>Botaurus lentiginosus</i>	American bittern	1994	SC/M	
<i>Brachycercus prudens</i>	A caenid mayfly	1999	SC/N	
<i>Buteo lineatus</i>	Red-shouldered hawk	2000	THR	
<i>Callophrys henrici</i>	Henry's elfin	1990	SC/N	
<i>Catinella gelida</i>	A land snail	1997	SC/N	
<i>Chlidonias niger</i>	Black tern	2000	SC/M	
<i>Chlosyne gorgone</i>	Gorgone checker spot	2000	SC/N	
<i>Cicindela patruela huberi</i>	A tiger beetle	2000	SC/N	
<i>Cicindela patruela patruela</i>	A tiger beetle	2000	SC/N	
<i>Cionella morseana</i>	Appalachian pillar	1997	SC/N	
<i>Circus cyaneus</i>	Northern harrier	2001	SC/M	
<i>Clemmys insculpta</i>	Wood turtle	1994	THR	
<i>Coturnicops noveboracensis</i>	Yellow rail	1994	THR	
<i>Diadophis punctatus edwardsii</i>	Northern ringneck snake	1998	SC/H	
<i>Emydoidea blandingii</i>	Blanding's turtle	2000	THR	
<i>Enallagma anna</i>	River bluet	1986	SC/N	
<i>Enallagma traviatum</i>	Slender bluet	2000	SC/N	
<i>Epioblasma triquetra</i>	Snuffbox	2001	END	
<i>Erimyzon sucetta</i>	Lake chubsucker	1979	SC/N	
<i>Erynnis persius</i>	Persius dusky wing	1994	SC/N	
<i>Etheostoma microperca</i>	Least darter	1979	SC/N	
<i>Euphyes bimacula</i>	Two-spotted skipper	1994	SC/N	
<i>Euphyes dion</i>	Dion skipper	2000	SC/N	
<i>Falciennis canadensis</i>	Spruce grouse	1989	THR	
<i>Fundulus diaphanus</i>	Banded killifish	1995	SC/N	
<i>Gallinula chloropus</i>	Common moorhen	2000	SC/M	
<i>Glyphyalinia rhoadsi</i>	Sculpted glyph	1997	SC/N	
<i>Gomphurus lineatifrons</i>	Splendid clubtail	2000	SC/N	
<i>Gomphurus ventricosus</i>	Skillet clubtail	1999	SC/N	
<i>Gomphus viridifrons</i>	Green-faced clubtail	1998	SC/N	
<i>Gyrinus impressicollis</i>	A whirlygig beetle	2000	SC/N	
<i>Haliaeetus leucocephalus</i>	Bald eagle	1992	SC/FL	LT,PD
<i>Haliplus leopardus</i>	A crawling water beetle	2000	SC/N	
<i>Haliplus pantherinus</i>	A crawling water beetle	2000	SC/N	
<i>Hemidactylium scutatum</i>	Four-toed salamander	2000	SC/H	
<i>Hemileuca sp 3</i>	Midwestern fen buckmoth	1974	SC/N	
<i>Hesperia comma</i>	Laurentian skipper	2000	SC/N	
<i>Hesperia leonardus leonardus</i>	Leonard's skipper	2000	SC/N	
<i>Hetaerina titia</i>	Dark rubyspot	1999	SC/N	
<i>Hydrobius melaenum</i>	A water scavenging beetle	2000	SC/N	
<i>Hydrometra martini</i>	A water measurer	2000	SC/N	
<i>Hydroporus vittatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Isoperla bilineata</i>	A perlid stonefly	1996	SC/N	
<i>Isoperla lata</i>	A perlid stonefly	1996	SC/N	
<i>Isoperla richardsoni</i>	A perlid stonefly	1999	SC/N	
<i>Laccobius agilis</i>	A water scavenging beetle	2000	SC/N	
<i>Laccobius reflexipennis</i>	A predaceous beetle	2000	SC/N	
<i>Lepomis megalotis</i>	Longear sunfish	1979	THR	

Scientific Name	Common name	Lastobs Year	State Status	Federal Status
<i>Lestes vigilax</i>	Swamp spreadwing	2000	SC/N	
<i>Luxilus chrysocephalus</i>	Striped shiner	UNK	END	
<i>Lycaeides idas nabokovi</i>	Northern blue butterfly	1994	END	
<i>Lycaeides melissa samuelis</i>	Karner blue butterfly	2001	SC/FL	LE
<i>Lycaena dorcas</i>	Dorcas copper	2000	SC/N	
<i>Lycaena epixanthe</i>	Bog copper	2001	SC/N	
<i>Lythrurus umbratilis</i>	Redfin shiner	1979	THR	
<i>Macrochilo bivittata</i>	An owl moth	1994	SC/N	
<i>Microtus ochrogaster</i>	Prairie vole	1898	SC/N	
<i>Moxostoma carinatum</i>	River redhorse	1982	THR	
<i>Moxostoma valenciennesi</i>	Greater redhorse	1994	THR	
<i>Nannothemis bella</i>	Elfin skimmer	1990	SC/N	
<i>Napaeozapus insignis</i>	Woodland jumping mouse	1995	SC/N	
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	1999	SC/N	
<i>Notropis anogenus</i>	Pugnose shiner	1979	THR	
<i>Notropis texanus</i>	Weed shiner	1979	SC/N	
<i>Oeneis jutta</i>	Jutta arctic	2000	SC/N	
<i>Ophiogomphus carolus</i>	Riffle snaketail	2000	SC/N	
<i>Ophiogomphus howei</i>	Pygmy snaketail	1999	THR	
<i>Ophisaurus attenuatus</i>	Western slender glass lizard	1989	END	
<i>Opsopoeodus emiliae</i>	Pugnose minnow	1979	SC/N	
<i>Pandion haliaetus</i>	Osprey	1992	THR	
<i>Pelocoris femorata</i>	A creeping water bug	1999	SC/N	
<i>Perisoreus canadensis</i>	Gray jay	1994	SC/M	
<i>Phyciodes batesii</i>	Tawny crescent spot	2000	SC/N	
<i>Picoides arcticus</i>	Black-backed woodpecker	1994	SC/M	
<i>Pieris virginiana</i>	West virginia white	1995	SC/N	
<i>Plauditus cestus</i>	A small minnow mayfly	2000	SC/N	
<i>Plebejus saepiolus</i>	Greenish blue	1994	SC/N	
<i>Pleurobema sintoxia</i>	Round pigtoe	1997	SC/H	
<i>Poanes massasoit</i>	Mulberry wing	2000	SC/N	
<i>Poanes viator</i>	Broad-winged skipper	2000	SC/N	
<i>Pompeius verna</i>	Little glassy wing	1991	SC/N	
<i>Protonotaria citrea</i>	Prothonotary warbler	2000	SC/M	
<i>Rana catesbeiana</i>	Bullfrog	1986	SC/H	
<i>Ranatra nigra</i>	A water scorpion	2000	SC/N	
<i>Reithrodontomys megalotis</i>	Western harvest mouse	1976	SC/N	
<i>Satyrodus eurydice fumosa</i>	Smokey eyed brown	1994	SC/N	
<i>Schinia bina</i>	Bina flower moth	1996	SC/N	
<i>Schinia indiana</i>	Phlox moth	1992	END	
<i>Simpsonaias ambigua</i>	Salamander mussel	1992	THR	
<i>Somatochlora incurvata</i>	Warpaint emerald	2000	END	
<i>Sorex arcticus</i>	Arctic shrew	2000	SC/N	
<i>Sorex hoyi</i>	Pigmy shrew	1995	SC/N	
<i>Sorex palustris</i>	Water shrew	1995	SC/N	
<i>Sperchopsis tessellatus</i>	A water scavenging beetle	2000	SC/N	
<i>Spermophilus franklinii</i>	Franklin's ground squirrel	1990	SC/N	
<i>Sterna forsteri</i>	Forster's tern	1987	END	
<i>Strix nebulosa</i>	Great gray owl	1995	SC/M	
<i>Stylogomphus albistylus</i>	Least clubtail	1994	SC/N	
<i>Stylurus notatus</i>	Elusive clubtail	1999	SC/N	
<i>Stylurus scudderii</i>	Zebra clubtail	1999	SC/N	
<i>Trimerotropis maritima</i>	Seaside grasshopper	1999	SC/N	
<i>Tritogonia verrucosa</i>	Buckhorn	1995	THR	
<i>Tyto alba</i>	Barn owl	1981	END	
<i>Wormaldia moesta</i>	A caddisfly	1980	SC/N	

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Federal Status: Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened; LELT = listed endangered in part of its range, threatened in another part; PE = proposed endangered; PT = proposed threatened; PEPT = proposed endangered in part of its range threatened in another. **Group Name:** ^ = aquatic species.

PART 4 - KEY ISSUES FOR NATURAL RESOURCES AREA PLANNING

The following are ecological issues that have emerged after review of data collected during three field seasons in the Wolf River Basin. These issues were developed for use by the Department's planning team to help develop overall recommendations for the DNR properties and surrounding areas. This biotic inventory and analysis are only a part of a broader assessment that will be completed for master planning and will consolidate a variety of information to develop the overall recommendations. Site specific management issues and considerations are provided in the individual site descriptions in Appendices B (Priority Sites) and C (Priority Stream Segments). In addition, Part 5 outlines conservation needs and priorities within the NRA.

Fragmentation

When European settlement began in the Wolf River Basin, the landscape consisted of a complex mosaic of forests, savannas, prairies, and wetlands. Other communities like cliffs were embedded in this matrix created and maintained by landforms and intricate drainage patterns formed from glacial deposits, highly variable edaphic conditions, and periodic natural disturbances. Even to a casual observer, land use patterns are considerably different today than at presettlement times. As settlement proceeded, land was cleared for residential and commercial development or planted to row crops and seeded to "improved" pasture.

Riparian areas have often been viewed as desirable places to live. Settlements depended on rivers for transportation, food sources, and drinking water. Rivers were dammed for various reasons, including hydropower generation and to power gristmills, resulting in isolated populations of aquatic organisms. Not only are they a physical barrier to many aquatic organisms dams also alter and reduce habitat for many organisms, in part by changing the timing and quantity of water flow and water temperature. Today, rivers are still a desirable place to live. And in fact, in a number of places, upland shorelines have been almost completely developed in some areas for residential and recreational purposes. Development of homes, the construction of roads and utility corridors, and the alteration of the vegetation that accompanies development can affect travel corridors and greatly damage important habitat used by many species. Semi-permanently moored houseboats, or "fishing rafts," can also be found along some river stretches. These provide the ability of humans to inhabit riparian shorelines that would otherwise be off limits to human habitation.

In the past, wetlands have been viewed as an impediment, and the values and service of such communities were not recognized. Ditches were dug and wetlands tilled in an effort to support agriculture and other endeavors. In fact, drainage of wetlands has been extensive. In some counties in the lower Wolf River Basin over 30 percent of wetlands has been lost since 1961. Even with all of the efforts at conversion over the years, the largest, most intact native ecosystems persisting in the Wolf River Basin are wetland complexes within the floodplains of the Wolf River and its major tributaries. There are also several large wetland complexes within insular depressions in glacial till, outwash, and lakeplain landforms.

Planning efforts should attempt to address the causes of fragmentation and suggest viable options to minimize fragmentation in the future. Ideally, planning teams could try to develop links and corridors between existing unconnected natural communities and habitat.

Ecosystem Simplification

The structure, composition, and function of ecosystems native to the region have been significantly modified, often in ways that have led to the loss of characteristic species or other attributes. The loss of characteristic species like large carnivores, some large ungulates, and certain habitat specialists can have a ripple effect and change nutrient and mineral cycling pathways. Important functions and services may be lost from ecosystems as diverse natural communities are replaced by monocultures of agriculture. Suppression of fire has diminished or eliminated prairie and savanna habitats and their associated species due to encroachment of open habitats by woody species. Grazing and browsing pressure, both by domestic livestock and high populations of deer, have altered ecosystems by suppressing reproduction of trees, especially by those species that are preferred forage for browsers and grazers. Heavy grazing has also subjected some herbs and shrubs to pressures they cannot withstand and has resulted in losses of populations. Logging has reduced the extent of older forest successional stages, and can change successional pathways by favoring certain tree species over others. Invasive species now dominate some ecosystems, crowding out the natives and altering ecosystem function.

Extensive wetlands found along the lower portion of the Wolf River have been significantly altered by drainage, construction of impoundments, and a phenomenon called marsh recession. Wetland alterations such as ditching and diking in floodplains can diminish or even destroy habitat for specialists that depend on big rivers, backwaters, and extensive forests and marshes. Some of the fixes attempted for these problems, such as rough fish control or rip-rapping of eroding shorelines, may actually further simplify native ecosystems. While rip-rap may benefit a few fish species, studies have shown that the overall fish assemblage quality is lower on rip-rapped sites. Rip-rap is often placed on sandy eroding banks resulting in the loss of habitat for nesting river turtles and bank burrowing birds that rely on the increasingly scarce open sandy bank habitat. Eventually, rip-rap will alter the dynamics of river morphology and development.

Lakes in the Basin have been subjected to many stresses. In the large lakes in the lower Wolf River, faunal communities have been substantially altered by the replacement of mayflies and native fish as dominants, to midges and non-native fish.

Planning could reduce ecological simplification by identifying and prioritizing high quality natural communities, promoting the restoration of degraded communities, and advocating the reconstruction of extirpated communities. The restoration of sandy river banks and alternatives to the use of rip-rap could be explored.

Invasive Species

Invasive species are increasingly being recognized as serious management concerns. Invasive species are often not native to Wisconsin, but there are also non-native aggressive strains of native species, such as common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*), that are capable of rapidly and greatly expanding their dominance. As invasive species become established in natural communities, they can out-compete and displace native species leading to an impoverished ecosystem. Wetlands seems to be subject to many invasives including those that are particularly difficult to control such as reed canary grass, common reed, purple loosestrife, glossy buckthorn, and flowering rush. Forests can be overwhelmed by invasive species like common buckthorn, several honeysuckle species, and garlic mustard. Aquatic systems are not immune and can be infested by animals like carp and rusty

crayfish and plants like Eurasian milfoil. Zebra mussels are a significant, but yet unrealized, threat to any warmwater firm-bottomed aquatic habitat in the lower Wolf River Basin.

Managers and resource planners could identify infestations of invasive species and work to eradicate or control those outbreaks. As new populations of invasives are identified, they could be targeted for control action early before they become widespread. Among others, local governments, landowner associations, and individual landowners could be supplied with current information about the most effective methods of control and encouraged to eliminate invasive species on their properties.

Hydrological Manipulation

There are at least 196 dams impounding a minimum of 18,000 acres in the Wolf River Basin. By far, the majority of these are on streams west of the Wolf River. At least 17 dams are within the Lower Wolf River Bottomlands NRA. Dam heights in the Basin range from one to 38 feet. Some of these dams are operated to maximize production of electricity, or so that spring flood levels are minimized. The net result is that natural fluctuations in the flow regime have been changed thereby affecting natural communities and species that require seasonal fluctuations. Formerly continuous aquatic habitats are fragmented into disjunct segments, preventing the movements of some species between different stretches of streams.

The effects of dams and their water regimes on rare species and natural communities are well documented. Recommendations for the management of dams that would emphasize compatibility between biological diversity and dam operation could be developed. As dams come up for re-licensing, each could be evaluated for their continued need.

Water Quality

Water quality in the lower Wolf River Basin has declined markedly since the advent of intensive farming, residential development, and industrialization. Many point sources of organic and chemical pollutants have been identified and subsequently addressed. However, nonpoint source pollutants, such as those resulting from lawn fertilization or maintaining roads in the winter, remain a significant threat to aquatic diversity in the Wolf River Basin.

Landowners and managers could be encouraged to use practices that minimize pollutants that adversely affect water quality. Efforts could be made to maintain adequate upland buffers and vegetation.

Multiple Ownerships

Ownership within the Wolf River Basin is predominantly private with limited public ownership. Additionally, most of the tribally owned Menominee reservation is in the Wolf River Basin. DNR properties within the Basin include state natural areas, state wildlife areas, fishery management areas, state parks, state trails, and tower sites. There is some national forest land in the northern part of the Basin. The public lands contain a modest percentage of the area's representative natural communities and rare species. As an illustration, the Wolf River corridor is the biologically richest portion of the lower Basin, but DNR-owned properties are scattered along its length and have few connecting corridors resulting in less direct influence on management decisions for large areas.

The high percentage of private ownership represents both a challenge and an opportunity for managing landscapes and developing a long-term conservation plan. Opportunities may exist for managing and linking high quality sites by engaging private landowners with a variety of conservation and protection alternatives.

PART 5: CONSERVATION NEEDS AND PRIORITIES

To ensure long-term viability for some of the sensitive plants, animals, natural communities, and aquatic features within the NRA we are recommending the natural features listed in this section as priority considerations for conservation. These recommendations are not intended to devalue or exclude other priorities such as providing additional recreational opportunities, enhancing populations of game species, or providing public access; rather, they are meant to emphasize ecological considerations that are particularly important in the Lower Wolf Basin, based on survey work conducted by BER.

Floodplain Forest

Increased protection for floodplain forest will create ecological linkages and dispersal corridors between existing managed properties, promote long-term enhancement of water quality, and provide essential habitat for sensitive forest interior species and numerous other native plants and animals. No other locations in eastern Wisconsin offer comparable opportunities in terms of scale or overall quality. Larger stands of intact, older forest within the NRA would be the top priorities, particularly where such stands adjoin other valuable features such as marsh or sedge meadow communities, oxbow ponds, or running sloughs. Especially important sites to consider (and priority site numbers from Appendix B) include Wolf River Corridor – Shaw’s Landing to Fremont (17), Mosquito Hill – Liberty Bottoms (16), Leeman Bottoms (2), Outagamie Bottoms (8), Maine Bottoms (6), Lower Embarrass River Bottoms (10), and S&M Bottoms (15).

Marsh – Emergent and Submergent Types

These communities are well represented in the lower basin by large occurrences of good quality marshes. They provide critical habitat for waterfowl, terns, bitterns, rails, and many other marsh inhabitants. Many rare birds are resident in the marshes of the lower Wolf River Basin. Important sites include Lower Wolf River Marshes (20), Rat River (19), Clark’s Point (23), Piacenza Marsh (22), Poygan Islands (24), and the Wolf River Corridor – Shaw’s Landing to Fremont (17), especially on the margins of Partridge, Partridge Crop, and Cincoe Lakes.

Uncommon or Rare Community Types

These community types are uncommon or rare in the lower basin but are represented by occurrences of large size, in good condition, and/or support rare species not documented elsewhere in the lower basin. Community types and sites to consider in this category include: Northern Sedge Meadow at Winchester Meadows (21), Southern Mesic Forest at both Leeman Bottoms (2) and Lower Embarrass River Bottoms (10), and Tamarack Swamp at Wolf River Corridor – Shaw’s Landing to Fremont (17).

Buffer Areas

These areas around public lands include lands needed to facilitate management, maintain site quality, provide access, or increase the effective size of managed areas (e.g. old field grasslands adjoining marshes or sedge meadows, upland forest adjoining Floodplain Forest). Also, buffers are important along river shorelines for protecting water quality and providing additional habitat for wildlife.

Aquatic Habitats

Perhaps the most outstanding ecological features in the NRA are the many miles of large warm water stream habitat. These well-connected segments provide habitat for a large number of species, many of which are rare in eastern Wisconsin. Protecting and increasing buffers and riparian areas will contribute to overall water quality and improve aquatic habitat. However, maintaining the integrity of large rivers and streams is difficult using standard protection methods such as land acquisition, conservation easements, and management agreements alone. In order to effectively maintain or improve water quality, point and nonpoint source pollution needs to be controlled (e.g. through landowner contacts/agreements and education) and management activities on public lands that affect aquatic habitats must be carefully considered in the future. Appendix C describes four priority stream segments identified within the NRA.

FOR ADDITIONAL INFORMATION

The results of the biotic inventory provide useful information regarding the locations and habitat affinities of rare plants and animals. Our hope is that land and water managers, as well as knowledgeable biologists, can interpret the information contained in this report along with other available information to optimize management strategies for natural communities and rare species residing in the basin.

Many other sources of information regarding the management needs of rare species, as well as strategies for controlling invasive species, are available through the WDNR Bureau of Endangered Resources website (<http://www.dnr.state.wi.us/org/land/er/>) and can be used in conjunction with this report. The website will continue to post information, as it becomes available. New guides continue to be developed to assist land managers, as well as private landowners. Examples of guides that are available include the following:

- *Habitat Management Guidelines for Amphibians and Reptiles of the Midwest.* (B. Kingsbury and J. Gibson, 2002).
- *Managing Habitat For Grassland Birds: A Guide For Wisconsin* (Sample and Mossman 1997)
- *Threatened and Endangered Species in Forests of Wisconsin* (Kopitzke and Sweeney 2000).
- *Wisconsin Cerulean Warbler Recovery Plan* (Flaspohler 1993)
- *Wisconsin DNR Endangered Species Consultation for Taking Authorization for Grassland or Savanna Management on Public or Private Lands* (available online). (WDNR 2001)
- *Wisconsin Manual Of Control Recommendations For Ecologically Invasive Plants* (Hoffman and Kearns 1997)

GLOSSARY

aquatic macrophyte - vascular plants with special adaptations to aquatic habitats (lakes, streams, springs).

bog - wetlands characterized by high acidity, low nutrient availability, the accumulation of sphagnum moss peat, and a group of highly specialized vascular plants that includes ericaceous shrubs (e.g., leatherleaf, bog laurel, cranberries), sedges, and insectivorous species. By the strictest definition, a bog can receive nutrients only from precipitation, and is isolated from mineral enriched groundwater by thick beds of living sphagnum mosses and partially decomposed moss peat. "Open" bogs are those lacking a dense overstory of coniferous trees. Forested, or treed, bogs support a relatively dense growth and correspondingly closed canopy of black spruce, sometimes mixed with tamarack. See "*muskeg*."

complex – used here to reference an integrated mosaic of natural communities and/or aquatic features.

cover type – Cover typing is a generalized but sometimes useful method of broadly classifying vegetation based on the single species or species group comprising a majority of the living plants (usually commercially important trees when used in a forestry context). Cover types may also reference cultural features such as cornfields or pastures ("grass"). In cases where a clear plurality of a single species is not apparent, terms have been invented to reference groups of commonly co-occurring species, such as "northern hardwoods" (see definition below), and "swamp conifers." The terms and/or their meanings are not necessarily consistent across agency lines.

DBH – diameter at breast height (a standard height for measuring tree diameter of 4.5 ft or 1.37 m above the ground on the uphill side of the tree).

diversity - used in this report as a shortened form for biological diversity, or biodiversity. A general definition (Matthiae et al., 1993) is "the spectrum of life forms and the ecological processes that support and sustain them. Biological diversity is a complex of four interacting levels: genetic, species, community, and ecosystem."

drumlin - streamlined, teardrop shaped hills created by glacial action. The long axis parallels the direction of past glacial movement.

ecological landscape – units that have been mapped by the WDNR based on similar ecological potential and geography. This classification borrows information both from the watershed based Geographic Management Units, and the ecological classification system known as the National Hierarchical Framework of Ecological Units (NHFEU) (Avers et al. 1994).

ecoregion – geographic units that are differentiated by climate, subsurface geology, physiography, hydrology, soils, and vegetation. These units have been defined and organized in different ways by various institutions but in this document we use the National Hierarchical Framework of Ecological Units (NHFEU). As described by Avers et al (1994), the NHFEU can provide a basis for assessing resource conditions at multiple scales. In this report we have most frequently referred to "ecological landscapes" developed by the WDNR and between section and subsection in size. The boundaries generally follow section or subsection lines.

edaphic – pertaining to soil

element –the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries and mussel beds. In short, an

element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

element occurrence – An Element Occurrence (EO) is an area of land and/or water in which a rare species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historic) presence and/or regular recurrence at a given location. For species, the EO often corresponds with the local population, but when appropriate may be a portion of a population (e.g., a single nest territory or long distance dispersers) or a group of nearby populations (e.g., metapopulation). For communities, the EO may represent a stand or patch of a natural community or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs may cross jurisdictional boundaries (*modified from <http://whiteoak.natureserve.org/eodraft/index.htm>*)

ericaceous – pertaining to a family of plants, the Ericaceae, especially characteristic of highly acidic habitats such as bogs and muskeg. Members include well-known plants such as blueberries, cranberries, leatherleaf, Labrador tea, and bog rosemary.

exemplary – used in this report to describe aquatic communities or organismic assemblages that are especially good representatives of their respective types. Usage of the term, while somewhat subjective, entails a comparison of like entities based on their diversity, water quality characteristics, disturbance history, and values to scientific study.

fen - wetlands that receive nutrients via direct contact with mineral enriched groundwater. A "poor" fen has very low concentrations of plant nutrients and floristically resembles a bog. A "rich" fen has relatively high concentrations of nutrients, but is still characterized by the accumulation of peat (though this is likely to be primarily from the remains of plants other than sphagnum mosses, such as sedges and brown mosses). While some plants tolerate, and in fact may thrive under, a wide range of conditions, others are quite restricted and typically occupy only a narrow range of nutrient concentrations. This last group can be useful in the identification of peatland communities.

fragmentation – the breaking up of large and continuous ecosystems, communities, and habitats into smaller discontinuous areas that are surrounded by altered or disturbed lands or aquatic features.

habitat – references those environmental attributes necessary to provide a niche that supports the needs of a species or group of species.

habitat type – all sites capable of producing similar climax plant communities. This system uses the floristic composition of a plant community as an integrated indicator of those environmental factors that affect reproduction, growth, competition, and community development. These include soils, moisture, nutrient levels, and topography. Some professional foresters in the upper Great Lakes region have begun using this system as a forest management tool. To date, this system has been developed primarily for upland forest communities.

invasive species – (Wisconsin Governor's Task Force draft definition) - A non-indigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Many invasive non-indigenous species tend to be superior competitors and form monospecific stands at the expense of native species.

inventory site - also "site" in text. The geographic location at which a biological survey has been conducted. These may be large or small, depending on the nature of the species or community surveyed. Boundaries may be finite and discrete (a property boundary, a single stand of a forest community), or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes, they are sometimes referred to as "macrosites."

landtype association (LTA) - this level in the ecoregional hierarchy covers areas of tens to thousands of acres. Landform, soils, and vegetation are the key factors.

Lepidoptera - a large Order of insects that includes the butterflies, moths, and skippers.

macroinvertebrate - Used in the report to refer to aquatic insects and mollusks.

macrosite – two or more standard survey sites in close proximity, where consideration of their collective attributes is in some way related to the viability ecological values of the larger site.

marsh recession – used in this report to describe the loss of marsh vegetation along the shore of a lake or river, usually as a result of raised or fluctuating water levels and subsequent strong wave and ice action.

matrix - used in this document to refer to the dominant land cover within which other features of the landscape are embedded.

mesic - used by ecologists to describe site conditions that are well-drained but almost never excessively dry or inundated.

moraine - landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “till” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

MPA – methyl purple alkalinity, a measure of the carbonates, bicarbonates, and hydroxides present in water, expressed as milligrams/liter of calcium carbonate. Used to express the relative fertility of water. Low MPA are generally biologically less productive than those with higher MPA. Needs to be considered with pH and Conductivity for a proper evaluation.

muskeg – similar to “open bog.” Used to describe highly acidic peatlands characterized by a sparse growth of scattered, stunted black spruce and tamarack over ericaceous shrubs, sedges, and a deep carpet of sphagnum mosses.

National Hierarchical Framework of Ecological Units (NHFEU) – a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): “The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions.”

natural community – an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

natural division – six major natural divisions have been delineated for the state of Wisconsin based on gross differences in vegetation, soils, and geomorphology. Recent collaborative work by the USDA Forest Service, The Nature Conservancy, the WDNR, and others has resulted in a somewhat similar but hierarchical classification system of “ecoregions.”

Natural Heritage Inventory – A system developed by the Science Division of The Nature Conservancy for collection, management, and use of biological, ecological, and related information. In Wisconsin, the Natural Heritage Inventory was established by an act of the state legislature in 1985, after which the program was installed within the WDNR’s Bureau of Endangered Resources.

northern hardwoods –generally applied to those forests of northern Wisconsin composed primarily of hardwoods such as sugar maple, basswood, ash, and birch. It is also sometimes used to refer to forests with a significant component of red maple or red oak, or sometimes even aspen, but which lack strong representation by coniferous species. The term is also in wide usage in Michigan, northern Minnesota, and other locations that have vegetation similar to that of northern Wisconsin.

old-growth – various definitions exist, but among the points they usually share in describing old-growth attributes are large living trees, standing snags, coarse woody debris, pit and mound microtopography, and

complex multi-layered canopies. Old-growth stages of many forest types were formerly common and/or widespread in northern Wisconsin but are now very rare (Frelich, 1995).

outwash - composed of materials sorted and deposited by glacial meltwaters. The resulting topography can be a level plain (“uncollapsed”) or very hilly (“collapsed” or “pitted”). Pitted outwash may contain numerous lakes, which originated when blocks of ice stranded by a receding glacier were buried within outwash deposits. As the ice melted, depressions were created that filled with water. This is the most extensive landform found on the NH-AL SF.

peat – organic deposits consisting of the partially decomposed remains of plants, which accumulate over time more rapidly than decomposition processes can break them down. Peat may be derived from the remains of mosses, sedges, or woody plants.

peatland –wetlands characterized by the gradual accumulation of peat, the partially decomposed remains of plants. Open bog, muskeg, black spruce swamp, tamarack swamp and poor fen are among the common peatland communities on the NH-AL SF.

rare– used in this report to refer to native species and natural communities known or suspected to be rare and/or declining in the state (included on NHI’s “Working List”). Included are species legally designated as “Endangered” or “Threatened” by either the State of Wisconsin or the federal government, as well as species in the Department’s advisory “Special Concern” category and on the U.S. Fish & Wildlife Service’s “Candidate” and “Species of Concern” lists.

restoration – used in this report to refer to the re-establishment of a natural community, habitat, species population, or other ecological attribute, that has been eliminated or greatly reduced on a given property or landscape. Many factors, sociological as well as ecological, must be weighed when making a decision to engage in a restoration project.

site – see “survey site.”

State Natural Area - formally designated sites that contain outstanding examples of native biotic communities, both rare types and those that are common or representative, and are often the last refuges in the state for rare and endangered species of plants and animals. Areas are devoted to scientific research, the teaching of conservation biology, and especially to the preservation of their natural values and genetic diversity for future generations. The Department of Natural Resources currently administers 326 State Natural Areas encompassing more than 120,000 acres of land and water.**survey site** – The geographic location at which a biological survey or evaluation has been conducted. Survey sites may be large or small, depending on the nature of the species or community surveyed and other factors. The boundaries of a survey site may be finite and discrete (a property boundary, the margins of a single stand of a natural community, or even the limits of a rare plant population) or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes they may be referenced as “macrosites.”

tension zone – a narrow region extending from northwest to southeast across Wisconsin, approximating an s-shape and separating the northern hardwood and prairie floristic provinces (Curtis 1959). This zone contains species associated with both provinces where many occur at the extent of their respective ranges.

thalweg - the deepest part of the channel cross section at any particular point on the stream

TNC - The Nature Conservancy, a private conservation organization responsible for developing the standardized methodology used by Natural Heritage programs.

xeric – characterized by excessive dryness.

SPECIES LIST

List of plant and animal species referred to by common name in the text of the report.

Common Name	Scientific Name
Alder	<i>Alnus incana</i> ssp. <i>rugosa</i>
American elm	<i>Ulmus americana</i>
American redstart	<i>Setophaga ruticilla</i>
Ant lions	<i>Myrmeleontidae</i>
Arrowhead	<i>Sagittaria</i> spp.
Aspen	<i>Populus</i> spp. (<i>P. tremuloides</i> , <i>P. grandidentata</i>)
Basswood	<i>Tilia americana</i>
Beech	<i>Fagus grandifolia</i>
Bellflower	<i>Campanula (americana)</i> spp.
Big bluestem	<i>Andropogon gerardii</i>
Bitternut hickory	<i>Carya cordiformis</i>
Black ash	<i>Fraxinus nigra</i>
Black oak	<i>Quercus velutina</i>
Black spruce	<i>Picea mariana</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
Blue flag iris	<i>Iris virginica</i>
Boneset	<i>Eupatorium perfoliatum</i>
Brassy minnow	<i>Hybognathus hankinsoni</i>
Brown creeper	<i>Certhia americana</i>
Bullhead minnow	<i>Pimephales vigilas</i>
Bulrush	<i>Scirpus</i> spp.
Bur oak	<i>Quercus macrocarpa</i>
Bur-reed	<i>Sparganium</i> spp.
Buttonbush	<i>Cephalanthus occidentalis</i>
Canada bluejoint grass	<i>Calamagrostis canadensis</i>
Cardinal flower	<i>Lobelia cardinalis</i>
Carp	<i>Cyprinus carpio</i>
Cattail	<i>Typha latifolia</i> , <i>Typha angustifolia</i>
Cerulean warbler	<i>Dendroica cerulea</i>
Channel shiner	<i>Notropis wickliffi</i>
Clam shrimp	<i>Lycneus brachyunis</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common reed	<i>Phragmites australis</i>
Coontail	<i>Ceratophyllum demersum</i>
Cottonwood	<i>Populus deltoides</i>
Cuckoo flower	<i>Cardamine pratensis</i>
Curly pondweed	<i>Potamogeton crispus</i>
Deam's rockcress	<i>Arabis missouriensis</i> var <i>deamii</i>
Dogwood	<i>Cornus</i> spp.
Duckweed	<i>Lemna</i> spp.
Elm	<i>Ulmus</i> spp.
Elusive clubtail dragonfly	<i>Stylurus notatus</i>

Common Name	Scientific Name
Eurasian milfoil	<i>Myriophyllum spicatum</i>
False nettle	<i>Boehmeria cylindrica</i>
Flowering rush	<i>Butomus umbellatus</i>
Fowl mannagrass	<i>Glyceria striata</i>
Fox sedge	<i>Carex vulvinoidea</i>
Garlic mustard	<i>Alliaria petiolata</i>
Giant reed	<i>Phragmites australis</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Golden alexanders	<i>Zizia aurea</i>
Glossy buckthorn	<i>Rhamnus frangula</i>
Gray-headed coneflower	<i>Rudbeckia laciniata</i>
Gray's sedge	<i>Carex grayi</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Green dragon	<i>Arisaema dracontium</i>
Hackberry	<i>Celtis occidentalis</i>
Handsome sedge	<i>Carex formosa</i>
Hemlock	<i>Tsuga canadensis</i>
Hickory	<i>Carya ovata, Carya cordiformis</i>
Honeysuckle	<i>Lonicera spp.</i>
Hop sedge	<i>Carex lupulina</i>
Hornwort	<i>Ceratophyllum demersum</i>
Indian cucumber-root	<i>Madeola virginiana</i>
Jack pine	<i>Pinus banksiana</i>
Joe-pye-weed	<i>Eupatorium maculatum</i>
Jumpseed	<i>Polygonum virginianum</i>
Lake sedge	<i>Carex lacustris</i>
Lake sturgeon	<i>Acipenser fulvescens</i>
Large lested damselflies	<i>Lestidae spp.</i>
Leafy white orchis	<i>Platanthera dilatata</i>
Marsh fern	<i>Thelypteris palustris</i>
Marsh valerian	<i>Valeriana sitchensis ssp uliginosa</i>
Mimic shiner	<i>Notropis volucellus volucellus</i>
Mississippi grass shrimp	<i>Palaemonetes kadiakensis</i>
Monkey flower	<i>Mimulus ringens</i>
Muskingum sedge	<i>Carex muskingumensis</i>
Oaks	<i>Quercus spp.</i>
Ostrich fern	<i>Matteucia spp.</i>
Panicled aster	<i>Aster lanceolatus</i>
Paper birch	<i>Betula papyrifera</i>
Plains clubtail dragonfly	<i>Gomphurus externus</i>
Poison sumac	<i>Rhus vernix</i>
Pond weed	<i>Potamogeton spp.</i>
Prairie dock	<i>Silphium laciniatum</i>
Pugnose minnow	<i>Notropis emiliae</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Red maple	<i>Acer rubrum</i>
Red oak	<i>Quercus rubra</i>
Red pine	<i>Pinus resinosa</i>
Prairie sunflower	<i>Helianthus pauciflorus</i>
Reed canarygrass	<i>Phalaris arundinacea</i>
River bulrush	<i>Scirpus fluviatilis</i>

Common Name	Scientific Name
River darter	<i>Percina shumardi</i>
River redhorse	<i>Moxostoma carinatum</i>
River shiner	<i>Notropis blennioides</i>
Rough-winged swallowtail	<i>Stelgidopteryx serripennis</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Scrub oak	<i>Quercus ellipsoidalis</i>
Sedges	<i>Carex</i> spp.
Sensitive fern	<i>Onoclea sensibilis</i>
Shoal chub	<i>Macrhybopsis aestivalis</i>
Shortnose gar	<i>Lepisosteus platostomus</i>
Silver maple	<i>Acer saccharinum</i>
Slenderhead darter	<i>Percina phoxocephala</i>
Snuffbox mussel	<i>Epioblasma triquetra</i>
Soft maple	<i>Acer saccharinum, Acer rubrum</i>
Soft-stem bulrush	<i>Scirpus validus</i>
Spatterdock	<i>Nuphar luteum</i>
Speckled chub	<i>Macrhybopsis aestivalis</i>
Spikerush	<i>Eleocharis</i> spp.
Stinging nettle	<i>Urtica dioica</i> ssp. <i>Gracilis</i>
Sugar maple	<i>Acer saccharum</i>
Swamp milkweed	<i>Asclepias incarnata</i>
Swamp white oak	<i>Quercus bicolor</i>
Tall bellflower	<i>Campanula americana</i>
Tamarack	<i>Larix laricina</i>
Tiger beetles	<i>Carabidae (Cicindelinae)</i>
Tuckerman's sedge	<i>Carex tuckermanii</i>
Water celery	<i>Vallisneria spiralis</i>
Water horsetail	<i>Equisetum fluvatile</i>
Water milfoil	<i>Myriophyllum spicatum</i>
Waterweed	<i>Elodea canadensis</i>
Western sand darter	<i>Ammocrypta clara</i>
White ash	<i>Fraxinus americana</i>
White cedar	<i>Thuja occidentalis</i>
White grass	<i>Leersia virginica</i>
White oak	<i>Quercus alba</i>
White pine	<i>Pinus strobus</i>
White snakeroot	<i>Eupatorium rugosum</i>
White water crowfoot	<i>Ranunculus aquatilis</i>
Wild rice	<i>Zizania aquatica</i>
Willow	<i>Salix</i> spp.
Winterberry holly	<i>Ilex verticillata</i>
Wire-leaved sedge	<i>Carex lasiocarpa</i>
Wood nettle	<i>Laportea canadensis</i>
Wood turtle	<i>Clemmys insculpta</i>
Woodland brome grass	<i>Bromus pubescens</i>
Yellow birch	<i>Betula alleghaniensis</i>
Yellow water buttercup	<i>Ranunculus (delphiniifolius) flabellaris</i>
Zebra mussel	<i>Dreissena</i> spp.

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APPENDIX A

Natural Heritage Inventory Overview and General Methodology

The Wolf River Basin inventory and analysis is being conducted by the Wisconsin Natural Heritage Inventory program, which is part of an international network of NHI programs. The defining characteristic of this network, and the feature that unites the programs, is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers was established, and is currently coordinated by, The Nature Conservancy, an international non-profit organization.

Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant "tracking" and which are more common. Similar to most states, Wisconsin biologists had a general idea of which species in the better-studied taxonomic groups (e.g., mammals, birds, and vascular plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of species to track and gathering the data were quite dynamic. Initially, NHI staff cast a wide net, collecting data on many species from existing sources (e.g., scientific literature, field guides, books, maps, and museum collections) as well as from direct contact with experts throughout the state. As more data were gathered, it was clear that some species were more common than originally thought and the NHI program stopped collecting data on them. Thus, the list of which elements are tracked, the NHI Working List, changes over time as species' populations change (both up and down) and as our knowledge about their status and distribution increases. This evolution continues today, with the NHI Working List typically going through several revisions a year. The most current Wisconsin Natural Heritage Working List for the State of Wisconsin as of this writing (dated December, 2001) is available through the NHI office.

In general, there are two approaches to surveying biodiversity: (1) those focused on locating occurrences of particular elements, and (2) those focused on assessing the components of a particular area. The latter approach employs a "top down" analysis that begins with an assessment of the natural communities and aquatic features present, their relative quality and condition, the surrounding landscape pattern, and current land use and results in the identification of future species-oriented surveys. This approach, commonly referred to as "coarse filter-fine filter," concentrates inventory efforts on those sites most likely to contain target species. It also allows sites to be placed in a larger, landscape context for more broad applications of ecosystem management principles.

The Wolf River inventory used the top-down, coarse filter-fine filter approach. The initial analysis assessed the entire region and determined the important ecological attributes and the biological processes supporting them. Criteria to evaluate sites were established and then vegetative communities were identified and characterized. Based upon existing habitat characteristics and known habitat preferences of various rare species, sites where species-specific surveys were most appropriate were identified. ***No doubt, occurrences of rare species exist that were not located through these inventories.*** However, by concentrating inventory efforts on the

highest quality or otherwise suitable sites, it is most likely that the populations with the highest conservation value were located.

The NHI methodology for organizing and storing data is actually a system of three inter-related data storage techniques: structured manual information files, topographic map files, and a computer database that integrates the various information. The computer component, known as the Biological & Conservation Data System (BCD), was developed by The Nature Conservancy for use by the Heritage Network. It is a sophisticated relational database management application built upon the Advanced Revelation application environment. Owing to the diversity and complexity of the information managed--from species taxonomy and ecosystem classification to real estate transactions--the system contains 36 database files and more than 2,000 information fields. The data in the Biological & Conservation Data System populate the NHI Geographic Information System.

Methods of Inventory

The following is a description of standard NHI methods for conducting NHI inventories. Any step may be modified, dropped, or repeated as appropriate to the project.

File Compilation: Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from the Biological & Conservation Data system, housed within DNR's Natural Heritage Inventory. Other databases with potentially useful information may also be queried, such as: forest stand/compartments reconnaissance, which is available for many public agency owned lands; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; museum/herbarium collections for various target taxa; soil surveys; and the fish distribution database (by watershed, WDNR-Research).

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources contain information on a variety of subjects relevant to the inventory of natural features and are frequently useful.

Literature Review: Field biologists involved with a given project consult basic references on the natural history and ecology of the region within which the study area is situated. This can both broaden and sharpen the focus of the investigator.

Target Elements: Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active.

Map Compilation: USGS 7.5 minute topographic quadrangles serve as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth.

Ecoregion maps are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. As these maps evolve, they should become increasingly useful, even for relatively small, localized projects.

Geographic Information Systems (GIS) are increasing our ability to integrate spatial information on lands and waters of the state and are becoming a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

Aerial photographs: These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time.

Original Land Survey Records: The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. These notes also record general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns.

Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield information not available in other formats.

Analysis of Compiled Information: The compiled information is analyzed to identify inventory priorities, determine needed expertise, and develop budgets.

Meetings: Planning and coordination meetings are held with all participants to provide an overview of the project, share information, identify special equipment needs, coordinate schedules, and assign landowner contact responsibilities. Team development may be a part of this step.

Aerial Reconnaissance: Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.

Appendix B

Site Descriptions for Primary Inventory Locations

Aquatics are addressed in Appendix C.

BER Primary Inventory Sites Within the Lower Wolf River Bottomlands Natural Resources Area

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Primary Site Descriptions of the Lower Wolf River Bottomlands Area

This section contains site descriptions, an assessment of site significance, and inventory and management considerations for surveyed sites, including all or portions of the 14 state-owned properties within the Lower Wolf River Bottomlands Natural Resources Area and 10 additional privately owned sites. Map 10 depicts each of the 24 final inventory sites. Six new sites have been added since the release of the interim report (WDNR 2000) and several of the former site boundaries have changed as a result of inventories conducted in 2000 and 2001. Generally, these descriptions describe only the natural communities or habitats within and/or around the property. Because each was not exhaustively surveyed (e.g. old agricultural land, reed canary grass stands, very small and highly disturbed vegetation patches were typically not surveyed), the site descriptions are preliminary and do not represent complete descriptions of each property. Thus, adequate information was not available for all sites to develop management considerations. Refer to the main body of the report for a more detailed discussion of site selection.

Over 30 occurrences of natural communities were surveyed within these 24 sites. Significant findings within any site are highlighted as appropriate within the site description. Management considerations for individual plant and animal species are provided in Appendices O and P.

Each inventory site description is organized in three sections:

Site Description: describes the location, existing natural features, surrounding land uses, and some of the past management activities.

Site Significance: significance can include extent, condition, and type of important natural communities, successional stages or habitats, rare or otherwise noteworthy species, existing land use designations, and overall significance at both the local and regional levels.

Management Considerations: describes the management considered relevant for master planning or other planning efforts to protect, maintain and enhance the important features of the site. Development of these considerations included:

- identifying those processes or actions needed to maintain the integrity of ecosystems and ecosystem complexes and rare species present.
- identifying potential impacts from natural disturbances, human use, and development pressure.
- highlighting the importance of selecting the most appropriate land use classifications or designations for each site via the master planning process.

Within each site description, discrepancies may exist between the rare species mentioned in the site narratives and those listed in the site tables. For example, a site narrative may mention the presence of a rare plant or animal, but the species is not included in the site table. This can occur for the following reasons:

1. Certain rare plants and animals are disturbance sensitive or vulnerable to exploitation and these records were deleted from the table and/or descriptions.
2. Locations of some species, particularly animals, may be generalized in the NHI database and did not always show up within our site survey polygon boundaries. An example is a species with high mobility, such as timber wolf.
3. Also, several long river segments are described in Appendix C as Priority Stream Segments. Some of the Priority Stream Segments flow through Primary Inventory Sites and there will be overlap between the tables of associated species in both appendices, especially for riverine animals. Reference to Appendix C is provided in these descriptions as appropriate.

1. Navarino State Wildlife Area

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T25N-R 15E sec. 11-14, 23, 24; T25N-R 16E sec. 01-18, 20, 21, 24;
T25N-R 17E sec. 06; T26N-R 16E sec. 25-27, 34-36; T26N-R 17E sec. 31
Size: 17,604 acres

Site Description

Located in southeastern Shawano County and northeastern Waupaca County between the Wolf and Shioc rivers, Navarino has nearly level terrain, with shallow depressions and low sandy ridges providing most of the topographic relief. Navarino is surrounded by agricultural lands, and scattered, usually small, forest remnants. The Wolf River floodplain occurs along the western edge of the site while the Shioc River meanders along the eastern border.

The Shioc River area consists mostly of a logged floodplain forest of silver maple, swamp white oak, and green ash. The Wolf River floodplain contains a similar but much more extensive forest, also composed of silver maple, swamp white oak, and green ash. The condition of natural communities within the Wildlife Area is generally good, while the condition is more variable on adjacent private property.

Extensive wetland communities of varying quality occupy much of the area between the two rivers. Wetland communities or cover types include emergent and submergent marshes, tamarack swamp, shrub-carr, semi-open swamp/meadow, wet-mesic red maple-white cedar swamp, sedge meadow, poor fen, and reed canary grass meadow. The sedge meadow and tamarack swamp communities are of especially high significance because of their generally good condition.

The low sandy uplands include open, formerly disturbed areas, such as abandoned fields and sand pits, that now support recovering or re-created barrens-sand prairie communities. Several old fields have been reclaimed and planted to re-create stands of sand prairie. The forested uplands support thickets of aspen as well as significant stands of relatively undisturbed, mature dry-mesic forest of white pine, red oak, red maple, aspen, and paper birch. There are also a few patches of more mesic forest composed of red oak, white pine, red maple, and hemlock that support colonies of the regionally restricted Indian cucumber root (*Medeola virginiana*). There are also short sections of free flowing streams and several springs that are worthy of special management consideration and protection.

Also see Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

Navarino SWA encompasses a large acreage that contains significant occurrences of several natural communities, including floodplain forest, sedge meadow, emergent marsh, and dry-mesic forest. Many rare species were documented here, including several that are state-listed as threatened or endangered (see table below). The boggy wetland in particular was considered unique for east-central Wisconsin in that it supports 31 aquatic invertebrate species, nearly half of which are new county records, and many of the species collected were at their northern or southern range limits.

Below Navarino, the extensive forested floodplain of the Wolf is relatively undeveloped and also supports significant natural communities and many sensitive species. The dry, more open, uplands provide valuable habitat for grasshoppers, Lepidoptera, ant lions, tiger beetles, and other insects associated with open sand habitats. Breeding season records for several rare grassland bird species, e.g., Henslow's

Sparrow, were also obtained. Very few stands of mature white pine-hardwood forest were identified anywhere in the lower basin.

Management Considerations

Because of the size, context, content, and ownership of this site, Navarino has high potential for the management or restoration of many natural communities and sensitive species. Natural communities with high management potential include floodplain forest, northern dry-mesic forest, sedge meadow, marsh, and sand prairie. From the standpoint of offering additional protection to some of the more sensitive forest dwelling species, e.g., birds, it is desirable to maintain large patches of mature forest with high canopy closure, especially within the corridor of the Wolf River.

Navarino and several of the other public and private lands along the lower Wolf constitute opportunities of critical importance to conserving the native biodiversity of the basin.

NAVARINO STATE WILDLIFE AREA EO's

Scientific Name	Common Name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Agabus bicolor</i>		SC/N		1999
<i>Agabus wasastjernae</i>	Predaceous diving beetle	SC/N		2000
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Ammodramus henslowii</i>	Henslow's sparrow	THR		2000
<i>Baetisca obesa</i>	A mayfly	SC/N		1999
<i>Botaurus lentiginosus</i>	American bittern	SC/M		2000
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Celina hubbelli</i>	a predaceous diving beetle	SC/N		1999
<i>Chlidonias niger</i>	Black tern	SC/M		2000
<i>Cicindela lepida</i>	Little white tiger beetle	SC/N		2000
<i>Cicindela patruela huberi</i>	A tiger beetle	SC/N		2000
<i>Cicindela patruela patruela</i>	A tiger beetle	SC/N		2000
<i>Clemmys insculpta</i>	Wood turtle	THR		1989
<i>Copelatus glypticus</i>	Predaceous diving beetle	SC/N		2000
<i>Cymbiodyta minima</i>	A water scavenging beetle	SC/N		1999
<i>Dubiraphia bivittata</i>	A dubiraphia riffle beetle	SC/N		1999
<i>Emydoidea blandingii</i>	Blanding's turtle	THR		2000
<i>Enochrus consortus</i>	A water scavenging beetle	SC/N		2000
<i>Enochrus perplexus</i>	A water scavenger beetle	SC/N		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Etheostoma clarum</i>	Western sand darter	SC/N		1994
<i>Euphyes dion</i>	Dion skipper	SC/N		2000
<i>Gallinula chloropus</i>	Common moorhen	SC/M		2001
<i>Graphoderus manitobensis</i>	a predaceous diving beetle	SC/N		1999
<i>Haliaeetus leucocephalus</i>	Bald eagle	SC/FL	LT,PDL	1989
<i>Helocombus bifidus</i>	A water scavenging beetle	SC/N		1999
<i>Hesperia leonardus leonardus</i>	Leonard's skipper	SC/N		2000
<i>Hesperocorixa semilucida</i>	A water boatman	SC/N		1999
<i>Hydrometra martini</i>	A water measurer	SC/N		1999
<i>Hydroporus badiellus</i>	A predaceous diving beetle	SC/N		1999
<i>Hydropsyche bidens</i>	A caddisfly	SC/N		1999
<i>Ilybius discedens</i>	A predaceous diving beetle	SC/N		1999
<i>Ilybius ignarus</i>	Diving beetle	SC/N		1999
<i>Ilybius incarinatus</i>	A predacious diving beetle	SC/N		2000
<i>Ixobrychus exilis</i>	Least bittern	SC/M		2000
<i>Lepomis megalotis</i>	Longear sunfish	THR		1926
<i>Moxostoma carinatum</i>	River redbhorse	THR		1981
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	SC/N		1999
<i>Ophiogomphus howei</i>	Pygmy snaketail	THR		1999
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1973
<i>Pandion haliaetus</i>	Osprey	THR		2001

Scientific Name	Common Name	State Status	Federal Status	Lastobs Date
<i>Paracloeodes minutus</i>	A small minnow mayfly	SC/N		1992
<i>Pelocoris femorata</i>	A creeping water bug	SC/N		1999
<i>Plauditus cestus</i>	A small minnow mayfly	SC/N		1999
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Poanes massasoit</i>	Mulberry wing	SC/N		2000
<i>Poanes viator</i>	Broad-winged skipper	SC/N		2000
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Rhantus sinuatus</i>	A predaceous diving beetle	SC/N		2000
<i>Simpsonaias ambigua</i>	Salamander mussel	THR		1989
<i>Spharagemon marmorata</i>	Northern marbled locust	SC/N		1999
<i>Stenelmis bicarinata</i>	A riffle beetle	SC/N		1999
<i>Stenelmis fuscata</i>	A riffle beetle	SC/N		1999
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Medeola virginiana</i>	Indian cucumber-root	SC		1999
Communities				
Floodplain forest		NA		2000
Northern dry-mesic forest		NA		1999
Northern sedge meadow		NA		2000
Sand prairie		NA		1999
Spring pond		NA		1981
Stream—fast, hard, cold		NA		1981

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

2. Leeman Bottoms

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T25N-R15E-sections 23-26, 36
T25N-R16E-sections 30, 31, 32
T24N-R16E-sections 4, 5,
Size: 4,586 acres

Site Description

Just to the north and east of the border junction of Shawano, Waupaca, and Outagamie counties, Leeman Bottoms encompasses a 5 mile stretch of the Wolf River floodplain from the bridge crossing at State Highway 156 downstream to County Highway 'C'. The river floodplain is approximately 1 mile wide throughout most of this site. The primary natural community is a lowland hardwood forest composed of silver maple, swamp white oak, and green ash. Representative understory species include many native lowland forest grasses and sedges, wood nettle, false nettle, gray-headed coneflower, green dragon, jumpseed, and cardinal flower.

Characteristic birds noted in association with the lowland forest included American Redstart, Pileated Woodpecker, Yellow-throated Vireo, Brown Creeper, Great-crested Flycatcher, Hooded Merganser, Wood Duck, and Barred Owl.

A number of running and cut-off sloughs are present. These support stands of emergent and submergent aquatic macrophytes and small patches of shrub swamp and sedge meadow. Also, see Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This site contains significant stands of mature floodplain forest, which in places exhibit old-growth characteristics. Limited surveys on foot were conducted here, but the entire corridor, including the backwater sloughs, was canoed during the month of June and yielded breeding season records for rare birds such as Red-shouldered Hawk, Cerulean Warbler, and Prothonotary Warbler at multiple locations. The state-threatened Blanding's turtle is also present, as are many rare aquatic species including fish, mussels, and insects.

An oxbow pond sampled for aquatic invertebrates produced "an amazing mass of invertebrates". Large Lestid damselflies dominated, but other large invertebrates were also abundant, including the rare freshwater shrimp. Species diversity was considered astounding for the limited sampling effort made. Fish are present here, but apparently do not limit invertebrate diversity and production in this case.

Management Considerations

Most of this site is privately owned and may be subject to development or ill-advised logging. Heavily logged areas in the eastern half of section 32 and in the northeastern quarter of section 5 are now heavily overrun with dense stands of the highly invasive and vexingly persistent reed canary grass. Little re-growth of trees was occurring in these infested areas. Purple loosestrife is present but uncommon at scattered locations along the banks of the main stem. Several cottages were constructed recently on slightly elevated terraces near the river. Shoreline rip-rapping and the replacement of native vegetation by lawns has accompanied some of this development.

The more intact floodplain communities should be a high priority for protection. The extent of relatively undisturbed forest was significantly greater in the late 1970s, when the Scientific Areas section of WDNR's Bureau of Research conducted preliminary inventory work in the vicinity. The entire river corridor is important, and even the highly disturbed forest in the southern part of the site should be considered for remedial restoration activities.

LEEMAN BOTTOMS EO's

	Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals					
	<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
	<i>Agabetes acuductus</i>	A hydrophilid beetle	SC/N		2000
	<i>Alasmidonta marginata</i>	Elktoe	SC/H		1999
	<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
	<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000
	<i>Emydoidea blandingii</i>	Blanding's turtle	THR		1980
	<i>Epioblasma triquetra</i>	Snuffbox	END		1995
	<i>Etheostoma clarum</i>	Western sand darter	SC/N		1994
	<i>Hebrus buenoi</i>	A velvet waterbug	SC/N		2000
	<i>Hydrometra martini</i>	A water measurer	SC/N		2000
	<i>Lestes inaequalis</i>	Elegant spreadwing	SC/N		2000
	<i>Moxostoma carinatum</i>	River redhorse	THR		1981
	<i>Nepa apiculata</i>	A water scorpion	SC/N		2000
	<i>Notropis texanus</i>	Weed shiner	SC/N		1981
	<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1973
	<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
	<i>Procambarus acutus</i>	White river crawfish	SC/N		2000
	<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
	<i>Pseudiron centralis</i>	A heptageniid mayfly	SC/N		2000
	<i>Simpsonaias ambigua</i>	Salamander mussel	THR		1999
	<i>Stylurus notatus</i>	Elusive clubtail	SC/N		1980
	<i>Trienodes nox</i>	A caddisfly	SC/N		2000
	<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants					
	<i>Medeola virginiana</i>	Indian cucumber-root	SC		2001
Communities					
	Floodplain forest		NA		2000
	Northern sedge meadow		NA		2000
	Northern wet-mesic forest		NA		2001
	Southern mesic forest		NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

3. Deer Creek State Wildlife Area

Ecological Landscape: Central Lake Michigan Coastal
 Town-Range-Section: T24N-R15E sec. 01-03, 11; T25N-R 15E sec. 34, 35
 Size: 2,017 acres

Site Description

Located on the border of Outagamie and Waupaca counties, this site is situated about midway between the Wolf and Embarrass rivers. The SWA is bordered primarily by agricultural lands with small fragments of disturbed natural communities around the periphery. The south-central portion of the site was formerly a mint farm.

Remnant natural communities of ecological significance include tamarack-black spruce swamp and muskeg-open bog, associated with relatively small stands of southern sedge meadow, shrub-carr, emergent aquatic, and submergent aquatic. The majority of Deer Creek SWA is an unnaturally dry wetland because it is drained by a large “+” shaped ditch system. Reed canary grass has invaded the site and is established in several of the open wetland communities.

The uplands consist of low, broad to narrow ridges and plains. Open areas are primarily abandoned farms and quarries. The forested portions have been heavily logged and are disturbed. There are a few fragments of somewhat less disturbed forest which support colonies of Indian cucumber-root (*Medeola virginiana*). Some open sand habitat, perhaps created by human disturbance, was planted to prairie twelve years ago. Grasses appear to be crowding out insects that inhabit patches of open sand.

Site Significance

This property contains examples of several natural communities of moderate quality and provides secure habitat for many common native plants and animals. “Northern” peatland communities are generally uncommon anywhere in the lower Wolf basin. The clam shrimp *Lycneus brachyunis* was found here and at one other site in the Lower Wolf River Bottomlands Natural Resources Area. These collections constitute a new state record. This species may be added to the Wisconsin Special Concern list in the future.

Management Considerations

The majority of this site is owned and managed by the WDNR as Deer Creek State Wildlife Area. Potential for natural community management and restoration is limited at this time by past ditching, agricultural impacts, infestations of reed canary grass, and other disturbances, but the peatland types are relatively intact, uncommon in this part of the Wolf basin, and important components of this landscape’s community mosaic.

DEER CREEK WILDLIFE AREA EO’s

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Emydoidea blandingii</i>	Blanding’s turtle	THR		1992
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Trachyrhachys kiowa</i>	Ash-brown grasshopper	SC/N		1999
Plants				
<i>Medeola virginiana</i>	Indian cucumber-root	SC		1995
Communities				
	Open bog	NA		1999

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
	Tamarack (poor) swamp	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

4. Embarrass River - CTH XX to CTH F

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T24N-R15E-sections 4, 5, 9, 10, 15, 16, 21, 22, 26, 27, and 27
Size: 2,314 acres

Site Description

This site consists of a 5 mile stretch of the Embarrass River in northwestern Outagamie County from the bridge crossing at County Highway `XX` downstream to the bridge at County Highway `F`. The floodplain varies in width but is generally between one-quarter and one-half mile wide. The primary community is a continuous strip of floodplain forest composed mostly of silver maple, swamp white oak, and green ash. Hackberry, basswood, American elm, and bitternut hickory are among the common or widespread canopy associates. Characteristic understory plants include wood nettle, false nettle, fowl manna grass, tall bellflower, sensitive fern, green dragon, cardinal flower, hop sedge, and Tuckerman's sedge.

Patches of emergent marsh occur in some of the protected backwaters. These consist of arrowheads, soft-stem bulrush, river bulrush, lake sedge, cattails, and bur-reeds. Most of the emergent stands are rather small, seldom exceeding 10 acres. Submergent macrophyte beds are also present, composed of species such as coontail, waterweed, various pondweeds, and white water crowfoot.

The uplands bordering the floodplain are used intensively for agriculture throughout this stretch. See Appendix C. Stream Priority # 3 for additional description of riverine features associated with this site.

Site Significance

This site contains several good quality stands of mature floodplain forest and emergent marsh and provides the only extensive habitat available in the local landscape for many native plants and animals. Several rare animals were documented in the floodplain forest community and in the river itself.

Management Considerations

All lands at this site are privately owned. Maintenance of larger patches of intact forest is an important consideration here, as the floodplain becomes very narrow to the north and diking and ditching has been extensive within the floodplain to the south. Invasive species that occur at scattered locations here and could easily spread further include reed canary grass, purple loosestrife, and curly pondweed. Maintaining the native floodplain vegetation is an important water quality consideration along this intensively cultivated stretch of the Embarrass River.

Embarrass River - CTH XX to CTH F EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Pseudiron centralis</i>	A heptageniid mayfly	SC/N		1999
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Communities				
Floodplain forest		NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

5. Maine State Wildlife Area

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T24N-R 16E sec. 14, 15, 22
Size: 1,632 acres

Site Description

Located in northwestern Outagamie County, this SWA consists of extensive wetlands on nearly level topography with scattered low, narrow upland ridges. A privately-owned area of similar size, vegetation, and topography borders the site to the northeast. The entire complex is surrounded by agricultural land.

The dominant wetland community is a semi-open to open meadow/shrub swamp of sedges, reed canary grass, bluejoint grass, willow, poison sumac, alder, and cattail, with scattered young tamarack, red maple, American elm, and ash. There are a few small patches where tamarack is locally dominant. The low ridges are vegetated with logged over mesic to wet-mesic forests of aspen, red maple, paper birch, basswood, green ash, red oak, bur oak, white oak, and sugar maple.

Site Significance

Several rare to uncommon species of aquatic macroinvertebrates including a very rare water scavenger beetle were found in the swamp. Total aquatic invertebrate diversity was considered very good for a habitat of this type. The site provides secure habitat for many common native plants and animals.

Management Considerations

Enhancing the wetlands by restoring site hydrology where feasible and allowing patches of tamarack and swamp hardwood forest to mature are considerations for this property. The adjoining private property of similar topography, vegetation, and size to the northeast may be worthy of additional inventory and protection.

MAINE STATE WILDLIFE AREA EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Celina hubbelli</i>	A predaceous diving beetle	SC/N		1999
<i>Cymbiodyta acuminata</i>	A water scavenger beetle	SC/N		1999
<i>Enochrus consortus</i>	A water scavenging beetle	SC/N		1999
<i>Laccobius agilis</i>	A water scavenging beetle	SC/N		1999
<i>Liodessus cantralli</i>	Cantrall's bog beetle	SC/N		1999
<i>Rhantus sinuatus</i>	A predaceous diving beetle	SC/N		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

6. Maine Bottoms

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T24N-R16E-sections 8, 9, 16, 17, 21, 28, and 29
Size: 2,044 acres

Site Description

Maine Bottoms includes a segment of the Wolf River floodplain in northwestern Outagamie County. The north end of the site is the County Highway `F' bridge across the Wolf. The southern boundary is the northern edge of Outagamie State Wildlife Area approximately 4 miles downstream. The site is contained within the floodplain of the Wolf River, which averages roughly 1 mile in width. The river is bordered by lowland hardwood forest dominated by silver maple, green ash, and swamp white oak. Understory composition is typical for the lower Wolf, and includes buttonbush, winterberry holly, wood nettle, false nettle, ostrich fern, sensitive fern, cardinal flower, green dragon, jumpseed, fowl manna grass, and many native sedges.

Patches of emergent and submergent marsh are also present. Characteristic plants are cattails, bulrushes, arrowheads, lake sedge, coontail, white water crowfoot, waterweed, and several pondweeds. Stands of marsh immediately adjacent to the river are generally small, though some larger patches are present in the extensive wetland complex to the west.

The adjoining uplands are almost totally dedicated to agricultural production. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This site encompasses an important and unprotected segment of the highly significant lower Wolf River corridor (see Appendix C.). Though logging has occurred at one time or another in most stands, there are areas of mature forest with large trees and high canopy closure. Rare species were documented in these habitats, including the Prothonotary Warbler and wood turtle. Additional rare species occur as part of the aquatic biota.

Management Considerations

Protection of the river corridor and adjacent floodplain forest is needed to provide secure habitat for the more sensitive species present. A change in local logging practices is desirable, as some of the more heavily cut stands are now badly infested with dense growths of the highly invasive reed canary grass. Other invasive species should be monitored and controlled as appropriate and feasible.

This site is entirely in private ownership, but some of the more intact forest is contiguous with Outagamie State Wildlife Area. Maine State Wildlife Area is only one-quarter mile to the east, but connection would be very difficult owing to the location of state highway 187 and the predominantly agricultural use of the lands between the Wildlife Area and the Wolf River floodplain.

MAINE BOTTOMS EO'S

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Clemmys insculpta</i>	Wood turtle	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Etheostoma clarum</i>	Western sand darter	SC/N		1994
<i>Notropis texanus</i>	Weed shiner	SC/N		1981
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1973
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Simpsonaias ambigua</i>	Salamander mussel	THR		1989
<i>Stylurus notatus</i>	Elusive clubtail	SC/N		1999
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Communities				
	Floodplain forest	NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

7. Wolf River Wetlands

Ecological Landscape: Central Lake Michigan Coastal
 Town-Range-Section: T24N-R 15E sec. 24, 25, 36; T24N-R 16E sec. 19, 30, 31
 Size: 3,366 acres

Site Description

Located in northwestern Outagamie County, this site is located midway between the Wolf and the Embarrass rivers, and is generally congruent with the boundary of Wolf River Bottoms-K&S Unit- State Wildlife Area. This site's topography is low and nearly level, with scattered low sandy ridges. The vegetation and hydrology have been altered by heavy logging and extensive waterfowl management projects. County Highway M passes along the east edge, where some residential development exists. An area of similar topography and vegetation borders the site to the north, and agricultural lands border it to the west.

Wetland communities present include emergent aquatic marsh, shrub-carr, alder thicket, reed canary grass meadow, and hardwood swamp. The uplands have, for the most part, been cleared. The forested areas are predominantly young aspen thickets. There are several small fragments of formerly pastured, selectively logged mesic forest of sugar maple-basswood-red oak-aspen-red maple-paper birch in the northeast corner of the site. Several upland prairie plantings also exist. The management emphasis is to promote waterfowl habitat. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This site contains communities of moderate quality that provide secure habitat for many common native plants and animals that inhabit marshes, shrub swamps and younger forests. Several rare species were also documented here, including marsh birds such as the King Rail and Least Bittern.

Management Considerations

No management modifications are recommended at this time. The hydrology has been affected by the extensive ditching conducted here in the past, and roads surround and at least partially isolate the site.

WOLF RIVER WETLANDS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Botaurus lentiginosus</i>	American bittern	SC/M		2000
<i>Emydoidea blandingii</i>	Blanding's turtle	THR		2000
<i>Enochrus consortus</i>	A water scavenging beetle	SC/N		1999
<i>Euphyes dion</i>	Dion skipper	SC/N		1990
<i>Gallinula chloropus</i>	Common moorhen	SC/M		2001
<i>Haliplus canadensis</i>	A crawling water beetle	SC/N		1999
<i>Hydrometra martini</i>	A water measurer	SC/N		1999
<i>Ixobrychus exilis</i>	Least bittern	SC/M		2000
<i>Poanes viator</i>	Broad-winged skipper	SC/N		2000
<i>Rallus elegans</i>	King rail	SC/M		2000
Communities				
Southern mesic forest		NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

8. Outagamie Bottoms

Ecological Landscape: Central Lake Michigan Coastal
 Town-Range-Section: T23N-R 16E sec. 04, 05, 08, 09; T24N-R 16E sec. 32, 33
 Size: 2,338 acres

Site Description

Located in northern Outagamie County, this site encompasses the Wolf River corridor from the northern boundary of Outagamie County State Wildlife Area south to the village of Shiocton. Both units of the SWA are included but ecologically significant floodplain habitats extend well beyond the SWA boundaries along the Wolf River. The floodplain narrows appreciably near Shiocton and is bordered by agricultural land and residential developments.

The floodplain forest community is composed of silver maple, swamp white oak, and green ash. Condition is variable, but several mature stands are present. There are also several relatively undisturbed stands of emergent marsh (bulrushes, bur-reeds, sedges) and sedge meadow, though the continued encroachment by the highly invasive reed canary grass is problematic. Some of the wetlands within the northern portion of the SWA have been altered by dike and ditch construction to benefit waterfowl. These areas are now vegetated with wild rice, cattail, bulrushes, sedges, willows, dogwoods, and reed canary grass. Small thickets of lowland aspen also occur here. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This site occupies a strategic location within the highly significant Wolf River corridor. Rare species that are resident here include the state-threatened Cerulean Warbler, Red-shouldered Hawk, and Wood Turtle, and the site provides secure habitat for many common and characteristic plants and animals as well.

Management Considerations

Extending protection south to Shiocton would benefit several sensitive forest animals, as would provision for a core area of older forest with high canopy closure within the SWA. Invasive species should be monitored and controlled as feasible.

OUTAGAMIE BOTTOMS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Botaurus lentiginosus</i>	American bittern	SC/M		2000
<i>Clemmys insculpta</i>	Wood turtle	THR		2000
<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000
<i>Emydoidea blandingii</i>	Blanding's turtle	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Etheostoma clarum</i>	Western sand darter	SC/N		1994
<i>Euphyes dion</i>	Dion skipper	SC/N		2000
<i>Ixobrychus exilis</i>	Least bittern	SC/M		2000
<i>Notropis texanus</i>	Weed shiner	SC/N		1981
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Poanes massasoit</i>	Mulberry wing	SC/N		2000
<i>Poanes viator</i>	Broad-winged skipper	SC/N		2000
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Simpsonia ambigua</i>	Salamander mussel	THR		1989
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Communities				
	Emergent aquatic	NA		1999
	Emergent aquatic - wild rice	NA		1999
	Floodplain forest	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

9. Mack State Wildlife Area

Ecological Landscape: Central Lake Michigan Coastal
 Town-Range-Section: T23N-R 16E sec. 13, 14, 23, 24
 Size: 2,730 acres

Site Description

This Wildlife Area is located in central Outagamie County and is surrounded by agricultural and abandoned agricultural land, with the exception of bordering wetlands to the south and a large wetland to the southeast. A 3/4 square mile property owned by the Wisconsin Department of Transportation (WIDOT) as a wetland mitigation site borders the SWA and has been included within the site boundary.

Mack SWA is nearly level site consisting of ditched wetlands bisected by a railroad and Highway 54. The predominant community is a young, dense, moist aspen stand. Open to semi-open areas are composed primarily of reed canary grass, sedges, and willows. There is a semi-open cottonwood-willow swamp on the eastern end of the property. South of the railroad there is a logged over red maple-ash-elm forest; an open meadow/shrub swamp of willow, reed canary grass, sedge, and cattail; and a white cedar, red maple, basswood swamp forest with altered drainage. The WIDOT property is reclaimed agricultural land that is dominated by cattail and reed canary grass, with willow in some areas. The area is ditched and some of the ditches are impounded to create additional habitat for waterfowl and other marsh species.

Site Significance

This site contains recovering examples of several natural communities and provides secure habitat for many common native plants and animals. Several rare birds inhabit the marshes and grasslands. The area between Nichols Creek and Bear Creek is an important stopover for migrating waterfowl. There is a historical record for the rare showy lady's slipper from this area, but BER botanists could not relocate the species over the course of this project.

Management Considerations

Natural community management and restoration potential is low due to the disturbed nature of the site, especially from the altered hydrology due to ditching. The large wetland to the southeast is a candidate for inventory and potential protection. Numerous small smoldering fires occurred in the peaty soils in late October 1999 in the northeastern portion of the area.

MACK STATE WILD LIFE AREA EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Ammodramus henslowii</i>	Henslow's sparrow	THR		2000
<i>Chlidonias niger</i>	Black tern	SC/M		2000
<i>Euphyes dion</i>	Dion skipper	SC/N		1999
<i>Ixobrychus exilis</i>	Least bittern	SC/M		2000
Plants				
<i>Cypripedium Reginae</i>	Showy lady's-slipper	SC		1916
Communities				
Southern hardwood swamp		NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

10. Lower Embarrass River Bottoms

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T23N- R15E-sections 10, 11, 14,15, 22, 23, 26, 27, 28, 33, and 34
Size: 2,150 acres

Site Description

Lower Embarrass River Bottoms encompasses a 5-mile stretch of the Embarrass River floodplain in northwestern Outagamie County, from the bridge crossing at State Highway 76 downstream to the bridge at Spurr Road. The floodplain is broad in the northern part of the site, approaching a width of almost 2 miles. An area of over 2 square miles on the east side of the river toward the northern end of the site has been extensively ditched and dike to create additional waterfowl habitat.

The river is bordered by a lowland hardwood forest dominated by silver maple, green ash, swamp white oak, and basswood. Common or characteristic understory plants include wood nettle, false nettle, jumpseed, white snakeroot, sensitive fern, ostrich fern, fowl manna grass, white grass, woodland brome grass, and hop sedge.

A stand of relatively undisturbed mesic hardwood forest with a canopy of sugar maple, beech, and basswood occurs on a slightly elevated terrace just above the river floodplain in section 22. Butternut is among the canopy associates. A number of plants near their northern range limits are present, as are several rare species.

The uplands bordering the floodplain are currently almost wholly dedicated to agricultural production. See Appendix C. Stream Priority # 3 for additional description of riverine features associated with this site.

Site Significance

This site supports several rare species, including plants, birds, and aquatic animals. Several relatively undisturbed natural community occurrences were documented here, including a significant stand of upland hardwood forest. This is one of the very few examples of this type that is not severely affected by past use history or isolation.

Management Considerations

The lands within this site are entirely in private ownership. Maintenance of the remaining forested floodplain and associated patches of mesic hardwood forest are key considerations. Additional clearing of floodplain forest was occurring in the northwestern part of the site west of the river in 2000.

LOWER EMBARRASS RIVER BOTTOMS EO's

Scientific name	Common name	State status	Federal status	Lastobs date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		UNK
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Hydropsyche bidens</i>	A caddisfly	SC/N		1999

	Scientific name	Common name	State status	Federal status	Lastobs date
	<i>Notropis texanus</i>	Weed shiner	SC/N		1979
	<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
	<i>Stenelmis fuscata</i>	A riffle beetle	SC/N		1999
	<i>Stylurus notatus</i>	Elusive clubtail	SC/N		1999
	<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants					
	<i>Carex formosa</i>	Handsome sedge	THR		2001
	<i>Phegopteris hexagonoptera</i>	Broad beech fern	SC		2001
Communities					
		Floodplain forest	NA		2000
		Southern mesic forest	NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

11. Hortonville Bog State Natural Area

Ecoregion: Central Lake Michigan Coastal
Town-Range-Section: T22N-R 15E sec. 02-04, 09-11, 14-16
Size: 1,782 acres

Site Description

Hortonville Bog is a large insular peatland located in west central Outagamie County, two miles east of New London. The central core of the site supports an open muskeg and bog composed of sphagnum mosses, sedges, and ericaceous shrubs with a scattering of stunted tamarack and black spruce. With the exception of a shallow ditch and a few ORV trails, the muskeg is in very good condition.

Away from the center of the peatland tree cover increases significantly, forming a closed canopy conifer forest of tamarack and black spruce.

There are several stands of more calcareous, wet-mesic forest near the peatland margins. White cedar becomes a dominant tree, with tamarack, red maple, and paper birch also present. Past disturbance is more evident here than in the more acid communities closer to the site's interior. Poison sumac is a common tall shrub. This calcareous swamp supports colonies of cuckoo flower (*Cardamine pratensis*), a state special concern plant.

Relatively small stands of alder thicket, shrub-carr, sedge meadow, and hardwood swamp are also present. These communities tend to be disturbed, and infestations of the highly invasive reed canary grass are locally common. Wetlands to the east of the site boundary have been ditched and are in a generally highly disturbed condition.

Site Significance

Bogs are not common in this part of Wisconsin, and this property was established as a State Natural Area in 1987 to achieve long-term protection for large relatively undisturbed examples of regionally representative peatland communities. Several rare plants and a number of regionally uncommon birds such as the Lincoln's Sparrow and Palm Warbler have been documented here.

Management Considerations

Protection or restoration of site hydrology is of paramount importance, with primary emphasis focused on the ditched eastern portion of the wetland. Additional buffering around the wetland margins is desirable to reduce high contrast edge and improve the quality of water draining into the wetland interior. Periodic monitoring is needed to assess the status and efficacy of control of invasive species.

HORTONVILLE BOG STATE NATURAL AREA EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Plants				
<i>Cardamine pratensis</i>	Cuckooflower	SC		1999
<i>Carex gynocrates</i>	Northern bog sedge	SC		1931
Communities				
Northern wet-mesic forest		NA		1999
Open bog		NA		1999
Tamarack (poor) swamp		NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

12. LaSage Bottoms

Ecological Landscape: Central Lake Michigan Coastal
 Town-Range-Section: T22N-R 16E sec. 07, 08, 18
 Size: 1,387 acres

Site Description

Located to the west of the Wolf River in west central Outagamie County, this site is situated within a matrix composed almost entirely of agricultural lands. The site is contiguous with forested floodplain to the north, south, and east, and a hardwood swamp and semi-open wetland to the west. A gravel road crosses the site, leading to a house with outbuildings, lawn, and a pond. Telephone and power line rights-of-way are also present. A circular ditch/impoundment dominates the west-central portion of the area. The core of this site is the LaSage Unit of the Lower Wolf River Bottoms State Wildlife Area.

The primary natural community is a mature floodplain forest composed of large silver maple, swamp white oak, and green ash. There is at least one pocket of swampy red maple forest with buttonbush and sedge. The impounded area and small pond contain pondweeds (*Potamogeton spp.*), waterweed (*Elodea canadensis*), duckweeds (*Lemna spp.*), and white water crowfoot. The disturbed open to semi-open wetlands around the pond and impoundment support emergent aquatic and meadow communities of sedge, bur-reed, bulrush, reed canary grass, willow, and buttonbush with scattered young elm, silver and red maple, and green ash. The site contains good quality wet to wet-mesic forest.

The northeastern portion of the site supports a moderately disturbed mesic hardwood forest on a slightly elevated floodplain terrace. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This site contains an intact stand of older floodplain forest that supports several rare animals such as the Cerulean Warbler and Red-shouldered Hawk. In addition, a remnant stand of rich mesic hardwood forest is present sustaining at least one rare plant, the state-threatened handsome sedge (*Carex formosa*), a lush carpet of spring ephemerals, and regional rarities such as bladder-nut (*Staphylea trifolia*).

Management Considerations

Maintenance and, where possible, expansion of stands of older forest with high canopy closure is critical if this and other sites featuring lowland hardwoods are to continue to support some of the sensitive forest interior species that are now present. Allowing the forests to mature, planning for large patches of mature forest, protecting wetlands to the east and west, and maintaining or establishing ecological connections with the Wolf River corridor both upstream and downstream are among the major management considerations. Control of invasive species like reed canary grass will enhance the values of the natural communities present and should be accounted for in the new master plan now under development.

LASAGE BOTTOMS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Baetisca obesa</i>	A mayfly	SC/N		1999
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
<i>Enochrus sayi</i>	A water scavenging beetle	SC/N		1999
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Hydrochara spangleri</i>	A water scavenger beetle	SC/N		2000
<i>Hydropsyche bidens</i>	A caddisfly	SC/N		1999
<i>Matus bicarinatus</i>	A predaceous diving beetle	SC/N		1999
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Procambarus acutus</i>	White river crawfish	SC/N		2000
<i>Stenelmis antennalis</i>	A riffle beetle	SC/N		1999
<i>Stenelmis fuscata</i>	A riffle beetle	SC/N		1999
<i>Stylurus notatus</i>	Elusive clubtail	SC/N		1999
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Carex formosa</i>	Handsome sedge		THR	1999
Communities				
Floodplain forest		NA		1999
Southern mesic forest		NA		2001

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

13. Wolf River State Fishery Area

Ecological Landscape: Southeast Glacial Plains
Town-Range-Section: T22N-R 14E sec. 02, 03, 11
Size: 1,380 acres

Site Description

The Wolf River State Fishery Area consists of three small parcels on the north side of the Wolf River just west of New London in eastern Waupaca County. Topography is low and nearly level. Private lands that are predominantly wetlands surround the state property on three sides. State Highway 54 and a railroad corridor pass through the site. Uplands to the east and west of the Wolf River corridor are a combination of agricultural lands, abandoned agricultural lands, and developed and developing areas. The SFA is bracketed by the cities of Northport and New London, both of which are expected to experience increased residential development.

The easternmost unit is a 35-acre triangular parcel tucked in between the highway and railroad. It has been ditched and contains several small impoundments. Over half of the site is open wetland of reed canary grass, willow, buttonbush, and sedges. The ponds support stands of bulrush, cattail, sedge, and yellow water buttercup. There are small patches of silver maple forest with reed canary grass understories. The ditch banks are fringed with silver maple.

The central unit of 135 acres is situated on the north side of the Wolf River. The highway, railroad, and a ditch pass through the north end, which is the most disturbed portion of this unit, with an open reed canary grass meadow - emergent aquatic marsh and a semi-open silver maple swamp with a reed canary grass understory. A five-acre circular pond is located in the north-central end of the unit. The pond has a sedge border on the east end and a sedge-cattail border on the west end. There are several other smaller ponds scattered along the eastern boundary, with shallow water supporting sedges, buttonbush, bulrush, cattail, reed canary grass, duckweed, and yellow water buttercup. The greater part of this area supports a silver maple forest with green ash and swamp white oak that is in fair to good condition owing to its maturity and generally intact canopy. An interesting feature of the site is a mesic floodplain terrace forest of silver maple, basswood, red oak, swamp white oak, and green ash. This community supports many forest understory plants that are not presented in the silver maple-dominated stands within the floodplain proper.

The westernmost unit is about 32 acres in size and is situated on the east side of the confluence of Cedar Creek with the Wolf River. The vegetation includes willows, sedges, cattails, and the invasive weeds purple loosestrife and reed canary grass. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site

Site Significance

This site contains examples of marsh, meadow, shrub swamp and floodplain forest communities of moderate to low quality. These provide habitat for many common native plants and animals and several that are rare, such as the state threatened Blanding's turtle.

Management Considerations

From a community perspective, the greatest management potential lies in the central unit and the less disturbed forests emergent marshes. A high priority for protection would be adjacent forested areas between the central unit and New London and the central unit and Northport. Both areas are in good

condition and have a high probability of being fragmented or destroyed by future development. The Cedar Creek drainage requires additional inventory. Invasive plants are an important issue here as both purple loosestrife and reed canary grass are well-established and locally dominant. The impacts of the rights-of-way crossing these wetlands need further clarification, as they can adversely affect site hydrology, hinder animal movement, and serve as a source of pollutants.

WOLF RIVER STATE FISHERY AREA EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Emydoidea blandingii</i>	Blanding's turtle	THR		1987
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Hydrobius melaenum</i>	A water scavenging beetle	SC/N		2000
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Carex gynocrates</i>	Northern bog sedge	SC		1931
<i>Platanthera orbiculata</i>	Large roundleaf orchid	SC		1931
Communities				
	Floodplain forest	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

14. Mukwa Bottoms

Ecological Landscape: Southeast Glacial Plains
Town-Range-Section: T22N-R 14E sec. 09-11, 15, 16, 21
Size: 2,224 acres

Site Description

Located in eastern Waupaca County just west of New London, this site is situated around the confluence of the Little Wolf River and Wolf River. Mukwa SWA includes most of the undeveloped land in the immediate area. Land uses in the surrounding landscape include agriculture (abandoned and active), residential development, and recreation.

The most extensive plant community is the silver maple-dominated floodplain forest that varies in condition from highly disturbed to excellent. There is also a disturbed, open to semi-open swamp/meadow of reed canary grass, purple loosestrife, and sedges, with scattered young silver maple and elm. There are high quality emergent aquatic and sedge meadow communities in abandoned oxbows, some of which support colonies of the state special concern cuckooflower and beds of wild rice. Upland edges and adjacent uplands support fragments of mesic sugar maple-basswood forest with colonies of the rare handsome sedge. Many of these upland forest stands have been logged, and have potential for future residential development.

East of the Wolf River the wetland communities are disturbed (e.g., by ditches and infestations of reed canary grass) but there are significant patches of emergent marsh (bulrushes, bur-reeds, spikerushes), sedge meadow, and shrub-carr. Scattered individuals and small groves of ash, elm, and silver maple forest also occur here. See Appendix C. Stream Priority # 2 and #4 for additional description of riverine features associated with this site.

Site Significance

This site contains highly significant stands of floodplain forest and emergent marsh, supports rare plants and animals, and has excellent potential for expansion. The larger patches of mature closed canopy forest support rare, area-sensitive animals. This site occupies an integral portion of the lower Wolf River corridor and is contiguous with the vast bottomland forests downstream, to the south of Shaw's Landing. The corridor of the Little Wolf River is also of high significance, especially to aquatic life.

Management Considerations

Protecting and, where possible, increasing the silver maple floodplain forest will protect water quality and provide additional habitat. Significant stands of floodplain forest to the south of the property warrant protection. Decreasing the invasives, especially reed canary grass and purple loosestrife, and increasing sedge meadow and emergent aquatic elements, are important considerations for managers. Other important natural communities include the floodplain of the Wolf River east of New London, the Cedar Creek Area to the north, and the numerous fragments of mesic sugar maple-basswood-oak forest adjacent to the floodplain. Expanding protection and allowing these forests to mature would benefit these communities and their associated flora and fauna.

MUKWA BOTTOMS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Botaurus lentiginosus</i>	American bittern	SC/M		1984
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Chlidonias niger</i>	Black tern	SC/M		1984
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	SC/M		1984
<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000
<i>Emydoidea blandingii</i>	Blanding's turtle	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Etheostoma clarum</i>	Western sand darter	SC/N		1979
<i>Hetaerina titia</i>	Dark rubyspot	SC/N		1999
<i>Hydropsyche bidens</i>	A caddisfly	SC/N		1999
<i>Lioporeus triangularis</i>	A predaceous diving beetle	SC/N		1999
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	SC/M		1984
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	SC/N		1999
<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	THR		1984
<i>Ophiogomphus howei</i>	Pygmy snaketail	THR		1999
<i>Pandion haliaetus</i>	Osprey	THR		2000
<i>Pentagenia vittigera</i>	An ephemerid mayfly	SC/N		1992
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Poanes viator</i>	Broad-winged skipper	SC/N		2000
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Stenelmis fuscata</i>	A riffle beetle	SC/N		1999
<i>Stylurus notatus</i>	Elusive clubtail	SC/N		1992
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Cardamine pratensis</i>	Cuckooflower	SC		1999
<i>Carex formosa</i>	Handsome sedge	THR		1999
<i>Carex gynocrates</i>	Northern bog sedge	SC		1931
<i>Platanthera orbiculata</i>	Large roundleaf orchid	SC		1931
Communities				
	Emergent aquatic	NA		1999
	Floodplain forest	NA		1999
	Southern mesic forest	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

16. Mosquito Hill / Liberty Bottoms

Ecological Landscape: Central Lake Michigan Coastal
Town-Range-Section: T22N-15E-sections 14-18, 19-23, 26-28
Size: 3,420 acres

Site Description

This site contains a 5 mile stretch of the Wolf River floodplain from the County Highway M bridge in Outagamie County west (downstream) to the city limits of New London. The primary community surveyed is an extensive floodplain forest lining both banks of the Wolf. Dominant trees are silver maple, swamp white oak, and green ash. Characteristic understory plants include buttonbush, wood nettle, gray-headed coneflower, cardinal flower, fowl manna grass, green dragon, hop sedge, muskingum sedge, Gray's sedge, and fox sedge. The forest occurs in a continuous strip typically one-half to one-quarter of a mile wide. Beyond the gallery forest lining the river banks there are extensive areas of shrub swamp and emergent marsh. Sloughs and old oxbows often hold beds of emergent and submergent aquatic macrophytes, including some large stands of wild rice and river bulrush.

Though the marsh habitats away from the floodplain were not surveyed intensively, several of the stands examined were dominated almost entirely by native wetland plants. Several rare birds, most notably Black Tern and Northern Harrier, were seen foraging over the marshes during the month of June. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

The forested floodplain and the substantial emergent marsh and shrub swamp communities include stands in very good condition. Among the rare species documented here are Red-shouldered Hawk, Cerulean Warbler, Prothonotary Warbler, and Red-headed Woodpecker. Other noteworthy resident birds include Pileated Woodpecker, Barred Owl, Yellow-billed Cuckoo, Black Tern, Northern Harrier, and American Redstart. Few, if any, other sites in the local landscape have the potential to support the more sensitive species.

Three different ponds/wetlands sites were sampled here for aquatic invertebrates and each tended to have lots of species, many of which were not found in the other ponds. Combined, the taxa richness was 92 species which is very high for such a small area. These include four new county records and several rare species.

Management Considerations

Additional protection efforts are warranted here. Only Mosquito Hill Nature Center near the western edge of the site, and small remnant fishery area (approximately 50 acres) along the Wolf River are publicly owned. Protection priorities included intact stands of mature floodplain forest, sloughs and oxbows with stands of emergent and submergent aquatics. There is a need for monitoring and control of invasive species such as reed canary grass and purple loosestrife. The marshes away from the forested river corridor merit additional survey work in the future.

MOSQUITO HILL / LIBERTY BOTTOMS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Chlosyne gorgone</i>	Gorgone checker spot	SC/N		1991
<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000
<i>Dubiraphia bivittata</i>	A dubiraphia riffle beetle	SC/N		2000
<i>Enochrus consortus</i>	A water scavenging beetle	SC/N		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Erynnis lucilius</i>	Columbine dusky wing	SC/N		1991
<i>Euphyes bimaculata</i>	Two-spotted skipper	SC/N		1989
<i>Euphyes dion</i>	Dion skipper	SC/N		1991
<i>Hesperocorixa semilucida</i>	A water boatman	SC/N		2000
<i>Hydrochara spangleri</i>	A water scavenger beetle	SC/N		2000
<i>Hydrometra martini</i>	A water measurer	SC/N		2000
<i>Ilybius ignarus</i>	Diving beetle	SC/N		2000
<i>Matus bicarinatus</i>	A predaceous diving beetle	SC/N		2000
<i>Meropleon ambifusca</i>	Newman's brocade	SC/N		1994
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Poanes viator</i>	Broad-winged skipper	SC/N		1992
<i>Procambarus acutus</i>	White river crawfish	SC/N		2000
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Communities				
	Floodplain forest		NA	2001
	Emergent aquatic – wild rice		NA	2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

17. Wolf River Corridor –Shaw's Landing to Fremont (Bayou Country)

Ecological landscape:	Southeast Glacial Plains
Town-Range-Section:	T21N-R 13E sec. 01, 11-14, 24-26, 36; T21N-R 14E sec. 04-08, 18, 19, 30, 31; T22N-R 14E sec. 19-22, 27-33
Size:	12,861 acres

Site Description

This eight-mile stretch of the Wolf River in southeastern Waupaca County is predominantly privately-owned. It was surveyed only by boat. Topography is nearly level with a gentle slope to the south. The Wolf River valley is up to five miles wide at this location, and the river meanders in a maze of sloughs, oxbows, channels, and shallow lakes. The adjacent uplands are used for agriculture and low density residential development. No bridges exist along this section of the river. Small floating cabins, moored along the riverbanks, are a common feature.

Extensive floodplain forest of silver maple, swamp white oak, and green ash vegetates much of the area. Areas of quiet water, including lakes, sloughs, oxbows, and stagnant areas in channels, support submergent aquatics such as water celery, spatterdock, water weed, water milfoil, pondweed, and hornwort. Open emergent wetlands are also present, as are larger inland wetlands, composed of cattails, reed canary grass, bulrushes, wild rice, willows, bur-reeds, common reed, and arrowheads. The invasives flowering rush, common reed, and purple loosestrife are locally established.

Three drainage lakes occur within this stretch of the Wolf River floodplain: Cincoe, Partridge Crop, and Partridge Lakes. Extensive beds of emergent marsh occur on the lake margins. Only the southern end of Partridge Lake is heavily developed, near the village of Fremont.

Of additional interest is an extensive conifer swamp dominated by tamarack, just to the east of “Templeton Bayou”. The biota is totally unlike that occurring elsewhere along the Lower Wolf and constitutes a unique opportunity for protection within this corridor. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site.

Site Significance

This area encompasses over twenty square miles of extensive natural communities and provides secure habitat for many common and several rare native plants and animals. The large areas of lowland forest support rare animals such as Red-shouldered Hawk, Cerulean Warbler, and Prothonotary Warbler. Both Forster’s and Black Terns were frequently noted foraging in the marshes and sloughs. The large tamarack swamp just east of the river supports many species absent from the lowland hardwood forests, marshes, wet meadows, and shrub swamps that comprise the prevalent plant cover over most of this site

The Wolf River mainstem, including sites 16 and 17, was identified by The Nature Conservancy as a site of ecoregional significance, meaning conservation activities will be initiated or facilitated by The Nature Conservancy to ensure protection of the diversity of aquatic and wetland species found here. This site was one of four sites identified by The Nature Conservancy as conservation priorities within the Wolf River basin.

Management Considerations

This site offers an excellent opportunity to preserve the native landscape on a large scale and is among the highest priorities for protection. Agricultural runoff and future development should be addressed. Habitat specialists, including extensive forest and extensive marsh species, warrant special attention here. Invasive species are a significant problem in some areas and should also receive attention.

WOLF RIVER CORRIDOR –SHAW'S LANDING TO FREMONT EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1991
<i>Alasmidonta marginata</i>	Elktoe	SC/H		1995
<i>Ardea herodias</i>	Great blue heron	SC/M		2000
<i>Botaurus lentiginosus</i>	American bittern	SC/M		1984
<i>Buteo lineatus</i>	Red-shouldered hawk	THR		2000
<i>Chlidonias niger</i>	Black tern	SC/M		2000
<i>Cicindela patruela huberi</i>	A tiger beetle	SC/N		1999
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	SC/M		1984
<i>Dendroica cerulea</i>	Cerulean warbler	THR		2000
<i>Epioblasma triquetra</i>	Snuffbox	END		1995
<i>Erimyzon sucetta</i>	Lake chubsucker	SC/N		1981
<i>Etheostoma clarum</i>	Western sand darter	SC/N		1981
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	SC/M		1984
<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	THR		1984
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1981
<i>Pandion haliaetus</i>	Osprey	THR		2000
<i>Pentagenia vittigera</i>	An ephemerid mayfly	SC/N		1992
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Protonotaria citrea</i>	Prothonotary warbler	SC/M		2000
<i>Ranatra nigra</i>	A water scorpion	SC/N		2000
<i>Stylurus notatus</i>	Elusive clubtail	SC/N		2000
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Carex gynocrates</i>	Northern bog sedge	SC		1931
<i>Valeriana sitchensis ssp uliginosa</i>	Marsh valerian	THR		1944
Communities				
	Emergent aquatic	NA		2000
	Floodplain forest	NA		2000
	Lake—oxbow	NA		2000
	Northern wet forest	NA		2000
	Shrub-carr	NA		2000
	Tamarack swamp	NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

18. Shaky Lake

Ecological Landscape: Southeast Glacial Plain
Town-Range-Section: T21N-R 15E sec. 07, 08
Size: 725 acres

Site Description

Located in southwestern Outagamie County, this site occupies a portion of a shallow depression within the drainage of an unnamed creek. There are significant natural features around the periphery of the depression and within the drainage, both above and below the lake. A core area of ca 220 acres has been designated a State Natural Area. Agricultural lands now surround the site, but residential development is increasing rapidly.

There are areas of open water in the depression, including Shaky Lake proper, that support emergent and submergent aquatic vegetation. Cattails are abundant. A floating mat dominated by wire-leaved sedge surrounds the lake and is in turn surrounded by tussock sedge meadow and black ash swamp. The sedge meadows and black ash swamp support colonies of cuckooflower (*Cardamine pratensis*).

A low, narrow ridge runs along the edge of the depression. The eastern portion supports a small but intact forest of white pine, basswood, paper birch, red maple, green ash, and oaks. Just to the east of this is a depression with a hardwood swamp of silver maple, red maple, American elm (mostly saplings – Dutch elm disease killed most of the trees), and ashes. The remainder of the ridge and the adjacent slopes are vegetated with an early successional basswood-dominated forest.

Site Significance

The wetland communities found on this property (listed below) are diverse, in good condition, and represent regionally rare types. Rare species are present, representing a variety of taxa.

Management Considerations

The continued protection of high quality wetland communities and the adjoining upland ridge is an important management consideration and should be given high priority. Additional protection may be needed for some of the adjoining tracts. Development within adjoining forest remnants could have adverse impacts to the natural communities within the site. Protection of site hydrology is a high priority. The water level has risen recently, possibly due to beaver activities, inundating portions of the lowland forest, shrub swamp, and wire-leaved sedge meadow and apparently increasing the prevalence of cattails. Efforts to control aggressive invasive plants, especially purple loosestrife, should continue.

SHAKY LAKE EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Clemmys insculpta</i>	Wood turtle	THR		1987
<i>Empidonax vireescens</i>	Acadian flycatcher	THR		2000
<i>Ilybius ignarus</i>	Diving beetle	SC/N		2000
<i>Rhantus sinuatus</i>	A predaceous diving beetle	SC/N		2000
Plants				
<i>Cardamine pratensis</i>	Cuckooflower	SC		1999
<i>Medeola virginiana</i>	Indian cucumber-root	SC		1968
Communities				
Emergent aquatic		NA		1999
Hardwood swamp		NA		1999

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Lake--shallow, hard, seepage		NA		1999
Northern sedge meadow		NA		1999
Northern wet forest		NA		1999
Southern dry-mesic forest		NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

19. Rat River

Ecological Landscape: Southeast Glacial Plains
Town-Range-Section: T20N-R 14E sec. 13, 23, 24; T20N-R 15E sec. 01-03, 07-11, 14-18;
T20N-R 16E sec. 04-09
Size: 6,342 acres

Site Description

Located in northern Winnebago County, this site includes an eight-mile, free flowing stretch of the Rat River, a tributary of the Wolf River. Much of the wetland acreage within this corridor is within the Rat River SWA. Agricultural land and residential developments occupy the uplands adjoining the property.

The major natural feature is the Rat River, a shallow, slow, meandering, hard water stream, and a large emergent marsh bordering much of the river's length. The marsh dominants include cattails, bulrushes, bur-reeds, arrowheads, and spike-rushes. Stands of wet meadow are also present, often in a zone between the marsh and shrub-carr and hardwood swamp communities. The wet meadows are composed of tussock and lake sedges, Canada bluejoint grass, and wetland forbs such as swamp milkweed, joe-pye-weed, boneset, and monkey flower. Reed canary grass is a significant problem, especially in formerly grazed wet meadows and some shallow marshes, and in stands of hardwood swamp that had been heavily logged or grazed.

Other wetland vegetation within or adjacent to the site includes ash-dominated hardwood swamp, shrub-carr, alder thicket, and small patches of tamarack.

There are also old fields that were formerly used for agricultural purposes. A community that appears to be reclaiming former old field and pasture is a shrub-carr-wet-meadow wetland type, now composed of dogwood, willow, sedge, and bluegrass. There are small fragments of mesic forest around the upland edges of the wetlands. Most of these upland forest remnants are disturbed, but several are in good condition. A disturbed hardwood swamp community, composed of bur oak, green ash, black ash, elm, silver maple, with abundant reed canary grass in the understory, represents the forested wetlands on the site. The best example of the hardwood swamp community is located east of Hillcrest Road, where very little reed canary grass is present. Canopy dominants in this community include silver maple, swamp white oak, bur oak, green ash, basswood, and white cedar. This stand grades upslope into a fragment of mesic hardwood forest, and contains several undisturbed springs.

Small, scattered patches of mesic prairie with big bluestem, prairie dock, golden alexanders, and prairie sunflower are found along roadsides.

A variety of butterfly habitats was noted in the area along Shady Lane, including dry open areas and wet areas, and these patches supported high butterfly diversity.

Site Significance

The emergent marsh is extensive and supports rare as well as common marsh-dwelling species. Notable resident birds include Virginia Rail, Sora, Marsh Wren, Black Tern, Black-crowned Night Heron, and Least Bittern. Golden-winged Warblers were recorded at several locations in dense patches of tall wetland shrubs with scattered trees. The fragments of tall grass prairie occurring within the site boundary are at the northern range limit for this community type. Remnants of mesic prairie of any size are now very rare throughout Wisconsin. The Rat River area was the only site surveyed in 1999 where a

rare mammal, the Arctic shrew, was documented. The presence of high quality shrub-carr here is thought to be highly significant for this species.

Management Considerations

Management issues include: the restoration of hydrology, reduction of the presence of invasive plants in the meadows and marshes, allowing forest patches of swamp hardwoods and mesic hardwoods to mature, increasing the acreage of prairie by conducting controlled burns and, where feasible, planting locally collected seed, and maintaining acreages of shrub-carr habitat at selected sites. Abandoned agricultural lands and lands in the conservation reserve program (CRP) adjoining or near the wetlands have the potential to support significant populations of grassland birds.

RAT RIVER EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Chlidonias niger</i>	Black tern	SC/M		2001
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Ixobrychus exilis</i>	Least bittern	SC/M		2000
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Poanes viator</i>	Broad-winged skipper	SC/N		2000
<i>Sorex arcticus</i>	Arctic shrew	SC/N		1999
Plants				
<i>Carex formosa</i>	Handsome sedge	THR		2001
Communities				
	Emergent aquatic	NA		2000
	Northern mesic forest	NA		1999
	Northern wet-mesic forest	NA		1982
	Southern hardwood swamp	NA		1999
	Southern sedge meadow	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

20. Lower Wolf River Marshes (Wolf River State Wildlife Area)

Ecological Landscape: Southeast Glacial Plains
Town-Range-Section: T20N-R 14E sec. 02, 03, 10, 11, 14-16, 22, 23
Size: 4,261 acres

Site Description

Located in northwest Winnebago County, this site encompasses a vast marsh bordering the lowermost stretches of the Wolf River. The two slightly disjunct units of the Wolf River State Wildlife Area are contained within the site boundary. Topography is low and nearly level, with a barely perceptible slope toward the south.

The northeastern part of the site is dominated by reed canary grass, with some areas of willows and cattails. Ditches and impoundments are prominent. Around the site periphery there are scattered patches of hardwood swamp composed of bur oak, green ash, silver maple, basswood, and aspen, as well as both active and fallow agricultural lands.

The southern portion of the site includes a huge emergent marsh of cattails, bulrushes, spike-rushes, bur-reeds, arrowheads, common reed, and, locally, wild rice. Large sloughs within this marsh support extensive beds of floating-leaved and submergent aquatic macrophytes, such as pondweeds, hornwort, water celery, waterweed, spatterdock, and water milfoils. American lotus beds occur in some of the protected shallow bays. Linear strips of silver maple, green ash, box elder, and other swamp hardwoods occur along certain stretches of the lower Wolf River and on some of the spoilbanks bordering old ditches. See Appendix C. Stream Priority # 2 for additional description of riverine features associated with this site

Site Significance

Owing to its size and generally good quality, this site contains an exceptionally significant marsh. Bird life is diverse and includes many rare and declining species. Among the latter are Forster's and Black Terns, Least and American Bitterns, Northern Harrier, and Common Moorhen. At least one rare plant, the state threatened handsome sedge, occurs here. Some of the adjoining open uplands are not currently used for agricultural purposes. These old field habitats are used by many grassland birds, including species experiencing regional declines such as the Grasshopper Sparrow, Bobolink, Eastern Meadowlark, and Dickcissel.

Management Considerations

The marsh contains an extensive emergent/submergent marsh community of very high value. Managing the site to maintain these aquatic macrophyte beds in the vicinity of the slough in a natural condition would protect the value of the community. A number of invasive species are present, including purple loosestrife, reed canary grass, common reed, and flowering rush. These should be monitored and controlled where feasible. In a few areas, potholes have been created to provide waterfowl habitat. Such sites are possible entry points for invasive plants. Additional breeding bird surveys are warranted, as poor weather and the difficulty in accessing some of the interior marsh areas hampered some of the survey efforts. The site also has some wet to wet-mesic forest invertebrate potential.

LOWER WOLF RIVER MARSHES (WOLF RIVER STATE WILDLIFE AREA) EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1978
<i>Botaurus lentiginosus</i>	American bittern	SC/M		2001
<i>Chlidonias niger</i>	Black tern	SC/M		2001
<i>Erimyzon sucetta</i>	Lake chubsucker	SC/N		1979
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Luxilus chrysocephalus</i>	Striped shiner	END		UNK
<i>Moxostoma valenciennesi</i>	Greater redhorse	THR		1974
<i>Notropis anogenus</i>	Pugnose shiner	THR		1963
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	SC/M		2001
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1978
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Sterna forsteri</i>	Forster's tern	END		1984
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995
Plants				
<i>Cardamine pratensis</i>	Cuckooflower	SC		1999
Communities				
	Emergent aquatic	NA		1999
	Emergent aquatic - wild rice	NA		1999
	Floodplain forest	NA		1999

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

21. Winchester Meadows

Ecological landscape: Southeast Glacial Plains
Town-Range-Section: T20N-R15E- parts of sections 19, 20, 30, and 31
Size: 941

Site Description

Winchester Meadows encompasses extensive sedge meadow and emergent marsh communities on muck soils of the Willette series. The meadow is unique in this part of the Lower Wolf Basin for its floristic composition and size. The eastern border of the meadow is dominated by tussock sedge and Canada bluejoint grass, with spotted joe-pye-weed, swamp milkweed, and paniced aster among the common associates. The interior meadow is dominated by the wire-leaved woolly sedge (*Carex lasiocarpa*). Associates include marsh bellflower, water horsetail, marsh fern, blue flag iris, soft-stem bulrush, and many additional sedges. Shrub cover is generally low in the meadow-marsh interior, with willows, especially slender willow, the most common species.

The meadow grades into an emergent marsh dominated by bulrushes, lake sedge, cattails, and, locally, common reed. Arrowhead and marsh cinquefoil are common associates.

Other communities present include shrub-carr, dominated by willows and dogwoods, and southern hardwood swamp, composed mostly of willow and ashes.

Animals noted during the month of June included Marsh and Sedge Wrens, Northern Harrier, American Bittern, Forster's Tern (foraging), and Purple Martin. Yellow Rails have been reported here recently in late spring (May), but have not yet been documented during the breeding season.

Surrounding uplands are, or have been, used for agricultural purposes. Some of this land is now fallow, and residential development is increasing in the area.

Site Significance

The "wire-leaved" meadow community (northern sedge meadow) is of high significance owing to its size, composition, and generally undisturbed nature. Arguably this is the best such wet meadow in the entire Wolf basin. Certainly it is the best example of the type in the lower basin. Portions of the emergent marsh and southern sedge meadow communities are also in good condition and in aggregate have high potential to support sensitive species. In addition to the many common and characteristic plants and animals that are resident, the site currently supports rare plants and rare animals.

Management Considerations

This privately owned site is a high priority for protection, as it is large and contains the best example of a wire-leaved (northern) sedge meadow community in the entire basin. Hydrologic function of the site needs to be better understood here, as it is important that the meadows not convert to emergent marsh communities due to artificially elevated water levels. Hydrologic connections to Lake Poygan to the southwest and Lake Winneconne to the southeast appear to be present via ditched wetlands. Invasive plants, including purple loosestrife, reed canary grass, and common reed, are locally established and should be carefully monitored. Additional surveys for rare birds such as Yellow Rail and LeConte's Sparrow, and selected invertebrate groups, have high potential for yielding valuable information.

WINCHESTER MEADOWS EO's

Scientific Name	Common Name	SRANK	GRANK	State Status	Federal Status	Lastobs Date
Plants						
<i>Triglochin maritima</i>	Common bog arrow-grass	S3	G5	SC		2000
Communities						
Emergent aquatic				NA		2000
Northern sedge meadow		S3	G4	NA		2000

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22. Piacenza Marsh

Ecological Landscape: Southeast Glacial Plains
 Town-Range-Section: T20N-R15E-sections 29, 31-33
 Size: 369 acres

Site Description

This site contains a substantial acreage of emergent and submergent marsh located on the northcentral shore of Lake Winneconne. Marsh dominants include cattails, bulrushes, arrowheads, and common reed. Beds of wild rice occur in the sheltered waters of the central embayment.

Site Significance

The extensive marshes are an important portion of the remnant marsh complex associated with the lower Wolf River and the Winnebago Pool lakes. The marshes support many common and characteristic wetland species, as well as rare aquatic animals. Also significant is the direct hydrological connection of this site with the Winchester Meadows complex situated one mile to the northwest.

Management Considerations

This site was briefly examined during a 1999 survey via powerboat. More detailed survey information is desirable, but the site is clearly important for the extensive open wetland communities it contains. Monitoring, and as appropriate, controlling invasive species is an important consideration here, as is monitoring annual changes to the extent of the marshes due to wave and ice action.

PIACENZA MARSH EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Erimyzon sucetta</i>	Lake chubsucker	SC/N		1979
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Luxilus chrysocephalus</i>	Striped shiner	END		UNK
<i>Moxostoma valenciennesi</i>	Greater redhorse	THR		1974
<i>Notropis anogenus</i>	Pugnose shiner	THR		1963
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1978
Communities				
	Emergent aquatic - wild rice	NA		1999
	Northern sedge meadow	NA		2000

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

23. Clark's Point

Ecological landscape: Southeast Glacial Plains
 Town-Range-Section: T20N-R 15E sec. 19, 20, 29-33
 Size: 282 acres

Site Description

This privately owned site is located on the northeast end of Lake Winneconne in northcentral Winnebago County. The property was inventoried by boat only. The surrounding uplands include agricultural fields, abandoned agricultural lands, and residential developments. The property borders Lake Winneconne to the south and additional wetlands to the north and west (see sites #21 and 22).

An estuary-like bay of Lake Winneconne extends into the cattail marsh along the shoreline and supports dense beds of submergent aquatics including pondweeds, spatterdock, and hornwort. A narrow fringe of other emergents, including wild rice, bulrushes, arrowhead, and common reed, occurs around the edges of the open water and borders the cattail marsh.

Site Significance

This site contains examples of several natural communities of moderate quality and provides secure habitat for many common native plants and animals. Rare species such as Forster's and Black Terns forage here. Detailed survey work was not possible due to private ownership concerns and limited time. Therefore significance determination is preliminary.

Management Considerations

This site was briefly examined during a 1999 survey via powerboat. More detailed survey information is desirable, but the site is clearly important for the extensive open wetland communities it contains. Monitoring, and as appropriate, controlling invasive species is an important consideration here, as is monitoring annual changes to the extent of the marshes due to wave and ice action.

CLARK'S POINT EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Erimyzon sucetta</i>	Lake chubsucker	SC/N		1979
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Luxilus chrysocephalus</i>	Striped shiner	END		UNK
<i>Moxostoma valenciennesi</i>	Greater redhorse	THR		1974
<i>Notropis anogenus</i>	Pugnose shiner	THR		1963
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1978

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

24. Poygan Islands

Ecological landscape: Southeast Glacial Plains
Town-Range-Section: T19N-R14E- sections 1, 2, 4, and 5
Size: 155 acres

Site Description

This site consists of scattered small islands of emergent marsh within Lake Poygan, approximately one mile from the mouth of the Wolf River. The emergent stands have been established on piles of rock dropped into the shallow but exposed lake basin to provide a stable substrate and break wave action. The dominant plant is common reed.

Significance

These isolated islands of emergent marsh provide critical nesting habitat for the state-endangered Forster's Tern. Several hundred pairs have nested here annually in recent years, but adverse weather conditions can drop nesting success to 0. In 2001 the entire colony was flooded out (pers. Comm., A. Techlow 3/2002).

Management Considerations

The present Lake Poygan marshes are a vestigial remnant of a vast marsh that historically filled much of the lake basin. Exposure to wind, wave, and ice action, and heavy use of the lake by recreational boaters, present significant challenges to maintaining these small marsh remnants as viable tern habitat.

POYGAN ISLANDS EO's

Scientific Name	Common name	State Status	Federal Status	Lastobs Date
Animals				
<i>Acipenser fulvescens</i>	Lake sturgeon	SC/H		1978
<i>Erimyzon sucetta</i>	Lake chubsucker	SC/N		1979
<i>Fundulus diaphanus</i>	Banded killifish	SC/N		1974
<i>Luxilus chrysocephalus</i>	Striped shiner	END		UNK
<i>Moxostoma valenciennesi</i>	Greater redhorse	THR		1974
<i>Notropis anogenus</i>	Pugnose shiner	THR		1963
<i>Opsopoeodus emiliae</i>	Pugnose minnow	SC/N		1978
<i>Pleurobema sintoxia</i>	Round pigtoe	SC/H		1995
<i>Sterna forsteri</i>	Forster's tern	END		2000
<i>Tritogonia verrucosa</i>	Buckhorn	THR		1995

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened. The complete NHI listed is provided in Appendix Q.

Appendix C

Descriptions for Priority Stream Segments

BER Priority Stream Segments Within or Tributary to the Lower Wolf River Bottomlands Natural Resources Area

<i>Priority Stream Segments</i>	<i>page</i>
1. WOLF RIVER CORRIDOR – SHAWANO TO CTH CCC	2
2. WOLF RIVER CORRIDOR – CTH CCC TO LAKE POYGAN.....	5
3. LOWER EMBARRASS RIVER CORRIDOR.....	9
4. LITTLE WOLF RIVER CORRIDOR.....	11

1. Wolf River Corridor – Shawano to CTH CCC

Ecological Landscape: Northern Lake Michigan Coastal
Town-Range-Section: T27N-R 15E sec. 36; T26N-R 16E sec. 06-08, 16-17, 20, 29
River-miles: 10

Site Description

This Stream Segment includes a 10-mile stretch of the Wolf River beginning at the dam in Shawano and continuing downstream to CTH CCC north of Navarino SWA in eastern Shawano County. This segment is distinct in character from the remaining 90+ river-miles of the Wolf beginning immediately downstream (site # 2). The reason for the difference in this section of river from that downstream is the presence of a transition from the glacial moraine and till in the north to the sandy outwash and glacial lake bed deposits in the south. This section of river has a relatively narrow floodplain and few off-channel aquatic habitats such as sloughs, oxbows, and backwaters. The river here is 50 m to 75 m wide with a mean thalweg depth of 1-2 m (Lyons, unpublished data). A few deep riffles and shallow fast runs are present. Bottom substrates are predominately sand and gravel with areas of cobble and some boulders. Extensive macrophyte beds develop in the summer in some shallow areas. Abundance of large woody debris in the channel is low to moderate. Rock rip-rap is uncommon.

Below Shawano, riverside residences are currently uncommon, but there is potential for heavy future development. This portion of the river has been subjected to a number of disturbances including the dam at Shawano, construction of three bridges, paper mill and sewage treatment effluent, urban run-off, and, most recently, a bentonite leak from a pipeline drilling project. Another pipeline and powerline also cross the river in this segment.

The shoreline is mainly upland shrubs and forest. The associated small patches of floodplain forest are composed of silver maple, bur oak, and green ash. The condition of these patches is variable, based on past disturbance and recovery. Red maple and white cedar are mixed in with this forest community at the northern end of the site. A fringe of silver maple lines the riverbank. Several small patches of open, often disturbed wetlands occur and are dominated by reed canary grass, willow, bulrush, nettle, alder, and sedge. Steeper riverside slopes support narrow strips of relatively undisturbed mesic forest of hemlock, white pine, red oak, sugar maple, basswood, and yellow birch.

Site Significance

This segment is the uppermost 10 miles of one of the longest unimpounded warmwater river reaches remaining in the Midwestern United States. The abundant gravel and cobble substrate here supports good populations of several aquatic animals including 20 mussel species, 109 aquatic insect and crustacean species, and at least 55 species of fish. Several of these taxa are either much less common or absent downstream.

There is an excellent diversity of Endangered, Threatened, or Special Concern aquatic animals here including two true bugs, six dragonflies, four fish, two stoneflies, one mayfly, six mussels, and one turtle. Eight of these species are globally rare and eight are state Threatened or Endangered. The shoal chub (formerly speckled chub) population here is the only one known in the Great Lakes basin (Lyons et al., 2000). There are several important mussel beds in rocky-gravelly sections of this stretch of the Wolf River as well, especially immediately below the dam

in Shawano where one of the best populations of the globally imperiled snuffbox is found. More on the fish diversity of this segment is addressed in the priority stream site 2 description below.

Two different portions of this segment feature relatively high sandy banks that are important nesting sites for kingfishers, bank and rough-winged swallows, and riverine turtles including the Threatened wood turtle. Both areas are significantly degraded by human activities but are restorable.

This section of stream was identified by The Nature Conservancy as a site of ecoregional significance, meaning conservation activities will be initiated by The Nature Conservancy to ensure protection of the diversity of aquatic species found here. The segment was one of five such sites identified by The Nature Conservancy as aquatic conservation priorities within the Wolf River basin (see Map 1). These TNC Sites were considered the best remaining examples of aquatic features within the ecological drainage unit, based on the large number of aquatic animals (especially rare species) found here. See Part 1 of this report for a description of TNC's Ecoregional Planning Process (The Nature Conservancy, 2000).

Management Considerations

While there were a number of known past perturbations affecting this section of river, field surveys for this project noted relatively few factors potentially affecting water quality. Occasional turbidity, sludge, urban, and point source problems were noted, mostly all at the sample site in Shawano (Appendix E.3). Additional management considerations are touched on in the site description above. The conservation of the natural values here will depend upon the protection of the water quality including the physical river corridor and adjacent uplands. This section of river has a number of obvious factors compromising stream integrity. While the overall level of development is low presently downstream of Shawano, the high amount of upland shoreline and the lack of public ownership suggest a high potential for future residential development.

WOLF RIVER CORRIDOR # 1 AQUATIC ANIMAL EO's

Wolf River (Shawano dam to CTH CCC)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
A creeping water bug	<i>Pelocoris femorata</i>	1999		SC/N	BUG^
A velvet waterbug	<i>Hebrus burmeisteri</i>	1999		SC/N	BUG^
Dark rubyspot	<i>Hetaerina titia</i>	1999		SC/N	DRAGONFLY^
Elusive clubtail	<i>Stylurus notatus</i>	1999		SC/N	DRAGONFLY^
Green-faced clubtail	<i>Gomphus viridifrons</i>	1999		SC/N	DRAGONFLY^
Pygmy snaketail	<i>Ophiogomphus howei</i>	1999		THR	DRAGONFLY^
Skillet clubtail	<i>Gomphurus ventricosus</i>	1999		SC/N	DRAGONFLY^
Stygian shadowfly	<i>Neurocordulia yamaskanensis</i>	1999		SC/N	DRAGONFLY^
Lake sturgeon	<i>Acipenser fulvescens</i>	2000		SC/H	FISH^
River redhorse	<i>Moxostoma carinatum</i>	1982		THR	FISH^
Shoal chub	<i>Macrhybopsis aestivalis</i>	2000		THR	FISH^
Western sand darter	<i>Etheostoma clarum</i>	2000		SC/N	FISH^
A Perlid stonefly	<i>Isoperla bilineata</i>	1999		SC/N	INSECT^
A Perlid stonefly	<i>Isoperla richardsoni</i>	1999		SC/N	INSECT^
A small minnow mayfly	<i>Paracloeodes minutus</i>	1992		SC/N	MAYFLY^
Buckhorn	<i>Tritogonia verrucosa</i>	1995		THR	MUSSEL^
Elktoe	<i>Alasmidonta marginata</i>	1989		SC/H	MUSSEL^

Wolf River (Shawano dam to CTH CCC)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
Round pigtoe	<i>Pleurobema sintoxia</i>	1991		SC/H	MUSSEL^
Salamander mussel	<i>Simpsonaias ambigua</i>	1992		THR	MUSSEL^
Slippershell mussel	<i>Alasmidonta viridis</i>	1991		THR	MUSSEL^
Snuffbox	<i>Epioblasma triquetra</i>	1995		END	MUSSEL^
Wood turtle	<i>Clemmys insculpta</i>	1987		THR	TURTLE^

2. Wolf River Corridor – CTH CCC to Lake Poygan

Ecological Landscapes:	Central Lake Michigan Coastal, Southeastern Glacial Plain
Town-Range:	T20N-R 14E; T21N-R 13-14E; T22N-R 13-16E; T23N-R 16E; T24N -R16E; T25N-R 15-16E; T26N-R 16E
River Miles:	about 91

Site Description

This Stream Segment includes about 91 river-miles of the Wolf River beginning at the CTH CCC bridge and continuing downstream to Lake Poygan in Winnebago County. Compared to site 1 upstream, this stretch flows through a much wider and largely intact floodplain with extensive off-channel habitats. This long river segment overlaps a number of terrestrial sites also identified in this report Appendix B (Sites 1, 2, 6, 7, 8, 12, 13, 14, 15, 16, 17, and 20).

From 10 to 75 miles below the Shawano dam, the river is typically 25-50 m wide with mean thalweg depths of 2-4m. Riffles are absent and shallow fast runs scarce, although occasional mid-channel, shallow, sand “flats” are present. Bottom substrates are sand, silt, and clay, and naturally occurring rock is rare. Macrophytes are common in off-channel habitats but uncommon in the main-channel. Large woody debris is common in both main- and off-channel habitats. The shoreline is mainly swamp with sand/clay banks, but the outside of many bends has been stabilized with boulder rip-rap, especially near towns, bridges, and fishing rafts.

For the last 25 river miles, beginning just below the mouth of the Little Wolf River, the river widens to 70-80 m and remains 2-4 m deep. Several large side channels with significant flow are present (e.g., Big Cut, Mill Cut) and there are two small and shallow main channel lakes (Partridge and Partridge Crop). Silt and clay substrate dominates, but some sand is present. Macrophytes and large woody debris are common in both main and off-channel habitats. Extensive silver maple-dominated floodplain forest covers much of the area. The shore is bordered by a mix of swamp forest and open marsh, with marsh predominating in the last 10 miles. Many banks have been stabilized with rip-rap. Topography is nearly level with a gentle slope to the south. The Wolf River Valley is up to five miles wide at this location, and the river meanders in a maze of sloughs, oxbows, channels, and shallow lakes. The adjacent uplands are used for agriculture and low-density residential development. No bridges exist along this section of the river. Small fishing rafts, moored along the riverbanks, are a common feature.

Overall, areas of quiet water, including lakes, sloughs, oxbows, and stagnant areas in channels support submergent aquatics such as water celery, spatterdock, water weed, water milfoil, pondweed, and hornwort. Open emergent wetlands along the river, and larger inland wetlands, consist of cattail, reed canary grass, bulrush, wild rice, willow, burreed, nettle, giant reed, and arrowhead. The southern end of Partridge Lake is heavily developed. The exotic flowering rush and purple loosestrife are established in some areas.

Site Significance

This segment plus the 10 river-miles immediately upstream (Stream Segment 1) comprises one of the longest un-impounded warmwater river reaches remaining in the Midwestern United States. The wide diversity of aquatic habitats found here supports an excellent fauna including 148 insects and crustaceans, 23 mussels, and about 61 fish species. The big river habitat here supports several animals that are otherwise rare or absent in the WI portion of the Lake Michigan basin

including the Mississippi grass shrimp, elusive clubtail dragonfly, plains clubtail dragonfly, and snuffbox mussel, plus several fish species discussed below.

As with the section immediately upstream, there is an excellent diversity of Endangered, Threatened, or Special Concern aquatic species here including ten beetles, six true bugs, two caddisflies, two crustaceans, five dragonflies, seven fish, six mayflies, five mussels, and one turtle. Six of these species are globally rare, and many are restricted to relatively intact larger warmwater streams.

This segment and the one upstream support a diverse overall fish fauna. Sixty-nine species have been found between Shawano and Lake Poygan. Most of these species are native inhabitants of the river, but some like the brassy minnow are likely present in the river only as strays from small tributaries and others such as the muskellunge have been introduced. The origin of 10 species – shortnose gar, gizzard shad, speckled chub, river shiner, channel shiner, pugnose minnow, bullhead minnow, western sand darter, slenderhead darter, and river darter – is unclear. All are characteristic of large rivers in the Mississippi River basin but have distributions in the Lake Michigan basin that are essentially limited to the Fox-Wolf River drainage (in some cases also including lower Green Bay or its tributary the Menominee River; Lyons et al., 2000). There are a few mussel species with a similar distribution pattern (Mathiak, 1979). Becker (1976, 1983) suggested that at least some of these fish species may be non-native to the Fox-Wolf system, having perhaps invaded the Lake Michigan basin from the Mississippi River basin only recently via a canal built in the 1800's between the Wisconsin River (Mississippi basin) and the upper Fox River at Portage. However, a regular flood connection between the Wisconsin and Fox rivers at Portage prior to construction of the canal provided a ready mechanism for natural colonization of these and other fishes from the Mississippi basin over the last several thousand years, making them possibly native to the lower Wolf (Becker, 1983; Lyons et al., 2000).

The rich diversity of the fish fauna and the presence of at least seven rare fishes indicate that the Lower Wolf has great ichthyological value above and beyond its fisheries. Conservation of the rare fishes is particularly important. As mentioned, the lower Wolf River speckled chub population is the only one of its kind in the entire Great Lakes basin. The only Great Lakes basin populations of the western sand darter occur in the Wolf, Embarrass, Waupaca, and Menominee rivers (Lyons et al., 2000). Of these four, the lower Wolf River appears to support the largest number of individuals (Lyons, unpublished data). The lake sturgeon occurs throughout the Great Lakes basin, but the Wolf River likely has the greatest reproduction of any river in the basin (Folz and Myers 1985). The pugnose minnow has been reported from the Lake Michigan basin only from the Fox-Wolf River drainage and from Wolf Lake in northeastern Illinois, where it no longer occurs (Becker, 1976). Becker (1976, 1983) believed river redhorse to be extirpated from the Lake Michigan basin, but recent surveys confirm their presence in the lower Wolf (Fago, 1992; Lyons et al., 2000; Appendix J), and Fox (Lyons et al., 2000) rivers in Wisconsin. The channel shiner, although not rare in the Mississippi basin of Wisconsin (Lyons et al., 2000), has its only population in the entire Great Lakes basin in the lower Wolf River. Earlier surveys (e.g., Fago, 1992) may have confused channel shiners in the lower Wolf with the very similar mimic shiner, which also occurs there. See Appendix J for a more complete discussion of the fish fauna.

At least seven different areas in this segment feature relatively high sandy banks which are important nesting sites for kingfishers, bank and rough-winged swallows and riverine turtles including the Threatened wood turtle. Condition of these banks varies, but they all are restorable to functional quality.

This section of stream and site 1 together were identified by The Nature Conservancy as an aquatic priority conservation site, meaning conservation activities will be initiated by The Nature Conservancy to ensure protection of the diversity of aquatic species found here. The segment was one of five such sites identified by The Nature Conservancy (The Nature Conservancy, 2000) as aquatic conservation priorities within the Wolf River basin. These TNC Sites were considered the best example of that type within the ecological drainage unit. This was based on the large number of aquatic animals, especially rare species, found here (The Nature Conservancy, 2000).

Management Considerations

Field surveyors noted a number of factors potentially affecting water quality in this section of river (see Appendix E.3. for a complete list). Some 24 sites were sampled in this segment and bank erosion was noted as significant at 13 sites, turbidity at 11, and silt at 7. Also noted as significant were septic effluent (4 sites), urban runoff (6 sites), and point source pollution (2 sites). The area around CTH X stands out in having five different factors with potential to significantly affect water quality. As with the segment immediately upstream, the conservation of natural features here will depend upon the protection of the river corridor and adjacent uplands. This section of the lower Wolf corridor includes some excellent natural communities, very few bridges, and low development potential. Agricultural runoff and future development should be addressed.

The prevalence of rip-rapping in this segment is a concern in several regards. Fish assemblage quality, as measured by the IBI, scored consistently lower on rip-rapped sites than other sites. Also, rip-rapping tends to be placed on eroding sandy banks which are becoming a scarce habitat on the lower Wolf. Nesting river turtles and bank burrowing birds rely on these sandy banks.

Another concern is the high volume of boat traffic and the impact on turtles attempting to bask. Turtles likely suffer stress from repeatedly being frightened from their basking logs (an essential nutritional behavior) and may be struck by watercraft. Also the wake from these craft alters shoreline microhabitats that are important for amphibious animals.

Eventually these rip-rapped shorelines will alter the dynamics of river morphology. Many wetland alterations such as ditching and diking have taken place in the floodplain of this section of river. Habitat specialists, including big river, backwater, extensive forest and extensive marsh species, warrant special attention here. Invasive species are a significant problem in some areas and should also receive attention.

Also of concern here is the presence of numerous semi-permanently moored fishing rafts along the shore. These provide the ability for occupants to inhabit riparian shorelines that would otherwise be off limit to human habitation. A number of management concerns are presented by the presence of these structures.

Wolf River Corridor # 2 Aquatic Animal EO's

Wolf River (CTH CCC to Lake Poygan)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
a water scavenging beetle	<i>Hydrochara spangleri</i>	2000		SC/N	BEETLE^
a Dubiraphia riffle beetle	<i>Dubiraphia bivittata</i>	2000		SC/N	BEETLE^
a predaceous diving beetle	<i>Agabetes acuductus</i>	2000		SC/N	BEETLE^
a predaceous diving beetle	<i>Lioporeus triangularis</i>	1999		SC/N	BEETLE^
a predaceous diving beetle	<i>Matus bicarinatus</i>	2000		SC/N	BEETLE^

Wolf River (CTH CCC to Lake Poygan)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
a riffle beetle	<i>Stenelmis antennalis</i>	1999		SC/N	BEETLE^
a riffle beetle	<i>Stenelmis bicarinata</i>	1999		SC/N	BEETLE^
a riffle beetle	<i>Stenelmis fuscata</i>	1999		SC/N	BEETLE^
a water scavenging beetle	<i>Enochrus consortus</i>	2000		SC/N	BEETLE^
diving beetle	<i>Ilybius ignarus</i>	2000		SC/N	BEETLE^
a creeping water bug	<i>Pelocoris femorata</i>	1999		SC/N	BUG^
a velvet waterbug	<i>Hebrus buenoi</i>	2000		SC/N	BUG^
a water measurer	<i>Hydrometra martini</i>	2000		SC/N	BUG^
a water scorpion	<i>Nepa apiculata</i>	2000		SC/N	BUG^
a water scorpion	<i>Ranatra nigra</i>	2000		SC/N	BUG^
a caddisfly	<i>Triaenodes nox</i>	2000		SC/N	CADDISFLY^
white river crayfish	<i>Procambarus acutus</i>	2000		SC/N	CRAYFISH
Palaemonetes kadiakensis	<i>Mississippi grass shrimp</i>	2001		SC/N	CRAYFISH
elegant spreadwing	<i>Lestes inaequalis</i>	2000		SC/N	DRAGONFLY^
elusive clubtail	<i>Stylurus notatus</i>	1999		SC/N	DRAGONFLY^
plains clubtail	<i>Gomphurus externus</i>	1999		SC/N	DRAGONFLY^
pygmy snaketail	<i>Ophiogomphus howei</i>	1999		THR	DRAGONFLY^
Stygian shadowfly	<i>Neurocordulia yamaskanensis</i>	1999		SC/N	DRAGONFLY^
greater redhorse	<i>Moxostoma valenciennesi</i>	2000		THR	FISH^
lake chubsucker	<i>Erimyzon sucetta</i>	1981		SC/N	FISH^
lake sturgeon	<i>Acipenser fulvescens</i>	2001		SC/H	FISH^
pugnose minnow	<i>Opsopoeodus emiliae</i>	2000		SC/N	FISH^
river redhorse	<i>Moxostoma carinatum</i>	2000		THR	FISH^
weed shiner	<i>Notropis texanus</i>	2001		SC/N	FISH^
western sand darter	<i>Etheostoma clarum</i>	2001		SC/N	FISH^
a caddisfly	<i>Hydropsyche bidens</i>	1999		SC/N	INSECT^
a water boatman	<i>Hesperocorixa semilucida</i>	2000		SC/N	INSECT^
a Heptageniid mayfly	<i>Pseudiron centralis</i>	1999		SC/N	MAYFLY^
a mayfly	<i>Baetisca obesa</i>	1999		SC/N	MAYFLY^
a primitive minnow mayfly	<i>Parameletus chelifera</i>	1993		SC/N	MAYFLY^
a small minnow mayfly	<i>Paracloeodes minutus</i>	1992		SC/N	MAYFLY^
a small minnow mayfly	<i>Plauditus cestus</i>	1999		SC/N	MAYFLY^
an Ephemerid mayfly	<i>Pentagenia vittigera</i>	1992		SC/N	MAYFLY^
Buckhorn	<i>Tritogonia verrucosa</i>	1995		THR	MUSSEL^
Elktoe	<i>Alasmidonta marginata</i>	1995		SC/H	MUSSEL^
round pigtoe	<i>Pleurobema sintoxia</i>	1995		SC/H	MUSSEL^
Salamander mussel	<i>Simpsonaias ambigua</i>	1989		THR	MUSSEL^
Snuffbox	<i>Epioblasma triquetra</i>	1995		END	MUSSEL^
wood turtle	<i>Clemmys insculpta</i>	2000		THR	TURTLE^

3. Lower Embarrass River Corridor

Ecological Landscape: Northern Lake Michigan Coastal and Central Lake Michigan Coastal

Town-Ranges: T22N-R 14-15E; T23-25N-R 15E; T26N-R 14-15E

River Miles: 55

Site Description

This priority stream segment includes the lower 55 miles of the Embarrass River corridor beginning at the dam in Pella and continuing downstream to New London where it joins the Wolf River. The Wolf River itself has about 30 unimpounded river-miles below the confluence of the Embarrass, which in total results in about 85 river miles of free flowing warm water stream. Land cover in the Embarrass watershed below Pella is mostly farmland with a significant amount of forest, especially along the river corridor. Below STH 156 the river begins to meander in a well defined floodplain. This section of stream is classified as a small river with warm water, high alkalinity, moderate to low gradient, with mixed surface and groundwater sources. The upper two-fifths of this segment (above STH 156) has low runoff and high groundwater input, while the lower three-fifths of this segment has high runoff and low groundwater input. Water is turbid and bottom substrates are sand, rock, and gravel upstream, and predominantly firm sand and silt in the lower portion.

Site Significance

This segment of river is similar to the lower Wolf River to which it is tributary in that it harbors an excellent diversity of aquatic animals that are generally restricted to large river habitats. These include 95 aquatic insects and crustaceans, 14 mussels, and 68 fish species. The area below the dam at Pella is significant in that it harbors one of the few likely viable populations of the globally rare snuffbox mussel. Just upstream of the impoundment at Pella (and this segment) there is very high macroinvertebrate diversity.

There is also an excellent diversity of Endangered, Threatened, and Special Concern species here including four beetles, two dragonflies, three fish, one caddisfly, two stoneflies, two mayflies, and three mussels. Six of these species are globally rare and three are state Endangered or Threatened.

This section of stream was identified by The Nature Conservancy as a site of ecoregional significance, meaning conservation activities will be initiated by The Nature Conservancy to ensure protection of the diversity of aquatic species found here. The segment was one of five such sites identified by The Nature Conservancy as aquatic conservation priorities within the Wolf River basin. These TNC Sites were considered the best example of that type within the ecological drainage unit. This was based on the large number of aquatic animals, especially rare species, found here. See Part 1 for a description of TNC's Ecoregional Planning Process (The Nature Conservancy, 2000).

Management Considerations

The effects of dam operations at Pella on rare species found up and down stream will need to be evaluated. It appears that this dam is a barrier to upstream movement of lake sturgeon and snuffbox mussels. The Embarrass just before it enters the impoundment (Pella Pond) has the highest macroinvertebrate site diversity found in the basin. Construction of the Pella Pond likely

altered the downstream extent of this rich fauna. Management options that address agricultural runoff and future development should be considered. Field surveyors noted turbidity, siltation, cropland runoff, and bank erosion as significant factors potentially affecting water quality at the 13 sites sampled (Appendix E.3).

Lower Embarrass River Corridor Aquatic Animal EO's

Embarrass River (Pella dam to mouth)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
a predaceous beetle	<i>Laccobius reflexipennis</i>	2000		SC/N	BEETLE
a riffle beetle	<i>Stenelmis bicarinata</i>	1999		SC/N	BEETLE^
a riffle beetle	<i>Stenelmis fuscata</i>	1999		SC/N	BEETLE^
a water scavenging beetle	<i>Sperchopsis tessellatus</i>	1999		SC/N	BEETLE^
elusive clubtail	<i>Stylurus notatus</i>	1999		SC/N	DRAGONFLY^
pygmy snaketail	<i>Ophiogomphus howei</i>	1992		THR	DRAGONFLY^
lake sturgeon	<i>Acipenser fulvescens</i>	1980		SC/H	FISH^
weed shiner	<i>Notropis texanus</i>	1979		SC/N	FISH^
western sand darter	<i>Etheostoma clarum</i>	1999		SC/N	FISH^
a caddisfly	<i>Hydropsyche bidens</i>	1999		SC/N	INSECT^
a Perlid stonefly	<i>Isoperla bilineata</i>	1999		SC/N	INSECT^
a Perlid stonefly	<i>Isoperla marlynia</i>	1999		SC/N	INSECT^
a Heptageniid mayfly	<i>Pseudiron centralis</i>	1999		SC/N	MAYFLY^
a mayfly	<i>Baetisca obesa</i>	1999		SC/N	MAYFLY^
Elktoe	<i>Alasmidonta marginata</i>	1995		SC/H	MUSSEL^
salamander mussel	<i>Simpsonaias ambigua</i>	1988		THR	MUSSEL^
Snuffbox	<i>Epioblasma triquetra</i>	1995		END	MUSSEL^

4. Little Wolf River Corridor

Ecological Landscapes: Central Lake Michigan Coastal and Southeastern Glacial Plain
Town-Ranges: T22N-R 13-14E; T23N-R 13E
River Miles: about 15

Site Description

This priority stream segment begins with the North Branch of the Little Wolf at the dam in Manawa and continues as the mainstem of the Little Wolf below the confluence of the South Branch of the Little Wolf River until it joins the Wolf River. This comprises approximately 15 river miles. Below the confluence, the Wolf River has approximately 25 unimpounded river-miles which, in combination with the Little Wolf, creates a relatively long free flowing warm water stream. Land cover in the Little Wolf watershed below Manawa is mostly farmland with frequent small forests. Much of the riverbank abuts farmland directly, except for the last few miles where extensive floodplain forest predominates. Overall this is a slow, clear, hard warm water stream with some sections of moderate current and rapids. Upstream sections of both branches harbor cool to coldwater species.

Site Significance

This segment of river is similar to the lower Wolf River to which it is tributary in that it harbors a good number of rare aquatic animals that are generally restricted to large river habitats. These include 69 aquatic insects and arthropods, two mussels, and 49 fish species. There also are stretches of fast water and rapids - uncommon habitat in the lower Wolf Basin.

There is also an excellent diversity of Endangered, Threatened, and Special Concern species here including one beetle, four dragonflies, one mayfly, three fish, and one mussel. Four of these species are globally rare, and two are state Endangered or Threatened.

Management Considerations

Field surveyors noted several factors potentially affecting water quality including exotics, cropland runoff, and bank erosion. Septic and urban impacts were noted at few sites. See Appendix E.3 for a full list. Management options that address agricultural runoff and future development should be considered. The effects of dam operations at Manawa on rare species found downstream will need to be evaluated.

Little Wolf River Corridor Aquatic Animal EO's

Little Wolf River (Manawa dam to mouth)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
a riffle beetle	<i>Stenelmis bicarinata</i>	1999		SC/N	BEETLE^
dark rubyspot	<i>Hetaerina titia</i>	1999		SC/N	DRAGONFLY^
pygmy snaketail	<i>Ophiogomphus howei</i>	1999		THR	DRAGONFLY^
skillet clubtail	<i>Gomphurus ventricosus</i>	1999		SC/N	DRAGONFLY^
Stygian shadowfly	<i>Neurocordulia yamaskanensis</i>	1999		SC/N	DRAGONFLY^
greater redhorse	<i>Moxostoma valenciennesi</i>	1994		THR	FISH^
lake sturgeon	<i>Acipenser fulvescens</i>	1991		SC/H	FISH^
western sand darter	<i>Etheostoma clarum</i>	1979		SC/N	FISH^

Little Wolf River (Manawa dam to mouth)

Common Name	Scientific Name	Last Observation	US ESA Status	State Status	Group name
a Caenid mayfly	<i>Brachycercus prudens</i>	1999		SC/N	MAYFLY^
snuffbox	<i>Epioblasma triquetra</i>	1988		END	MUSSEL^

Appendix D

Upper Wolf River Basin Priority Inventory Site Summaries 2000 (including rare animal and plants documented in 1999-2000)

Inventory in the northern portion of the basin, demarcated by Hwy 29 in Shawano County, should be considered preliminary. For all but a few specific species only one field season of recent work has been completed. More comprehensive inventories at the natural community and species levels are needed to determine species distributions and site boundaries, as well as to better characterize this portion of the Wolf River Basin. The inventory planning and field survey methods are detailed in Appendix A.

Forest County

Bog Brook State Wildlife Area T34N R13E S25,36; T34N R14E 30

This site is primarily in state ownership and features a large *Carex* and *Sphagnum* dominated poor fen mat, and emergent marsh floating on a medium hard water, slightly acid flowage created by a six foot head dam on Bog Brook and maintained by Forest County. The associated marsh vegetation has a distinct zonation pattern, with a broad floating fen mat bordering the upland shore, giving way first to sometimes dense submergent aquatic beds and finally to an open water channel in the center. A wet mat of *Sphagnum* mosses underlies the marsh. Common or characteristic herbs include *Carex lasiocarpa*, *Calamagrostis canadensis*, *Campanula aparinoides*, *Potentilla palustris*, *Dulichium arundinaceum*, *Thelypteris palustris*, *Cicuta bulbifera*, *Onoclea sensibilis*, and discreet patches of *Typha angustifolia*. *Alnus incana* and *Betula pumila* are present in the shrub layer but are patchily distributed. The marsh occurs in a sand and gravel outwash plain within a rapidly developing, extensively forested matrix, along CTH DD just north of STH 52. The uplands surrounding the marsh have been intensively managed for timber; aspen and relatively young hardwoods are the current dominant cover types.

Himley Lake T34N R14E S4; T35N R4E S33

The site occurs within the Chequamegon - Nicolet National Forest, a few miles west of Wabeno in southern Forest County. The shore of this shallow, hard seepage lake is mostly upland with small inclusions of sedge meadow, alder thicket and boggy leatherleaf dominated areas. Characteristic species of the wetlands include: *Carex lacustris*, *C. stricta*, *Asclepias incarnata*, *Thelypteris palustris*, *Impatiens capensis*, *Alnus incana*, *Eupatorium perfoliatum*, *Aster borealis*, *Sium suave*, *Chamaedaphne calyculata*, *Larix laricina*. Submergent aquatic beds along the shore are sparse, and composed of with species including *Bidens* spp., *Potamogeton* spp., and *Najas flexilis*. An extensive wetland complex is also present along the outlet stream to its inlet at Roberts Lake. Development bordering the shore includes some drive-in campsites, an unpaved boat ramp and a single cabin on the northeastern corner of the lake. Uplands on all sides have been select cut and are dominated by a mix of aspen, paper birch, and maple with an occasional large white pine, hemlock or red oak. Intensive select cut management of the uplands and increased recreational use could threaten the water quality at this site. This lake should be considered for a non-motorized and electric motors only use restriction. The presence of freshwater sponges in the shallows of this lake is noteworthy. Two preliminary aquatic macroinvertebrate samples taken from the north and south ends of the lake yielded a somewhat low species richness value of four.

Lily Lake Fen T34N R13E S14,23

This privately owned site occurs on a ground moraine, three miles north of the Langlade County line, and just west of CTH DD. This wetland community is a high quality poor fen, occupying the southeastern most

shore of the lake and the lowland borders on both sides of the Lily River, continuing for ¾ of a mile south of the lake. This hard water, slightly acid, drainage lake is impounded by a four foot head dam approximately one mile south of the Lily River outlet. The fen is shrub dominated with diverse low shrub and herb layers. Characteristic species include *Myrica gale*, *Betula pumila*, *Chamaedaphne calyculata*, *Potentilla palustris*, *Carex lasiocarpa*, *Larix laricina*, *Sphagnum* spp., and *Thelypteris palustris*.

There are dense beds of diverse submergent vegetation present in the river channel. The characteristic species include: *Nymphaea odorata*, *Nuphar variegata*, *Ceratophyllum demersum* *Myriophyllum* sp., *Elodea canadensis*, *Najas flexilis*, *Potamogeton amplifolius*, *P. natans* and *P. robbinsii*. The uplands adjacent to the marsh have been developed with cottages, and in the surrounding area have been managed for timber or developed as low density residential areas. The lake is a popular fishing and boating spot. Continuing development of the surrounding area and a likely increase in boat traffic on both the lake and river may threaten the persistence of this community. This site should be a priority for acquisition or a conservation and management easement.

Little Rice Lake T36N_R12E S8-10 16

This muck bottomed, soft water (M.P.A. 35-p.p.m.) drainage lake occurs on a ground moraine, within a state wildlife area located four miles northwest of Crandon. This impoundment was created by the 1936 installation of an 8 foot head dam at the outlet of the Wolf River. An extensive wild rice (*Zizania palustris*) bed of natural origin covers the northernmost portion of the flowage. This rice bed occurs with a diverse suite of associates including *Pontederia cordata*, and the submergent aquatics *Ceratophyllum demersum*, *Nymphaea odorata*, *Potamogeton natans*, *P. amplifolius*, *P. robbinsii*, *P. pectinatus*, *Myriophyllum* sp., and *Najas flexilis*. The water is light brown and moderate in transparency. The water depth in the rice stands is around a meter or so with the lake's maximum depth reaching over 3 meters. The rice bed has numerous channels meandering through its moderately dense stands. Even the densest stands are navigable with a canoe. There are duck blinds present on the emergent wetland edges though few ducks were during the August 2000 survey.

The wetland vegetation complex has distinct zones with Wild Rice (*Zizania palustris*) dominating the open water areas, a fairly diverse emergent marsh dominated by *Carex* and *Typha* sp., and more boggy areas with leatherleaf (*Chamaedaphne*) and tamarack prominent. The rice marsh borders uplands that are being used for timber production and residential purposes. Maintenance of the water levels, a minor exotic infestation of purple loosestrife, and increased recreational boating traffic are threats to this occurrence. Two special concern water beetles, a whirligig beetle (*Gyrinus impressicollis*) and a crawling beetle (*Halipplus pantherinus*) were documented from this site.

Shoe Lake T34N R14E S16,21

This site is located four miles west of Wabeno, within the Chequamegon - Nicolet National Forest. Most of the shoreline is in public ownership. A medium hard water spring lake, Shoe Lake has clear, alkaline water of low transparency. Three dwellings are present on private in-holdings on the shore of the lake. There are scattered beds of submergent aquatics, where *Nymphaea odorata*, *Nuphar variegata*, *Potamogeton natans* are the most prevalent species. The best development of these beds is near the outlet stream, which has been dammed by beaver a short way below the carry-in boat landing.

Along the southwestern and northernmost shores are boggy shrub dominated wetlands. The wetlands along the southern portion of the lake are small while more extensive *Chamaedaphne* dominated shrub swamp (muskeg grading into poor fen) forms a "cap" on the northern portion of the lake. Characteristic species include *Larix*, *Carex lasiocarpa*, *C. comosa*, *Calamagrostis canadensis*, *Sphagnum* sp., *Potentilla palustris*, *Typha* sp., *Dulichium arundinaceum*, *Hypericum pyramidatum*, *Muhlenbergia glomerata*, and *Galium tinctorium*. The small undeveloped island in the middle of the lake has a small moderate quality mesic forest

dominated by conifers with a very vigorous and extensive population of yew (*Taxus canadensis*). The uplands surrounding the lake are predominately second growth northern hardwoods with vigorous conifer regeneration (*Abies balsamea* and *Pinus strobus*) present along the shore. Due to recent increased development of the shoreline, the lake is no longer natural area quality. The bog areas along the northern edge of the lake should be protected from potential threats including increased wave action and water level manipulation.

Langlade County

Sites along the main stem of the Wolf River progressing from the Langlade County line in the south to Town of Langlade wayside in the north.

Hanson Rapids - CTH M Woods T31N R15E S31

This site is located along the west side of Wolf River and stretches from CTH M to the southern boundary Gardener Dam Boy Scout lands. This site is a rich northern mesic forest with a quite diverse complement of canopy trees, shrubs and herbaceous species. Local dominants include hemlock (*Tsuga*), and sugar maple (*Acer saccharum*), and important associates include beech *Fagus*, yellow birch *Betula alleghaniensis*, basswood *Tilia*, and balsam fir (*Abies balsamea*). The uplands beyond the 300', no-cut setback from the river have been selectively harvested previously. The stand classed as 15"+ D.B.H. northern hardwoods is marked for cutting, but the timber has not yet been sold (as summer 2000). There is a well-used footpath through the terrace forest right along the river that links up with the Boy Scout camp to the north. Hemlock stands with a depauperate groundlayer dominate the lower terrace along the river. Rich northern hardwoods occupy the gently sloping, silt loam capped pitted plains above the river corridor. Characteristic groundlayer species include *Sanguinaria canadensis*, *Actaea rubra*, *Adiantum pedatum*, *Arisaema triphyllum*, *Polygonatum biflorum*, *Claytonia virginica*, *Osmorhiza claytoni*, *Aralia nudicaulis*, *Trillium cernuum*, and *Aster macrophyllum*.

The upland forests surrounding this site have been managed for timber by select cutting. Second-growth northern hardwoods and aspen are the dominant cover types. The area to the west and south has been developed for recreational and low density residential uses.

This community type is very well represented on the Menominee Indian Reservation, only a short distance south of this site. However, when combined with neighboring forestlands to the north and east this site does provide an opportunity to develop a block of interior forest with older-growth characteristics. Consideration should be given to expanding the no-cut zone further away from the river or extending the timber rotations. Another option to consider is setting the area aside as a part of a large-scale natural area that could include the undeveloped Boy Scout lands to the north and east.

Gardner Dam Boy Scout / DNR Woods T31N R14E S25, 26; T31N R15E S30;

The Gardener Dam Boy Scout Camp is a major landowner with significant in-holdings within the Wolf River State Fishery Area (WRSFA) boundary. Located along the Wolf River in southern Langlade County, this site is just upstream from the CTH M woods. It occupies the silt loam capped pitted outwash plain south of the river, the sandy loam capped gravelly hummock complex north of the river and lower mucky alluvial terraces bordering the Wolf River. This woods features a mixture of upland and lowland northern forest types of variable quality. Included are an old growth stand of hemlock hardwoods and a small, older growth character white pine stand, both are on the northern side of the river. Outside the 300' no-cut zone bordering the Wolf River, young aspen and northern hardwoods dominate. Within the river corridor on the loamy soils, second growth northern hardwoods and small stands of hemlock hardwoods are present. Characteristic species

include *Tsuga canadensis*, *Pinus strobus*, *Acer saccharum*, *Populus* spp., *Tilia americana*, *Dryopteris intermedia*, *Viola pubescens*, *Polygonatum biflora*, *P. pubescens*, *Diervilla lonicera*, *Adiantum pedatum*, *Actaea pachypoda*, *Carex pensylvanica*, *Maianthemum canadense*, *Hydrophyllum virginianum*, *Athyrium filix-femina*, and *Caulophyllum thalictroides*. Cedar and black ash dominate the lower terraces and drainages. These stands are of moderate quality. The site is fragmented by logging access roads, well-worn path paths, and camp facility development. The possible conservation actions for this site were described in the Hanson Rapids - CTH M woods summary. Small mammal trapping was conducted at this site but no rare species were documented.

The Ledges T31N R14E S35

This site lies within the WRSFA due west of Gardener Dam Boy Scout/DNR woods, at the intersection of pitted plains and unpitted alluvial terraces. It features a mixture of northern upland and lowland forest types. In the uplands, the northern mesic forests are dominated by *Tsuga* on the steep north facing slopes, and *Acer saccharum* or *Populus* spp. on the more gentle slopes and ridge tops. The lowlands bordering the river are seepy and springy, with bands of northern wet-mesic forest dominated by white cedar (*Thuja occidentalis*) and black ash (*Fraxinus nigra*). The upland forests occupying the slopes and ridge top are of variable quality with local areas of richer indicator species such as *Hydrophyllum virginianum*, *Caulophyllum thalictroides*, *Sanguinaria canadensis*, but with other areas characterized by early successional or regenerating species. The most prevalent herbaceous species in the upland forest include *Aster macrophyllus*, *Dryopteris intermedia*, *Lycopodium* spp. *Aralia nudicaulis*. The lowland terrace forests bordering the Wolf River are variable in area, canopy closure, and composition. They are seepy and springy with a fair diversity of groundlayer species including, *Glyceria striata*, *Carex leptalea*, *Phryma leptostachya*, *Chelone glabra*, *Eupatorium maculatum*, *Epilobium* sp., *Laportea canadensis*, *Onoclea sensibilis*, and *Impatiens capensis*.

Access and logging roads are present along the shore of the Wolf River and the upland forest has been logged previously. The dredge spoil islands created by DNR Fisheries are dominated by purple loosestrife and reed canary grass with a few common native wetland species as associates. Conversion of the surrounding uplands to agricultural fields, and residential/recreational uses combined with the emphasis on commercial timber production in the area have significantly limited the natural area qualities of this site. Extending the timber rotations in the area may offer potential for this site to contribute to the development and restoration of old growth forest characteristics along the Wolf River between STH 64 and CTH M.

Spring Creek Woods T31N R14E S26, 27, 35

This site lies within the WRSFA and surrounding uplands due west of the Ledges. The plant communities bordering this portion of the Wolf River include small pockets of alder thicket, spring runs, and more extensive stands of northern mesic and northern wet-mesic forest as well as hardwood swamp. The upland slopes and ridges in the southern portion of the site are characterized by extensive stands of regenerating 0-5" D.B.H. aspen; the second growth northern uplands are more intact with 5-11" D.B.H. *Quercus rubra* and *Acer Saccharum* dominating. Closer to the river, a narrow band of larger D.B.H. northern mesic forest is dominated by second growth *Acer saccharum*, *Abies balsamea*, and *Populus* species. The lowland terrace forest alternates between hardwood swamp dominated by *Fraxinus nigra* with an average D.B.H. of 5-11" (in a local stand they reach almost 20"), and northern wet-mesic forest stands dominated by *Thuja*. Small *Tsuga* inclusions are present on slightly higher microsites. These low terraces are generally springy and seepy with frequent moss covered boulders, as well as hummock and hollow topography. Some of the *Thuja* stands have fairly sizable blowdowns. These swamps are rich in groundlayer species with numerous prevalent and characteristic species including *Impatiens capensis*, many *Carex* spp., *Athyrium filix-femina*, *Onoclea sensibilis*, *Cystopteris bulbifera*, and *Caltha palustris*.

A network of access and logging roads is present in the uplands. Much of the area outside the 300' no-cut zone has been clear cut or intensively select cut. The surrounding uplands are currently used for abandoned and active agricultural fields (hay, pasture, and sunflower), low density residential and recreational

development, and timber production. These neighboring land-uses have significantly limited the conservation values of this site. Extending the timber rotations in the area may offer potential for this site to contribute to the development and restoration of old growth forest characteristics along the Wolf River between STH 64 and CTH M. This portion of the Wolf River is used intensively by rafters, canoe/kayakers, and anglers.

Twenty day rapids T31N R14E S22, 23

This site lies within the WRSFA and is the next site north from the Spring Creek area. It is an existing but unmapped site in the Natural Heritage Inventory database with good survey information from the original county survey in the early 1980's. Due to our emphasis on sites with little or no previous documentation, the interior of this site was not visited in person. But, from visits to the northern and southern most portions of this area and the examination of aerial photos, it is apparent that a high quality closed canopy, large, mature cedar swamp is still intact at this site.

Spaulding access to bend above Twenty Day Rapids T31N R14E S15, 22, 23

Located just above Twenty Day Rapids on the western side of the river, this site is located on an unpitted outwash plain and alluvial terrace. The communities bordering this section of the Wolf River between Horserace and Twenty Day Rapids, are combination of lowland forests, thickets and predominately disturbed upland forest types. In the narrow bands of swampy and springy areas, alder thicket, and cedar or black ash swamps dominate. Some of the typical swamp understory species are present including *Mitella nuda*, *Onoclea sensibilis*, *Dryopteris cristata*, and *Circaea alpina*, but disturbance indicators such are *Laportea canadensis* are also present. Selectively cut, small diameter northern hardwoods dominate the more extensive uplands. Sugar maple (*Acer saccharum*), which dominates away from the river, paper birch (*Betula papyrifera*), red maple (*Acer rubrum*), balsam fir (*Abies balsamea*) and hemlock (*Tsuga canadensis*), are prevalent canopy species closer to the river. Sugar maple (*Acer saccharum*) dominates the subcanopy throughout the uplands. Prevalent sapling and seedling species include American elm (*Ulmus americana*), beech (*Fagus grandifolia*), red maple (*Acer rubrum*) and green ash (*Fraxinus pennsylvanica*). The groundlayer is relatively depauperate with characteristic species including *Aster macrophyllus*, five *Lycopodium* spp., *Vaccinium myrtilloides*, *Pteridium aquilinum*, *Osmorhiza claytoni*, and *Hepatica americana*.

The surrounding uplands have been intensively managed for timber and developed for low density residential and recreational uses. The condition of the site as well as that of the surrounding forest lands significantly limits the conservation values of this site. It may hold some potential as part of a long-term landscape scale restoration of natural process-driven forest and wetland communities along the Wolf River between STH 64 and CTH M.

Rocky Rips Road to Horserace Rapids cedar swamp and uplands T31N R14E S10, 15

This site is located on a rocky pitted outwash plain and alluvial terrace east of the Wolf River. It stretches from the bottom of Crowle Rapids to the private in-holding south of Horserace Rapids. This site is a mix of highly disturbed to relatively undisturbed northern forest community types, including northern dry-mesic, northern mesic and northern wet-mesic forest stands. The rolling, more upland slopes and higher terraces, both closer to and further away from the river, feature a diverse suite of canopy species with local dominants that include sugar maple (*Acer saccharum*), hemlock (*Tsuga canadensis*), and aspen (*Populus* spp.). Interesting or important canopy and subcanopy associates include *Ostrya*, *Carpinus*, *Picea glauca*, *Pinus strobus*, *Abies balsamea*, and *Quercus rubra*.

The least disturbed portions of this site are the northern wet-mesic forest stands located on the lower terraces and at the base of the sloping outwash plain. Canopy coverage in these stands is variable, but the high quality portions have developed an "old growth character", with many down and leaning cedar trees, and natural gaps with dense local sapling sized regeneration of *Abies*, *Thuja*, and *Tsuga*. These stands are dominated by cedar (*Thuja occidentalis*). Black ash (*Fraxinus nigra*), yellow birch (*Betula alleghaniensis*), and hemlock

(*Tsuga canadensis*) are common local canopy and subcanopy associates. The d.b.h.'s average in the range of 5"- 15", with 20" d.b.h plus individuals of *Pinus* and *Tsuga* also present. The ground is covered with moss-covered boulders forming hummock and hollow microtopography. Characteristic species include *Coptis groenlandica*, *Equisetum scirpoides*, *Ribes lacustre*, *Solidago flexicaulis*, *Athyrium filix-femina*, *Dryopteris cristata*, *Mitella nuda*, *Asarum canadense*, *Pyrola secunda*, *Circaea alpina*, *Clintonia borealis*, *Trientalis borealis*, *Viola renifolia*, *Aralia racemosa*, and mosses other than *Sphagnum* spp..

The surrounding uplands are managed intensively for timber and the current forest is a mixture of second growth northern forest types. Species composition and sandy soils offer potential to manage at least a portion of the uplands at this site for white pine and red oak. This option should be given serious consideration. Intensive agricultural and low density residential developments are also present in the nearby uplands. This site does connect with variable quality conifer and hardwood stands that are present along the alluvial terrace, and outwash plains. Recreational uses of this portion of the Wolf River include canoeing and kayaking, and fishing.

Larzelere Rapids T31N R14E S4

Just upstream from the STH 64 crossing of the Wolf River, this portion of the WRSFA is highly disturbed. Tree felling by beaver and commercial timber harvesting are the main influences on the composition and structure of this forest. This site is situated on an outwash plain and alluvial terrace and the forest near the river is dominated by a mix of young aspen (*Populus tremuloides*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*), with cedar (*Thuja*) and hemlock (*Tsuga*) as minor associates. Average d.b.h.s are in the 5"-9" range, and there are many stumps as well as evidence of charring present. Seepy areas and spring runs are frequent on the lower slope. The upland slopes have been selectively cut and the canopy is fairly open. The forest on top of the slope is richer and dominated by sugar maple (*Acer saccharum*) in both the canopy and subcanopy, and hazelnut (*Corylus cornuta*) in the shrub layer. Associates include white ash (*Fraxinus americana*) in the canopy, and yellowbud (*Carya cordiformis*) in the sapling and seedling layers. Prevalent groundlayer species include *Aster macrophyllus*, *Pteridium aquilinum*, *Clintonia borealis*, *Rubus* sp., *Lycopodium obscurum*, and *Dryopteris intermedia*. Little coarse woody debris is present, mostly as fallen trunks.

Within this portion of the fishery area the uplands have been cleared and are now old field and fallow agricultural lands. On the adjacent lands, low density residential development, agriculture, and timber production are the main land-uses, and in this area they significantly altered the surrounding uplands and river. This section of the river is heavily used for recreational purposes including kayaking, canoeing, rafting and fishing.

Hemlock/Cedar Rapids T32N R14E S31, 32

This site is located within the WRSFA between the carry in public access parking lot off of STH 55, a mile south of Ninemile Hill and the bend below Oxbow Rapids. It occupies a rocky, pitted, rolling outwash plain and alluvial terrace bordering along the Wolf River. The site is a mosaic of northern mesic, northern wet-mesic, and hardwood swamp stands with moderate to high conservation values. The hemlock (*Tsuga canadensis*) stands occur on the intermittent higher drier terraces and slopes above the river within the WDNR's 300' "aesthetic management" (no-cut) zone. D.B.H.s average in the 15"-20" range, and a number of 20" plus d.b.h. individuals are present. Though these stands have over 70% canopy closure, there is little in the way of structural diversity. There are only sparse areas of sapling (*Abies*) regeneration, though there is fair amount of coarse woody debris present locally, both as standing snags and fallen trunks. The ground, seedling, and sapling layers are depauperate and generally have extremely low cover values, and *Tsuga* needle duff is the dominant ground cover. Characteristic species include *Tsuga canadensis*, *Maianthemum canadense*, *Lonicera canadensis*, *Clintonia borealis*, *Lycopodium lucidulum*, *L. obscurum*, *Monotropa uniflora*, and *Dryopteris intermedia*.

The undisturbed northern wet-mesic forest stands are dominated by cedar (*Thuja occidentalis*), and the hardwood swamp is dominated by black ash (*Fraxinus nigra*). These types occur on the lower terraces adjacent to the river, at the base of slopes or in lower basins away from the river, respectively. D.B.H.s average in the 5"-11" range with individuals reaching over 15". *Betula alleghaniensis* and *Abies balsamea* are the most common canopy and subcanopy/sapling associates.

Though these stands have variable canopy coverage, some structural diversity, including both coarse woody debris and standing snags, is present, although development is not exceedingly complex. There are patches of seedling and sapling sized regeneration but only spotty small seedlings of cedar are present; most of the regeneration is of *Fraxinus* spp. and *Abies*. The ground is seepy and boulder laden, with many pools, and hummock and hollow microtopography. The groundlayer is diverse, with characteristic species include *Rubus pubescens*, *Onoclea sensibilis*, *Caltha palustris*, *Lonicera canadensis*, *Carex intumescens*, *C. disperma*, *C. leptalea*, *Glyceria* sp., *Epilobium ciliatum*, *Circaea alpina*, *Mitella nuda*, *Dryopteris cristata*, and *Equisetum sylvaticum*.

The stands at this site vary in width with respect to the local topography, and at times stretch beyond the WDNR's 300' aesthetic management (no-cut) zone. There are scattered inclusions of alder thicket in seepages and along the river. The surrounding uplands are managed intensively for timber and the cover type is second or third growth northern hardwoods, with sugar maple and aspen as the most prevalent species. Intensive agricultural and low density residential developments are also present in the nearby uplands. This site does connect with other conifer and hardwood stands, in variable condition, that are also present along the alluvial terrace. Recreational uses of this portion of the Wolf River include canoeing, kayaking, and fishing.

Oxbow Rapids Hemlock Hardwoods 032N014E S30

This site is located 2.7 miles north of Langlade on STH 55, embedded in forested landscape along corridor of Wolf River. The Bear Caves State Natural Area is located 1 mile to the east and Oxbow Rapids State Natural Area is across the river to the west. Ownership is predominantly public (WDNR- Wolf River State Fishery Area) but also includes some private forest crop land. This second-growth mesic hemlock-hardwood forest is of moderate size (99 acres), but mature with no signs or recent disturbance, good context and significant microhabitat diversity. Set in the bottoms, on steep slopes, and on the plateau of the east bank of the Wolf River, the highest quality part of site is a nearly pure, older second-growth 12"-18" D.B.H. stand of hemlock (ca. 20 acres) at the tip of "oxbow". This stand has a sparse understory and groundlayer, and some seeps with white cedar are present. The remainder of the site (farther north and east) is sugar maple-dominated, hardwood forest (with scattered conifers, mainly hemlock, balsam fir) with yellow birch and basswood frequent associates. No beech was seen. Trees here range from 6"-14" d.b.h., with some up to 24". Sugar maple saplings are locally common in the shrublayer. The following species are common in the groundlayer: maiden-hair fern (*Adiantum pedatum*), wild sasparilla (*Aralia nudicaulis*), lady fern (*Athyrium filix-femina*), silvery spleenwort (*A. thelypteroides*), sedges (*Carex leptoneuria*, *C. pedunculata*, *C. pennsylvanica*), blue-bead lily (*Clintonia borealis*), wood fern (*Dryopteris carthusiana*), Virginia water-leaf (*Hydrophyllum virginianum*), Canada mayflower (*Maianthemum canadense*), sweet cicely (*Osmorhiza claytonii*), broad beech fern (*Phegopteris connectilis*), false melic grass (*Schizachne purpurascens*), zig-zag goldenrod (*Solidago flexicaulis*), early meadow-rue (*Thalictrum dioicum*), large-flowered trillium (*Trillium grandiflorum*), downy yellow violet (*Viola pubescens*). In spots, the understory is richly mesophytic with blue cohosh (*Caulophyllum thalictroides*), common name for genera???(*Dicentra* spp.), Canadian white violet (*Viola canadensis*), and plantain-leaved sedge (*Carex plantaginea*).

The plateau-top on the east edge of the site is very rugged with deep, steep-sided potholes filled in spots with piles of glacial erratic boulders. There has been no recent logging entry. This section of the river corridor

receives heavy recreational use (canoes/kayaks and rafts). Two old, infrequently used logging roads traverse the site from east to west and terminate at the Wolf River. The main uses of surrounding lands are commercial forestry and recreation, including seasonal residences, hunting, fishing, canoeing/rafting. Deer browse is moderate to heavy at this site and may alter vegetation composition and successional trends over time. Other threats include invasion by exotic species such as garlic mustard, and disturbance due to ATVs.

Site protection recommendations include maintenance of gated restrictions on motorized access from STH 55. Consideration should be given to the deferring or lengthening logging rotations, as well as management for old growth characteristics. Explore possibilities of connecting this site with the Bear Caves SNA to the east, as the intervening area appears to have a rugged, jumbled bouldery, forested topography that may be difficult to conduct forestry on. A linkage with Oxbow Rapids SNA to the west is also a legitimate consideration.

Hollister Bridge (Ninemile Rapids) to Burnt Point Rapids T32N R13E S24; T32N R14E S19

This site is located within the WFSFA on an alluvial terrace and hummocky end moraine bordering the west bank of the Wolf River. The natural communities present here include a high quality cedar swamp and upland inclusions dominated by hemlock (*Tsuga canadensis*) close to the river, and second-growth sugar maple (*Acer saccharum*) and paper birch (*Betula papyrifera*) away from the river. This site is bounded by intensively managed forest to the west. Characteristic species in the rocky cedar swamp include *Thuja occidentalis*, *Fraxinus nigra*, *Taxus canadensis*, *Trillium cernuum*, *Lonicera canadensis*, *Solidago flexicaulis*, *Oxalis montana*, *Cystopteris bulbifera*, and *Ribes lacustre*. A large blow-down has occurred at the northern edge of the swamp along the bottom of Burnt Point Rapids. A beaver dam on a spring run in that same area is flooding out the swamp forest to the northwest. The intensive timber management in the uplands to the west and south diminishes the natural area qualities of this site.

Burnt Point Rapids to Little Sheen Rapids (on the west side of the river) T32N R13E S11, 12, 13

The site is a mosaic of northern mesic and northern wet-mesic forest and hardwood swamp communities occupying a low, alluvial terrace along the Wolf River. The upland forests are second growth and dominated by 9-11" D.B.H. sugar maple (*Acer saccharum*). White and green ash (*Fraxinus americana* and *F. pennsylvanica*), yellow birch (*Betula alleghaniensis*) and aspen (*Populus* spp.) are canopy associates. The subcanopy and sapling layers are moderately developed, with white spruce (*Picea glauca*) and black cherry (*Prunus serotina*) in the subcanopy, and sugar maple in the sapling layer. The extensive swampy area has many spring runs flowing into the river, and has been greatly impacted by flooding associated with beaver activity. The swamp is quite variable in composition due to minor changes in microtopography and the resulting differences in the depth to the water table.

In the areas with standing water, small D.B.H. black ash (*Fraxinus nigra*) is the canopy dominant, *Cornus stolonifera* and *Alnus incana* are the most common shrubs. The canopy is very open and there are many small D.B.H. standing snags. Characteristic groundlayer species include *Typha*, *Carex* sp., *Eupatorium maculatum*, *E. perfoliatum*, *Impatiens capensis*, *Cirsium muticum*, and *Lycopus uniflorus*. Cedar (*Thuja occidentalis*) dominates the slightly higher areas, and balsam fir (*Abies balsamea*) is an important associate, D.B.H.s average 5"-9" in these stands. Red maple (*Acer rubrum*) and black ash (*Fraxinus nigra*) are present in the subcanopy. The ground is springy and most of the area is underlain by Sphagnum mosses. Characteristic groundlayer species include *Rhamnus alnifolia*, *Carex intumescens*, *Trientalis borealis*, *Coptis groenlandica*, *Dryopteris cristata*, *Ribes lacustre*, *Mitella nuda*, *Glyceria striata*, and *Sphagnum* sp.

The uplands surrounding the site are intensively managed for commercial timber production, with relatively small D.B.H. (5"-11") aspen and northern hardwoods dominant. These lands are a combination of industrial, private, and publicly-owned forestlands. There is an extensive network of logging roads traversing the uplands and bisecting the swamp itself. Overall, between the beaver activity and intensive timber production in the adjacent uplands, the natural communities in this area have been significantly altered. Removal of

some of the beaver dams may lead to the development of a more closed canopy forest in the low lying areas. An extension of the timber rotation in the surrounding uplands is a long-term consideration in this area to complement the extensive lowland forest types present.

Big and Little Sheen Rapids (east side of the river) T32N R13E 11, 12

This stand is located on a rocky unpitted outwash plain and alluvial terrace southeast of the public access on Wolf River Road. The lower rocky hummock and hollow swales and dry terraces just above the river are dominated by cedar (*Thuja occidentalis*), with black ash (*Fraxinus nigra*) as a local associate. Characteristic species in the mucky soiled, boulder strewn, springy swamp portion include *Rhamnus alnifolia*, *Cystopteris bulbifera*, *Gaultheria hispidula*, *Linnaea borealis*, *Mitella nuda*, *Dryopteris cristata*, and *Sphagnum* spp. On the slightly more upland sites away from the river, the disturbed but richer northern hardwoods are dominated by sugar maple (*Acer saccharum*), basswood (*Tilia americana*), green ash (*Fraxinus pennsylvanica*), hemlock (*Tsuga canadensis*), white spruce (*Picea glauca*) are canopy associates. Subcanopy species include *Carpinus*, *Ostrya*, *Tsuga*, and *Betula papyrifera*. Pockets of regeneration of balsam fir, sugar maple and basswood, are common and these even include some small natural gaps created by windthrow. A great diversity of species is present in the seedling and sapling layers including *Abies balsamea* which is the most prevalent species, *Betula alleghaniensis*, *Acer rubrum*, *Thuja* and *Tsuga*. Characteristic species of the upland stand include *Athyrium thelypteroides*, *Adiantum pedatum*, *Aralia nudicaulis*, *Carex pensylvanica*, *Actaea* sp., *Aster macrophyllus*, *Dryopteris intermedia*, and *Taxus canadensis*.

Logging and the removal of cedar woody debris have taken place throughout the stand, though a small amount of down coarse woody debris does persist locally. A well traveled footpath runs south along the river from the access parking lot, and multiple access roads lead through the forest to the river. Throughout the site, evidence of substantial browse pressure is present on sensitive herbaceous and woody species such as *Thuja*, and *Tsuga* seedlings, and sparse low *Taxus* clones which are few in number and stunted in growth form. This stand is surrounded by low density residential development, old fields, and intensively managed forestlands. The rich groundlayer may suggest that the site deserves consideration for the extension of timber harvest rotations on the upland portions of the site. The stand would also benefit from the closure of the multiple access roads traversing the stand southeast of the public access parking lot. This portion of the Wolf River is the most popular with recreational boaters.

Little Slough Gundy north to Big Slough Gundy Rapids (Lawton tract M.F.L. and DNR lands) T32N R13E S2, 3

This site is located on an unpitted outwash plain and alluvial terrace bordering the Wolf River. A portion of this site was documented in the original county survey by DNR-Research in the early 1980's with a note that further inspection was desirable. The area encompassed here is a mixture of fairly narrow bands of cedar swamp, and more extensive upland hardwood forest. The upland parts of the stand have been managed under the DNR's Managed Forest Law program. While the stand retains a diverse suite of canopy and groundlayer species including *Athyrium thelypteroides*, *Adiantum pedatum*, *Caulophyllum*, *Allium tricoccum*, the structure and composition of this tract is now predominantly influenced by the timber management. The hemlock stands have a fairly typical, depauperate groundlayer, and they occupy the steeper slopes. Yew (*Taxus*) is present here. Characteristic species of the upland forest stands include *Dirca palustris*, *Osmorhiza claytonii*, *Aralia nudicaulis*, *Carex pensylvanica*, *Actaea* sp., *Aster macrophyllus*, *Dryopteris intermedia*, and *Taxus canadensis*.

The DNR lands to the north are dominated by small D.B.H. aspen and northern hardwoods, with small patches of hemlock (*Tsuga*) and yellow birch (*Betula alleghaniensis*) present on the steep side slope. Sedges and grasses, particularly *Carex pensylvanica*, dominate the groundlayer. Overall the cedar swamp remains in good condition but the upland forest could be considered for management deferral to allow the further development of characteristics that are the result of natural versus human-made processes.

A state threatened dragonfly, the pygmy snaketail, is documented from the Wolf River in this area.

CTH A to Town of Langlade Wayside Park T33N R12E S13, 15, 16, 22, 23, 24; T33N R12E S17, 18, 19, Unpitted terraces and outwash plain landforms characterize this stretch of the Wolf River. The wetland plant communities bordering this section are of mixed quality. The very upper and lower portions of this river section have class two rapids, while the middle of this stretch is generally of lower gradient than elsewhere in the county. This has allowed a relatively extensive, yet vegetatively simple, emergent marsh, and smaller, species poor submergent aquatic beds to develop. The forests along this segment include extensive black ash (*Fraxinus nigra*) dominated hardwood swamps, mixed conifer dominated wetland forests with a boreal character (white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) are important associates in these stands) and smaller cedar (*Thuja occidentalis*) dominated northern wet-mesic forests. Reed canary grass and purple loosestrife are present along this river section, particularly in the emergent wetlands. Some of the adjacent uplands have been managed for timber and the river shore is mostly undeveloped, with only a few cabins and a road bordering the middle portion. Two gravel quarries are present in the Squaw creek area, and the groundlayer of the cedar forests in public waysides have been degraded by trampling and erosion that have denude the groundlayer along the river. The forests and wetlands bordering this stretch of river should be more thoroughly inventoried.

Langlade County sites not located on the main stem of the Wolf River.

Crestwood Sugarbush T31N R12E S28, 33

This site is located 2.5 miles south of Polar on both sides of Crestwood road, and on the west side of Polar road. It is privately owned and was surveyed from the road only. This sugarbush is a 110 acre, select-cut mesic forest on rolling, hummocky glacial drift, embedded in a predominantly agricultural landscape. Sugar maple is the canopy dominant, with trees to 18" D.B.H. present. Hemlock, basswood, elm, black cherry are also common, and the understory is varies from open to well-stocked with sugar maple seedlings. There is a well developed, lush spring and showy herbaceous layer, with large flowered trillium (*Trillium grandiflorum*), wild blue phlox (*Phlox divaricata*), Canadian and downy yellow violets (*Viola canadensis*, *V. pubescens*), wild ginger (*Asarum canadense*), dutchman's breeches (*Dicentra cucullaria*), lady fern (*Athyrium filix-femina*), Virginia water-leaf (*Hydrophyllum virginianum*), wild leek (*Allium tricoccum*), blue cohosh (*Caulophyllum thalictroides*), false rue-anemone (*Isopyrum biternatum*), large-flowered bellwort (*Uvularia grandiflora*), broad-leaved toothwort (*Dentaria diphylla*), zig-zag goldenrod (*Solidago flexicaulis*). Some old, low-grade logging lanes are visible and the least disturbed area is along the north side of Crestwood road

County Line Oaks T34N R12E S3, T35N 12E S34

This red oak dominated forest stand is located on the crest of a drumlin, within the Langlade County Forest, east of STH 55 and just south of Mole Lake. The site has been selectively cut recently, leaving a fairly monotypic stand of red oak. The shrub layer is dense and relatively species rich; *Corylus*, *Hamamelis*, *Viburnum acerifloium*, *Acer rubrum* and *Rubus sp.* are prevalent. Characteristic groundlayer species include *Pteridium*, *Thalictrum dioicum*, *Polygonatum pubescens*, *Streptopus roseus*, *Aralia nudicaulis*, and *Diervilla lonicera*. This stand and the surrounding forested uplands have been intensively managed for timber products and developed with an extensive network of A.T.V. trails. An intact swamp of cedar and alder borders this site on the east. This site has been included in this inventory because it is an underrepresented community type within the basin, however better examples may exist elsewhere in the basin.

Demlow Lakes Swamp 030N012E S3

This site is located 5.5 miles southeast of Antigo, on Hill road 3 miles south of STH 64. It is part of a State Fishery Area managed by the WDNR. It is located in a matrix of agricultural and commercial private forestry land. This is a small (15 acre) but undisturbed white cedar-dominated seepage swamp with spring runs

surrounding the small, undeveloped Demlow lakes, Maxwell Springs, and the headwaters of Mayking Creek, a tributary of the Red River. Cedar is dominant, mostly ranging from 3"-15" D.B.H., with some trees and very old cut stumps reaching 30"D.B.H. Balsam fir, yellow birch, and hemlock are locally frequent and in the same size range. Old stumps are present but there has been no recent cutting. Deer browse vulnerable species such as yew (*Taxus*) and blue-bead lily (*Clintonia*) are abundant (and appeared healthy) in the understory, and locally there is cedar and hemlock regeneration. The general health and integrity of the forest (including lack of deer browse in an agricultural matrix) is noteworthy.

The best seeps and spring runs are at the northern and northwestern end of upper Demlow Lake, with cold, shallow water flowing over a sandy bottom. Frequent understory species are lady fern (*Athyrium filix-femina*), wood ferns (*Dryopteris* spp), long stalk sedge (*Carex pedunculata*), blue-bead lily (*Clintonia*), oak fern (*Gymnocarpium*), orange jewelweed (*Impatiens capensis*), Canada mayflower (*Maianthemum*), naked miterwort (*Mitella nuda*), northern wood sorrel (*Oxalis montana*), and bulbet bladder fern (*Cystopteris bulbifera*). Some semi-open hillside seeps at the far northwestern property line have purplestem angelica (*Angelica atropurpurea*), shining aster (*Aster firmus*), fowl meadow grass (*Poa palustris*), mint (*Mentha*), swamp thistle (*Cirsium muticum*), and golden ragwort (*Senecio aureus*). Small fenlike mats on the shores of lower Demlow lakes have, panicked sedge (*Carex diandra*), spikerushes (*Eleocharis* spp.), great water dock (*Rumex orbiculatus*), marsh-marigold (*Caltha palustris*), bog willow-herb (*Epilobium leptophyllum*), and round-leaved monkey flower (*Mimulus glabratus*). The main use of the site is for recreation, predominantly fishing and hunting.

Elmhurst Maples T30N R11E S29

This site is located 5.25 miles south, southwest of Antigo on the west side Old 26 Road. It is privately owned and was surveyed from road only. It is embedded in a matrix of agricultural land, rapidly developing residential areas, and moderately to heavily select-cut hardwood forests. This small (45 acre) but very rich older second growth forest composed mostly of hardwoods is located on a rolling, hummocky, southwest to northeast trending moraine separating the Wisconsin and Wolf River drainages. The dominant trees are 8"-21" D.B.H. sugar maple, with individual trees reaching up to 27". Basswood and white ash are frequent associates, while hemlock is uncommon, and butternut rare (a single 8" tree was seen). The understory is generally open, lacking dense thickets of maple saplings, brushy gooseberries (*Ribes* spp.) and bramble (*Rubus* spp.). The understory is very rich and free of exotic species, with wild leek (*Allium tricoccum*), large-flowered trillium (*Trillium grandiflorum*), and Virginia water-leaf (*Hydrophyllum virginianum*) dominant. Other frequent species include blue cohosh (*Caulophyllum thalictroides*), dutchman's breeches (*Dicentra cucullaria*), leatherwood (*Dirca palustris*), broad-leaved toothwort (*Dentaria diphylla*), long-beaked sedge (*Carex sprengelii*), sweet cicely (*Osmorhiza claytonii*), white trout lily (*Erythronium americanum*), wild blue phlox (*Phlox divaricata*), Carolina spring-beauty (*Claytonia caroliniana*), downy yellow violet (*Viola pubescens*), large-flowered bellwort (*Uvularia grandiflora*), and false rue-anemone (*Isopyrum biternatum*). No recent disturbance was noted. Consideration of special protection is warranted, as so few examples of older successional stages of this forest type have been formally protected.

Emil Springs area T32N R12E S30-32

This site is located three miles east of Lily. The DNR property at the spring is at the intersection of a till plain and postglacial organic sediment deposits. The site is a disturbed mosaic of northern upland and lowland forests, including an open pond created by a beaver dam, and surrounded by alder thicket. There are many species indicative of the springy nature of the site. Characteristic species include *Platanthera hyperborea*, *Symplocarpus foetidus*, *Carex* sp. and *Mitella nuda*. The uplands are intensively managed for timber, and small (5"-11") D.B.H. northern hardwoods now dominate. The surrounding privately-owned uplands have also been intensively managed for timber products; aspen and young hardwoods are the dominant cover types there. Many logging roads traverse the area. The beaver activity combined with the intensive timber

production in the adjacent uplands has significantly altered both uplands and wetlands within the site, and surrounding lands. The main conservation value of the site is the public ownership of the spring itself.

Evergreen State Fishery Area T31N R14E S30, 31

This DNR-owned site is located southeast of CTH P on unpitted outwash terraces and plains, and alluvial terraces bordering the Evergreen River. The upland forests are second growth, dominated by sugar maple (*Acer saccharum*) and trembling aspen (*Populus tremuloides*) with balsam fir an important understory species. Yellow birch (*Betula alleghaniensis*) is present locally. Sedges, particularly Pennsylvania sedge (*Carex pensylvanica*) dominate the groundlayer. Other groundlayer species present in the uplands include clubmosses (*Lycopodium* spp.) and dogbane (*Apocynum androsaemifolium*). The lowlands bordering the river are springy with a mix of open canopied forest and alder thicket. Local dominants include black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), cedar (*Thuja occidentalis*) and alder (*Alnus incana*).

Characteristic groundlayer species include *Arisaema triphyllum*, *Osmunda cinnamomea*, *Thalictrum dasycarpum*, *Carex intumescens*, *Sambucus* sp. *Caltha palustris*, *Platanthera psycodes*, *Viola* sp., *Athyrium filix-femina*, and *Equisetum sylvaticum*. Blowdowns are common near the river, where springy rivulets run from the base of the upland slope. While the river in this area is aesthetically pleasing, it has been altered by the many road crossings upstream. This site should be retained in public ownership due to its value and use as a fishery area. The surrounding uplands have been developed for low density residential and agricultural uses.

Florence Lake T31N R13E S32, 33

The portion of this site visited is owned by a Girl Scout camp. It occurs due south of Elton at the interface of an alluvial terrace and till plain. The plant communities present in and around Florence Lake have been disturbed by commercial timber production, development of recreational facilities, low density residential housing and cabins. The forested uplands occupying the steep slopes and ridges are second or third growth northern hardwoods, dominated by trembling aspen. The swampy lowlands bordering the lake and Drew Creek are dominated by 5"-11"D.B.H. cedar (*Thuja occidentalis*) over a rather homogeneous groundlayer characterized by *Carex leptalea*, *Dryopteris cristata*, *Aralia nudicaulis*, *Ribes lacustre*, *Carex disperma*, and *Abies balsamea* saplings growing on a carpet of mosses. A small emergent marsh is present at the mouth of Drew Creek; prevalent species include *Sparganium eurycarpum*, *Carex* spp., *Scirpus validus*, *Sagittaria* spp., and *Asclepias incarnata*. Both the inlet and outlet of the lake are silty with submergent and floating-leaved aquatic stands dominated by *Nymphaea odorata*, *Nuphar variegata*, *Ceratophyllum*, *Ranunculus longirostris*, *Potamogeton* spp., and *Myriophyllum* spp.

The eastern side of the lake and northern portion of the outlet stream have been developed with cottages, and there has been significant clearing of shoreline vegetation. The uplands within the Girl Scout camp have been logged at least once, and some large areas have been permanently cleared for the development of camp facilities. An equipment house and dock are present on their lake frontage. Most of the surrounding uplands have either been intensively managed for timber products or developed for recreational or residential uses. This intensive management and development of the surrounding uplands threaten the viability of the natural communities there. The western shore as well as inlet and outlet streams should be protected from further development.

Goto Lake T31N R12E S22, 23

This site occurs on a collapsed hummocky gravel moraine complex and unpitted gravel plain, three miles southeast of Antigo. This State Fishery Area has a fairly complicated vegetation mosaic. The forested wetland occupying the peaty sediments near the lake is dominated by cedar (*Thuja*) and yellow birch (*Betula alleghaniensis*) over a carpet of Sphagnum mosses. Characteristic herbs include *Carex trisperma*, *Dryopteris cristata*, *Cornus canadensis*, and *Clintonia borealis*. The open canopied, forested wetland away from the lake has widely spaced tamarack (*Larix laricina*), black

spruce (*Picea mariana*), and red maple (*Acer rubrum*) over an understory dominated by *Sphagnum*, *Eriophorum*, and *Carex* species. This wetland borders a small pond created by beaver, is dominated by *Nymphaea odorata*, and bordered by a small emergent marsh characterized by more nutrient demanding species such as *Typha angustifolia*, *Carex lacustris*, *Scirpus cyperinus*, and *Dulichium arundinaceum*. The uplands to the west of the lake are relatively unremarkable managed northern mesic forest of variable condition. Closer to the lake and access road, the loam capped gravel ridges and ravines are dominated by sugar maple (*Acer saccharum*), with basswood (*Tilia americana*), yellow birch, and hemlock (*Tsuga canadensis*) as canopy associates. The site has little structure or coarse woody debris and the D.B.H.s average 5” –9”. While the understory retains a few individuals of some species indicative of a relatively rich site conditions such as *Caulophyllum thalictroides*, *Arisaema triphyllum* and *Sanguinaria canadensis*, the dominant species are ferns, grasses, and sedges, especially *Dryopteris intermedia* and *Carex pensylvanica*. The forest occupying the ridge and ravine away from the lake is more intact with the larger D.B.H. (11+”) canopy trees of the species mentioned above but with a richer, more diverse ground flora including silvery spleenwort (*Athyrium thelypteroides*). A small floristically depauperate alder thicket borders the inlet stream to the north.

There are stumps near the lake that suggest that trees were removed to facilitate fishing access. The upland mesic forest has been selectively harvested in the recent past, and the residual D.B.H.s top out around 11”. A well-developed access road is present, as are numerous stumps and patches of disturbance species such as Wood Nettle. The uplands in the far western portion of the site are open weedy fields. The surrounding uplands have been significantly altered through the conversion of forestland to agricultural and residential uses. The upland forests at this site have limited restoration potential. Possible considerations include lengthening the timber harvest intervals to retain and enhance the “rich” groundlayer species component, develop more forest structure, and maintain the diversity of canopy trees

Miniwakan Lake and Peatlands T34N R11E S24,25, 35, 36

Located on Langlade County Forest land south of Lower Post Lake, this site is an extensive peatland complex formed on an outwash plain and includes a XXX acre XXX lake. Two major plant communities are present, muskeg and poor fen. The muskeg has scattered stunted black spruce (*Picea mariana*) and tamarack (*Larix laricina*) underlain by a continuous layer of *Sphagnum* mosses. Hummock and hollow microtopography characterizes the surface, with species composition varying between the higher “drier” hummock tops and the lower hollow sides and bottoms. Black spruce dominates the open “canopy” while tamarack is more commonly present as regeneration. Ericaceous shrubs are common throughout the site *Ledum*, *Kalmia polifolia*, and *Chamaedaphne* are the most prevalent. Other characteristic species include *Carex oligosperma*, *C. paupercula*, *C. trisperma*, *C. pauciflora*, *C. canescens*, *Eriophorum angustifolium*, *E. vaginatum*, *Gaultheria hispidula*, *Vaccinium oxycoccos*, *V. angustifolium*, *Andromeda glaucophylla*, *Smilacina trifolia*, *Dryopteris cristata*, and *Drosera rotundifolia*. This muskeg is noteworthy due to its size, its public ownership, and its context within a landscape mosaic of other high quality peatland communities.

As you head west to the lake, the muskeg grades into a narrow band of tamarack swamp, and then ultimately into a large undisturbed, poor fen mat that surrounds Miniwakan Lake. The fen is sedge dominated (*Carex diandra*, *C. stricta*, *C. lasiocarpa*, *C. interior*) grading into shrubby thickets of bog birch (*Betula pumila*) or stands of cattails (*Typha* spp.). Prevalent or characteristic species of this fen are bog rosemary, bog laurel, small cranberry, pitcher plant, bog muhly (*Muhlenbergia glomerata*), cotton grasses, rose pogonia (*Pogonia ophioglossoides*), blue-joint grass, marsh cinquefoil (*Potentilla palustris*), leatherleaf and horned bladderwort (*Utricularia cornuta*) and the special concern species, swamp-pink (*Arethusa bulbosa*). Two additional special concern plants, common bog-arrow grass (*Triglochin maritima*) and sparse-flowered sedge (*Carex tenuiflora*) are also present in the fen mat.

Most of the surrounding upland forest has been clearcut, or selectively logged, which has significantly altered their composition and structure. An extensive network of logging roads is present on the county forest owned lands, while on the site itself an A.T.V trail runs through the forested upland along the

wetland's northeastern shore. In the managed forest stands aspen, young hardwoods, and locally, pine, are the dominant trees. For the most part, the remaining uplands have undergone residential development. Measures should be taken to protect the hydrology of this site from disruption due to surrounding land-uses or water table manipulation.

The surveys targeting invertebrates along the eastern edge of the muskeg in the Miniwakan Lake complex yielded three special concern species of butterflies, including jutta arctic (*Oeneis jutta*), bog fritillary (*Boloria eunomia*), and bog copper (*Lycaena epixanthe*). An additional special concern butterfly, the tawny crescent spot (*Phyciodes batesii*) is documented from the cut-over mixed pine forest on sandy soils, with grasses, hawkweed (*Hieracium* spp.), clover and hazel (*Corylus* spp.), bordering the eastern edge of the bog/muskeg. A state endangered dragonfly, the warpaint emerald (*Somatochlora incurvata*), is also documented from this site, in an open bog/muskeg near several small bog pools, with black spruce (*Picea mariana*), tamarack (*Larix laricina*) and leatherleaf (*Chamaedaphne*) among the characteristic plants.

Moose Lake Springs (VIEWED BY CANOE) T30N R12E S16

Located 5.5 miles southeast of Antigo, this site is privately owned and was surveyed from canoe only. It contains a 32 acre second-growth tamarack (rich) swamp, foresting the shores and islands of a calcareous spring complex at the headwaters of the Red River on the west end of Moose Lake. The dominant trees are 2"-6" D.B.H. tamarack and, in some places, white cedar. The tall shrub understory includes abundant *Alnus incana* and the exotic *Rhamnus frangula*, while low understory shrubs include *Cornus stolonifera*, *Betula pumila*, *Salix* spp (*S. candida*, *S. serissima*, and others), and *Ledum groenlandicum*. *Carex diandra* dominates the understory, and other frequent species are *Calamagrostis canadensis*, *Campanula aparinoides*, *Impatiens capensis*, *Scirpus atrovirens*, *Thelypteris palustris*. Other characteristic species are *Galium labradoricum*, *Asclepias incarnata*, and *Sphenopholis intermedia*. Channels present within the site are mucky and marly, with cold seepage water. Characteristic aquatic macrophytes associated with this habitat are *Ranunculus aquatilis*, and *Mimulus glabratus*, the exotic *Nasturtium officinale*, *Typha latifolia*, and *Utricularia vulgaris*. No rare plant species were noted.

Moose Lake Springs is embedded in a privately owned mix of agricultural, commercial forest, and residential land. Moose Lake is a 140 acre drainage lake with seasonal and permanent housing developments along both the north and south shores. The lake receives heavy recreational use, which apparently does not impact the site because of shallow water in the spring seepage area. The main threat is the continued expansion of the invasive glossy buckthorn. Reed canary grass is also present but is currently only a minor problem.

Ninemile Creek T32N R14E S17, 18

This site is located just east of Hollister on alluvial terrace and hummocky complex landforms bordering Ninemile Creek as it drains to the Wolf River. Communities present are disturbed alder thicket and northern wet-mesic forest. The alder thicket stretches along the course of Ninemile Creek all the way to its confluence with the Wolf River. It has a moderately diverse groundlayer that is dominated by grasses and sedges (*Carex* spp.), and includes *Alnus incana*, *Calamagrostis canadensis*, *Carex stricta*, *Aster novae-angliae*, *Urtica dioica*, *Phalaris arundinacea*, and *Chelone glabra*. Away from the creek, northern wet-mesic forest is present, dominated by *Thuja*, with *Abies balsamea* and *Fraxinus nigra* as associates in the sub-canopy and sapling layers. This forest has fairly pronounced hummock and hollow microtopography and the characteristic groundlayer species include *Coptis groenlandica*, *Dryopteris cristata*, *Poa palustris*, *Rubus pubescens*, *Pyrola secunda*, and *Sphagnum* and brown mosses.

There has been some cutting in the forested portion of the site, and reed canary grass dominates along the creek banks. Roads and residential development bound Ninemile Creek to the east and south, and the creek passes through numerous culverts before reaching its outlet at the Wolf River. It is likely that these developments have significantly altered the hydrology of this site. Land use practices and developments appear to be permanent and afford little hope to fully restore the site's hydrology. The intrusion of reed

canary grass along the creek threatens the maintenance of native wetland vegetation at this site and throughout the Ninemile Creek corridor. Prescribed burning may be a useful management tool here.

Perch Lake T30N R12E S8, 17

This State Fishery Area (SFA) is located in the Town of Norwood, several miles north of STH 47, in an area of rolling sand and gravel outwash plains. The majority of the site is upland forest, of variable disturbance history. Overall, sugar maple (*Acer saccharum*) is the dominant species on the ridge top and away from the lake, with yellow birch (*Betula alleghaniensis*) a locally common sapling and subcanopy associate. Hemlock (*Tsuga canadensis*) forms a narrow band along the slope surrounding the entire lake. At the south end of the lake a wetland forest inclusion of tamarack (*Larix laricina*) and red maple (*Acer rubrum*) is present. Under the maple the groundlayer is moderately rich, with characteristic species such as *Sanguinaria*, *Asarum*, *Caulophyllum*, and *Adiantum* present. Other, more disturbed portions of the forest, are grass and sedge dominated with *Carex pensylvanica* and *Brachyelytrum erectum* forming a rather simple carpet-like groundlayer. Under hemlock the groundlayer is very depauperate, with *Lycopodium* spp and *Dryopteris* ferns dominant.

There is an access road running from Trout Rd across the Red River which passes through a culvert and through the upland forest down to the lake. There is a spruce plantation to the north, and logging has taken place throughout most of the uplands within the fishery area. The surrounding uplands have been developed for low density residential use and timber production. The maintenance of an access road has encouraged unintended recreational uses of the site by local landowners, namely horseback and A.T.V. riding on the trails. The site would benefit from closure of the road and an extension of the timber harvest rotation to favor development of a more closed canopy forest.

Spider Creek Wetland complex T34N R12E S17-20, 29, 30

This site, located east of Lower Post Lake, includes a diversity of natural community types. The quality and condition of the communities is variable. The major communities present are northern sedge meadow, muskeg, and black spruce swamp. There are minor inclusions of poor fen, alder thicket, northern wet-mesic and dry-mesic forests, submergent and floating-leaved aquatic communities. The wetland vegetation bordering the creek has a typical zonation. The communities grade from sedge meadow, to shrub-carr and alder thicket, then to northern wet-mesic forest away from the creek. The tussock and lake sedge (*Carex lacustris* and *C. stricta*) dominate the sedge meadow, with *Calamagrostis canadensis* the most prevalent associate. The alder thicket and northern wet-mesic forest support a diverse understory. Prevalent species include *Betula pumila*, *Eupatorium maculatum*, *Impatiens capensis*, *Stellaria longifolia*, *Caltha palustris*, *Potentilla palustris*, *Onoclea sensibilis*, *Sphagnum* spp., and many species of *Carex*. The extensive muskeg and swamp bordering the flowage to the east has variable canopy cover dominated by *Picea mariana* with regenerating *Larix laricina* as an associate. Canopy coverage ranges from 0 to over 60%. The groundlayer is depauperate, and characteristic species include *Ledum*, *Eriophorum angustifolium*, *E. virginicum*, *Chamaedaphne*, *Carex oligosperma*, *C. disperma*, and *Sphagnum* spp. A brief herptile survey in a portion of this complex documented wood frogs (*Rana sylvatica*) and the special concern species, the four-toed salamander (*Hemidactylium scutatum*).

Spider Creek has been dammed and bermed to form Spider Creek Flowage. Further downstream it passes through a culvert under Lost Lake Road. Reed canary grass is beginning to intrude upstream into the sedge meadow/shrub-carr at the outlet into the Wolf River. The upland forests surrounding the wetland complex have been extensively logged to regenerate aspen and red pine plantations have been established. A.T.V. trails and logging roads traverse much of the upland area. The flowage is maintained for waterfowl production and to provide hunting opportunities. The extensive clearcut, early successional forest management of the surrounding uplands may impact the hydrology and water quality of the neighboring wetlands and contribute to the lack of regeneration of the browse sensitive species present, such as white

cedar. There is restoration potential for sedge meadow, poor fen, and shrub communities at this site, if the dam and berm are removed from the flowage outlet.

Marathon County

Mud Lake Muskeg T28N R10E S 9,10,15,16

This site is located 3.5 miles northeast of Hatley. It is privately owned and was surveyed from canoe and roadsides only. It is a large (194 acre), acid muskeg between Mud Lake to the west and Mayflower Lake to the east-southeast, that is part of the large (1500 acre), Mud-Mayflower Lake wetland complex. A small (3 acre) bog pond, called bluegill lake, is embedded within this site. The muskeg is characterized by scattered small tamarack and black spruce trees overtopping a dense low shrub layer of *Chamaedaphne*, *Aronia*, *Nemopanthus*, *Ilex*, and *Ledum*. The groundlayer is densely sphagnum, and includes *Carex oligosperma*, *Thelypteris palustris*, *Osmunda cinnamomea*, *Calamagrostis canadensis*, and *Iris versicolor*. Mud Lake has beds of *Pontederia*, *Brasenia*, and *Typha* along shoreline.

Surrounding lands include an unsurveyed swamp believed to be dominated by tamarack, Mud Lake, and developed agricultural and residential lands. There is a public boat landing used for fishing access and one permanent residence at the southeast corner of Mud Lake.

Norrie Lake Wetlands T28N R10E S21 and 22

This site is located 7 miles northwest of Wittenberg. The surveyed area is privately owned and mostly along the north side of the Mountain-Bay State Bike Trail. The primary community is a large (278 acre), mature conifer swamp forest about 1 mile long and 0.25 mi wide, mostly north of the mountain-bay state bike trail. White cedar and tamarack are co-dominant and range from 3"-10" D.B.H., and up to 10 meters in height. The understory varies from brushy with tag alder, bog birch, and swamp buckthorn near the trail, to quite open, deeply sphagnum, and floristically rich in the swamp's interior. Common species include *Carex leptalea*, *Cornus canadensis*, *Glyceria striata*, *Rubus pubescens*, *Thelypteris palustris*, *Carex interior*, *C. stricta*, and *Polygonum arifolium*. Within 50-100 meters of the old railroad grade the understory is very wet, suggesting impeded drainage with *Caltha palustris*, *Carex stricta*, and *C. utriculata* common. Farther away from the right-of-way the hydrology is apparently undisturbed. Two rare plant species are documented at this site, the state-threatened *Valeriana uliginosa*, and the special concern *Carex gynocrates* are present. Overall floristic diversity is excellent with rare calciphiles present and few or no exotic plants noted.

Four species of rare, special concern butterflies were documented at this site: Jutta arctic (*Oeneis jutta*), bog copper (*Lycaena epixanthe*), dion skipper (*Euphyes dion*) and the mulberry wing (*Poanes massasoit*). All four were found to be most common on the north side of the Mountain-Bay Bike Trail where bog graded into brushy sedge marsh.

The surrounding landscape includes a vast acidic, sphagnum dominated muskeg that borders the bike trail on the south side. This wetland complex is embedded within predominantly agricultural lands, with managed forests to the north, and partly developed Norrie Lake to the southeast. There are no apparent threats aside from continued disruption of the hydrology by the bike trail (on an old railroad grade). However, this disruption may partly maintain the character of this site and the muskeg to the south of the trail. This may be the largest, most intact peatland in Marathon County and should receive high priority for protection.

Shawano County

Cranberry Lake wetlands T29N R12E S18

This site is located northeast of Birnamwood and is part of a large, privately owned complex of forested and shrub wetland communities. The exterior portion of the site is a mix of deciduous and coniferous wetland types disturbed by ditching, drainage and logging. The herbaceous and woody flora of the site is fairly diverse, with small D.B.H. (2"-9") black ash (*Fraxinus nigra*), white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), tag alder (*Alnus incana*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*) dominating locally, and canopy closure ranges from 5 to 70 percent. Prevalent groundlayer species include *Carex crinita*, *C. intumescens*, *Onoclea sensibilis*, *Calamagrostis canadensis*, *Osmunda cinnamomea* and *Aralia nudicaulis* in the more nutrient rich areas, and *Smilacina trifolia*, *Nemopanthus mucronatus*, *Eriophorum virginicum*, *Carex oligosperma*, *Drosera rotundifolia*, *Ledum*, *Andromeda* and *Sphagnum* spp. in the lower nutrient "boggy" areas.

The upland inclusion and portions of the low swamps have been logged. The owner noted that large D.B.H. tamarack had been removed. The land uses in the surrounding uplands are residential development, agriculture, and commercial forestry. Effects of the hydrological disruption from ditching and drainage include invasion by reed canary grass on the western edge of the site. There may be some restoration potential but the hydrologic disruptions may be difficult to reverse. Intensive agricultural development of the neighboring uplands may also limit potential.

Herman Swamp T27N R14E S15

This privately owned site is located between STH 29 and Gresham on a ground moraine or outwash plain. The hydrology has been drastically altered by the construction of a highway across the middle of the site, as well as access roads into the eastern interior. It is a somewhat fragmented complex of predominately northern wet-mesic forest (cedar swamp), with inclusions of hardwood (black ash) swamp. In spite of the disturbed hydrology, this minerotrophic swamp has classic hummock and hollow microtopography. Prevalent or characteristic species include *Osmunda regalis*, *Eupatorium maculatum*, *Symplocarpus*, *Rubus pubescens*, *Carex leptalea*, *Carex lacustris*, and *Galium triflorum*. There is a small upland inclusion with stands of large D.B.H. hemlock (*Tsuga*) and dense pole-sized exclusion stage beech (*Fagus*). The CTH U right-of-way is mowed up to the forest edge. Some logging has taken place and is most noticeable in the upland inclusions. Surrounding upland land use includes low density residential development, agriculture and commercial forestry. The only exotic noted was reed canary grass, which was present in the hardwood swamp, in the site's interior.

Mattoon Swamp T29N R11E S8, 17, 18

This privately owned swamp complex is located just southeast of Aniwa on a ground moraine. The site is a mosaic of shrub thickets and open canopied, wetland forest communities. While the herbaceous and woody flora of these areas are fairly diverse; the main factor influencing these portions of the site is hydrologic disturbance. In the disturbed portions of the site, the dominant canopy and shrub species change frequently and include *Thuja occidentalis*, *Fraxinus nigra*, *Picea mariana*, *Larix laricina*, and *Alnus incana*. The ground layer ranges from being quite species rich where *Alnus*, *Fraxinus*, and *Thuja* dominate to depauperate in the *Picea* and *Larix* dominated areas. Characteristic species include *Osmunda regalis*, *Typha angustifolia*, *Eupatorium maculatum*, *Symplocarpus*, *Carex leptalea*, *Carex lacustris*, *Galium triflorum*, *Thelypteris palustris*, *Ilex verticillata*, *Dryopteris cristata*, *Impatiens capensis*, *Maianthemum canadense*, and *Sphenopholis intermedia*. The interior of the site does harbor a high quality open bog and muskeg complex. The ericaceous shrub, *Chamaedaphne* is the overwhelming dominant here with *Larix* and *Picea mariana* present at low cover values. Associates include *Sphagnum* moss, *Ledum*, *Andromeda*, *Vaccinium macrocarpon*, *V. oxycoccos*, *Carex paupercula*, *C. trisperma*, *C. oligosperma*, *Smilacina trifolia*, and *Eriophorum virginicum*.

The hydrology has been drastically altered by the construction of highways and access roads, within or bordering all but the eastern most portion of the site. Non-commercial logging has taken place in the

wetland, and the northern mesic forest upland inclusion in the middle of the site has been selectively logged. The southern most portion of the stand appears to have been grazed. The land use in the surrounding uplands includes residential, recreational, and forestry.

The affects of the hydrological disruption from road construction are apparent in all but the most interior portion of this site. Exotic species were absent. While this is a species rich complex, only the interior portions have potential for the conservation of intact natural communities. The site should be protected from further disruptions of its hydrology.

Aquatic features and habitat types in the upper Wolf River Basin (excerpted from Schmude's 2000 Aquatic Macroinvertebrate Inventory)

Very Large Rivers

Two very large rivers in the upper Wolf River Watershed were sampled, the Wolf and Red rivers. High species richness values (40-53) and abundance of aquatic macroinvertebrates were found, similar to what was discovered in the lower Wolf River Watershed in 1999, when values of species richness of 38 to at least 80 were recorded. Two outstanding sites on the upper Wolf River were located at Wolf River Landing Road (Langlade Co.) and Meister-Stuckley Road (Oneida Co.). The Wolf River at Chaney Lane (Forest Co.) did not produce species richness values or abundance data that were as high as other sites along the Wolf River. This site seemed to be disturbed, with dark algal mats covering the rocks, and a perceived water quality of only fair. It is not clear what might be causing this disturbance. The site on the Red River was located at the canoe landing near Gresham where the waterfall area exists. This site was particularly difficult to sample due to high water, raging currents, and bedrock substrates. Undoubtedly, species richness would have been much greater at this site if a more thorough effort could have been accomplished.

Medium to Large Rivers

Thirteen medium to large rivers were sampled throughout the entire Wolf River basin. Species richness ranged from 18 in Ninemile Creek (Langlade Co.) to 71 in the Embarrass River (Shawano Co.). Most appeared to have good water quality, with high species richness and include those species that were intolerant to organic enrichment.

Small to Medium-sized Streams

A total of 37 different streams in this category were sampled throughout the entire Wolf River basin. Taxa richness values ranged from 5 in Pearl Creek (Portage Co.) to 47 in Krause spring and creek (Langlade Co.), but there were very few new county records discovered for species. Low richness values for Pearl, Allen (Portage), and an unnamed creek (SCH063-Waupaca Co.) (Table 1) may not necessarily be attributed to man-made disturbance, but perhaps to very cold temperatures and lack of suitable, heterogeneous substrates. Overall, most of the streams indicated very good water quality, with many of the same taxa present in most of the streams.

Lakes

Twenty different lakes were sampled for aquatic invertebrates within throughout the Wolf River basin. Species richness values ranged from 4 at Himley Lake's south end (Forest Co.) to 38 in Fountain Lake (Portage Co.). Obviously, lakes within the same general area and with the same general size have macroinvertebrate communities that vary in abundance and diversity, and understanding what contributes to this disparity is very difficult.

Two lakes were of special interest, Lawrence Lake in Langlade County and Little Rice Lake in Forest County. Lawrence Lake is undeveloped, except for a dirt road and boat landing. The water is very clear with rubble, submerged logs, short macrophytes, and sand along the littoral zone; some quieter bay areas have muck and emergent vegetation. A fairly diverse (34 species richness) and abundant macroinvertebrate fauna occurred on a variety of the substrates that were present. Little Rice Lake is located near the

headwaters of the Wolf River. The lake had an abundant and diverse macroinvertebrate fauna (37 species richness), which was probably due to diverse habitats and substrates. Collecting was limited to one boat landing on this complex lake. It is likely that the documented species richness would increase dramatically with a more thorough sampling effort.

FUTURE INVENTORY

Aquatic invertebrates of the upper Wolf River Basin remain under sampled. This part of the basin would certainly benefit from more extensive and thorough surveys comparable to the effort that was focused on aquatic habitats in the Lower Wolf River Bottomland Natural Resources Area.

Rare animals documented in 1999-2000, at other sites in the upper Wolf River Basin, listed by county

Forest County

Little Long Lake T34N R14E S19

A special concern butterfly, the bog copper (*Lycaena epixanthe*), was documented from an isolated bog with leatherleaf (*Chamaedaphne*), labrador tea (*Ledum*) small cranberry (*Vaccinium oxycoccos*), and few-seeded sedge (*Carex oligosperma*).

Pedro Creek wetlands T35N R11E S32

A population of the special concern butterfly, the dorcas copper (*Lycaena dorcas*), was documented in an area of bog that had graded into a mucky alder and willow shrub swamp vegetated with species including sedges, yarrow, clover and cattail.

Pine Lake Outlet Swamp T37N R12E S34

Two special concern insects a dragonfly, the forcipate emerald (*Somatochlora forcipata*) and a skipper, Laurentian skipper (*Hesperia comma*) are documented in a sedge, alder, willow, spruce and maple wetland and meadow opening bordering the Wolf River.

Langlade County

Langlade County Forest – Ainsworth Bog T34N R12E S31 NW4SE4

Populations of three special concern butterflies, the bog copper (*Lycaena epixanthe*), laurentian skipper (*Hesperia comma*), and bog fritillary (*Boloria eunomia*) and a single individual of the special concern dragonfly the black-tipped darner (*Aeshna tuberculifera*) were documented in a muskeg and bog pond with sphagnum mosses, cottongrass (*Eriophorum* spp.), cranberry (*Vaccinium* spp.), and pitcher plants (*Sarracenia purpurea*).

Langlade County Forest – Lost Lake Road Uplands T34N R12E S28,29

A special concern butterfly, the tawny crescent (*Phyciodes batesii*), was documented at this site in sandy forest openings vegetated with red and jack pine (*Pinus resinosa*, *P.banksiana*), hawkweed (*Hieracium* spp.), grasses, and clover.

Shawano County

Lulu Lake T27N R16E S12

Two special concern, aquatic insect species were documented at this site, the dragonfly, swamp spreadwing (*Lestes vigilax*) and a crawling water beetle (*Haliphys pantherinus*).

North Branch Embarrass River T28N R12E S26

A special concern dragonfly, the zebra clubtail (*Stylurus scudderi*) was documented at this site.

Red River - Gilmer Falls T27N R15E S6

A special concern dragonfly, the slender bluet (*Enallagma traviatum*) was documented at this site.

Westcott Township (Norton Drive, Woods Road Pines and CTH HH) T27N R16E S4, 5, 8

Colonies of the special concern tiger beetle species (*Cicindela patruela patruela*) were documented at two sites, along Norton Drive and Woods Road Pines about four miles north-northeast and northeast of the city of Shawano. A closely related, special concern tiger beetle species (*Cicindela patruela huberi*) was documented seven miles northeast of Shawano along CTH HH. Leonard's skipper (*Hesperia leonardus leonardus*), a special concern skipper was also present at the Woods Road Pines site. These species were documented in openings of dry, sandy, mixed hardwood and pine woodlands vegetated with species including pines (red, white and/or jack), black oak, big bluestem, blazing star, brown mosses, and Pennsylvania sedge.

Discussion

The natural communities documented in this report are, for the most part, highly representative types for the northern Wolf River basin. In Langlade County, extensive documentation was compiled for the natural communities bordering the main stem of the Wolf River. The predominant communities were cedar and black ash swamps on the lower alluvial terraces, and northern mesic forests on the higher terraces and slopes adjoining the river. The adjoining, fairly intact cedar swamps occupying most of the lower terraces along the Wolf River in Langlade County are of regional and possibly statewide significance from the perspective of landscape scale management potential. This is because the majority of these swamps along the river are already within public ownership as part of the Wolf River State Fishery Area, and little recent disturbance has occurred. In addition, many of the private in-holdings are under state directed cooperative management programs such as Managed Forest Law. To some extent, however, the conservation values of these swamps are limited by the narrowness of the protected corridor (there is only a 300' setback until lands can undergo active timber management), and by the intensive nature of the timber management in the adjoining uplands. At almost every site inventoried, the forests beyond the 300' setback had been either select or clear cut recently enough that the effects of the timber harvest were still major factors in determining composition and structure of the stands.

The secondary impacts of these management practices may be manifesting themselves in the swamps and terrace forests. Regeneration of species that are preferred as browse, such as cedar and hemlock, is virtually nonexistent at sites inventoried throughout the upper basin, with only a few sites having individuals that have survived to the recruitment stage. If this trend continues, the long-term persistence of the current natural communities present is questionable.

There were some exemplary stands of both cedar and hemlock present within the study area. A few of these sites had been documented as part of the Langlade County natural areas inventory conducted by DNR's Bureau of Research in the early 1980's. These include Hemlock/Cedar Rapids and the Lawton tract. Additional high quality examples not documented in the original survey include swamps at Horserace and

Burnt Point Rapids. Due to their small size and landscape context, the sites themselves are only of local and regional significance.

With the exception of the Menominee Reservation, not covered in this study, hemlock stands were not common in inventoried parts of the upper basin either along the river corridor or in the upland forests away from the Wolf River. Where these stands exist they are small in extent. Due to the rarity of this type, existing stands would be considered of local and regional significance, and should be explicitly considered in any planning done for the basin. The uplands away from the river have been and are used for commercial timber production, and the residual stands, although extensive, are of only moderate to low quality from a natural community perspective. Only two stands of upland forest bordering the Wolf River were of interest from the natural area perspective. The first, Gardener Dam Camp Woods, (also known as the Boy Scout Mesic Forest) was documented in a previous county inventory. It is one of only a hand-full of upland forest stands in the entire northern Wolf River basin that has developed old growth characteristics. This stand is of local, regional, and statewide importance. The location and condition of this site presents an opportunity to restore a larger block of older growth forest if it is combined with neighboring Boy Scout and DNR owned forest lands. One notable DNR owned forest in this area is the Hanson Rapids - CTH M woods, located to the southwest of the Gardener Dam Camp on the west side of the Wolf River just north of the CTH M bridge. This forest block has a rich complement of hardwood and conifer species including yellowbud, hemlock, yellow birch, and beech. This northern forest community is well represented on the Menominee Indian Reservation just a short distance to the south.

Away from the Wolf River the overall quality of sites was highly variable. The most important site in this group was Little Rice Lake. The northern half of this lake harbors a naturally occurring wild rice bed that is of statewide significance because it is natural in origin, large, and occurs within a context of high quality wetland types including submergent aquatic, emergent aquatic, and muskeg communities.

Additional sites of regional significance include the Spider Creek wetland complex, Bog Brook Wildlife Area, and Miniwakan Lake peatlands. These sites also large wetland complexes that occur on publicly owned lands, and they have very good examples of muskeg, sedge meadow, and poor fen communities. Norrie Lake wetlands and Lily Lake fen also fall in this group due to their high quality species rich, northern wet-mesic forest and poor fen communities respectively. Though there is no public ownership at these sites, which are located within rapidly developing areas, conservation planning is a priority. This could include the acquisition or the negotiation of conservation and management easements.

Of local significance are the oak stands in the drumlin rich region of northernmost Langlade County. Due to the difficulty in locating the owners of undeveloped parcels of this type, only one stand was visited. The stand had been recently managed through selective cutting and lacked structure and large diameter trees but could recover to provide a habitat type that is poorly represented, by older age stands with high canopy closure, in the basin. The Shawano County sites (Herman Swamp, and Cranberry Lake Wetlands) and the Langlade sites (Goto and Florence Lakes) also fall within this category due to the multiple disturbances that limit their restoration potential, including logging, neighboring land-use effects and hydrologic disruption. The undeveloped lakes and river stretches including Perch Lake, Evergreen River SFA, and Ninemile Creek are also important, locally significant sites that should be protected and restored where possible. Intrusions including access roads, bridges, road crossings, and residential and recreational developments currently limit the potential conservation values of these sites.

Priority inventory sites in the northern Wolf River basin that were not included in this study due to time limitations include Mud Creek Meadows (adjoining Lower Post Lake), Lake Lucille and Pedro Creek (NEH02) in Oneida County, sites within the Menominee and Stockbridge Reservations, and the extensive meadows bordering the Wolf River south of Pine Lake (NEH01).

Many sites need additional inventory to better document the natural communities present or surveys for rare plants and animals; these include the Wolf River section between CTH A to the Town of Langlade, Twenty Day Rapids, Burnt Point and Horserace Rapids, Bog Brook Wildlife Area, Lily Lake fen, Little Rice Lake, Spider Creek Wetlands, Crestwood Sugarbush, Elmhurst Maples, Norrie Lake Wetlands and Mud Lake Muskeg.

APPENDIX E.1

Aquatic Macroinvertebrate Biotic Field Surveys and Taxonomy – 1999 Results

Submitted by Kurt L. Schmude, Ph.D., Lake Superior Research Institute, November 30, 1999

Introduction

The Wisconsin Department of Natural Resources (WDNR) initiated a broad-based inventory (flora, fauna, and natural communities) of the Wolf River GMU in 1999. This inventory project will support the state master planning process by providing information to public agency administrators, planners, and managers and aiding the prioritization of sites and species for protection by public and private conservation organizations. Field inventory of aquatic macroinvertebrates is essential for managing and protecting natural resources and thus an important component in the biotic inventory process. Many aquatic macroinvertebrates are sensitive indicators of habitat quality and land use.

The inventories will allow biologists and planners to understand the distribution and relative abundance of some of the most important aquatic species and communities, and to select the most appropriate sites for conserving rare taxa and intact natural communities. The information will also be used for comparing biota of manipulated versus natural systems. Several potentially rare aquatic insects are known, suspected, or have a high probability of occurring within the project area. Because no systematic search for them has occurred, WDNR is presently unable to assign status or conservation priority to many of these species with confidence.

A total of 76 sites within the lower Wolf River Watershed were sampled for aquatic macroinvertebrates. Sites were located in Outagamie, Shawano, Waupaca, and Winnebago counties. Sampling occurred on May 21, and from June 2 through June 9, 1999. Sampling was performed by Dr. Kurt Schmude and three student assistants (Chris Brennan, Jason Tanck, Andrea Anderson).

Methods

Lotic Sites

A total of 56 lotic sites were sampled. At each site, the available habitats were determined and each person was responsible for a particular habitat(s). Sampling was performed using a D-frame aquatic net (approx. 1 mm mesh). The kick-sampling method was used in riffles and runs, while undercut banks were sampled by rigorously manipulating the net in the undercut substrates. Sample debris was placed on a large mesh screen over a large plastic tray and the organisms fell through the mesh into the tray. Sample debris was then searched for cryptic, slow-moving organisms; all specimens were preserved in plastic vials containing 70% ethanol. Submerged structures (wood, rocks) were taken out of the water and inspected, and other habitats (water surface, shoreline) were visually inspected for organisms and exuviae. Habitats that were sampled included the following:

- A. rocky riffles and runs
- B. submerged wood and roots
- C. undercut banks
- D. submerged and emergent vegetation

- E. sandy, silty, and/or clayey runs near the shoreline
- F. shallow and deep sand bars and sand bar drop-offs
- G. surface (surface-dwelling organisms)
- H. shorelines and bridges (exuviae)

Lentic Sites

A total of 20 lentic sites were sampled. The available habitats were again determined and each person was responsible for a particular habitat(s) or area(s) to sample. The same methods were employed. Habitats that were sampled included the following:

- A. shallow, vegetated areas
- B. water column of deeper areas
- C. submerged wood
- D. shallow sandy/silty areas near the shoreline
- E. surface
- F. shoreline searches for exuviae

In addition, the sites listed below were sampled using submerged bottle traps. Two traps were placed in shallow, vegetated areas. The traps were deployed from June 7 to June 9, approximately 48 hours. The sites were chosen by James Robaidek (WI DNR), who provided assistance in locating each site on each day. The sites represented a wide range of habitats over a large area within the Wolf River GMU. Each site was located on state-owned property. Many of the sites were actively being managed, and Mr. Robaidek thought it would be valuable to obtain biotic information on these sites.

- A. Hortonville Bog (SCH99-101)
- B. flowages on LaSage Property (SCH99-103)
- C. Shioc Mitigation Site (SCH99-104)
- D. Maine Wildlife Area (marsh/swamp) (SCH99-105)
- E. Maine Wildlife Area (bog) (SCH99-106)
- F. bog in Navarino State Wildlife Area (SCH99-107)
- G. Pikes Peak Flowage (marsh) (SCH99-108)
- H. McDonald Flowage (marsh) (SCH99-110)

Sampling Problems

Sampling deep portions of large streams for benthic macroinvertebrates has always been difficult or impossible, even with specialized equipment. Some segments of the Wolf and Embarrass Rivers were not sampled for these reasons. Another problem was the timing of this study did not allow sampling during the most productive periods for some insect groups such as winter stoneflies, spring caddisflies, or summer and fall bugs and beetles. Finally, many fast moving lentic species are difficult to sample with standard nets and collecting techniques

Remedies

Sample the above rivers and sites with a boat, and use dredges or other deep-water sampling equipment. For dragonflies properly timed shoreline exuvia searches were conducted adjacent to deep water segments. Unfortunately most other groups are not detectable with method. Also, sampling would likely have been more productive in terms of abundance and diversity if the timing of the trips took place in early to late May. Sampling the sites at different times of the year would allow detection of aquatic insects that were low in numbers or absent during the study period.

Results

The table below lists each site, the minimum number of taxa identified at each site, the habitats sampled, the number of new county records, and pertinent notes on the sampling effort or identification of the site. Sites are grouped into the following major categories:

- A. Large rivers
- B. Small to medium-sized rivers
- C. Flowages
- D. Shallow marshes
- E. Swamps
- F. Bogs
- G. Springs
- H. Sloughs
- I. Lakes

Taxa were identified to the lowest taxonomic level possible based on current literature and the expertise of the participating taxonomists (Dr. Kurt Schmude - all macroinvertebrates, Mr. William Smith - odonates, Dr. William Hilsenhoff - consultant). In some cases, specimens were identified to a higher taxonomic level due to the lack of a key to species, even though two or more species were clearly recognizable among the specimens; sites where this situation occurred are marked with a plus (+). Seven sites were sampled with both nets and submerged bottle traps. The number of taxa collected by each method is listed, along with the total number of different taxa collected by both methods.

Habitat codes are as follows: A=riffle, B=run, C=pool, D=lake, E=bank.

New county records were determined based on published scientific literature, and previous DNR survey studies of macroinvertebrates performed by the author. Many groups of aquatic macroinvertebrates have not been intensively studied at the species level, and detailed data on their distribution in Wisconsin is not available. Data for the following taxa were available for the determination of new county records:

1. all Heteroptera (aquatic and semi-aquatic bugs)
2. almost all aquatic Coleoptera (beetles, except Chrysomelidae, Curculionidae, Scirtidae)
3. Baetiscidae, Heptageniidae, Pseudironidae (mayflies)
4. Perlodidae (stoneflies)
5. Hydropsychidae, Brachycentridae (caddisflies)

Sampling effort was restricted at some sites due to the difficult and/or dangerous conditions at the site.

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
<u>LARGE RIVERS</u>				
Wolf River (18 sites)				
SCH99-053	80	B,E	6	
SCH99-055	55	B,E	3	
SCH99-058	16	B,E	1	
SCH99-059	25	B,E	1	
SCH99-060	54+	B,E	2	
SCH99-063	8	B	1	restricted sampling
SCH99-066	12	B,E		restricted sampling

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
SCH99-067	2	only wood		restricted sampling
SCH99-068	4	E		very restricted sampling
SCH99-069	9	B,E		restricted sampling
SCH99-077	39	B,E	3	
SCH99-078	18	B,E	2	
SCH99-079	24	B,E	2	
SCH99-084	15+	E		restricted sampling
SCH99-085	28	B,E	1	
SCH99-097	29	B,E	3	
SCH99-098	30+	B		
SCH99-128	29+	B,E	1	
Little Wolf River (6 sites)				
SCH99-080	61	A,B,E	2	
SCH99-091	40	B,E		
SCH99-092	35	B,E	2	
SCH99-093	34+	A,B,E	2	
SCH99-094	42	A,B,E		
SCH99-126	45	A		
South Branch Little Wolf River				
SCH99-089	38	B,E	3	
SCH99-090	36+	B,E	1	
Embarrass River (10 sites)				
SCH99-096	44+	B,E	1	
SCH99-100	32	B,E	1	
SCH99-117	40+	B,E	2	
SCH99-118	9	B,E	2	restricted sampling
SCH99-119	24+	B,E	1	
SCH99-120	18+	B	2	
SCH99-121	12+	B	2	
SCH99-122	12	B,E		
SCH99-124	19+	B	1	
SCH99-125	22	B,E		
Waupaca River				
SCH99-082	36	B,E		
SCH99-088	40+	B,E	1	
<u>SMALL TO MEDIUM-SIZED RIVERS</u>				
Bear Creek #1				
SCH99-070	16	B,E		
SCH99-071	8	B,E		
Bear Creek #2				
SCH99-123	17	B,E		

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
Cedar Creek				
SCH99-073	10-11	B,E		
Hatton Creek				
SCH99-086	23	B,E	1	
Maple Creek				
SCH99-074	8	B,E		
SCH99-075	23	B,E	1	
SCH99-076	10	B	1	
Pigeon River				
SCH99-095	22	B,E	1	
Shioc River				
SCH99-064	34	B,E	2	lentic shoreline area
SCH99-065	6	B		
SCH99-109	24	B		
Walla Walla Creek				
SCH99-083	29	B,E		
SCH99-087	17	B,E	3	
unnamed creeks				
SCH99-054	22	A,B,C,E	1	
SCH99-056	18	A,E		
SCH99-057	14	B,E		
SCH99-061	12	B	1	
SCH99-072	11	B,E		
<u>FLOWAGES</u>				
SCH99-103	20(net) 13(bottles) 27(total)		3	
SCH99-108	23(net) 23(bottles) 39(total)		6	Pikes Peak Flowage 80-Acre Flowage
SCH99-111	31(net)			
SCH99-112	20(net)			Wolf River Flowage
SCH99-113	17(net)			Wolf River Flowage
SCH99-115	37(net)		5	Wolf River Bottoms
SCH99-116	23(net)		2	Wolf River Bottoms
<u>SHALLOW MARSHES</u>				
SCH99-104	22(net) 15(bottles) 31(total)			Shioc Mitigation Site McDonald Marsh
SCH99-110	25(net) 18(bottles) 36(total)		5	
<u>SWAMPS</u>				
SCH99-105	38(net)		3	Maine W.A. (swamp)
SCH99-114	17(net)		1	Deer Cr. W.A.

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
<u>BOGS</u>				
SCH99-101	27(net) 23(bottles) 40(total)		6	Hortonville Bog
SCH99-106	32(net) 32(bottles) 53(total)		10	Maine W.A. (bog)
SCH99-107	19(net) 10(bottles) 26(total)		11	Navarino Bog
<u>SPRINGS</u>				
SCH99-102	6(net)		1	artesian spring outlet
SCH99-102	32(net)		7	spring pond area
<u>SLOUGHS</u>				
SCH99-062	25(net)		2	slough to Wolf River
SCH99-081	28(net)		2	Colic Bayou
<u>LAKES</u>				
SCH99-099	22(net)			White Clay Lake
SCH99-127	22(net)			White Lake

Rare Species

The following species were collected during this study and are considered rare in the state. These species should be added or considered for addition the WI NHI Working List.

COLEOPTERA

Hydrophilidae

Cymbiodyta minima Notman

Uncommon statewide. Known from 201 specimens from 32 sites, but 131 of these are one site. Found in shallow lentic habitats and margins of streams.

Enochrus collinus Brown

Rare statewide. Known from 15 specimens and 11 populations. Found in ponds, marshes, and 1 from a bog.

Enochrus consortus Green

Uncommon southern 1/3 of the state, rare elsewhere. 210 specimens from an estimated 24 populations. Found in ponds, marshes, margins of lakes and streams.

Enochrus sayi Gundersen

Uncommon in southern half of the state (Pierce to Shawano counties) and absent in the northern half. 266 specimens known from at least 15 populations. Known from ponds. Most have been collected at blacklight traps.

Helocombus bifidus (LeConte)

Uncommon statewide with 51 specimens from at least 33 populations. Found in shallow lentic habitats. Most records were single specimen collections, and so is rare even when found.

Laccobius agilis (Randall)

Rare to uncommon statewide. 28 specimens known from at least 16 populations. Found in ponds, spring ponds, seeps, and margins of streams.

Laccobius reflexipennis Cheary

Marathon and Menominee counties. 2 specimens from 2 populations. Found in margins of streams and ponds.

Sperchopsis tessellata (Ziegler)

Rare in western ¾ of state (Florence to Dane counties), not recorded from eastern ¼. 26 specimens from over 20 sites. Found in small, cool streams, usually with sand.

Cymbiodyta acuminata Fall

Fairly common in northern 2/3 of state and uncommon in southern 1/3. 115 specimens known from at least 23 sites. Found in shallow lentic habitats.

Hydrochara leechi Smetana

One adult was collected from site SCH99-105, a swamp in the Maine Wildlife Area close to the main access road. The specimen was collected in a bottle trap. This species is represented in the state by only 3 known specimens collected in Dane Co. in 1915 and 1916; it has not been collected in 83 years (Hilsenhoff 1995). The specimen was a female, which are more difficult to identify than males, but it was verified by Dr. Hilsenhoff. A total of 97 specimens and 4 species of *Hydrochara* were collected in the 2 bottle traps, but only 1 specimen of *H. leechi* was found.

Laccobius reflexipennis Cheary

One adult was collected from Walla Walla Cr. (SCH99-087). Less than 6 specimens were previously known from the state, and only 3 previous county records (Hilsenhoff 1995).

Dytiscidae

Agabus bicolor (Kirby)

Fairly common in northern 1/3 of Wisconsin (Burnett to Marinette counties), rare elsewhere. 64 specimens found in 20-60 populations. Found primarily in black spruce-tamarack swamps with a few in sedge-cattail marshes and shallow ponds.

Agabus inscriptus (Crotch)

Rare to uncommon statewide. 47 specimens known from at least 15 populations. Most were collected from habitats with Sphagnum.

Celina hubbelli Young

Uncommon south of a line from St. Croix to Sheboygan counties, absent elsewhere. 54 specimens found from at least 13 populations. Known in shallow cattail habitats, where oxygen can be obtained from cattails.

Hydroporus badiellus Fall

Common in northern 1/3 of state (Polk to Marinette counties) but rare elsewhere. 200 specimens known from 20 to 100 populations. Located in habitats containing Sphagnum.

Ilybius discedens Sharp

Common in northern 1/3 of state (Polk to Marinette counties), rare elsewhere. 141 specimens found in 20-100 populations. Known in habitats containing Sphagnum.

Ilybius ignarus (LeConte)

Uncommon throughout state

Graphoderus manitobensis Wallis

Uncommon south of a line from Pepin to Manitowoc counties, absent elsewhere. 63 specimens known from at least 10 populations. Found in large sedge and cattail marshes.

Liodessus cantralli (Young)

Three adults were collected in bottle traps from SCH99-106 (Maine Wildlife Area bog). Only 3 specimens had been previously collected in the state from 2 counties (Hilsenhoff 1994).

Lioporeus triangularis (Fall)

One adult was collected on submerged wood from the shoreline of the Wolf River in New London (SCH99-077). It was previously known from only 3 counties in the state, and by only 10 specimens (approximately).

Matus bicarinatus (Say)

Eight specimens were collected from an artesian spring and spring pond (SCH99-102), and 1 from the Shioc River (SCH99-064). Although this species occurs in several counties in the southern third of the state, it is relatively rare and the 9 specimens collected in this study represent the most northern collection of this species in the state (Hilsenhoff 1993).

Neoporus vittatus (LeConte)

Uncommon statewide. 78 specimens known from at least 34 populations. Most were located in small to medium stream habitats. Also adjacent to ponds and spring ponds.

Neoscutopterus hornii (Crotch)

This species is fairly common in the northern third of Wisconsin, but it is rare in the central portion of the state, and absent in the southern third (Hilsenhoff 1993). One specimen was collected from the Hortonville Bog (SCH99-101) with a net, and it likely represents the most southern distribution record for the state. This species is found only in black spruce-tamarack swamps that contain *Sphagnum*.

Rhantus sinuatus (LeConte)

Uncommon statewide. 76 specimens found in at least 24 populations. Located mostly in shallow sedge or cattail marshes, often with sphagnum. Almost all were collected in bottle traps, suggesting nocturnal species.

Elmidae

Dubiraphia bivittata (LeConte)

Uncommon south of a line from La Crosse to Outagamie counties. Rare in Burnett and Vilas counties, apparently absent elsewhere. 106 specimens found in at least 21 populations. Found in plants and submerged wood in medium to large rivers and adjacent sloughs, marshes and ponds.

Stenelmis antennalis Sanderson

Common in Burnett Co., rare to locally common in central WI, and absent elsewhere. 395 specimens known from at least 13 populations. Found in submerged wood, largely sandy rivers.

Stenelmis bicarinata LeConte

Common in northwest Wisconsin, rare in northern half (Buffalo to Outagamie counties), absent in southern half. 469 known specimens from at least 32 populations. Found in submerged wood and large sandy rivers.

Stenelmis fuscata Blatchley

Rare along a linear distribution from Iowa to Oconto counties. 138 specimens known from at least 11 populations. Found in submerged wood and large sandy rivers.

Haliplidae

Haliplus pantherinus Aube

Uncommon throughout the state. 47 specimens found from at least 10 populations. Located in lakes, ponds, and stream margins.

Haliplus canadensis Wallis

Uncommon in eastern 1/3 of state, absent elsewhere. 43 specimens found in at least 10 populations. Located in lentic habitats.

HETEROPTERA:

Corixidae

Hesperocorixa semilucida (Walley)

Uncommon south of a line from Trempealeau to Shawano counties, absent elsewhere. 45 specimens found in at least 21 populations. Located in ponds in the spring and larger rivers to overwinter.

Hebridae

Hebrus burmeisteri Lethierry & Severin

Rare statewide, apparently absent in the Northwest. Distribution could be misleading because of its very small size leading to sampling bias. 28 specimens found in at least 14 populations. Known in shallow lentic habitats.

Hydrometridae

Hydrometra martini

Located statewide. 61 specimens found in at least 19 populations. Found in ponds, sloughs, and other lentic sites.

Naucoridae

Pelocoris femoratus (Palisot de Beauvois)

Four specimens were collected from Shawano County in the Wolf River (SCH99-097) and an unnamed tributary to the Wolf River (SCH99-061). This species of creeping water bug is uncommon to rare in southern Wisconsin, and Shawano Co. represents the most northern record of the species (Hilsenhoff 1984).

Nepidae

Ranatra nigra Herrich-Schaffer

Rare in south of Lincoln Co, apparently absent in north. 52 specimens from 13 collections. Found in large, deep lentic sites and rivers.

EPHEMEROPTERA:

Baetidae

Plauditus cestus

Found in Barren and Dunn counties. 12 specimens found in at least 10 populations. Located on Turtle Creek. Hilsenhoff has other unpublished records.

Baetiscidae

Baetisca obesa (Say)

Rare, known only from Wisconsin River, (Columbia Co and south) and St. Croix River. 55 specimens known from 18 populations. Located in large sand-bottomed rivers

Pseudironidae

Pseudiron centralis McDunnough

This relatively rare species is known from several large, sand-bottomed rivers throughout the state, although mainly western and southern in distribution. It was previously collected from the lower Wolf River watershed in the Embarrass River at Behnke Road in Waupaca County (Lillie 1995). During the current study, *Pseudiron* was found at 1 site on the Wolf River (SCH99-063, Hwy 156) and 3 new sites on the Embarrass River (SCH99-118: Hwy 156, SCH99-120: Hwy I, SCH99-121: Hwy XX). Fairly large to large populations occurred at all 4 sites. Larvae occurred in shallow (6 inches) to deep (4 feet) water on shifting sand bars. Larvae could be detected by eye in the shallow water, but their cryptic coloration made them camouflaged against the sand background. Several specimens were observed for 15 minutes resting and scurrying along the sand.

Diptera: Chironomidae

Axarus

One larva of this genus of chironomid was collected from the Embarrass River (SCH99-119). I am aware of only one other specimen collected from the state (Manitowoc Co.).

ODONATA:

Corduliidae

Neurocordulia yamaskanensis Provancher

A total of four exuviae were found at three sites: Little Wolf River (SCH99-091, -126) and Wolf River (SCH99-079). No larvae of this large corduliid were collected.

Gomphidae

Ophiogomphus howei Bromley

Many specimens (mostly exuviae) were collected from the Embarrass River (SCH99-096, -100 & -117), Little Wolf River (SCH99-080, -093 & -094), and the Wolf River (SCH99-053, -060 & -098). Its range extended from the city of Shawano to River Road boat landing on the Wolf River, from Ridge Line Road to Behnke Road on the Embarrass River, and from Kretchner Road to County Highway X on the Little Wolf River.

Stylurus notatus (Rambur)

A total of 13 larval specimens and 1 exuvia of this species were collected from 3 rivers: Embarrass (SCH99-122, -124, -125), Wolf River (SCH99-058, -066), and the Waupaca River (SCH99-082).

PLECOPTERA:

Perlodidae

Isoperla bilineata (Say)

Common in western and southwest WI, rare or absent elsewhere. At least 360 specimens known from up to 100 populations. Found in large rivers.

Isoperla marlynia Needham & Claassen

Uncommon in northern 1/3 of state, rare in Juneau, Crawford, and Green counties, apparently absent elsewhere. At least 25 specimens found from at least 13 populations. Located in large rivers.

Isoperla richardsoni Frison

Uncommon in northern half of state, absent in southern third and extreme north. At least 175 specimens found from 20-100 populations. Found in large rivers.

TRICHOPTERA:

Hydropsychidae

Hydropsyche bidens Ross

Uncommon in lower Wisconsin, Chippewa, St. Croix, Wolf Rivers, absent elsewhere. 91 specimens found from at least 11 populations. Located in submerged wood in large sandy rivers.

New State Records

The following taxa were collected during this study and represent new records for Wisconsin.

Trichoptera: Leptoceridae

A. *Oecetis nocturna* Ross (2 larval specimens)

B. *Oecetis* near sp. A (Floyd 1995) (1 larval specimen)

C. *Triaenodes flavescens* Banks (1 larval specimen)

D. *Triaenodes nox* Ross (1 larval specimen)

All four species of these caddisflies were expected to occur in Wisconsin based on their U.S. distributions (Floyd 1995, Glover 1996). As a matter of fact, larval specimens may already exist in the University of Wisconsin's Insect Research Collection (UWIRC). However, the recent larval keys by Floyd (1995) and Glover (1996) have not yet been used to identify the specimens of these two genera that are housed in the UWIRC.

Diptera: Chironomidae

A. *Omisus* (1 larval specimen)

B. *Zavreliella marmorata* (Wulp) (2 larval specimens)

These specimens were collected from Pikes Peak Flowage (SCH99-108). Both taxa were expected to occur in Wisconsin.

Oligochaeta: Naididae

Dero vaga (Leidy) (3 specimens)

This species was collected from Pikes Peak Flowage (SCH99-108) and Wolf River Bottoms W.A. (SCH99-115); it was expected to occur in Wisconsin.

Conchostraca

Lycneus brachyurus Muller

Many specimens of this species of clam shrimp were collected in McDonald Flowage (SCH99-110) and Deer Creek Wildlife Area (SCH99-114). No published records of this species in Wisconsin could be found, but the species was expected to occur in the state.

Notable Sites

Large Rivers.

Without question, the most important water bodies within the lower Wolf River Watershed with regard to abundance and diversity of aquatic macroinvertebrates are the large rivers: Wolf, Little Wolf, South Branch, Embarrass, and Waupaca. A minimum taxa richness value of at least 38 was observed in each of

the rivers, and a maximum value of at least 80 was observed in the Wolf River at Highway 29 (SCH99-053). These values are obviously conservative estimates because

- 1) some taxa could not be identified to the species level;
- 2) some taxa had already emerged and were not present as larvae (brachycentrid caddisflies –cases were observed);
- 3) some taxa were likely present only as eggs or very immature and unidentifiable larvae;
- 4) some taxa were missed by the collecting efforts and techniques;
- 5) some taxa were not targeted (many small midge larvae and worms)

These water bodies also provided many records of rare species and new county records, as mentioned above.

Small to Medium-Sized Rivers

Some of the small to medium-sized rivers provided habitat for species that inhabit smaller, colder-water streams (e.g. *Cordulegaster maculata*). In particular, the unnamed streams SCH99-056 and SCH99-061 that empty directly into the Wolf River were notable streams because of their good water quality and contrasting habitat compared to the large Wolf River. On the other hand, unnamed stream SCH99-057 and Bear Creek (SCH99-123) were notable because of their poor water quality and lack of abundant and diverse stream-dwelling species.

Flowages, Sloughs, Swamps, and Shallow Marshes

Most of these types of water bodies had large numbers of macroinvertebrates with relatively high diversity. In general, the macroinvertebrate communities in these habitats could be summarized as being dominated by very common, “weedy” species; species that are abundant throughout the state and are quick to colonize new bodies of water and areas that have been disturbed.

Notable exceptions include Pikes Peak Flowage (SCH99-108), Wolf River Bottom-K&S Unit site SCH99-115, McDonald Marsh (SCH99-110), and the swamp at the Maine Wildlife Area (SCH99-105). These sites contained several new county records, and/or new state records, and had the highest values for taxa richness. As was stated above, the taxa richness values underestimate the true diversity that occurs at these sites. In particular, the aquatic and semi-aquatic Heteroptera and Coleoptera were undoubtedly underrepresented because of the early spring or late-summer life cycles exhibited by many species.

Bogs and Springs

These habitats were rare in the Wolf River Watershed. Consequently, the macroinvertebrate communities within these sites yielded many rare species and new county records. All three bogs that were sampled (Hortonville Bog SNA, Maine and Navarino wildlife areas) had high values (26-53) of taxa richness, along with the single spring pond that was sampled (32).

Lakes

The two lakes that were sampled were marl lakes. Taxa richness was moderate for both lakes, and the communities were composed of relatively common species. However, due to the soft sediments, the difficulty in reaching sites away from the public boat landings, and the differing life cycles of lentic species (Heteroptera, Coleoptera) mentioned above, taxa richness values for these two lakes were very conservative.

Considerations For Management And Protection

Large Rivers

Without a doubt, the large rivers in the lower Wolf River Watershed are the most important bodies of water for the aquatic macroinvertebrate communities, and each river should be considered during any management and protective activities. There are at least three critical characteristics of the large rivers that promote species abundance and diversity:

1. good water quality
2. consistent and proper flow
3. substrate diversity

Good shoreline development practices will address all three characteristics. Proper sewage treatment, agricultural practices, and riparian vegetation and structures will assist in protecting water quality.

Substrate diversity is especially noticeable in the Wolf River where substrates vary from rocky bottom, to sand/gravel bottom, to shifting sand bottom, to mostly clay and silt. Submerged wood is vitally important in all streams, but particularly in larger rivers where substrate diversity is lacking and shifting sand bottoms or clay bottoms are prevalent. In most cases, submerged wood is the only substrate in sections of a river where large numbers and high diversity of aquatic macroinvertebrates will occur. Removing submerged wood or preventing large wood from entering a river system should be considered detrimental to a healthy aquatic macroinvertebrate community. Also vitally important in both the Wolf and Embarrass rivers are the areas of shifting sand and sand bars. These areas are colonized by the rare mayfly *Pseudiron centralis*, its prey, and possibly other rare species that were not found during this study. These large, open, sandy areas are often considered deserts because of the perceived scarcity of organisms (abundance and diversity) due to the apparent lack of suitable substrates for colonization. On the contrary, these areas can harbor large populations of specialized species that have adapted to living on shifting sand. These areas must be protected from siltation and destructive flows, including minimal flows that will allow sand bars to become exposed, heavy flows that will move large amounts of sand downstream, or flows that will in anyway narrow the channel and reduce the amount of surface area of the substrate.

Small to Medium-Sized Streams

These streams are more easily disturbed than the large rivers. Although some of these streams appear to be good shape, others are clearly in questionable or poor condition, such as both Bear creeks, portions of Maple Creek, the Shioc River, and unnamed creeks SCH99-054, -057 and -072. Water quality studies should occur on these streams.

Shallow Marshes

The two shallow marshes that were sampled for aquatic macroinvertebrates (Shioc Mitigation Site, McDonald Marsh) were quite productive, exhibiting high abundance and diversity, even though many of the taxa were common, “weedy” species. It is likely that the high abundance and diversity can be attributed to the shallow water, dense vegetation, and relative lack of vertebrate predators (fish). All three characteristics promote the occurrence of large, soft-bodied and sedentary species (odonates), and species that are atmospheric breathers, which must come to the surface to obtain oxygen. Rising to the surface to obtain oxygen makes the adults and some of the larvae very visible and prone to predation. Maintaining these marshes with shallow water and dense vegetation will likely continue to promote species abundance and diversity, provided that fish populations (sticklebacks, mudminnows, catfish, and others) do not explode.

Bogs and Springs

Since all of the bogs that were sampled harbored rare to uncommon, bog-inhabiting species, and because bogs are uncommon for this portion of the state, it is recommended that all of the bogs be protected from disturbance. It is also recommended that the single artesian well that was sampled (SCH99-102) be protected, as well as the spring pond downstream. The artesian well can either be left alone, or reconstructed to provide more natural habitat.

Future Inventory

Additional sites and habitats should be sampled, along with the re-sampling of some sites. Prioritizing sites and habitats should be done in cooperation with pertinent project personnel who have knowledge and concerns about these sites and habitats. This should occur after initial reports have been studied and workshops have been attended.

Earlier sampling is advised to collect species that emerge in late winter/early spring and were missed during the current study. Also, later sampling should be considered to collect late summer/early fall species.

Sampling of inaccessible sites along the Wolf River and Embarrass River should occur. These sites can be accessed by boat.

Sampling lentic sites by using submerged bottle traps should be expanded. More bottle traps at each site can be done.

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APPENDIX E.2

Aquatic Macroinvertebrate Biotic Field Surveys and Taxonomy – 2000 Results

Submitted by Kurt L. Schmude, Ph.D., Lake Superior Research Institute, December 22, 2000

INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR) initiated a broad-based inventory (flora, fauna, and natural communities) of the Wolf River GMU in 1999. This inventory project will support the state master planning process by providing information to public agency administrators, planners, and managers and aiding the prioritization of sites and species for protection by public and private conservation organizations. Field inventory of aquatic macroinvertebrates is essential for managing and protecting natural resources and thus an important component in the biotic inventory process. Many aquatic macroinvertebrates are sensitive indicators of habitat quality and land use.

The inventories will allow biologists and planners to understand the distribution and relative abundance of some of the most important aquatic species and communities, and to select the most appropriate sites for conserving rare taxa and intact natural communities. The information will also be used for comparing biota of manipulated versus natural systems. Several potentially rare aquatic insects are known, suspected, or have a high probability of occurring within the project area. Because no systematic search for the species has occurred, WDNR is presently unable to assign status or conservation priority to many of them with confidence.

This report documents the results of the second consecutive year of the biotic field survey and the taxonomic analysis performed for the aquatic macroinvertebrates collected in the Wolf River Geographic Management Unit (GMU) during 2000. The first year concentrated only on the immediate lower Wolf River Basin, from Shawano to Fremont (Schmude 1999). The current study was expanded to include all of the GMU. Not only was additional work completed in the area that was sampled in 1999, but several exceptional sites that were previously sampled were revisited. Consequently, the immediate lower Wolf River Basin was sampled more intensively during the two-year study than the other areas of the GMU. Additional factors that contributed to the disparity in sampling effort were 1) the large size of the GMU, 2) the enormous number of aquatic sites within the GMU, and 3) time and financial constraints.

The format of this report is very similar to the 1999 report, and parts of the text are identical. Table 1 documents all of the sites that were sampled in 2000 and includes the data from 1999 for sites that were re-sampled, providing a comparative and cumulative analysis for those sites.

METHODS

A total of 114 sites were sampled for aquatic macroinvertebrates; data from one additional site from a previous study were also included. Many of the sites were chosen based on the future inventory needs that were outlined in "Biotic Inventory & Analysis of the Wolf River Basin: An Interim Report" (WDNR 2000). Sites and areas were listed and mapped as having high potential for conservation and inventory

Sites (#) were located in Forest (5), Langlade (8), Marathon (2), Oneida (1), Outagamie (13), Portage (11), Shawano (28), Waupaca (28), Waushara (12), and Winnebago (6) counties. Sampling occurred on May 17-19, 22-27, and June 5-9, 2000. Dr. Kurt Schmude and two student assistants, Chris Brennan and Jamie Denninger performed sampling.

Lotic Sites

In total, 67 lotic sites were sampled. At each site, the available habitats were determined and each person was responsible for a particular habitat(s). Sampling was performed using a D-frame aquatic net (approx. 1-mm mesh opening). The kick-sampling method was used in riffles and runs, while undercut banks were sampled by rigorously manipulating the net in the undercut substrates. Sample debris was placed on a large mesh screen over a large plastic tray and the organisms fell through the mesh into the tray. Sample debris was then searched for cryptic, slow-moving organisms; all specimens were preserved in plastic vials containing 70% ethanol. Submerged structures (wood, rocks) were taken out of the water and inspected, and other habitats (water surface, shoreline) were visually inspected for organisms and exuviae. Four deep-water sites on the Wolf River were also sampled (SCH100-101, 103, and at Hwy M in Outagamie Co.). The deep-water areas were sampled using a large Ekman grab. In general, habitats that were routinely sampled included the following:

- A. rocky riffles and runs
- B. submerged wood and roots
- C. undercut banks
- D. submerged and emergent vegetation
- E. sandy, silty, and/or clayey runs near the shoreline
- F. shallow and deep sand bars and sand bar drop-offs
- G. surface (surface-dwelling organisms)
- H. shorelines and bridges (exuviae)

Lentic Sites

In total, 47 lentic sites were sampled. The available habitats were again determined and each person was responsible for a particular habitat(s) or area(s) to sample. The same methods were employed. Habitats that were sampled included the following:

- A. shallow, vegetated areas
- B. water column of deeper areas
- C. submerged wood
- D. shallow sandy/silty areas near the shoreline
- E. surface
- F. shoreline searches for exuviae

In addition, the sites listed below were sampled using submerged bottle traps. Two to six traps were placed in shallow, vegetated areas. The traps were deployed from May 17-18 or 19, May 22-24 or 25, and June 5-7, ranging from 24-72 hours. The sites were chosen based on previous experience with the sites and the probability that larger numbers and diversity of macroinvertebrates would be captured passively with the traps, rather than actively with nets. Several of the sites are currently being managed by the WI

DNR.

- A. ponds and flowages on LaSage Property (SCH003-007) (May 17-19)
- B. Shioc Mitigation Site-marsh (SCH008) (May 17-19, June 5-7)
- C. Maine Wildlife Area-swamp (SCH009) (May 17-19, June 5-7)
- D. McDonald Flowage-marshes (SCH010: May 17-19; SCH011: May 18-19)
- E. Frog pond, marsh, and oxbow at Mosquito Hill Nature Center (SCH021-023) (May 17-19)
- F. Pikes Peak Flowage-marsh (SCH024) (May 22-25)
- G. Shaky Lake State Natural Area (SNA) (SCH025) (May 22-24)
- H. oxbow, Hwy 156 near Wolf River (SCH052) (May 22-25, June 5-7)
- I. bog in Navarino State Wildlife Area (SCH053) (May 22-25)

Sampling Problems

- A. Restricted seasonal sampling. Populations of aquatic insects were high in numbers for most spring emergents. However, populations of winter stoneflies and late summer/early fall species were very low in numbers or absent. The inability to get contracts in place as soon as possible prevented field crews from working earlier in the year (March-early May), especially before high water levels occurred.
- B. High water levels due to frequent and heavy rains. The lower Wolf River below Shawano was too high during the sampling period to allow for safe sampling, even in the shallow areas along the banks. Although the lower Wolf River was sampled using an Ekman grab at 4 sites, sampling with an aquatic net was very limited. High water levels and strong currents were also prevalent on streams throughout the basin, but sampling was still possible at all of the smaller streams.

RESULTS

Table 1 below lists each site, the minimum number of taxa identified at each site, the habitats sampled, the number of new county records, and pertinent notes on the sampling effort or identification of the site. Sites are grouped into the following major categories:

- A. Very large rivers
- B. Medium to large rivers
- C. Small to medium-sized rivers
- D. Shallow marshes, flowages, floodplains
- E. Oxbows
- F. Swamps
- G. Bogs
- H. Springs, spring ponds
- I. Ponds, woodland pools
- J. Lakes

Taxa were identified to the lowest taxonomic level possible based on current literature and the expertise of the participating taxonomists (Dr. Kurt Schmude - all macroinvertebrates, Mr. Wayne Steffens - odonates).

In some cases, specimens were identified to a higher taxonomic level due to the lack of a key to species, even though two or more species were clearly recognizable among the specimens; sites where this situation occurred are marked with a plus (+). Seven sites were sampled with both nets and submerged bottle traps.

The number of taxa collected by each method is listed, along with the total number of different taxa collected by both methods.

Habitat codes are as follows: A=riffle, B=run, C=pool, D=lake, E=bank.

New county records were determined based on published scientific literature, previous WI DNR surveys of macroinvertebrates performed by the author, and unpublished data known to the author. Many groups of aquatic macroinvertebrates have not been intensively studied at the species level, and detailed data on their distribution in Wisconsin is not available. Data for the following taxa were available for the determination of new county records:

- A. all Heteroptera (aquatic and semi-aquatic bugs)
- B. almost all aquatic Coleoptera (beetles, except Chrysomelidae, Curculionidae, Scirtidae)
- C. Baetiscidae, Heptageniidae, Pseudironidae (mayflies)
- D. Perlodidae (stoneflies)
- E. Hydropsychidae, Brachycentridae (caddisflies)

Sampling effort was restricted at some sites due to the difficult and/or dangerous conditions at the site. Site records followed by "Not processed" include samples from small to medium-sized streams that were not taxonomically processed due to the large volume of samples collected and the perceived sameness of that particular habitat.

TABLE 1.

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
<u>VERY LARGE RIVERS</u>				
Wolf River (7 sites)				
no sourcecode	0(dredge)	B		Co. Hwy M, Outagamie Co.
SCH100	11(dredge)	B		New London
SCH101	0(dredge) 31(net)	B,E	1	Gill's Landing
SCH102	20(net)	B	1	Fremont
SCH103	7(dredge) 24(net) 30(total)	B		near Hwy H
SCH126	53	A,B,C,E	3	Wolf River Landing Road
SCH130	48	A,B,C,E		Chaney Lane
SCH132	53	B,E		Meister-Stockley Road
Red River				
SCH116	40	B,C,E		high water, waterfall, bedrock
<u>MEDIUM TO LARGE RIVERS</u>				
Crystal River				
SCH027	45	B,E		
Embarrass River				
SCH058	71	A,B,C,E	4	
SCH059	36	E	1	
SCH060	40	A	1	
TOTAL	94			

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County</u> <u>Records</u>	<u>Notes</u>
Middle Branch Embarrass River				
SCH071	60	B,E	3	
SCH120	46	A,B,E		
North Branch Embarrass River				
SCH115	49	A,B,E		
South Branch Embarrass River				
SCH002	27	B		
Ninemile Creek				
SCH125	18	B,E		
Pickereel Creek				
SCH134	34	B,E	1	
Pigeon River				
SCH061	45	A,B,C,E		
Pine River				
SCH049	28	B,E		
Shioc River				
SCH056	51	A,B,C,E		
Waupaca River				
SCH093	61	A,B,C,E		
West Branch Red River				
SCH119	41	A,B,C,E		
Little Wolf River				
SCH065	50	A,B,C,E	1	
SCH112	24	A,B,E		
<u>SMALL TO MEDIUM-SIZED RIVERS</u>				
Alder Creek				
SCH043	20	B,E		
SCH044	--	B,E		Not processed
Allen Creek				
SCH015	13	A		
Beetle Creek				
SCH001	--	C,E		Not processed
Bradley Creek				
SCH110	43	A,B,E		
Cedar Creek #1				
SCH019	--	B,E		Not processed
spring seep to Cedar Creek #1				
SCH020	9	B,E	1	
Cedar Creek #2				
SCH051	28	A,B,E		
Cleveland Creek				
SCH113	25+	B,E		

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>New County Records</u>	<u>Notes</u>
Comet Creek SCH066	46	B,E		
SCH072	--	A,B,E		Not processed
Emmons Creek				
SCH029	38	B,E		
SCH030	46	A		
Flume Creek				
SCH109	45	A,B,E		
Krause springs and creek				
SCH121	47	A,B,C,E	2	
Logemanns Creek				
SCH068	34	A,B,E		
McGee Creek				
SCH124	47	A,B,E	1	
Mill Creek				
SCH105	36	A,B,E		
Murry Creek				
SCH031	30	B	3	
Pearl Creek				
SCH032	5	A		
Peterson Creek				
SCH096	47	A,B,E		
Pine River				
SCH034	32	B,E		
Pony Creek				
SCH069	47	A,B,C,E		
SCH070	--	A,B,E		Not processed
Porters Creek				
SCH045	--	B,E		Not processed
Potters Creek				
SCH104	--	A,B,E		Not processed
Radley Creek				
SCH028	37	B,E		
Rat River				
SCH038	19	A,B,E		
SCH039	23	B,E		
Spring feeder to Red River				
SCH117	11	B	1	
Tributary to Sannes Creek				
SCH095	23	B,E		
Silver Creek				
SCH118	41	A,B,E		
Spider Creek				
SCH133	23	A,B,E	1	
Twin Creek				
SCH055	--	B,E		Not processed

Upper Pine River

SCH033	36	A,B,E	New County	
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<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>Records</u>	<u>Notes</u>
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Walla Walla Creek

SCH026	--	B,E		Not processed
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West Branch Shioc River

SCH054	30	A,B,E	1	
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Whitcomb Creek

SCH106	32	A,B,E	1	
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S. Fork Whitcomb Creek

SCH107	28+	B,C,E		
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Willow Creek

SCH036	--	A,B,E		Not processed
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unnamed creeks

SCH037	27	A,B,E		
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SCH063	8	A,B,E		
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SHALLOW MARSHES/FLOWAGES/FLOODPLAINS (9 sites) [1999 data]

SCH004	5			LaSage flowage, north unit
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SCH005	15		1	LaSage flowage, south unit
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[SCH99-103] [20(net) 13(bottle) 27 (total)]

Grand Total 34

SCH008	16(May 17-19)	30(June 5-7)	15(May 17-19, ditch)	39(total)	Shioc Mitigation Site
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[SCH99-104] [22(net) 15(bottles) 31(total)]

Grand Total 58

SCH010	13		1	McDonald Marsh (south unit)
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SCH011	22			McDonald Marsh (north unit)
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[SCH99-110] [25(net) 18(bottles) 36(total)] [5]

Grand Total 49

SCH024	31(net)	20(bottle)	41(total)	7	Pikes Peak Flowage
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SCH023	47(net)	32(bottle)	67(total)	1	"Marsh" Mosquito Hill Nature
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New County

<u>Site</u>	<u># Taxa</u>	<u>Habitat</u>	<u>Records</u>	<u>Notes</u>
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SCH040	23			Rat River, Hwy M
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SCH041	22		3	Rat River, Hwy W
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OXBOWS (2 sites)

SCH022	26(net)	12(bottle)	31(total)	1	Mosquito Hill Nature Center
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SCH052	44(net)	42(bottle)	65(total)	4	Hwy 156 near Wolf River
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SWAMPS

SCH009	25(May 17-19)	36(June 5-7)	41(total)	2	Maine Wildlife Area (swamp)
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[SCH99-105] [38(bottle)] [3]

Grand Total 52

BOGS (3 sites)

SCH025	8(net) 20(bottle) 25(total)			Shaky Lake
SCH053	14(bottle)		4	Navarino Bog
	[SCH99-107]	[19(net) 10(bottles) 26(total)]	[11]	
	Grand Total 31			
SCH064	26		1	Mud Lake bog SNA

SPRINGS/SPRING PONDS (5 sites)

SCH003	7 (net) 3 (bottle) 10 (total)			spring pond, LaSage Prop.
	[SCH99-102]	[32(net)]	[7]	
	Grand Total 39			
SCH016	25		2	spring pond, Todd Close Prop.
SCH017	26			spring pond, Todd Close Prop.
SCH050	7			Cedar Springs
SCH111	21			woodland spring pond

PONDS/WOODLAND POOLS (6 sites)

SCH006	7			woodland pool, LaSage Prop.
SCH007	12			woodland pool, LaSage Prop.
SCH018	14			retention pond, Close Prop.
SCH021	36(net) 17(bottle) 41(total)		2	"Frog pond" Mosquito Hill
SCH048	32		1	woodland pool, SNA
SCH099	12			woodland pool, Myklebust Lk.

LAKES (22 sites)

SCH012	18	D		Wolf Lake
SCH013	16	D	1	Pickereel Lake
SCH014	38	D	1	Fountain Lake
SCH035	17	D		Gilbert Lake
SCH042	28	D	1	Lake Poygan
SCH046	13	D		unnamed bog lake
SCH047	13	D	1	fishless lake SNA
SCH057	19	D		Lulu Lake
SCH062	11	D		Keller Lake
SCH067	11	D		Wilson Lake
SCH094	23	D	1	Grenlie Lake SNA
SCH097	19	D		Rollofson Lake
SCH098	29	D		Myklebust Lake
SCH108	24	D		Sunset Lake
SCH114	20	D	1	Hennig Lake
SCH122	9	D		Rabe Lake
SCH123	34	D	2	Lawrence Lake
SCH127	4	D		Himley Lake (south end)
SCH128	11	D		Himley Lake (north end)
SCH129	27	D	1	Pine Lake

SCH131	37	D	D	2	Little Rice Lake
no source code 117		D		1	Silver Lake, Waushara County

RARE SPECIES

The following species were collected during this study and are considered rare in the state.

COLEOPTERA-beetles

Hydrophilidae (water scavenger beetles)

Enochrus consortus Green

This species occurs in a variety of lentic habitats. Single specimens were collected from the "marsh" within the Mosquito Hill Nature Center (SCH023), and from Pikes Peak Flowage (SCH024). There are 24 county records and 210 individuals known (Hilsenhoff 1995), with 81% having been collected by blacklight traps at a single location in southern WI.

Enochrus perplexus (LeConte)

This species is more rare in Wisconsin than the previous species of *Enochrus*. Hilsenhoff (1995) reported only 17 adults from 15 counties; this data reveals that only single specimens are collected when they are found. Indeed, single specimens were collected during the current study from Pikes Peak Flowage (SCH024) and the Navarino Bog (SCH53). Adults have been collected from a variety of habitats, and when coupled with their seemingly solitary behavior, it is too difficult to speculate on their natural history.

Hydrobius melaenus (Germar)

Adults of this uncommon beetle occur in small, spring-fed streams. Three specimens were taken from Murry Creek (SCH031) and one from a spring-seep feeder to Cedar Creek on Todd Close's property (SCH020). Hilsenhoff (1995) reported 15 county records and a total of 76 specimens; 4 additional county records are known.

Hydrochara spangleri Smetana

This species is an inhabitant of shallow lentic habitats in floodplains of rivers. Hilsenhoff (1995) reported a total of 193 specimens from 11 counties; however, 91% of his specimens were collected from one specific area along the lower Wisconsin River. Three sites during the current study yielded adults of this species: a flooded woodland pool beside the road within the LaSage Property (n=16) (SCH006), a single specimen from the oxbow and 5 adults from the marsh within the Mosquito Hill Nature Center (SCH022, 023).

Laccobius agilis (Randall)

Single adult specimens were collected from Murry Creek (SCH031) and Mud Lake (SCH064). Hilsenhoff (1995) reported this species as uncommon statewide, with 15 county records and only 28 specimens known. I am aware of 2 additional county records.

Laccobius reflexipennis Cheary

One adult was collected from the Embarrass River (SCH059). Less than 6 specimens were previously known from the state, and only 4 previous county records (Hilsenhoff 1995). One specimen was collected during last year's study (Schmude 1999).

Dytiscidae (predaceous diving beetles)

Agabetes acuductus (Harris)

This very uncommon species was collected at 2 sites: the swamp in the Maine Wildlife Area (SCH009, n=2) and the oxbow along Hwy 156 (SCH052, n=3). Only 32 specimens from 11 counties have been reported for Wisconsin (Hilsenhoff 1992). It occurs in woodland pools and wooded river sloughs, especially temporary habitats.

Agabus bicolor (Kirby)

Hilsenhoff (1993b) reported 14 county records (predominately northern counties) and 64 specimens for this species, and "at least 64% of the adults were found in association with *Sphagnum*, almost all in black spruce-tamarack...swamps." The Navarino Bog (SCH053) yielded 2 specimens during this study and 1 in 1999, but these records for Shawano Co. are not new. However, these adults do represent one of the southernmost records in the state.

*Agabus wasastjerna*e (C.R. Sahlberg)

This rare species is known from *Sphagnum*-containing bogs, swamps, and marshes in northeastern and north-central WI, with 6 county records and 23 specimens (Hilsenhoff 1993b). A single adult was collected from the Navarino Bog (SCH053) in Shawano Co., which represents the southernmost record of this species in the state. In fact, it may also represent the southernmost record in North America (Larson 1996)!

Copelatus glypticus (Say)

A single adult was collected from the Navarino Bog (SCH053) and represents one of the northernmost records (Shawano Co.) in Wisconsin. Hilsenhoff (1993a) found 42 specimens from 13 counties, with only 1 county further north than Wood Co. (Bayfield Co.). The species occurs in a variety of aquatic habitats, but mainly in shallow temporary sites often associated with streams, which curiously does not describe the Navarino Bog.

Ilybius discedens Sharp

This species dwells almost exclusively in *Shagnum* swamps and bogs. Hilsenhoff (1993b) reported 141 specimens from 15 counties, with only 2 counties (Wood, Portage) occurring further south than Lincoln Co. A single adult was collected from the Navarino Bog (SCH053) in Shawano Co.; 2 specimens were taken from the same locality in 1999. This new county record is one of the southernmost records in the state.

Ilybius ignarus (LeConte)

This dytiscid beetle is an uncommon inhabitant in the southern two-thirds of Wisconsin and rare in the northern third. Although there are 30 county records, only 75 specimens have been reported (Hilsenhoff 1993b, unpublished data). Three sites in Outagamie Co. produced 5 adults: the "marsh" at the Mosquito Hill Nature Center (SCH023, n=2), Pikes Peak Flowage (SCH024, n=1), and Shaky Lake (SCH025, n=2). In addition, 1 specimen was collected in the Navarino Bog in 1999. Adults occur in permanent marshes, ponds, and swamps.

Ilybius incarinatus Zimmermann

Although this species is fairly common in the southern third of WI, it is uncommon in the central third, and rare in the northern third. There are 21 county records, but only 92 specimens reported (Hilsenhoff 1993b, unpublished data); most records are south of a line from Monroe to Winnebago counties, and more than half of the adults were trapped from the Horicon Marsh. A single adult was collected in Pikes Peak Flowage (SCH024) in Outagamie Co., a new county record. The species occurs in permanent ponds and marshes.

Liodessus flavicollis (LeConte)

This tiny species had been collected from 15 counties statewide for a total of 97 specimens (Hilsenhoff 1994,

unpublished data). It occurs in deeper water lentic habitats. A large collection of 36 specimens was taken from Lake Poygan (SCH042). Most were taken by scraping a net along the surface of a vertical retaining wall by a public boat landing.

Matus bicarinatus (Say)

Single specimens were collected from the spring pond on the LaSage Property (SCH003), and the Frog Pond and "marsh" within the Mosquito Hill Nature Center (SCH021, SCH023). This species was found in 13 counties in the southern third of WI, but is relatively rare (n=221), especially in the central part of the state (Hilsenhoff 1993a). Nine specimens were collected last year (Schmude 1999).

Rhantus sinuatus (LeConte)

This is an uncommon species statewide. Hilsenhoff (1993a) reported 76 individuals from 24 counties; I am aware of 1 additional county record. Six specimens were collected from the swamp in the Maine Wildlife Area (SCH009) and 1 from Pikes Peak Flowage (SCH024); all were collected in submerged bottle traps. Curiously, Hilsenhoff stated that all specimens he collected (except for 3) were collected in bottle traps, suggesting the adults are nocturnal. Although they can be found in a variety of lentic habitats, most often they are associated with *Sphagnum*.

Gyrinidae (whirligig beetles)

Gyrinus impressicollis Kirby

This is the third rarest species of whirligig beetles in Wisconsin (24 species), with only 6 northern-county records and 15 total specimens known (Hilsenhoff 1990). It occurs in larger lentic habitats and rarely flies into streams to overwinter, making it difficult to capture. Thus, it may be under represented. A single adult female was collected from Little Rice Lake in Forest Co. (SCH131), and it represents the northeastern-most record for WI.

Haliplidae (crawling water beetles)

Haliphus leopardus Roberts

Hilsenhoff and Brigham (1978) reported only 8 collections from ponds and sloughs in 7 counties, yielding 10 specimens; 1 additional county record is known (unpublished data). Two adults were taken from Lawrence Lake (SCH123) in Langlade Co., a relatively undisturbed, clear-water lake.

HETEROPTERA - true bugs

Corixidae (water boatmen)

Hesperocorixa semilucida (Walley)

This uncommon to rare species has been found in 11 southern counties with 45 specimens collected (Hilsenhoff 1984). A single specimen was taken from the "marsh" within the Mosquito Hill Nature Center (SCH023). Although this is not a new county record, it represents one of the northeastern-most records for the state. Adults overwinter in large rivers, but can be found in ponds during the spring.

Nepidae (water scorpion)

Nepa apiculata Uhler

This seemingly rare water scorpion has been collected in 16 counties (Hilsenhoff 1984, Cochran et al. 1992, unpublished data), with less than 40 individuals known. A single specimen was collected in a bottle trap from the oxbow along Hwy 156 near the Wolf River in Waupaca Co. (SCH052). This species occurs in a variety of lentic and lotic habitats, but typically in very shallow, mucky areas where there is dense vegetation.

Hebridae (velvet water bug)

Hebrus buenoi Drake and Harris

This species is apparently very rare in WI, with only 1 specimen having been reported (Racine Co.) (Hilsenhoff 1986), despite being collected in at least 8 sites in Minnesota (Bennett and Cook 1981). However, a single specimen was collected a few years ago in Perry Creek County Park in Jackson Co. during a WI DNR survey of the Black River State Forest. Another specimen was collected from the oxbow along Hwy 156 near the Wolf River in Waupaca Co. (SCH052). This represents the third specimen and county record known from Wisconsin.

Hydrometridae (marsh treader)

Hydrometra martini Kirkaldy

Hilsenhoff (1986) reported this species as uncommon throughout the state, with 18 county records and 61 individuals. It can be found walking on the surface in heavily vegetated lentic habitats. Fourteen specimens were collected from the following localities: oxbow pond within the Mosquito Hill Nature Center (SCH022, n=9), Pikes Peak Flowage (SCH024, n=2), Rat River wetland complex on Hwy W (SCH041, n=2), and the unnamed fishless lake State Natural Area in Waushara Co. (SCH047, n=1). Two of these sites represent new county records. Two additional county records were found in 1999 at the following localities: 80-acre Flowage in Shawano Co. (SCH99-111, n=1), and Wolf River Bottoms State Wildlife Area-flowages in Outagamie Co. (SCH99-115, n=3). Based on recent biotic surveys conducted for the WI DNR, it appears that this delicate water treader is more common and abundant in the state than first reported. Its small, cryptic stature has likely led to its lack of collection.

ODONATA - dragonflies/damselflies**Gomphidae (clubtails)**

Stylurus notatus (Rambur)

Several larval specimens of this species were collected in 1999 (Schmude 1999). One additional larval specimen was collected from the lower Wolf River at Gill's Landing (SCH101) in Waupaca Co. The species currently has a state rank of S2S3.

Lestidae (spreadwings)

Lestes inaequalis Walsh

A very large population of this species was found in the oxbow along Hwy 156 near the Wolf River in Waupaca Co. (SCH052); 56 large, mature larvae were collected along the flooded shoreline using aquatic nets and bottle traps. This species currently has a state rank of S2S3.

Lestes vigilax Hagen in Selys

A single larval specimen was collected in Lulu Lake (SCH057) in Shawano Co., and 2 larval specimens from Grenlie Lake State Natural Area (SCH094) in Waupaca Co. This species currently has a state rank of S3.

TRICHOPTERA - caddisflies

Leptoceridae (long-horned caddisflies)

Larval specimens of the following three species may exist in the University of Wisconsin's Insect Research Collection (UWIRC). However, the recent larval keys by Floyd (1995) and Glover (1996) have not yet been used to identify the specimens of these two genera that are housed in the UWIRC.

Oecetis nocturna Ross

Two larvae were collected in 1999 (Schmude 1999) and represented the first records of this species for the state. Single larval specimens were collected from Fountain Lake (SCH014) in Portage Co., and West Branch Shioc River (SCH054) in Shawano Co.

Oecetis near sp. A (Floyd 1995)

One larva was collected in 1999 (Schmude 1999) and represented a new state record. Single larval specimens were collected from Fountain Lake (SCH014) in Portage Co. and Lulu Lake (SCH057) in Shawano Co.

Triaenodes nox Ross (1 larval specimen)

One larva was collected in 1999 (Schmude 1999) and represented a new state record. One specimen was taken from the Shioc Mitigation Site (SCH008) in Outagamie Co.

DECAPODA

Cambaridae (crayfish)

Procambarus acutus (Girard)

This species is relatively rare in Wisconsin; Hobbs and Jass (1988) reported only 37 sites, and only 6 sites were located away from the extreme southeastern counties in the state. Eight specimens were collected in Outagamie Co. at the following localities: LaSage flowage (northern unit) (SCH004, n=1), a flooded woodland pool (SCH006, n=3) on the LaSage Property, and the "marsh" within the Mosquito Hill Nature Center (SCH023, n=4).

Palaemonidae (shrimp)

Palaemonetes kadiakensis Rathbun

This is the only species of freshwater shrimp that occurs in Wisconsin, where it is quite rare (7 counties). It occurs mainly in the St. Croix, Trempealeau-Black, Wisconsin, and Pecatonica-Sugar watersheds in the Mississippi drainage basin along the extreme western edge of the state (Hobbs and Jass 1988). The only other record is from Guth's Harbor, a lagoon along the Wolf River in Waupaca Co. A new Waupaca Co. site was discovered, the oxbow along Hwy 156 near the Wolf River (SCH052), where 11 specimens were collected.

CONCHOSTRACA - clam shrimp

Lycneus brachyurus Muller

Many specimens were collected in the McDonald Flowage (SCH99-110) and Deer Creek Wildlife Area (SCH99-114) in 1999 (Schmude 1999). A single specimen was collected from the Shioc Mitigation Site (SCH008) in 2000. In the 1999 report (Schmude 1999), I mentioned that I was unaware of any published records of this species in Wisconsin. However, Schneider and Frost (1996) reported it from ponds in the Northern Highland Lake District in Vilas Co.

NOTABLE SITES

Very Large Rivers

The 1999 report (Schmude 1999) stated that the very large rivers were considered the most important water bodies with regard to abundance and diversity of aquatic macroinvertebrates within the lower Wolf River Watershed. These very large rivers could not be adequately sampled or re-sampled in 2000 due to very high water levels. However the upper Wolf River Watershed did not receive the same rainfall amounts, and water levels were much lower, making it easier to access these sites. Two very large rivers were sampled, the Wolf and Red rivers. High taxa richness values (40-53) and abundance of aquatic macroinvertebrates were found, similar to what was discovered last year when values of taxa richness of 38 to at least 80 were recorded. Two outstanding sites on the upper Wolf River were located at Wolf River Landing Road (Langlade Co.) and Meister-Stuckley Road (Oneida Co.). The Wolf River at Chaney Lane (Forest Co.) did not produce taxa richness values or abundance data that were as high as other sites along the Wolf River. This site seemed to be disturbed, with dark algal mats covering the rocks, and a perceived water quality of only fair. It is not clear what might be causing this disturbance. The site on the Red River was located at the canoe landing near Gresham where the waterfall area exists. This site was particularly difficult to sample due to high water, raging currents, and bedrock substrates. Undoubtedly, taxa richness would have been much greater at this site if a more thorough effort could have been accomplished.

Medium to Large Rivers

Thirteen medium to large rivers were sampled. Taxa richness ranged from 18 in Ninemile Creek (Langlade Co.) to 71 in the Embarrass River (Shawano Co.). Most appeared to have good water quality, with high taxa richness and species that were intolerant to organic enrichment. The rivers included: Little Wolf, Crystal, Pine, Waupaca, and the branches of the Embarrass.

The Embarrass River at Hayman Park near Pella (Shawano Co.) was an exceptional area. Three separate sites within the park were sampled based on their apparent differences in habitat. One site was located within the waterfalls area (SCH058), another at the bridge where there was a relatively shallow, sandy run (SCH059), and another downstream from the bridge at the first large, wide, shallow riffle area (SCH060). Taxa richness ranged from 36-71 among the three sites, with an overall richness value of an amazing 94 for the entire stretch of the riverway; this value is assuredly still quite low because worms, many small larvae of flies, and other less conspicuous species were under represented. However, this was the highest taxa richness value observed within the entire Wolf River GMU for the two-year study.

The Shioc River in Navarino (Shawano Co.) was also interesting because of the very high numbers of stoneflies that were present (mainly *Perlesta*). At the same time, prey items such as baetid mayflies and hydroptychid caddisflies were not as equally abundant, despite a seemingly ideal habitat (shallow, fast water with abundant rubble and debris). Taxa richness (51) was high.

An exception to the good quality rivers was the West Branch of the Shioc River where agricultural runoff appeared to be having an impact on the river, despite a relatively high richness value of 41. I suspect that if the impacts could be eliminated or mitigated, water quality in this stream would improve dramatically. The fauna in the stream was indicative of a cold to cool-water stream, with relatively intolerant species present, but in low numbers.

Small to Medium-sized Streams

A total of 37 different streams in this category were sampled. Taxa richness values ranged from 5 in Pearl Creek (Portage Co.) to 47 in Krause spring and creek (Langlade Co.), but there were very few new county records discovered for species. Low richness values for Pearl, Allen (Portage), and an unnamed creek

(SCH063-Waupaca Co.) (Table 1) may not necessarily be attributed to man-made disturbance, but perhaps to very cold temperatures and lack of suitable, heterogeneous substrates. Overall, most of the streams indicated very good water quality, with many of the same taxa present in most of the streams. In fact, with the development of time and financial constraints in the study, and because of the perceived sameness in the fauna, the macroinvertebrate samples from 10 streams within this category were not taxonomically processed for this report (see Table 1)

Shallow Marshes, Flowages, Floodplains

Most of these types of water bodies had large numbers of macroinvertebrates with relatively high diversity. In general, the macroinvertebrate communities in these habitats could be summarized as being dominated by very common, Aweedy \cong species; species that are abundant throughout the state and are quick to colonize new bodies of water and areas that have been disturbed. Nine sites were sampled in 2000, all in the lower Wolf River Basin. Taxa richness values ranged from 5 in the LaSage flowage (SCH004, northern unit) to 67 in the "marsh" within the Mosquito Hill Nature Center (SCH023). Habitats that had populations of fish were less productive and diverse with regard to macroinvertebrates.

Three sites were sampled in both years: LaSage flowage (SCH005, southern unit), McDonald Marsh (SCH011, northern unit), and the Shioc Mitigation Site (SCH008). Bottle traps were used exclusively in 2000, resulting in additional taxa being found compared to 1999. As a result of the two-year collecting effort, relatively high taxa richness values were observed: 34 (LaSage), 49 (McDonald), and 58 (Shioc).

Two other sites of notable mention include Pikes Peak Flowage (SCH024), which was sampled at a site further west than in 1999, and the "marsh" at Mosquito Hill. Pikes Peak yielded 41 taxa with 7 new county records, while the marsh produced 67 taxa, but only 1 new county record. Both were very productive and harbored large invertebrate populations.

Oxbows

Two oxbows were sampled, and both proved to be extremely productive sites. The oxbow within the Mosquito Hill Nature Center (SCH022) produced 31 taxa. The biggest surprise during the study, however, was the oxbow on Hwy 156 in Waupaca Co. (SCH052) near the Wolf River. Net sampling along the margins of the oxbow resulting in an amazing mass of invertebrates; it was basically an invertebrate soup. Large lepid damselflies (*Lestes inaequalis*) dominated the biomass, but other large invertebrates were also abundant, including the rare freshwater shrimp *Palaemonetes kadiakensis*. Diversity was astounding (67 total taxa) when compared to the relatively little time that was spent sampling the area with nets (only a short stretch of shoreline was sampled). Bottle traps were deployed on two different occasions; each time the water level in the oxbow dropped a few feet leaving most of the traps out of the water, and yet 42 taxa were collected using bottle traps. In addition, fish inhabit the oxbow, such as northern pike (*Esox lucius*), along with some very large fish that were not identified. Normally, fish inhibit macroinvertebrate diversity and production, but certainly not in this case. Although only 4 new county records were established, several rare to uncommon species were found. In addition, large populations of common species also occurred.

Bogs and Swamps

Three bogs (Shaky Lake, Navarino Bog, Mud Lake Bog) and 1 swamp (Maine Wildlife Area) were sampled in 2000; the swamp and Navarino Bog were sampled last year also. Shaky Lake and Mud Lake Bog were relatively unproductive, but were very difficult to sample. The fauna in each lake was composed of mostly common species, but a more thorough sampling effort would likely show a more diverse, bog-inhabiting community.

The swamp within the Maine Wildlife Area next to Beyer Road was sampled with bottle traps three times during the past two years. A total of 38 taxa was collected in 1999 (Schmude 1999, bottle traps were used instead of a net as listed). In 2000, 25 taxa were collected from May 17-19, while 36 taxa were collected from June 5-7, resulting in 41 different taxa. Overall, 52 different taxa were found at this site during the two years, with 5 representing new county records. The extremely rare water scavenger beetle *Hydrochara leechi* was collected last year (Schmude 1999), but was not found in 2000. The swamp has a very large population of *Hydrochara*; 320 specimens were collected in total as follows: 297 *Hydrochara obtusata*, 17 *H. simula*, 5 *H. soror*, and 1 *H. leechi*. Several other rare to uncommon species of aquatic macroinvertebrates were found in this highly productive swamp.

The Navarino Bog is a very unique site for east-central Wisconsin. Nets and/or bottle traps were used to collect macroinvertebrates during the past two years. In total, 26 taxa were found in 1999 (Schmude 1999), while 14 taxa were collected in 2000, resulting in 31 different taxa for the two years. In addition, 15 or nearly half of the taxa were new county records! Most of the species represented bog inhabitants, and for many of them this site currently represents their southernmost (or in some cases the northernmost) limit in the state.

Springs, Spring Ponds

Five sites were sampled in 2000. The spring pond on the LaSage Property (SCH003) was sampled again resulting in a total of 39 taxa collected during the two years. Two spring ponds on the Todd Close Property (SCH016,017), along with one in Portage Co. (SCH111) yielded richness values of 21 to 26, with the fauna dominated by very common species and typical spring-pond species.

Ponds, Woodland Pools

Six sites were sampled: two on the LaSage Property (SCH006,007), and one each on the Todd Close Property (SCH018), Mosquito Hill Nature Center (SCH021), State Natural Area (SNA) in Waushara Co. (SCH048), and near Myklebust Lake (SCH099). Except for Mosquito Hill and the SNA, the fauna was not very diverse and was typical for ponds (very common species). The Frog Pond in the Mosquito Hill Nature Center and the woodland pool in the State Natural Area had considerably greater diversity, but only a total of 3 new county records. Again, the fauna was dominated by fairly common species.

Lakes

Twenty different lakes were sampled, with an additional one sampled during a different study (Silver Lake, Waushara Co.). Taxa richness values ranged from 4 in Himley Lake-south end (Forest Co.) to 38 in Fountain Lake (Portage Co.). The macroinvertebrates that contributed to the high richness value for Fountain Lake were collected in a relatively small area from the boat landing to the impoundment dam; the rest of the lake was not sampled. On the other hand, lower richness values (16-24) were obtained for Pickerel, Sunset, and Wolf lakes (Portage Co.) despite extensive sampling along greater stretches of shoreline. Obviously, lakes within the same general area and with the same general size have macroinvertebrate communities that vary in abundance and diversity, and understanding what contributes to this disparity is very difficult.

One lake of special interest was Lawrence Lake in Langlade Co. This lake is a wild lake without any

development, except for a dirt road and boat landing. The water is very clear with rubble, submerged logs, short macrophytes, and sand along the littoral zone; some quieter bay areas have muck and emergent vegetation. A fairly diverse (34 taxa richness) and abundant macroinvertebrate fauna occurred on a variety of the substrates that were present.

Another lake of interest was Little Rice Lake in Forest Co., near the headwaters of the Wolf River. The lake had an abundant and diverse macroinvertebrate fauna (37 taxa richness), which was probably due to diverse habitats and substrates. Minimal collecting was accomplished at only one boat landing on this complex lake. Taxa richness would assuredly increase dramatically with a more thorough sampling effort.

Silver Lake was studied in 1995 as part of a WI DNR shoreline study (WDNR 1996, Schmude et al. 1998). A total of 21 sites along the lakeshore were sampled by placing artificial substrates in shallow water for about 6 weeks immediately after ice-out. Taxonomic analysis of all macroinvertebrates resulted in a total taxa richness value of 117 for the study. Obviously, more intensive, quantitative studies can reveal high diversities of aquatic macroinvertebrates.

Mosquito Hill Nature Center

The Center has at least three separate aquatic habitats on the property: the Frog Pond, Marsh, and Oxbow. Although some species of aquatic macroinvertebrates occurred in each of the habitats, others occurred in only one or two of the sites. Taxa richness was quite high in each: 31 (Oxbow), 41 (Frog Pond), 67 (Marsh). However, as a single unit, taxa richness was very high for the Center (92!). Four new county records were established, and several additional rare species were collected. Macroinvertebrate productivity was also quite high. Undoubtedly, additional species occur within the habitats that were sampled. Also, the Center has additional aquatic habitats on the property. This area is certainly an outstanding natural resource for the region in terms of aquatic invertebrate production and diversity. Additional survey work in this area should be considered.

CONSIDERATIONS for MANAGEMENT and PROTECTION

Several considerations were discussed in Schmude (1999) and will not be repeated, although they remain pertinent.

Streams

Many of the streams that were sampled appeared to be good shape. Some exceptions include: upper Rat River (SCH038,039) in Outagamie Co., Alder Creek (SCH043,044) in Winnebago Co., Peterson Creek (SCH096) in Waupaca Co., Twin Creek (SCH055), West Branch Shioc River, and Shioc River (SCH056) in Shawano Co. All of these have questionable or clear water-quality problems. However, based on the fauna that was present in the streams, all seem to have the capability to recover if agricultural and suburban nutrient inputs could be eliminated or reduced.

Oxbows

The two oxbows that were studied appeared to be very valuable aquatic resources. These habitats are naturally and frequently "disturbed" by fluctuating water levels, but the communities that inhabit these sites have obviously adapted to this situation in a very productive manner. It is not known if man-made disturbances might affect these two sites, but I suggest that natural resource managers consider these sites (and other potentially similar sites) as being very important for invertebrate production and as refugia for species diversity.

Swamps

The swamp in the Maine Wildlife Area is another important site for invertebrate production and diversity. A potential problem was observed during a heavy rain event when soil from the agricultural field across from Beyer Road was washed into the ditch, traveled under the road in a culvert, and emptied into the Wildlife Area. Siltation, organic nutrients, and chemical contaminants are all potential problems that should be examined at this site.

Lakes

One issue that was brought to my attention by an area resident and fisherman was the susceptibility of many lakes in the southwestern Wolf River Basin (Portage, Waupaca, Waushara counties, and perhaps elsewhere) to disturbance by water jet skis. Many of these lakes are shallow and very soft-bottomed (marly). It seems obvious that considerable disturbance and destruction of the fragile littoral zone would occur if one or more jet skis were indiscriminately used in these lakes. Perhaps all it would take would be a few hours with several jet skis to disrupt life cycles of many species for the entire year, or years for species with longer life cycles (ephemerid mayflies, dragonflies, crayfish). In addition, some lakes have outlets, such as Fountain Lake in Portage Co., which empties into Emmons Creek. A considerable amount of sediment could be sent downstream and disrupt the fauna in both the lake and creek. It seems clear that some lakes are quite susceptible to sediment disturbance and that a ban on the use of jet skis in these lakes should be seriously considered.

FUTURE INVENTORY

If future inventory work is being considered, a prioritization of specific sites and habitats at specific times of the season should be accomplished for the lower Wolf River Basin. This would maximize time, minimize costs, and result in specific data being collected. The upper Wolf River Basin remains under sampled and would certainly benefit from a more thorough survey, similar to the effort that was accomplished in the southern basin.

ACKNOWLEDGMENTS

I extend my sincere gratitude to Andrew Galvin and William Smith who provided the overall foundation for this project to proceed and succeed. I wish to thank Ed Avery (Emmons Creek), Al Niebur (Wautoma), and many of the WI DNR personnel at Shawano who provided a wealth of information concerning descriptions and localities for potential sampling sites. I appreciate the assistance of Eric Roers (Shawano) for piloting the boat on the Wolf River for this study. I am especially grateful to James Robaidek (Shawano) for sharing his knowledge of the Lower Wolf River Basin, relating the management goals of the area, and escorting my team during the last two years to many super sites within the Basin that were difficult to access. In addition, I thank the staff at the Mosquito Hill Nature Center for assisting me while surveying that area; local New London resident Todd Close for bringing my attention to the aquatic habitats on his property and helping me sample his sites; and Josh Acker a UW-Stevens Point student intern for the WI DNR who traveled and sampled with my team for one day. Finally, I am grateful for the very hard work, long hours, and companionship that my undergraduate student assistants provided during the last two years; they include Chris Brennan, Andréa Anderson, Jamie Denninger, and Jason Tanck.

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Table E.3-2: Factors potentially affecting water quality for sites sampled within the Wolf River Basin (1999-2000)

Waterbody	Instream Water Quality Indicators							Factors Potentially Affecting Habitat Quality							Pollutant Sources									
	Turbidity	Scour	Macrophytes	Filament Algae	Plankton Algae	Slime	Fe Bacteria	Marl	Sludge	Silt	Ditching	Impoundment	Lowflow	Wetlands	Exotics	Livestock	Barnyard	Cropland	Tile	Septic	Bankerosion	Urban	Construction	Pointsource
1 80 Acre Flowage																								
2 Alder Creek																								
3 Alder Creek																								
4 Allen Creek																								
5 Bear Creek																								
6 Bear Creek																								
7 Bear Creek																								
8 Beetle Creek																								
9 Bradley Creek																								
10 Cedar Creek																								
11 Cedar Creek																								
12 Cincoe Lake																								
13 Cleveland Creek																								
14 Colic Bayou																								
15 Comet Creek																								
16 Comet Creek																								
17 Crystal River																								
18 Embarrass River																								
19 Embarrass River																								
20 Embarrass River																								
21 Embarrass River																								
22 Embarrass River																								
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28 Embarrass River																								
29 Embarrass River																								

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30 Emmons Creek							3				3													
31 Emmons Creek							3																	
32 Fishless Lake (SNA)							3																	
33 Flooded Woodland Pool																								
34 Flume Creek																								
35 Fountain Lake							3																	
36 Frog Pond																								
37 Gilbert Lake																							3	
38 Grenlie Lake (SNA)																								
39 Hatton Creek																								
40 Haymon'S Park Bridge Embarrass River									3															
41 Hennig Lake																3								
42 Himley Lake (N End)																								
43 Himley Lake (S End)																								
44 Hwy 156 Wolf River Oxbow																								
45 Keller Lake																								
46 Krause Spring & Creek																								
47 L Poygan Boat Landing																								3
48 Large Spring Pond				3					3	3			3			3	3							
49 Large Woodland Pond																								
50 Lawrence Lake																								
51 Lesage Property																								
52 Little Riverice Lake																								
53 Little Wolf River	3									3							3				3			
54 Little Wolf River															3					3	3	3		
55 Little Wolf River															3						3			
56 Little Wolf River																	3							
57 Little Wolf River															3		3							
58 Little Wolf River															3						3			
59 Little Wolf River																								

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	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant
60 Little Wolf River																								
61 Little Wolf River																								
62 Logemanns Creek																								
63 Lulu Lake																								
64 Maine Wildlife Area Swamp																								
65 Managed Floodplain Marsh																								
66 Managed Floodplain Marsh																								
67 Maple Creek																								
68 Maple Creek																								
69 Maple Creek																								
70 Marsh																								
71 Mcdonald Flowage																								
72 Mcdonald Flowage																								
73 Middle Branch Embarrass River																								
74 Middle Branch Embarrass River																								
75 Mill Creek																								
76 Mud Lake																								
77 Murry Creek																								
78 Myklebust Lake																								
79 N Br Pigeon River																								
80 N Branch Embarrass River																								
81 Navarino Bog																								
82 Navarino State Wildlife Area Bog																								
83 Ninemile Creek																								
84 Oxbow Pond																								
85 Pearl Creek																								
86 Peterson Creek																								
87 Pickerel Creek																								
88 Pickerel Lake																								
89 Pigeon River																								

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Waterbody	Instream Water Quality Indicators							Factors Potentially Affecting Habitat Quality							Pollutant Sources									
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90 Pikes Peak Flowage																								
91 Pikes Peak Flowage																								
92 Pine (Upper) River																								
93 Pine Lake																								
94 Pine River																								
95 Pine River																								
96 Pony Creek																								
97 Pony Creek																								
98 Porters Creek																								
99 Potters Creek																								
100 Rabe Lake																								
101 Radley Creek																								
102 Rat River																								
103 Rat River																								
104 Rat River Wetland Complex																								
105 Rat River Wetland Complex																								
106 Red River																								
107 Retention Pond																								
108 Rollofson Lake																								
109 S B Embarrass River																								
110 S Br Little Wolf River																								
111 S Br Little Wolf River																								
112 S. Fr. Whitecomb Creek (SNA)																								
113 Shaky Lake, Sedgemoadow, Woodland Pool																								
114 Shioc Mitigation Site																								
115 Shioc River																								
116 Shioc River																								
117 Shioc River																								
118 Shioc River																								
119 Silver Creek																								

Table E.3-2: Factors potentially affecting water quality for sites sampled within the Wolf River Basin (1999-2000)

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	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant	- Not Present	- Insignificant	- Significant
120 Slough To Wolf River																								
121 Small Springpond				3					3	3						3	3							
122 Spider Creek									3				3											
123 Spring Feeder Stream To Rivered River																								
124 Spring Pond																								
125 Spring Seep Creek							3																	
126 Spring-Fed Feeder Stream To Florence L																								
127 Springs (Cedar Creek Fishery Area)																								
128 Sunset Lake																								
129 Trib.To Sannes Creek																								
130 Twin Creek										3			3											
131 Un-Named Bog Lake																								
132 Un-Named Creek																								
133 Unnamed Creek	3		3							3	3							3						
134 Unnamed Creek																								
135 Unnamed Creek																								
136 Unnamed Creek	3		3	3														3						
137 Unnamed Creek																								
138 Unnamed Creek										3								3						
139 W Branch Rivered River																								
140 W Branch Shioc River										3								3						
141 Walla Walla Creek										3								3				3		
142 Walla Walla Creek										3								3				3		
143 Walla Walla Creek																		3						
144 Waupaca River																								
145 Waupaca River																		3			3	3		
146 Waupaca River																								
147 Waupaca River																								
148 Whitcomb Creek																								
149 White Clay Lake										3														

Table E.3-2: Factors potentially affecting water quality for sites sampled within the Wolf River Basin (1999-2000)

Waterbody	Instream Water Quality Indicators							Factors Potentially Affecting Habitat Quality							Pollutant Sources										
	Turbidity	Scour	Macrophytes	Filament Algae	Plankton Algae	Slime	Fe Bacteria	Marl	Sludge	Silt	Ditching	Impoundment	Lowflow	Wetlands	Exotics	Livestock	Barnyard	Cropland	Tile	Septic	Bankerosion	Urban	Construction	Pointsource	
150 White Lake																									
151 Willow Creek																									
152 Wilson Lake																									
153 Wolf Lake																									
154 Wolf River																									
155 Wolf River																									
156 Wolf River																									
157 Wolf River																									
158 Wolf River																									
159 Wolf River																									
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179 Wolf River																									

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180 Wolf River	■								■											■	■			
181 Wolf River	■								■												■			
182 Wolf River	■								■												■			
183 Wolf River	■																				■			
184 Wolf River	■												■								■			
185 Wolf River	■								■												■			
186 Wolf River	■		■						■												■			
187 Wolf River	■								■						■						■			
188 Wolf River Bottoms State Wildlife Area																								
189 Wolf River Flowage																								
190 Wolf River Bottoms State Wildlife Area																								
191 Woodland Pond (SNA)																								
192 Woodland Sedge/Cattail Pond																								
193 Woodland Spring Pond																								

APPENDIX F.1

Small Mammal and Miscellaneous Taxa Field Survey and Taxonomy Report – 1999 Results

Submitted by Richard Bautz, NHI, December 30, 1999

Introduction

The objective of this survey was to gather baseline data on nonvolant small mammal populations across a variety of natural plant community types in the Lower Wolf River area. The data consists of a direct measure of small mammal biodiversity and relative abundance using standardized and repeatable survey methods.

Methodology

A. Site selection:

Trapping locations were based upon a number of criteria, including habitat fragmentation, area land use, elapsed time since last major disturbance, plant community type, and in some cases, the probability of human vandalism. Site recommendations were provided by Bill Smith – ER/Madison and James Robaidek - Shawano.

B. Equipment and Techniques:

Museum Special snap traps were set out in wandering transects to maximize capture success. Small mammal sign, travel corridors, and micro-habitats were used as indicators of optimum locations for trap placement. The traps were baited with peanut butter and rolled oats and set out in pairs at intervals of about 15 meters. Each site was snap trapped for one night. Pitfall traps were made from either two #10 food cans taped together or 16 oz. plastic cups half-filled with water, and used with a drift fence. Pitfall traps were checked at least once per week until they were picked up.

C. Data management:

All collection locations were noted on USGS topographical maps. Field data and NHI Rare Animal Report forms were created and submitted for incorporation into the NHI Biological Conservation Database. Voucher specimens were kept frozen, and then deposited in the UW Zoology Museum. Photographs were taken at nearly every collection site.

Results

Small mammals of Special Concern and higher conservation status that were collected included 2 Arctic shrews (*Sorex arcticus*) taken at the Rat River State Wildlife Area in shrub-carr. Also collected in the Lower Wolf River Area were 37 white-footed mice (*Peromyscus* spp.), 4 meadow voles (*Microtus pennsylvanicus*), 9 meadow jumping mice (*Zapus hudsoni*), 2 red-backed voles (*Clethrionomys gapperi*), 4 masked shrews (*Sorex cinereus*), 4 short-tail shrews (*Blarina brevicauda*), 4 thirteen line ground squirrels (*Spermophilus tridecemlineatus*), and 1 cottontail rabbit (*Sylvilagus floridanus*). A total of 14 sites were surveyed - Museum Specials were used for 450 trapnights, and pitfall traps were used for 128 trapnights. This represents an average capture success rate of 11.6% for both traps.

Discussion

The significance of finding, or not finding expected species at a given location provides useful information to resource managers and planners. The need to collect accurate data across a very large landscape efficiently requires the ability to make rapid assessments in site selections, and then follow up with captures that reflects the species diversity at those sites. Voucher specimens complete the record, and provide verifiable data for current and future use.

Two Arctic shrews taken at the Rat River State Wildlife Area. They were the only species of Special Concern conservation status captured. This is rather important because the shrub-carr habitat, and its proximity to water strongly suggested the presence of this species. My impression was that the location of this occurrence has remained relatively undisturbed for a rather long period of time. I have captured Arctic shrews in several places around the state, all either in or near shrub-carr within close proximity to water. Other *Sorex* species were noticeably absent.

Finding relatively undisturbed study sites was difficult. The Lower Wolf River Area is quite large and dominated by human land uses such as agriculture, logging, wetland manipulation, and home/cottage development. Despite the overall acreage of the area, the southern part of the basin contains a great deal of their own type of "sameness" throughout. These lands also receive intense recreational use.

Many sites were investigated, but selection of collection sites was usually based upon finding the better of sub-optimal habitats. To a degree, the White-footed mouse or *Peromyscus* may be thought of as a pioneer species, it is typically the first species of small mammal to traverse and eventually colonize disturbed forest landscapes. Years of targeting *Peromyscus* for tick/Lyme disease research has acquainted me with habitat situations that hold *Peromyscus* populations at very high levels. Much of the Lower Wolf River area resembles ideal *Peromyscus* habitat. The challenge was to sample a site for small mammal species richness without having the ubiquitous *Peromyscus* fill all the traps. To compensate for this, greater numbers of traps were used in the transects.

One unusual observation was the low number of *Sorex* species (shrews) captured at the Lower Wolf River Area. As a double check of equipment and techniques, several sites were surveyed in southern Wisconsin (Scuppernon Prairie / Waukesha Co., Hogback Prairie / Crawford Co., Eagle Valley / Grant Co., etc. on my own time), and *Sorex* species were systematically collected.

If a site is trapped and a *Sorex* is not captured it could simply mean that they are difficult to catch (they are), but to trap many sites across a large scale area and find them almost totally absent, likely reflects wide spread and persistent negative alteration of the landscape. In times of drought, *Sorex* species become more restricted to the habitats close to water, but this was not the case in the Lower Wolf areas sampled.

In summary, the conservation status of small mammal populations in the 1999 study areas is presently best understood as the apparent result of ecological simplification and habitat fragmentation. Survey time and efforts were inadequate to ascertain a full understanding of the presence and distribution of small mammals, and additional work in the basin is recommended for next year.

APPENDIX F.2

Small Mammal and Miscellaneous Taxa Field Survey and Taxonomy Report – 2000 Results

Submitted by Richard Bautz, NHI, 2000

Introduction;

The purpose of this survey is to gather baseline data on nonvolant small mammal populations across a variety of geographic and natural plant community types in the Upper Wolf River area. The data consists of a direct measure of small mammal biodiversity and relative abundance using standardized and repeatable survey methods. Due to a limited time frame, only high quality sites were surveyed.

The capture of an arctic shrew (*Sorex arcticus*) at the Norrie Lake Wetland bog suggests a minimally disturbed area. The arctic shrew has a State Element Rank of S2

A population of pine voles (*Microtus pinetorum*) was discovered at the Wolf River Oxbow “Bear caves” area. Pine voles are ranked as S1 in Wisconsin. The pine vole is the second rarest* small mammal in Wisconsin. This very unique find is a new county record and the most northern occurrence of this species in the state.

*The only report of Wisconsin’s rarest small mammal, the least shrew (*Cryptotis parva*), is over fifty years old, and is based solely upon two skulls found in owl pellets. (1961. Jackson.). No one has ever trapped a least shrew in Wisconsin.

Background

There are no records of previous small mammal investigations in any of the sites surveyed.

Methods

Trapping locations were based upon a number of criteria, including access, the natural plant community type, size and age structure, area land use, and unique geographical features. Site recommendations were provided by Emmet Judziewicz, Eric Epstein, and Elizabeth Spencer.

Museum Special, regular snap traps and rat traps were set out in wandering transects to maximize capture success. Small mammal sign, travel corridors, and microhabitats were used as indicators of optimum locations for trap placement. The traps were baited with peanut butter and rolled oats and set out in pairs at intervals of about 15 meters. Each site was trapped for one night. GPS coordinates were taken at all collection locations as well as being noted on USGS topographical maps. Field data forms were created and used together with the Heritage Rare Animal Report forms. Voucher specimens were kept frozen, then deposited in the UW Zoology Museum. Photographs were taken at every collection site.

Results

Small mammals of significant conservation interest include 7 pine voles taken at the Wolf River Oxbow area. The pine vole’s State Element Rank is S1. An arctic shrew (S2) was taken at the Norrie Lake Wetland bog. Also collected in the Upper Wolf River area were 29 white-footed mice (*Peromyscus* spp.), 2 masked shrews (*Sorex cinereus*), 19 short-tail shrews (*Blarina brevicauda*), and one southern flying squirrel (*Glaucomys volans*). The combined results are: 59 small mammals captured in 300 trapnights. This represents a capture rate of 19.66 %.

Discussion

The rapid assessment survey method for small mammals I have developed over the years was rewarded by the capture of seven pine voles at the Wolf River Oxbow area. This is a very significant find. First, because this small mammal has been rarely collected in Wisconsin. Second, because of this vole's semifossorial live style which makes it characteristically difficult to capture even in southern states where it is common. The trap line through the Oxbow area was purposely long, and trapping success brings up a number of concerns: the pine vole is not ubiquitous in the area. Captures were restricted to in or near the talus slopes. The limited range they occupy also suggests this animal's inability to recover from previous large scale changes in land use (i.e. logging). This animal shuns areas of open or no forest canopy cover, and soil compaction (tire tracks) which greatly restricts its typical below ground foraging habits. The talus slopes provided a safe haven, but dispersion into the surrounding now suitable habitat has apparently not occurred. Very similar habitats at the Boy Scout Camp (sites 00BAU043 and 00BAU046) were also surveyed, but pine voles were not found. Because of this species small home range (15-30m / 50-100 ft.), short life span (ave. less than 3 months) and rarity in Wisconsin, efforts should be made to map its distribution, determine population viability, and investigate the effects of forest management in order to better insure its protection.

It is a bit difficult to quantify arctic shrew habitat. I have collected them in many sites ranging from marsh edges and tamarack bogs to red pine uplands. All sites had a few things in common, an adequate duff layer of grass / sedge, or coarse woody debris for protection from predators, and a lack of disturbance for a relatively long period of time.

The arctic shrew from the Norrie Lake Wetland was captured in the open bog area. It was about 150 meters from a large tamarack area, this suggests the fall dispersal from the more "preferred" tamarack habitat. Permission to trap the tamarack woods had not been granted. Other small mammals of important conservation status that may occupy this apparent high quality wetland include pygmy shrews (*Sorex hoyi*), water shrews (*Sorex palustris*), and southern bog lemmings (*Synaptomys cooperi*).

Another possible small mammal species that could exist in the extensive talus areas found near the Upper Wolf River is the rock vole (*Microtus chrotorrhinus*). This species has never been collected in Wisconsin, but it is found along the western shore of Lake Superior, eastward across Canada and down through the Appalachian Mountains. It is quite possible that the rock vole has remained undetected in Wisconsin.

References:

- Jackson, Hartley H.T. 1961. Mammals of Wisconsin. The University of Wisconsin Press. Madison, WI.
- Kurta, Allen. 1995. Mammals of the Great Lakes Region. The University of Michigan Press. Ann Arbor, MI.

APPENDIX G

Terrestrial Invertebrate Survey Report - 1999 Results

Submitted by Kathy Kirk, NHI, January 13, 2000

Introduction

This survey was a preliminary study to gather information on the availability of habitats for terrestrial invertebrates, particularly those currently listed as threatened, endangered, or special concern in the state (WNHI, 03/17/99). A limited amount of species-specific research was undertaken. The work focused on identification of areas (1) likely to support faunal diversity (2) habitat for species on the NHI working list (3) good examples of natural communities for diversity sampling sites.

Sites

The 1999 fieldwork was restricted to a number of sites in the lower Wolf River Basin. Attempts were made to visit each of the state wildlife areas with appropriate terrestrial habitat. Sites were selected based on consultation with ecologists and wildlife managers familiar with the sites. Although much wetland habitat is present in the area, these sites were not visited during 1999. Although some of the following sites were visited, no data was collected at the following state lands because they have limited terrestrial habitat:

- Wolf River Wildlife Area: The upland area occurs only near a house on the property and has been under agriculture for many years. Two visits to the area were made to the large area with the conclusion that the Wolf River W.A. is heavily diked and indeed, nearly completely wet. Some wet and wet-mesic forest invertebrate potential is present.
- Hortonville Bog State Natural Area: No visits. Wet, bog site. Potential for bog lepidoptera.
- Maine Wildlife Area: One visit to search for entry. Wet, bog site. Potential for bog lepidoptera.
- Mukwa Wildlife Area: No visits. Primarily aquatic communities.
- LaSage Unit: One visit. Good quality wet to wet-mesic forest habitat and river edge.

Data was collected at the following sites (site map numbers follow):

Site	Site Number
• Koepke County Park	KK01
• Mack Wildlife Area	KK02
• D.O.T. Mitigation Site	KK03
• Outagamie Wildlife Area	KK04
• Navarino Wildlife Area	KK05, KK07, KK08, KK13, KK14, KK15, KK19
• Rat River Wildlife Area	KK06, KK12, KK16
• Winnebago Co. Trail	KK11
• Deer Creek Wildlife Area	KK18, KK20

One early season visit was made to each of these sites:

- Tellock's Hill Woods SNA Waupaca County
- Jung Hemlock Beech Forest SNA Shawano County

Methodology

The early season visits occurred on May 9, 1999. The rest of the fieldwork was conducted over 8 days, primarily in June, with one visit in mid July and another in late August. During this period, 20 sites were visited and data collected from 18 sites. Insects were observed and data collected using a number of techniques including hand collection, photography, aerial net, sweepnet, pitfall trapping, funnel trapping, and black light trapping.

Sweepnetting for leafhoppers and other vegetation inhabitants was conducted in grassland areas and, at one site, along the edge of the Wolf River. Pitfall traps to sample the ground-dwelling invertebrates were used at grassland sites, woodland sites, and wetland edges. Funnel trapping was used at one site to capture wood boring beetles and cohorts on pine. Blacklight trapping was conducted at two sites for night-flying insects attracted to light.

Site	Collection Method
Koepke County Park	Hand
Mack Wildlife Area	Sweep
D.O.T. Mitigation Site	Pitfall
Outagamie Wildlife Area	Sweep, Pitfall
Navarino Wildlife Area	Sweep, Pitfall, Blacklgt, Funnel, Hand
Rat River Wildlife Area	Hand, Sweep
Winnebago Co. Trail	Hand
Deer Creek Wildlife Area	Hand, Sweep
Tellock's Hill Woods SNA	Photo
Jung Hemlock Beech Forest SNA	Photo, Hand

Specimen Handling

Invertebrate specimens were placed in 70% ethyl alcohol. In the laboratory, collections were sorted taxonomically. Hard-bodied Coleoptera, Orthoptera, Heteroptera, ants, large wasps and adults of Lepidoptera and Neuroptera were pinned and dried. Minute and soft-bodied insects, Diptera, Arachnida, Diplopoda, Chilopoda, and aquatic macroinvertebrate specimens were retained in alcohol vials. A total of 841 specimens were collected.

Taxonomy

The author of this report made taxonomic determinations to species for butterflies, Orthoptera, tiger beetles and a few other Coleoptera families, and some ants. Leafhoppers were determined where possible by staff of the DNR-Research Prairie Invertebrate Study. Others have been sent to Andrew Hamilton of Agriculture Canada for species determinations. Spiders have been sent to Frank Pascoe, University of St. Francis, Joliet, IL, for determination of Salticids and sorting to family of other groups. Beetles of the family Tenebrionidae, Scarabiidae, and Cantharidae have been sent to specialists at the Entomology Dept., UW-Madison. Aquatic macroinvertebrates were sent to Kurt Schmude, UW-Superior. Two hundred specimens have been identified to species, 52 to genus, 56 to subfamily and 332 to family level. The remaining specimens of the orders of Neuroptera, Diptera, Thysanoptera, Ephemeroptera, Hymenoptera other than Formicidae, as well as the non-insect arthropods have been retained in alcohol for future sorting and determinations. Preliminary species lists for butterflies and grasshoppers are attached to this report.

Data Handling

Data on all specimens collected were entered into Paradox database files. Rare taxa were documented on NHI Element Occurrence Forms and entered into the Biological Conservation Database (BCD).

Results

The early season visits were timed to search for the West Virginia White butterfly in high quality mesic forest within the study area. Neither the butterfly nor its host plant, toothwort, *Dentaria sp.*, were found at the site although the darkly-veined spring morph of the more common mustard white butterflies were present.

The grassland areas at Navarino Wildlife Area were found to contain some prairie elements but dominated by grasses and common forbs, offering minimal variation in structure and plant community needed to support insect diversity or prairie specialists.

Management history is valuable information to determine the potential habitat for insects in grasslands as well as the effects of management activities on the plants and animals present. Management activities at each site should be recorded annually.

Grassland areas that merge into sedge meadow appear to support the greatest diversity in Homoptera, Heteroptera, and other insects including Coleoptera families that inhabit vegetation as recorded by the limited surveys of the 1999 season (KK06, KK12 at Rat River and KK14 at Navarino). At the other ecological extreme, the area at Navarino on Hwy K with large sandblows (KK15) is valuable habitat for grasshoppers, antlions, tiger beetles, and other open sand inhabiting insects. The barrens habitat at KK08, as a continuation of the band of exposed sand habitat at Navarino, is similar in this regard but appears to support less diversity of the ammophilous or sand-loving community of species, perhaps as a result of size, proximity to the highway, and more canopy cover.

Deer Creek near the northern parking lot (KK18) has open sand habitat, perhaps anthropogenic. Along the northern border of Deer Creek are sandy areas said to have been planted with prairie species 12 years ago. The areas, however, are growing in and offer less habitat for the ammophilous insect community than the parking lot area.

The Rat River site along Shady Lane (KK12) is notable for the diversity of habitat available, both wet and dry, including open ground along the entrance road. Bottlebrush grass, *Elymus hystrix*, a savanna indicator, was observed near the woods edge. Many butterflies were observed using the habitat between the woodland edge and the wetland edge. Swamp milkweed and goldenrods were prominent, but so also was extensive, non-native brome grass.

The Winnebago County Trail (KK11) held little habitat for terrestrial invertebrates but harbors extensive knapweed and sweet clover along the edges of the trail.

The Wolf River Wildlife Area (KK10) has some purple loosestrife at the end of the road that goes through the community of cabins.

The LaSage Unit (KK17) is an excellent example of unmanipulated bottomland forest with a diverse canopy of hackberry, basswood, walnut, and maple; good groundflora including lady's thumb and cardinal flower; and lots of lianas near the river edge. Only a small stand of reed canary grass was observed at this site.

Element Occurrences from preliminary fieldwork:

The following are elements on the current NHI working list that were recorded from 1999 fieldwork.

- *Euphyes dion* Dion Skipper Site KK02 Mack W.A. June 29
1 specimen at DNR Research
- *Trachyrhachis kiowa* Ash-brown Grasshopper Site KK18 August 26
1 male specimen at DNR Research
- *Spharagemon marmorata* Northern Marbled Locust Site KK15 August 26
1 female, 2 male specimens at DNR Research

New County Records for Shawano County*:

The following are new county records for Shawano County. Neither species is on the current NHI working list.

Scarabaeidae Scarab Beetles

- *Macroductylus subspinosus* This is the “rose chafer” of the scarab beetle group that feeds on plants. It was quite abundant on flowers in June at several sites (KK13, KK14, KK15 at Navarino).
- *Melanocanthon nigricornis* and *Onthophagus nuchicornis* These are dung beetles that were collected in the pitfall traps at the Navarino prairie site KK13.

Additional animal observations of interest:

- Cuckoo nesting at Outagamie Wildlife Area (KK04).
- Bobolinks at Rat River Wildlife Area (KK06).
- Clay-colored sparrows at Rat River Wildlife Area (KK12).
- Yellow-headed blackbirds and black terns at DOT Mitigation Site (KK03).
- Golden-winged warbler at Navarino Wildlife Area (KK07).

Report submitted January 13, 2000

*Note: Nadine Kriska, a beetle specialist at the University of Wisconsin-Madison is at work on the Scarabaeidae of Wisconsin and has studied insect collections, literature, and other specialists to produce a list of species and records of collection by county. Relatively few other insect families have been well studied or surveyed in the state to offer biologists a similar perspective.

APPENDIX H

Herpetological Survey Of The Wolf River Geographic Management Unit With Emphasis On Rare Species

Submitted by Erik R. Wild, PhD, University of Wisconsin-Stevens Point, March 3, 2001

Introduction

This report is provided as part of the contractual agreement (Research Contracts NMJ00001783 and NMA00000022) with the Wisconsin Department of Natural Resources (WDNR) to perform the research project “Rare Herp Biotic Field Surveys: Flambeau River State Forest and Wolf River Geographic Management Unit (GMU)”. Reported herein are the results of the Wolf River GMU portion of this research project. The complete Problem Statement and Project Objectives can be found in the proposal for this project (13 April, 2000). In short, the objective of the project is to obtain data on the herpetofauna of the Wolf River GMU, with particular focus on rare species. Rare species herein refers to those listed by the WDNR as Endangered, Threatened, or Special Concern, plus others identified by Wisconsin’s Natural Heritage Inventory Program (NHI) Working List. Accordingly, there are two Endangered (*Acris crepitans*, *Ophisaurus attenuatus*) and two Threatened (*Clemmys insculpta*, *Emydoidea blandingii*) Wisconsin herps that have the potential of occurring in the Wolf River GMU, whereas four Special Concern (*Hemidactylium scutatum*, *Rana catesbeiana*, *Diadophis punctatus*, *Coluber constrictor*) species can be expected.

Methods

Fieldwork in the Wolf River GMU took place during 5 June – 17 July, 2000 involving five researchers (Erik R. Wild, P.I.; Joel A. Ernst, Graduate Assistant; Pam D. Widder, Intern; Darcy R. Robison and Neal Halstead, Volunteers). Twenty-five field visits were made on twenty-three different days for a total of 282 person hours in the field.

Site Selection

Sites were visited throughout the Wolf River GMU and in a variety of habitats, however, emphasis was placed on obtaining records for Endangered, Threatened, and Special Concern species, especially the Threatened *Clemmys insculpta* and *Emydoidea blandingii*, and the Special Concern *Hemidactylium scutatum*. Sites were selected using the interim reports of the Wolf River Experts Workshop and NHI Coarse Filter Screening (Biotic Inventory & Analysis of the Wolf River Basin, 2000Draft), plus NHI Program Element Occurrence Records. Of these, public lands including state wildlife and natural areas were emphasized as were the Wolf River, Little Wolf River, and select tributaries. Searches were performed and data gathered on other species of the herpetofauna when visiting these sites. Other additional localities were visited opportunistically

Fourteen Experts Workshop Sites, 20 NHI Program Element Occurrence Records Sites were visited encompassing many of the Coarse Filter Screening Sites. Approximately 20 miles of the Wolf River, ~8 miles of the Little Wolf River, and several tributaries were waded, canoed, or examined from shore for some portion of their length. A total of 46 specific localities were recorded, including observations of live or road-kill specimens, actual and potential nesting areas, and habitat with high potential for herp occurrences ([Appendix I](#)).

Survey Techniques

Due to limited time and the large area to be surveyed, the majority of fieldwork involved active searches with hand capture or road-cruising. Furthermore, as there was limited previous herpetological work in the Wolf River GMU, efforts were also made to visit sites of previous records, and identify new potentially valuable sites and habitats. As an effort to standardize the field work for site-to-site and year-to-year comparisons, survey effort was measured in person hours as is standard for surveys of organisms as diverse as reptiles and amphibians. Active searches primarily involved flipping rocks, logs, and debris on land; wading and using dip-nets and binoculars in waterways, and digging by-hand through moss and rotting logs in bogs. Road-cruising involved travel from site-to-site and exploration for appropriate habitat. This report should not be considered a comprehensive survey of the Wolf River GMU, nor is it a thorough sample of the area. Furthermore, no effort was made to perform equivalent sampling among ecological landscapes.

Specimen Data

All observations and specimens were recorded following, but not limited to, the methods of the Wisconsin Herp Atlas Project (Casper, 1999). Select specimens were measured, weighed, sexed, and photographed before release. For all observations, localities were recorded with township, range, and section from DeLorme Gazetteer, and latitude and longitude from a Garmin or a Magellan Map 410 GPS unit (waypoints taken with Garmin remain in its memory). Salvaged road-kill and select live specimens were taken as vouchers, photographed, fixed in 10% buffered formalin, preserved in 50% isopropyl alcohol, and deposited in the Herpetology Collection of the Museum of Natural History & Department of Biology, UWSP ([Appendix II](#)). Rare Animal Report forms were completed for any threatened, endangered, or special concern species, and for any new distribution records ([Appendix III](#)).

Results

Sites

A total of 46 specific localities were recorded for various reasons, including observations of live or road-kill specimens, actual and potential nesting areas, and habitat with high potential for herp occurrences. The complete data (date, time, latitude / longitude, township-range-section, county, locality description, significance, taxa present, and voucher material) for these sites are provided in the Site Spreadsheet ([Appendix I](#)). The sites include one locality for the Endangered *Acris crepitans*, thirteen observations of the Threatened *Emydoidea blandingii*, and two observations of the Special Concern *Hemidactylium scutatum*. One new county record is reported with *Lampropeltis triangulum* from Portage County.

Experts Workshop Sites with High Potential for Conservation and Inventory

The following sites were recognized as high potential for conservation and inventory by the NHI Experts Workshop. Effort was made to visit as many of these sites as possible to at least assess the potential for harboring rare herps. However, difficulties were encountered in obtaining access to some of the sites that were surrounded by private lands. Since there were numerous public access sites to survey as well, these were emphasized, and when difficulty was encountered obtaining landowner permission at the land-locked sites, these were abandoned. Several of these sites should be surveyed in the future. Most visits were too brief to adequately sample the herpetofauna. Herps that were encountered are reported, and the potential for rare species is discussed.

BAKER LAKE (NEH 11): Access to this lake was not acquired, but driving by indicated high potential for *Emydoidea blandingii*. This small, clear water lake had numerous downed limbs suitable for basking. Permission should be acquired and the lake thoroughly surveyed.

DALE ROAD WOODS (NEP 11): This site was visited once (1.75 person hours) producing *Rana pipiens* and *Chrysemys picta*.

EMMONS CREEK AREA (CSH 03): This site was visited four times (4.5 person hours). Only *Rana clamitans* was encountered at the edge of a small pond near the creek. In spite of the lack of productivity, this site holds great potential. The area is diverse with open sandy xeric areas, pronounced forested topography, and a high quality, fast flowing clear-water stream. This site holds high potential for *Clemmys insculpta*, and future surveys should work the stream by foot searching for these turtles.

FLYNN LAKE BOG (NEP 04): Attempts were made to visit this bog, but access permission could not be obtained.

HORTONVILLE BOG (NEP 08): This site was visited once (3 person hours) and in spite of intense effort, no herp species were found. This isolated sphagnum bog is very secluded and holds high potential for *Hemidactylum scutatum*. It was surprising that none were found, nor were any *Plethodon cinereus*, *Ambystoma laterales*, or *Rana sylvatica*, all species for which this bog is ideal habitat. Additional survey work should target this site because if a population of *Hemidactylum* does exist there, it is isolated and vulnerable.

MAINE STATE WILDLIFE AREA (NEP 03): This site was visited once (3 person hours). *Ambystoma laterale*, *Plethodon cinereus*, and *Hyla versicolor/chrysosecelis* were all documented. The area is isolated in the center of open agriculture, and shows evidence of past manipulation including ditches. A large portion of the wetland area was explored. The habitat is not suitable for *Clemmys* because there is no flowing water. *Emydoidea* could occur there, but this seems unlikely because no deeper, open bodies of water were found. No sphagnum bogs were found, but shallow puddles with other mosses were found in some forested areas. Nonetheless, it is unlikely that *Hemidactylum* occur there. This site could benefit from additional work, but it is low priority for the rare species considered herein.

MATTOON SWAMP (NEH 10): Access to this swamp was not acquired.

MOSQUITO HILL STATE WILDLIFE AREA AND NATURE CENTER (NEP 09): This site was worked thoroughly during a single visit (4 person hours). The site exhibits a variety of habitats from lowland riparian forest, to upland forest, plus open meadows and oxbow lakes and ponds. The entire river frontage was walked, and although numerous basking logs were present, no turtles were seen. The bank has extensive stretches of rip-rap in this area. The site holds great promise for *Emydoidea blandingii*, and in fact, a resident naturalist reported seeing them on the property in the past. This site should be worked more thoroughly in the future to confirm the presence of *E. blandingii* and assess the population status. Other herp species observed include: *Chrysemys picta*, *Rana clamitans*, *Rana sylvatica*, *Ambystoma laterale*, and *Thamnophis sirtalis*.

MUD LAKE FOREST HEADWATERS (NEH 16): This site is an undisturbed bog-lake with surrounding upland forest. The site was visited twice (4 person hours). Considerable effort was made to work sphagnum for *Hemidactylum*. Although none were found the site holds high potential because it is relatively undisturbed, has extensive floating sphagnum and other mosses in the low forest adjacent to the bog. It is likely that *Emydoidea* also inhabit the lake, although none were seen. Other herps observed include: *Chrysemys picta*, *Bufo americanus*, *Rana sylvatica*, *Plethodon cinereus* (UWSP 3820-21), and *Ambystoma laterale* (UWSP 3822).

NAVARINO STATE WILDLIFE AREA (NEP 01): This large wildlife area was worked intensively. It was visited on four separate occasions (25 person hours). Two of these occasions salvaged road-kill *Emydoidea blandingii* on Cty K passing through the western edge of the area (Herp 77, 82; UWSP 3802, 3810). These two sites were separated by approximately 10 meters and the road-kills by two days. It seems that Cty K was being used as a detour for Hwy 22 and that there was more semi-traffic than typical. Furthermore this local was just south of a bend in the road so that traffic could not see turtles ahead and Cty K lacks any shoulder space at all. All of these factors combined give a driver little opportunity of avoiding turtles. It is hoped that this problem is temporary because it appears the road is heavily traversed by these turtles. The site should be monitored into the future to assess the degree of mortality. Other *Emydoidea* were seen within the NSWA as well (Herp 83). There appears to be a healthy population of *E. blandingii* in the NSWA.

Other areas explored include the trail that passes Loop and Pikes Peak Flowages, Waltrach Flowage and drainage, and McDonald Flowage. Numerous predated turtle nests were found along the dike of Waltrach Flowage. A small stream (Herp 85) was worked on the east side of NSWA, just west of White Lake. This slower moving, muck bottomed stream was well protected by vegetation and holds potential for *Clemmys insculpta*. In addition to *Emydoidea*, the NSWA produced the following species: *Chrysemys picta*, *Rana clamitans*, *Rana sylvatica*, *Hyla versicolor/chrysosecelis*, *Thamnophis sirtalis*, *Chelydra serpentina*, and *Bufo americanus*.

NEW HOPE PINES (NEH 18): This site was visited once (2 person hours). The site exhibits good herp diversity with *Rana clamitans*, *Chrysemys picta*, *Plethodon cinereus*, and *Hyla versicolor/chrysosecelis* all being documented during this single visit. During visits of previous years, *Ambystoma laterale* and *Notophthalmus viridescens* were also encountered at the edge of a pot-hole pond. No *Hemidactylum*, *Emydoidea*, or *Clemmys* were encountered but additional work is recommended.

POYGAN MARSH STATE WILDLIFE AREA (SGP 03): A two brief visits were made to this site (2 person hours). *Rana clamitans*, *Rana pipiens*, and *Thamnophis sirtalis* were all that were encountered.

WHITE LAKE (NEP 02): A brief visit was made to the public boat landing of this lake with no herps being observed.

WOLF RIVER STATE WILDLIFE AREA (SGP 01): A brief visit was made to a marsh at this site (1 person hour). A large population of *Rana pipiens* was observed. More work needs to be done at this site.

Wisconsin Natural Heritage Program Element Occurrence Records

The following localities were provided from the Wisconsin Natural Heritage Program Element Occurrence Records or were read off a map provided by NHI. Element Occurrence Records were not provided for all map localities, so the precise location of some of the mapped sites was uncertain. Nineteen of the 31 sites were visited (61%) with five confirmations. Seventeen new rare herp records were added.

NHI 006 Diadophis punctatus, NHI 035, 036 Hemidactylum scutatum: All three localities in same general area. Large sphagnum bog deep in forest (Herp 80) produced two *H. scutatum*, each with a nest and in same raised sphagnum hummock over open water (ERW 1307-08). *Rana sylvatica* was also observed, but the presence of *D. punctatus* was not confirmed.

NHI 007 Diadophis punctatus: Visited public boat landing for Lake Lucerne (1 person hour) and found nothing.

NHI 023 Rana catesbeiana: Public landing for Little Rice Lake just above spillway produced a *Chrysemys picta* above, and *Rana clamitans* (UWSP 1305-06) downstream at Old Hwy 8 bridge (1.5 person hours). No *Rana catesbeiana* were observed.

NHI 026 Emydoidea blandingii: Two visits to this site (3.5 person hours) in the Navarino State Wildlife Area confirmed the presence of *E. blandingii*, and also documented *Chrysemys picta*, *Rana clamitans*, and *Chelydra serpentina*.

NHI 033 Ophisaurus attenuatus: Brief visit to site could not confirm the presence of *O. attenuatus*.

NHI 040 Emydoidea blandingii: Not visited

NHI 041 Emydoidea blandingii: Inspected the site from car, chose not to investigate.

NHI 043 Ophisaurus attenuatus: Brief visit to site could not confirm the presence of *O. attenuatus*.

NHI 060 Clemmys insculpta: Visited sphagnum bog in Langlade County Forest Croplands (2.5 person hours). Did not confirm presence of *C. insculpta*, but found nest of *Hemidactylum scutatum* (Herp 79) by the presence of a nest with 42 eggs in sphagnum hummock hanging over open water puddle created by treefall. Also present in bog was *Rana sylvatica* (UWSP 1304)

NHI 086 Acris creptians: Inspected Maple Creek from Hwy 45 (0.5 person hours) but

did not venture onto private lands. The presence of *Acris crepitans* was not confirmed, but the stream holds potential for *Clemmys insculpta*.

NHI 086 *Clemmys insculpta*: Not visited.

NHI 087 *Acris crepitans*: Not visited.

NHI 108 *Clemmys insculpta*: A stop by visit to Cty A bridge over Hennig Creek did not confirm the presence of *C. insculpta*. However Hennig Creek is a quick flowing, clear stream surrounded by dense alder thicket that shows great *Clemmys* potential. Access was limited so the stream was not worked.

NHI 121 *Clemmys insculpta*: Not visited.

NHI 121 *Emydoidea blandingii*: Not visited.

NHI 122 *Emydoidea blandingii*: A road-kill *Emydoidea blandingii* found on Shawano Cty K on 6 June (UWSP 3802) and another on 8 June (UWSP 3810) just 10 meters from the first, confirm the continued presence of this species in the area. Both these localities are on Cty K as it passes through Navarino State Wildlife Area.

NHI 123 *Emydoidea blandingii*: Approximately 20 person hours were spent in the Navarino State Wildlife Area including working trails that pass near this locality. The occurrence of *E. blandingii* in the area was confirmed near this site as well as elsewhere in NSWA (Herp 77 *Emydoidea blandingii*; Herp 82-83 *E. blandingii*). Also encountered within NSWA were *Thamnophis sirtalis*, *Chelydra serpentina*, *Chrysemys picta* (UWSP 3812-13), *Rana sylvatica* (Herp 85), and *Hyla chrysoscelis/versicolor*.

NHI 125 *Clemmys insculpta*: Not visited.

NHI 124 *Emydoidea blandingii*: A brief drive-by visit did not confirm the presence of *E. blandingii* in the area, but the exact locality was not clear.

NHI 127 *Clemmys insculpta*: A section of the Pigeon River above and below Knitt Rd was waded (2 person hours) but the presence of *C. insculpta* could not be confirmed. The stream, however, holds high potential for the occurrence of this species. Other species encountered include *Chelydra serpentina*, *Chrysemys picta*, and *Rana clamitans*.

NHI 140 *Clemmys insculpta*: Not visited.

NHI 141 *Clemmys insculpta*: Not visited.

NHI 148 *Clemmys insculpta*: Not visited.

NHI 149 *Clemmys insculpta*: Not visited.

NHI 152 *Clemmys insculpta*: Not visited.

NHI 155 *Clemmys insculpta*: The entire shore of School Section Lake was explored by canoe, and the creek that drains into the lake was waded upstream for ~1 mile (7 person hours) with no observations of *Clemmys insculpta*. *Chrysemys picta* and *Rana clamitans* were observed in the lake. The limited size and length of the stream flowing into the lake suggest that if *C. insculpta* are indeed present, the population is likely small and isolated.

NHI 187 *Emydoidea blandingii*: Not visited.

NHI 190 *Emydoidea blandingii*: Not visited.

NHI 197 *Clemmys insculpta*: This locality, near a boat landing at Cty CCC bridge over the Wolf River, produced *Chrysemys picta* and *Rana clamitans* along bank of river but did not confirm the presence of *C. insculpta* (1.5 person hours).

Wolf and Little Wolf Rivers

The primary objectives of river work was to document turtle species by observation of basking individuals, and to mark potential nesting sites. The Little Wolf River was worked downstream by canoe and the Wolf River was worked by motor boat.

LITTLE WOLF RIVER: An approximately 8 mile stretch of the Little Wolf River was canoed from the landing at the junction of Cty B and BB to Cty X (9 person hours). Some *Graptemys geographica* were seen basking on

emergent rocks, but a strong storm moved in so that only potential nesting sites were marked (Herp 99-108). This section of the stream holds high potential for *Clemmys insculpta* and should be surveyed further. The clear, shallow, fast flowing water with numerous basking sites and sufficient sandy banks make this ideal habitat for *C. insculpta*.

Permission was granted to visit private land trust with river frontage ~1 miles upstream from Big Falls. No observations of herps were made, but the site holds great potential. The trust is very interested in herpetological survey work in order to properly care for the herpetofauna.

WOLF RIVER North from Shiocton: The Wolf River was worked by boat north from Shiocton to approximately 1 mile upstream from Koepke Park (12 person hours). Numerous potential nesting sites including sand bars, banks, and washes were marked (Herp 109-122). Few turtles were seen basking, all appeared to be *Graptemys geographica*. A predated, active nesting site was discovered (Herp 120) at a sharp bend in the river where erosion had cut into a high bank. Two kinds of eggs were present, one *Chelydra serpentina* the other unknown (UWSP 3824-26). Across the river was a large exposed sand bar with turtle tracks and a *Rana pipiens*. *Rana pipiens* were also common at Keopke Park Landing. This stretch of the river seems to have lower potential for *Clemmys insculpta*. The river is deep, slow moving, not clear, and much of the bank has been modified including development and rock rip-rap.

Further northward, at the public boat landing at the junction of the Wolf River and Hwy 156, several *Chrysemys picta* and *Apalone spinifera* (UWSP 3803) were basking in floating vegetation of the backwater bay.

WOLF RIVER Shiocton south to New London: The Wolf River was worked by boat downstream from Shiocton to New London (28 person hours). Few basking turtles were seen and these were *Graptemys geographica* or *Chrysemys picta*. A few sand banks, bars, or washouts were marked as potential nesting sites (Herp 92-98). This stretch of the river seems to have lower potential for *Clemmys insculpta*. The river is deep, slow moving, not clear, and much of the bank has been modified including development and rock rip-rap.

General Overview of Herp Community

Nineteen species of reptiles and amphibians were observed in the Wolf River GMU during the study period (Table 2). This represents, 49% of the species otherwise known or expected to occur in the Wolf River GMU (Casper, 1999; Vogt, 1981). This total includes nine species of amphibians (six anurans, three salamanders) and ten species of reptiles (six turtles, four snakes). Three species of “rare” herps were recorded from the Wolf River GMU: the Endangered *Acris crepitans*, the threatened *Emydoidea blandingii*, and the Special Concern *Hemidactylum scutatum*. One new county record was established with *Lampropeltis triangulum* in Portage County with a specimen that was collected previous to the study period. The seemingly low percentage of the expected fauna encountered in this study can be attributed to limited sampling time and sampling bias (the primary objective was not to perform a comprehensive survey), combined with seasonal and climatic factors. Sampling was not performed in order to rigorously determine abundance over the entire GMU, nor within any subdivisions thereof. In this study, relative abundance is only useful within a particular site, and provides a baseline for future comparisons. Therefore, relative abundance of the herp species of the Wolf River GMU can only be discussed qualitatively and cautiously. Most of the species and abundancies encountered are what one would have predicted for a natural herpetofauna in the region.

Species Not Encountered

Several species of the expected herpetofauna of the Wolf River GMU were not encountered during the study. This is not to say they do not occur there and caution should be employed when considering the negative data of this study. Several factors can explain the absence of expected species from our data. Sampling timing was not ideal and sampling effort was clearly biased in favor of *Clemmys*, *Emydoidea*, and *Hemidactylum*

1. Sampling Time: Although the amount of time spent surveying the Wolf River GMU was limited by resources, there is a much more limiting factor to this survey, time of year. As poikilotherms, reptiles and amphibians are notoriously seasonal animals. Searches during other times of the year would certainly improve the data set. Early spring is an essential period of time for accurately assessing a herpetofauna. Amphibians call,

migrate, and congregate early in the spring, which makes them more easy to find. For example, *Pseudacris crucifer* and *P. triseriata*, are certainly located within the Wolf River GMU although none were seen. These diminutive frogs are vociferous in the spring, but very difficult to find later in the year. Likewise, *Ambystoma maculatum* and *A. tigrinum* should be present within the Wolf River GMU. These salamanders congregate in temporary ponds for mating in early spring, after which they disappear below ground, requiring extensive work and chance to find them.

2. Sampling Bias: Sampling effort targeting *Clemmys*, *Emydoidea*, and *Hemidactylum* biased the data against several other herps. Additional effort needs to be made in small lakes and ponds in order to document *Emydoidea* and in small streams and the Little Wolf for *Clemmys insculpta*. Active searches in more xeric, open habitats should reveal several of the species typically common in northern Wisconsin (*Elaphe vulpina*, *Diadophis punctatus*, *Heterodon platyrhinos*, *Lampropeltis triangulum*, *Storeria dekayi*) and for long-term study artificial cover boards could be used. Shoreline habitat along the main rivers, lakes, and streams should be given close inspection for *Nerodia sipedon*. Netting by hand in forest pools and swamps, and by seine in rivers should produce *Notophthalmus viridescens* and *Necturus maculosus* respectively.

Table 2. Amphibians and reptiles documented or expected to occur in the Wolf

River GMU (Casper, 1999). √ = recorded by this survey in the WR-GMU; E = Endangered, T = Threatened, SC = Special Concern.

AMPHIBIANS	REPTILES
Ambystomatidae	Chelydridae
√ Ambystoma laterale	√ Chelydra serpentina
Ambystoma maculatum	Emydidae
<i>Ambystoma tigrinum</i>	√ Chrysemys picta
Plethodontidae	<i>Clemmys insculpta</i> (T)
√ Hemidactylum scutatum (SC)	√ Emydoidea blandingii (T)
√ Plethodon cinereus	√ <i>Graptemys geographica</i>
Proteidae	<i>Graptemys pseudogeographica</i>
Necturus maculosus	Kinosternidae
Salamandridae	√ <i>Sternotherus odoratus</i>
<i>Notophthalmus viridescens</i>	Trionychidae
Bufonidae	√ <i>Apalone spinifera</i>
√ <i>Bufo americanus</i>	Colubridae
Hylidae	Coluber constrictor (SC)
√ <i>Acris crepitans</i> (E)	Diadophis punctatus (SC)
√ <i>Hyla versicolor/chrysoscelis</i>	√ Elaphe vulpina
Pseudacris crucifer	<i>Heterodon platyrhinos</i>
<i>Pseudacris triseriata</i>	√ <i>Lampropeltis triangulum</i>
Ranidae	<i>Nerodia sipedon</i>
Rana catesbeiana (SC)	<i>Opheodrys vernalis</i>
√ Rana clamitans	<i>Storeria dekayi</i>
<i>Rana palustris</i>	√ <i>Storeria occipitomaculata</i>
	√ Thamnophis sirtalis

√ *Rana pipiens*
Rana septentrionalis
√ *Rana sylvatica*

Scincidae

Eumeces fasciatus

Eumeces septentrionalis

Anguidae

Ophisaurus attenuatus (E)

Turtles

Among the turtles none were ubiquitous throughout the Wolf River GMU. The various species exhibited habitat preferences already documented (Vogt, 1981). Of the four species of turtles observed, their relative abundance of observation (not considering nests) in decreasing order was approximately: *Chrysemys picta* > *Graptemys geographica* > *Emydoidea blandingii* > *Chelydra serpentina* = *Apalone spinifera* > *Sternotherus odoratus*.

CHRYSEMYS PICTA was the most frequently encountered turtle throughout the Wolf River GMU. Turtles were observed from Forest County in the north (ca. NHI 023) to Waupaca County in the south. These turtles were observed in all types of aquatic habitats, but less frequently in the main river-ways and small streams. In spite of tremendous road-kill mortality, *Chrysemys picta* remain common.

GRAPTEMYS GEOGRAPHICA was commonly found basking on emergent tree snags or lowly hanging branches over the water of the Little Wolf and Wolf Rivers. In these main rivers, this species is more common than *Chrysemys picta*, but is less common in still water lakes. *Graptemys* was also frequently encountered in the Waupaca Chain O' Lakes, but here every individual had deep scars, fissures, or lacerations to the shell, apparently from boat propellers. I anticipate that *Graptemys geographica* will not be a resident species of the Chain O' Lakes for long. The habit of these species to sit amongst the bottom muck or forage in shallow areas makes them particularly vulnerable to the heavy boat traffic on these lakes. This problem needs immediate attention if *Graptemys* is to thrive in the Chain.

EMYDOIDEA BLANDINGII (Threatened) was commonly found throughout the study area. Individuals were found basking in marshes or hiking across roads, but most individuals were found as road-kill. The frequency with which these turtles were encountered indicates that they have healthy populations in some areas of the Wolf River GMU such as Navarino State Wildlife Area. It seems that movement to nesting sites is the danger for these turtles, and if these routes and/or nesting sites can be identified then protective measures can be taken. Further work to identify *Emydoidea blandingii* nesting sites is needed.

CHELYDRA SERPENTINA was not commonly seen, but these are typically secretive aquatic turtles. A newborn and a large adult were found along the Pigeon River. In Navarino State Wildlife Area numerous predated *Chelydra* nests were found on the dike of Waltrach Flowage and a young turtle on the edge of a gravel road at the southern edge of the area.

APALONE SPINIFERA was observed at one location, a backwater of the Wolf River (Herp 78) where at least two were laying on a thick mat of vegetation in the water. Many small *Chrysemys* were present as well. These turtles are probably more common than this study indicates. They are extremely wary and are quick to dive in the water when disturbed and easily missed unless they are being looked for. These turtles prefer larger streams with muddy banks, and these areas were not emphasized by this survey.

STERNOTHERUS ODORATUS is not common in the Wolf River GMU. One individual was found as a road kill near the Waupaca Chain O' Lakes. These turtles are apparently common locally in the chain, but not elsewhere in the Wolf River GMU. This represents the northwestern extreme of their range, and may be

isolated. The health of the population of *Sternotherus* in the Waupaca Chain should be established in future studies.

Snakes

Four species of snakes were encountered. This low number is a bit surprising considering the effort at active search under logs and debris, however the time of year and weather was not ideal and emphasis was placed on wetlands. Relative abundance of observations: *Thamnophis sirtalis* > *Storeria occipitomaculata* = *Elaphe vulpina* = *Lampropeltis triangulum*.

THAMNOPHIS SIRTALIS was the most commonly encountered snake in the Wolf River GMU. This species was found in Navarino SWA, Mosquito Hill SWA, Poygan Marsh SWA, and numerous road kills throughout the GMU.

STORERIA OCCIPITOMACULATA was found on one occasion (Herp 86) and was found as a road kill. Effort was not made to document this species so this low number is not surprising. They are likely quite common.

ELAPHE VULPINA was encountered once. A large individual was found dead on Hwy 54 as a road kill, just east of Royalton.

LAMPROPELTIS TRIANGULUM was previously unrecorded from Portage County. A person brought a dead and decapitated specimen to my office in May, 2000. The individual was reliable and the specific locality, in far eastern Portage County, was reasonable. As far as I can determine, this is the first record of *L. triangulum* in Portage County.

Salamanders

Three species of salamanders were observed: *Ambystoma laterale* > *Plethodon cinereus* > *Hemidactylium scutatum*. None of these species were very commonly encountered; they were usually found incidental to searches for the elusive *Hemidactylium scutatum*. Several sites were worked particularly hard for *Hemidactylium*, producing two localities.

AMBYSTOMA LATERALE is probably a very common salamander in the GMU where there is moist forest and small ponds. *Ambystoma laterale* was observed in Maine SWA, Mosquito Hill, and Mud Lake Forest Headwaters SWA.

PLETHODON CINEAREUS was occasionally observed, but efforts to find this forest species were not made. Nonetheless, specimens were observed in Maine SWA, Mud Lake Forest Headwaters SWA, and New Hope Pines.

HEMIDACTYLIUM SCUTATUM was documented at two northern sites, both close to two previous records (NHI 035-036). At one site (Herp 79) in Langlade County Forest Croplands a nest was found in a sphagnum bog. The nest was ~4" deep into a sphagnum hummock overhanging a small pool of water that had formed when a tree was uprooted. The nest had 42 eggs in one mass. At one moment I thought I saw a tail of a salamander disappear into the sphagnum but I could not find it to verify the observation. The second site was deep in the woods of Forest County (Herp 80). We explored a large (50 acre) sphagnum bog, and I found two nests ~4" deep in a sphagnum hummock overhanging a bit of open water. The hummock was near the base of a Tamarack tree. The two nests were just 5-6" apart. An adult individual was associated with each nest. One nest had about ten eggs, the other about 52.

Similar sampling efforts in other sphagnum habitats (Mud Lake Forest Headwaters, Hortonville Bog) surprisingly did not produce any more observations of this species. The status of *Hemidactylum* remains somewhat of a mystery, and continues to warrant the Special Concern status as more targeted survey work is needed for this species.

Frogs & Toads

Six species of anurans were encountered during the study period. Anurans have the advantage of being able to determine their presence by call as well as by visual observation; this aided in documenting at least one species (*Hyla versicolor/chrysoxcelis*). However, the study period did not correspond to the breeding (and thus calling) period for many of the anuran species in the Wolf River GMU. Most of the anuran observations were obtained while working lakes or streams for turtles, or bogs for *Hemidactylum*. Relative abundance of observations: *Rana clamitans* > *Rana sylvatica* > *Hyla versicolor/chrysoxcelis* > *Bufo americanus* > *Rana pipiens* > *Acris crepitans*.

RANA CLAMITANS was nearly ubiquitous in the Wolf River GMU, and was the most abundant frog observed. This species was observed on lakeshores, in small streams, and in marshes. Closer investigation is necessary to identify the habitat preferences of this species as they seem to be a true generalist.

RANA SYLVATICA was a very abundant frog encountered throughout the Wolf River GMU where there were forested habitats. *Rana sylvatica* was also frequently found in association with sphagnum bogs (e.g., Mud Lake Forest Headwaters SWA) as well as marshes (Navarino SWA) and other types of wetlands

HYLA CHRYSOSCELIS/VERSICOLOR was rarely visually observed, but the calls of this species complex could be heard near most of the still bodies of water with trees near it such as the stream of Navarino SWA (Herp 85), and Maine State Wildlife Area.

BUFO AMERICANUS was frequently observed but usually only as an isolated individual. Little effort was made in looking for this more terrestrial anuran.

RANA PIIPIENS were not commonly observed, but when they were found, they were usually abundant. One individual was observed on a sandbar of the Wolf River in the Outagamie Wildlife Area upstream from Koepke Park (Herp 120). Five individuals were captured and several others observed in the marsh of the Wolf River State Wildlife Area. *Rana pipiens* was also observed in the Poygan Marsh State Wildlife Area. This species seems to have a spotty distribution throughout the Wolf River GMU, preferring more marsh-like habitats or growths of emergent vegetation along lakeshores.

ACRIS CREPITANS was previously considered extinct from the greater portion of its range in Wisconsin (Hay XXX). Therefore, it was the most exciting find of this survey to discover an individual in the Chain O' Lakes of Waupaca County. Waupaca County was previously considered the northern extreme of this species range. The single frog was heard calling on 10 June. It continued to call intermittently for about one hour as we attempted to move closer. I had visual identification of the frog twice from just two feet away. Once I tried to grab it but it escaped. I continued to visit the site in the late evening and found the frog calling: 19 June 18:30-19:15; 25 June 18:00; 26 June 16:00-18:00; 5 July 16:30-19:00; 10 July 16:37; 11 July 17:48; and 17 July in the evening. The frog was recorded during the 26 June visit and a copy of the call was forwarded to Robert Hay (BER Cold Blooded Specialist) and the original kept in the Audio Collection of the Herpetology Collection of the Museum of Natural History, UWSP.

The habitat consisted of a soft mud flat that jutted out from a point that borders a channel to another lake. The site is 30 feet away from a public boat landing and is directly offshore of private land. The mud flat had small puddles of water between clusters of Water Willow (*Decodon verticillatus*; Robert Freckmann personal communication, UWSP). Later in the year Purple Loosetrife invaded the mud flat and then it

was sprayed with Roundup as is typically done on the Chain O' Lakes. It was about this time that the frog stopped calling.

It is possible that this frog was a single individual released by a fisherman at the boat landing. Numerous fishermen from Illinois visit the lakes during the summer, and *Acris* remains common in Illinois. The proximity to the boat landing and the presence of a single individual support this hypothesis.

Nonetheless, the frog managed to exist at the locality for over a month.

Acris typically prefer muddy banks on larger bodies of water. Many such sites, as with this one, have become invaded with Purple Loosestrife. Either the chemical treatment or the habitat alteration by this invading species may be related to the disappearance of this frog from the state. Further research investigating the correlation of this invasion and the disappearance of *Acris* would be insightful, as well as studies elsewhere where the two species co-occur. More immediately it is imperative that the occurrence of this species be checked again in spring.

Management & Protection Recommendations

To discuss management and protection needs of the herpetofauna in the Wolf River GMU, threats and problems need to be identified first. The Wolf River GMU is a trying place to be a herp unless one is fortunate enough to be in one of the state's protected areas. The landscape is highly fragmented and wetlands heavily used. Bogs are few and isolated, but undisturbed where they occur. There are many threats to the herpetofauna in general, and the rare herps in particular, throughout the Wolf River GMU.

ROADWAYS & AUTOMOBILE TRAFFIC: There was tremendous turtle and snake mortality on roadways throughout the GMU and during the entire study period. Most of our records for *Emydoidea blandingii* are from road-kills. Such threats are not limited to the main highways. Even a county road that passes through a state wildlife area such as County K through Navarino SWA has the potential to be a deadly corridor for herps, especially if they are used as detours for busy highways, as County K was in this case. Some kind of environmental impact assessment should be made before rural roads are designated detour routes.

Perhaps constraints on traffic alternatives need to be explored. This could be for certain types of vehicles (e.g., semi-trucks) and could apply to only rural roads. Another possibility is the identification of specific nesting sites and migration routes so that alternate pathways for the organisms can be constructed (tunnels etc.) or better yet, that the roadway can be removed. Identifying the specific time period for migrations will allow the closing of roads or sections of roads during prime migration time. This could be even for a very short period, as little as one night in the case of many amphibians. All these measures, however, will not eliminate the devastation of herps on the roads, but it should help.

WETLAND MODIFICATION & RECREATIONAL USAGE: As a result of the field work, two severe problems for herps on the Wolf River emerged: boat traffic and shoreline alteration. The Wolf River is heavily traveled with boats frequently travelling at high speeds. Turtles likely suffer stress from repeatedly being frightened from their basking logs (an essential nutritional behavior) and may even suffer direct injury from being hit by these boats. The wake from these vehicles alters shoreline microhabitats that are important for many amphibious herps, for that is the location where their terrestrial habitat meets their aquatic habitat. This is a severe problem on the Waupaca Chain O' Lakes where in this last summer I found three *Graptemys* with severely scarred, broken, or lacerated shells. These shallow muck-bottomed lakes with their narrow channels from one lake to the next leave a turtle without escape from the boats that pass by.

Even more troubling to me was the extent of direct shoreline alteration by man. Specifically, the use of rock, concrete, brick, or other solid debris as rip-rap along the shore. I suspect that this is used to prevent erosion and to favor fish spawning, but it severely modifies the river habitat in a way that is detrimental to many herps. In areas of this rip-rap there is no vegetation, no soft ground for nesting, and no erosion. Most herps could not negotiate the steep hard banks to even get out of the water to carry out their activities on land. A river following its natural course of evolution erodes banks away and creates new banks at the

same time. These eroded banks are the critical sites for turtle nesting. Using rip-rap to deter erosion forces the river to form a channel, thus eliminating shallow shoreline microhabitats such as backwater pools, eddies, and marsh. I suspect that long stretches of the river are herpetologically sterile due to the use of this rip-rap. Preservation and restoration of natural erosion processes would benefit many of the native herp species.

The introduced Purple Loosestrife may have a negative impact on herp species through the modification of critical habitat in many wetlands. This seems possible in the case of *Acris crepitans*. I am not sure, however, that chemical treatment of purple loosestrife is any better than no treatment at all. It eliminates the invader, but the impact to tadpoles developing in pockets of water directly below where the chemical is being sprayed is unknown.

DEVELOPMENT & HABITAT FRAGMENTATION: There is extensive development throughout the Wolf River GMU. This development fragments habitats. Large mammals may be able to move from one fragment to another fragment easily, but these are formidable barriers for herps. With herps isolated into small fragments and small populations, there is insufficient opportunity for the natural migration of individuals from fragment to fragment. This is particularly true for some of the land-locked wildlife areas. Riverfront development and the inevitable lawns, chemicals, pets, and shoreline modification that accompany it are additional problems for herps that I foresee becoming worse into the future.

WETLAND LOSS & AGRICULTURE: The agriculture lands that dominate our rural landscape also contribute to its fragmentation and pollution. Many farms use every last inch of property right-up to the edge of a wetland, leaving it isolated and unbuffered. This is true for other types of development as well. So much of the landscape is agriculture, that changes in agriculture practices could have far reaching positive effects on the surrounding herpetofauna. Leaving unplowed areas in addition to wetlands is one possibility.

Future Inventory

With the groundwork laid by this survey, future field work can be done more efficiently. The most important need of future work is documentation of breeding and actual turtle nesting sites earlier in the spring. *Clemmys insculpta* is secretive and terrestrial for much of the summer after mating in April–May, and laying eggs in early June (Vogt, 1981). Likewise, *Emydoidea blandingii* breed in April–May and lay eggs in early June. It is during these periods of time that these turtles are conspicuous, especially females as they venture to nesting sites and can frequently be found crossing roads. During this time period all the actual and potential nesting sites identified from this survey should be visited repeatedly. Efforts should be made to document proximity of roadways to migration routes so that problem localities can be managed.

Once nesting sites are identified, information is needed on the cause and impact of nest predation on turtles, especially *Clemmys* and *Emydoidea*. This could involve collection and identification of scat, and the trapping and population study of predators. First, however, population assessments need to be made on these turtles. The whole Wolf River GMU is not a single turtle population, at least it shouldn't be for management concerns. More localized units or gene pools need to be recognized. How many populations are there? What are the population ranges? What is the degree of migration among populations?

Furthermore, intense efforts should be made to work by foot the smaller creeks that flow into all parts of the Wolf River in order to document the distribution of *Clemmys insculpta*. Likewise, more effort needs to be made to search still wetlands and small lakes for *Emydoidea* than was done this year; the use of hoop-nets may work better for the more aquatic *Emydoidea* than for *Clemmys*.

Early spring visits would also benefit collecting data on species of amphibians (e.g., *Ambystoma maculatum*, *A. tigrinum*). The elusive *Hemidactylium scutatum* lays eggs in late April–early May (Vogt,

1981), and the bogs sites (Herp 12, 14) should be visited again during this time. Many of the anurans call during this early spring period as well (i.e., *Pseudacris triseriata*, *P. crucifer*), which would make it easy to perform call surveys for many sites. Dip netting and seines in streams and temporary pools would capture salamanders and their larvae.

Little data were collected on snakes in the Wolf River GMU. Although few snakes were identified as of concern in the NHI Working List, additional efforts to sample more open, xeric areas could be made. Long-term data on snakes could easily be obtained by using artificial cover objects such as sheet metal or plywood. Snakes use these cover objects as natural cover, and so they can be left in the field year after year and checked when convenient. Data on habitat, reproduction, distribution, and abundance could be obtained in this manner for a minimal initial investment into a couple hundred boards.

Little effort was made to document the presence of *Ophisaurus attenuatus*. This important species is located in the southernmost edge of the Wolf River GMU and priority was not made to visit this area until too late. Future surveys should be sure to make an effort at documenting this species. Lastly, future efforts may just want to focus on one of the ecological landscapes at a time. This would make it easier to summarize data in an ecological significant context, something that was not done this year.

Data collection methods should remain the same as this year with slight modification. Future efforts should continue to keep track of time in the field, but it would be useful to be able to break it down according to search method and habitat type to better standardize effort, which was not done this year.

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APPENDIX I

Wolf River Basin Bird Surveys - 2001

Submitted by Todd Miller, NHI, 2001

Introduction

In 2000, Dennis Kuecherer, Bill Smith, Sumner Matteson and Eric Epstein conducted several bird surveys in the Lower Wolf River Basin for the Natural Heritage Inventory (NHI)'s Biotic Inventory of the Wolf River Basin. In 2001, I surveyed several areas for birds in the Lower Wolf River Basin that had not been surveyed by NHI, including two privately owned tracts (Clark Wetlands for sale in northwest Winnebago County and the Fremont Station Swamp swamp in southeastern Waupaca County) and some floodplain forest in the Navarino State Wildlife Area (SWA) in Shawano County. I also surveyed two stretches of the Wolf River in Waupaca, Shawano, and Outagamie Counties, and the Wolf River Flowage in Navarino State Wildlife Area. I surveyed several areas in the region at night for rails, and accompanied Eric Epstein for two additional morning surveys on the Wolf River.

In all, I recorded 18 element occurrences of 12 species (including a Blanding's turtle). The richest site of those surveyed, in terms of rare birds, appears to be the nearly six square miles of floodplain forest along the Wolf River in Waupaca County south of Shaw Landing, north of Cincoe Lake and east of Partridge Lake. In this area, red-shouldered hawk was detected several times, as well as prothonotary warbler and red-headed woodpecker (see Table 1 for scientific names). Also notable was the number of common moorhen, detected by night surveys in several areas.

Methods

Point Counts

Morning surveys were conducted by point counts on June 4, 6, 21, 22, 2000 at sites selected by NHI Ecologist Eric Epstein. Three of the four surveys were conducted between 5:45- 9:30 AM; a fourth survey was extended to 10:00 AM because of difficult access (a flooded Navarino floodplain forest). NHI Zoologist suggested surveying an older forest stand in Navarino SWA for goshawk. Two additional points were surveyed along County Road K while en route to the Wolf River Flowage and floodplain forest. Points were located a minimum of 250 meters apart. The locations of birds were recorded on field sheets relative to the point center (marked on USGS quadrangle maps) using standardized species acronyms and symbols to record whether they were heard singing or calling, seen perched or flying.

Canoe Surveys

Two stretches of the Wolf River recommended by Eric Epstein were surveyed on June 27 and 28. These were from State Road 156 in Waupaca County to County Road F in Outagamie County, and from Shaw Landing to Gills Landing in Waupaca County. Numbers and species of birds were recorded while paddling or floating down the river. On June 14 and June 15, I accompanied Eric Epstein on surveys of two other stretches of the Wolf River.

Rail Surveys

Rail surveys were conducted at night on June 5, 14, 21, and 26 by playing recordings of vocalizations of each species for 30 seconds, then listening for 30 seconds. Many of these sites were included in 2000 and 2001 rail surveys by interns at Navarino SWA (this data set is appended in the binder).

Miscellaneous Observations

Several element occurrences were recorded while en route from a survey location. One additional element occurrence was recorded while looking for access to the Wolf River for canoe surveys.

Landowner Contact

For the two areas that are privately owned, permission was obtained by phone. Dave Neu, formerly of the DNR Northeast Region, had obtained permission for NHI to survey the Clark/Adolphson property in Winnebago County during the 2000 field season. I contacted the landowner to obtain permission to access the property in 2001. The tamarack swamp in Waupaca has numerous owners. By visiting the area beforehand, I was able to obtain phone numbers of several landowners and permission to access two properties (a log of landowner contact is included in the report binder).

GPS points were taken at a number of sites and are saved as c:/data/Todd/birds/Wolf River 2001/wolf river birds 2001-backup.apr

Results

In all, 89 species were encountered, including 21 element occurrences of 12 species (including a Blanding's turtle). Breeding bird survey summary sheets, site survey forms, rare animal field report forms, quad maps, bird point census forms are included in the report binder. Below is a list of element occurrences recorded by site:

EO Sites

Wolf River Flowage (Navarino SWA)

- American bittern
- black-crowned night-heron
- osprey
- black tern

Wolf River Floodplain Forest (Navarino SWA)

- red-shouldered hawk

Wolf River: State Road 156 (Waupaca County) to County Road F (Outagamie County)

- red-shouldered hawk

Wolf River: Shaw Landing to Gills Landing (Waupaca County)

- yellow-billed cuckoo
- red-shouldered hawk
- red-headed woodpecker
- prothonotary warbler
- great blue heron (rookery)
- black tern
- osprey

Egret Pool and Osprey Flowage (Wolf River Bottoms Wildlife Area)

- common moorhen

Pikes Peak Flowage (Navarino SWA)

- common moorhen

DOT Mitigation site (north of Mack SWA)

- common moorhen

State Road 187 at Shawano/Outagamie border

- northern harrier

Weiland's Landing

- Blanding's turtle

Non-EO Sites

Clark Wetlands

- none

Fremont Station Swamp

- none

Navarino SWA older-second growth stand (both sides of K, north of State Road 156)

- none

La Sage Unit (Wolf River Bottoms)

- none; surveyed for rails, only.

Discussion

Nearly 40% of the element occurrences I recorded during the various surveys were along the Wolf River between Shaw Landing and Gills Landing. This stretch of river and the stretch from Gill Landing to Fremont encompass more than 20 square miles of extensive natural communities (Epstein et al. 2000). Since many species of birds such as red-shouldered hawk and prothonotary warbler are sensitive to habitat fragmentation, managing this area as a large unit would maintain these and other rare species that likely occur here.

I detected common moorhens during night surveys at a number of sites. It is likely that king rail occur at some of these sites, too, but I would recommend further surveys to confirm this, since in some cases Virginia rails would respond to the playback of king rail recordings. While I heard all three calls of the Virginia rail during the surveys, I did not hear either of the two calls characteristic of king rail (a third, grunting call is very similar to number to the grunting call of the Virginia rail). Nevertheless, the surveys conducted by interns at Navarino SWA provide data on common moorhen from other sites that are probably reliable.

The High Potential Sites in the Wolf River Basin comprise more than 500,000 acres. Some of these sites are difficult to access and traverse, making coverage of large areas difficult. The rail surveys conducted by interns lead me to wonder whether NHI would benefit from experienced birders who might volunteer their time. One possibility is to make future inventory project boundaries available on the Bureau of Endangered Resources (BER) webpage, and request sightings of rare birds from volunteers via the WisBirdNet (see <http://www.uwgb.edu/birds/wso/> for more information). Theoretically, submissions of potential element occurrences from volunteers could be confirmed by BER staff, who are focusing on other areas.

Acknowledgments

I appreciate the assistance of several DNR staff during my surveys. Eric Roers, James Robaidek, Kay Brockman-Mederas and two interns from UW-Stevens Point provided logistical support for surveys of the Navarino SWA and nearby areas. Paul Samerdyke assisted in a canoe survey of the Wolf River, from Shaw Landing to Gills Landing.

References

Epstein, E., W. Smith, and A. Galvin. 2000. Biotic inventory & analysis of the Wolf River Basin: an interim report. Bureau of Endangered Resources, Wisconsin Department of Natural Resources.

Table 1. Scientific Names of Birds Mentioned

Common Name	Scientific Name
Great blue heron	<i>Ardea herodias</i>
American bittern	<i>Botaurus lentiginosus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Black tern	<i>Chlidonias niger</i>
Northern harrier	<i>Circus cyaneus</i>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Common moorhen	<i>Gallinula chloropus</i>
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Black-crowned night-heron	<i>Nycticorax nycticorax</i>
Osprey	<i>Pandion haliaetus</i>
Prothonotary warbler	<i>Protonotaria citrea</i>
King rail	<i>Rallus elegans</i>

APPENDIX J

A Synoptic Survey Of The Fishes Of The Lower Wolf River, Wisconsin

Submitted by John Lyons, Wisconsin DNR, March 2002.

Abstract

*The lower Wolf River, flowing 101 miles from the Shawano Dam to Lake Poygan in northeastern Wisconsin, is one of the longest unimpounded warmwater river reaches remaining in the midwestern United States, but has never had a comprehensive fish survey. Seine or electrofishing samples were collected from 102 sites from 1997-2001 to characterize the fish fauna of the Lower Wolf. A total of 13,992 fish in 69 species and 18 families were collected, including 12 species not previously reported from the river. One of these species, channel shiner *Notropis wickliffi*, has not been reported before from the Great Lakes basin. Three state-threatened species, speckled chub *Macrhybopsis aestivalis*, river redhorse *Moxostoma carinatum*, and greater redhorse, *Moxostoma valenciennesi*, and four special-concern species, lake sturgeon *Acipenser fulvescens*, weed shiner *Notropis texanus*, pugnose minnow *Opsopoeodus emiliae*, and western sand darter *Ammocrypta clara* were found. The most frequently encountered and common species were spotfin shiner *Cyprinella spiloptera*, emerald shiner *Notropis atherinoides*, sand shiner *Notropis stramineus*, bluntnose minnow *Pimephales notatus*, and johnny darter *Etheostoma nigrum*. The most frequently encountered and common gamefish were northern pike *Esox lucius*, bluegill *Lepomis macrochirus*, smallmouth bass *Micropterus dolomieu*, largemouth bass *Micropterus salmoides*, and yellow perch *Perca flavescens*. Individual species distributions and multivariate measures of fish assemblage composition showed few consistent patterns over the length of the study reach, but differed between off-channel (sloughs and backwaters) and main-channel habitats. Index of biotic integrity scores based on fish assemblages indicated that the overall environmental quality of the study reach was good. However, scores from survey sites with natural shorelines were significantly higher than scores from sites with 5-35% of their length stabilized with rock rip-rap.*

Introduction

The Wolf River supports some of the best-known and most-valuable river fisheries in Wisconsin and the Midwest. The upper river in Langlade County is nationally famous for trout fishing and is also an important white-water canoeing and rafting destination (Ross 1999). The lower river below the Shawano Dam is one of the longest unimpounded warmwater river reaches in the midwestern United States and has a largely intact floodplain with a wide variety of aquatic habitats. These habitats provide spawning grounds for large spring runs of walleyes and white bass (see Table 1 for scientific names of fishes) that draw many anglers (Preigel 1968, 1970a, 1970b). This spawning in turn supports major fisheries downstream in lakes Poygan, Winneconne, Butte des Morts, and Winnebago. Similarly, the lower Wolf is a major spawning and nursery area for the largest remaining lake sturgeon fishery in the United States (Folz and Myers 1985; Kempinger 1988; Lyons and Kempinger 1992).

Despite the importance of these fisheries, there has never been a comprehensive survey of the fishes of the Wolf River. Statewide and regional fish surveys (Greene 1935; Becker 1976, 1983; Fago 1992; Lyons et al. 2000a) have included data from the Wolf River, but the number of sampling sites has been limited and a list of species for the river has not been presented. Previous Wisconsin Department of Natural Resources surveys of the river have focused on selected gamefish species to the exclusion of most non-game fishes.

In the paper I summarize results of a synoptic survey of the fishes of the lower Wolf River. I report on the occurrence and abundance of all species and characterize the large-scale distribution patterns of selected species and

assemblages of species. I also use a fish-based index of biotic integrity to assess the overall environmental quality of the river.

Study Area

The fish survey covered the 101 miles of the lower Wolf River from Lake Poygan, Winnebago County (River Mile (RM) = 0.0), upstream to the Shawano Dam, Shawano County (RM 101.0), Wisconsin (Figure 1). This reach is free-flowing with no barriers to block fish movement. There are three main tributaries, the Embarrass (RM 32.1), Little Wolf (RM25.9), and Waupaca (RM 13.4) rivers, and at least 20 smaller tributaries. At New London (RM 32.0), just below the mouth of the Embarrass River, the Wolf River has a drainage area of 2,260 square miles and a mean annual flow of 1,770 cubic feet per second (Garn et al. 2001). At the Shawano Dam the drainage area is 816 square miles and mean annual flow is 763 cubic feet per second. For the entire reach, summer water conductivities typically range from 240-360 μ S, and maximum water temperature exceeds 27 C (Lyons, unpublished data). The water is generally stained a tea color from organic acids and is slightly to moderately turbid from suspended sediment during summer baseflows.

The character of the lower Wolf River changes over its length. For the first 10 miles or so below the Shawano Dam the river has a relatively narrow floodplain and few off-channel aquatic habitats such as sloughs, oxbows, and backwaters. The river is 50 to 75 m wide with a mean thalweg depth of 1-2 m (Lyons, unpublished data). A few deep riffles and shallow fast runs are present. Bottom substrates are predominately sand and gravel with areas of cobble and some boulders. Extensive macrophyte beds develop in the summer in some shallow areas. Abundance of large woody debris in the channel is low to moderate. The shoreline is mainly upland shrubs and forest. Rock rip-rap is uncommon.

For the remainder of its length, the Wolf River flows through a much wider and largely intact floodplain with extensive off-channel habitats. From 10 to 75 miles below the dam, the river is typically 25-50 m wide with mean thalweg depths of 2-4 m. Riffles are absent and shallow fast runs scarce, although occasional mid-channel, shallow, sand "flats" are present. Bottom substrates are sand, silt, and clay, and naturally occurring rock is rare. Macrophytes are common in off-channel habitats but uncommon in the main-channel. Large woody debris is common in both main- and off-channel habitats. The shoreline is mainly swamp forest with sand/clay banks, but the outside of many bends has been stabilized with boulder rip-rap, especially near towns, bridges, and fishing shacks. For the last 25 miles, below the mouth of the Little Wolf River, the river widens to 70-80 m and remains 2-4 m deep. Several large side channels with significant flow are present (e.g., Big Cut, Mill Cut) and there are two small main-channel lakes, Partridge and Partridge Crop. Silt and clay substrate dominates, but some sand is present. Macrophytes and large woody debris are common in both main and off-channel habitats. The shoreline is a mix of swamp forest and open marsh, with marsh predominating in the last 10 miles. Many banks have been stabilized with rip-rap.

Methods

Sampling took place during daylight between late May and late September from 1997-2001, with 98% of the sampling in 2000 and 2001. I chose the 102 sampling sites to cover the entire length of the lower Wolf River and to encompass all of the major habitat types that were present.

I used two sampling methods, seining and boat electrofishing. Two seines and three seining techniques were employed depending on habitat conditions. In riffles and fast runs, a 3 X 2 m seine with 6.4 mm delta mesh was set in place in the current and then the substrate upstream was disturbed by kicking to drive fish into the net. In deeper and slower main-channel areas, either this same seine or a larger 11 X 1.5 m bag seine with 6.4 mm delta mesh was pulled downstream with the current along the bank or in mid-channel on sand flats in water less than 1.2 m deep. In off-channel areas, which had little or no current, either of the same two seines was used, and each was pulled directly into shore from deeper water. For each seine haul, the total surface area seined was recorded. Two to five seine hauls were made at each sampling site, and 67 sites were seined (51 main-channel; 16 off-channel). All captured fishes were identified and counted, and then nearly all were released, except for a few specimens preserved as vouchers (deposited at the University of Wisconsin Zoological Museum, Madison) to confirm identifications.

Boat electrofishing involved a standard Wisconsin Department of Natural Resources “mini-boom” shocker and followed operating procedures and power settings recommended by Lyons et al. (2001). At 20 of the 23 main-channel sites shocking proceeded in a downstream direction along the bank and covered 1610 m (1 mile) of contiguous shoreline. The length of the shoreline with rock rip-rap was noted during this sampling. At the three remaining main-channel sites, shorter distances (100-500 m) were sampled to focus on species associated with rock rip-rap habitat. At the 12 off-channel sites, shocking also followed the shoreline, but the distance covered varied from 200 to 2000 m depending on the size of the site. An attempt was made to collect all fish observed in each shocking run. All captured fish were identified and counted. Gamefish species were measured for total length. At main-channel sites, fish were also weighed in aggregate by species. Again, nearly all captured fish were released, except for a few preserved as vouchers.

I summarized and analyzed the catch data by sampling site. Total catches and frequencies of occurrence of each species were then calculated for all sites combined. For those species that occurred at more than 5% of either the seining or shocking sites (“common species”), I calculated catch-per-unit-effort (CPUE) – either the number per m² seined or the number per 100 m of shoreline shocked.

Three analyses were conducted on the common species. These analyses were run separately for the seining and electroshocking data sets, and differences were considered significant if $P < 0.10$. First, I determined whether there were longitudinal patterns in the distribution of individual species along the length of the river. Each site was designated by a river mile value, and for each common species the mean and range of the river mile at which the species occurred was determined. A wide range with a mean river mile near 50 indicated that the species was found throughout the length of the river, whereas a narrow range or a mean much greater or less than 50 indicated a distribution concentrated in a specific part of the river.

Second, I compared the frequency of occurrence and abundance for each of the common species between main- and off-channel habitats. For frequency of occurrence, I carried out a chi-square test of the hypothesis that the species was equally likely to be encountered in the two habitat types (SAS 1990). Many species had limited occurrences and consequently the chi-square test had low statistical power, so to increase sample size, I also did the same analysis for the electroshocking and seining occurrences combined. For abundance, I did a t-test of CPUE between the two habitat types. Data were log-transformed to better approximate normality before the analysis.

Third, I carried out the multivariate ordination technique non-metric multi-dimensional scaling (NMDS; McCune and Mefford 1999) to identify assemblages of fishes and examine their distribution in the river. Ordinations were run on log-transformed CPUE data. Two ordination axes were extracted in each analysis. These axes represented the relative similarity in fish assemblage composition among the sampling sites. A plot of axis scores indicated which sites had similar assemblages. I correlated axis score with species CPUE to understand which species were most important in determining variation among sites in fish assemblage composition. Species with similar correlation coefficients for a particular axis tended to have similar distribution and abundance patterns among the sites. I correlated site river mile with axis score to determine whether assemblages were ordered longitudinally along the length of the river. Axis scores were compared between main- and off-channel habitats to reveal whether assemblage composition differed between the two habitat types.

My final analysis involved all species but only used the main-channel electroshocking data. For each site, I calculated an index of biotic integrity (IBI) score following procedures described in Lyons et al. (2001). This score could range from 0 to 100, with a higher score indicating a better quality fish assemblage and, by implication, better environmental quality. I used a t-test to compare IBI scores from sites with natural shorelines to sites with rock rip-rap.

Results

Sampling of the lower Wolf River produced a large variety and number of fish. The 102 sites (74 main-channel, 28 off-channel) yielded 69 species and one hybrid in 18 families and a total of 13,992 fish (Table 1). Twelve species, shortnose gar, gizzard shad, river shiner, bigmouth shiner, channel shiner, creek chub, brown bullhead, troutperch, brook silverside, brook stickleback, green sunfish, and Iowa darter, had not been previously reported from the lower Wolf River. Eleven of these were known from other parts of the Wolf River system (tributaries or downstream or upstream lakes), but the channel shiner had never been reported before from anywhere in the Great Lakes basin

(Becker 1983; Lyons et al. 2000a). The most frequently encountered and numerous species were spotfin shiner, emerald shiner, sand shiner, bluntnose minnow, and johnny darter (Table 1). These five species made up 70% of the total catch. Conversely, 27 species were represented by five or fewer individuals. The most frequently encountered and numerous gamefish were northern pike, bluegill, smallmouth bass, largemouth bass, and yellow perch. A total of 40 species were designated as “common species”, 34 in the electrofishing dataset and 29 in the seining dataset. Seven species, mooneye, blackchin shiner, spottail shiner, lake chubsucker (special concern), yellow bullhead, brown trout, and white crappie had been reported from the lower Wolf River by previous authors but were not found during this study.

Seven species considered rare by the Wisconsin Department of Natural Resources were encountered during my sampling (Table 2). Three threatened species were collected: speckled chub, river redhorse, and greater redhorse. A single speckled chub was taken from a mid-channel sand bar in the upper part of the Lower Wolf, a representative of the only known population of this species in the Great Lakes basin (Lyons et al. 2000a). Five river redhorse were collected from main-channel shorelines in the middle and upper part of the study area, whereas four greater redhorse were taken from main-channel shorelines in the lower portion of the study area. Four special-concern species were found: lake sturgeon, weed shiner, pugnose minnow, and western sand darter. Two young-of-year and one adult lake sturgeon were encountered in the main-channel of the upper part of the study area. Nineteen weed shiners were collected from main- and off-channel habitats in the middle of the study reach, and five pugnose shiners were caught in a single off-channel site in the lower part of the reach. A total of 67 western sand darters were taken from six main-channel sites throughout most of the study area.

Most of the common species had broad distributions over the length of the lower Wolf River (Table 3). Results from the analyses of the electroshocking and seining datasets were similar. Of the 40 common species, 30 had a range of at least 70 river miles with mean river mile between 40 and 60. Four species, gizzard shad, channel shiner, bullhead minnow, and greater redhorse, were limited to the lower half of the study area, and another five, northern redbelly dace, northern hog sucker, river redhorse, banded darter, and blackside darter, mainly occurred in the upper half. The central mudminnow was found only in the middle third of the lower Wolf.

The common species had complex patterns of occurrence and abundance between main- and off-channel habitats (Table 4). Nine species – longnose gar, bowfin, gizzard shad, common shiner, emerald shiner, fathead minnow, white sucker, shorthead redhorse, and johnny darter – had no significant differences in frequency of occurrence and CPUE for either electroshocking or seining between main- and off-channel habitats. Ten species – northern redbelly dace, northern hog sucker, river redhorse, golden redhorse, greater redhorse, white bass, western sand darter, banded darter, logperch, and blackside darter – were significantly more frequently encountered and more numerous in main-channel habitats, and one species – central mudminnow – was encountered only in off-channel habitats. The remaining 20 species either had differences between occurrence and abundance patterns or between the electrofishing and seining datasets. Black crappies occurred more frequently at main-channel sites for the electrofishing dataset and at off-channel sites for the seining dataset. For both datasets, there was no difference in black crappie CPUE between the two habitat types. Ten species – common carp, golden shiner, bluntnose minnow, bullhead minnow, spotted sucker, northern pike, pumpkinseed, bluegill, largemouth bass, and yellow perch – had a combination of no difference between habitats and a greater value for off-channel habitats, depending on the type of measure (occurrence or abundance) and dataset considered. The remaining nine species – spotfin shiner, sand shiner, channel shiner, silver redhorse, channel catfish, rock bass, smallmouth bass, walleye, and freshwater drum – had both no difference and greater values for main-channel habitats. Thus, overall, nine species showed no differences in use of main- and off-channel habitats, 11 tended to use off-channel habitats more, 19 tended to use main-channel habitats more, and one, black crappie, had a more complex habitat use pattern.

The NMDS analyses demonstrated that habitat type and to a lesser extent longitudinal position in the Lower Wolf could account for much of the difference in fish assemblages among sites. For the electroshocking dataset, the two ordination axes explained 82% of the variation in species CPUE among the sites. Site scores were not significantly correlated with river mile for either axis, indicating that there was no consistent change in fish assemblages in an upstream or downstream direction. However, a plot of the site scores revealed that off-channel sites tended to have different assemblages than main-channel sites (Figure 2). Off-channel sites usually had low scores on axis two and high scores on axis one, whereas the opposite was true for main-channel sites. The species with relatively large negative correlations ($r > 0.33$) with the first axis, spotted sucker, golden shiner, yellow perch, and northern pike, were considered off-channel species (see previous paragraph). Those with large positive correlations, silver redhorse, emerald shiner, golden redhorse, and spotfin shiner, were mostly main-channel species or species,

although the emerald shiner had no difference in habitat use between main- and off-channel habitats (Table 5). For the second axis, most of the large negative correlations were for main-channel species: smallmouth bass, rock bass, shorthead redhorse (no difference), freshwater drum, spotfin shiner, logperch, golden redhorse, northern hog sucker, channel catfish, and sand shiner. Most of the large positive correlations were for off-channel species: pumpkinseed, spotted sucker, yellow perch, bowfin (no difference), bluegill, and largemouth bass.

Results for the NMDS analysis of the seining dataset were somewhat similar but not as clear-cut. The two ordination axes explained 69% of the variation in species CPUE among sites. Site scores along the first axis were not significantly correlated with river mile, but scores on the second axis were negatively correlated ($r = -0.691$; $p < 0.01$). Thus, upstream sites tended to have lower scores along this axis than downstream sites, and therefore fish assemblages changed along the length of the study area. A plot of the site scores revealed that almost all off-channel sites had positive scores, whereas main-channel sites had both positive and negative scores (Figure 3). Main- and off-channel sites had little distinction along axis one, although main-channel sites had the lowest and highest scores. Therefore, overall, off-channel sites had a narrower range of fish assemblages than main-channel sites. The only species with a large positive correlation with axis one was northern pike, an off-channel species, whereas fishes with large negative correlations were a mix of the “no difference” species emerald shiner and white sucker, the off-channel species bullhead minnow, and the main-channel species sand shiner and channel shiner (Table 5). For axis two, the three fishes with large negative correlations were all main-channel species. One, sand shiner, was widespread, but the other two, northern hog sucker and banded darter, were found mainly in the upper half of the study area. Of the nine fishes with large negative correlations, seven, bluegill, bluntnose minnow, largemouth bass, golden shiner, pumpkinseed, and northern pike, were off-channel species, one, johnny darter, was a no difference species, and one, channel shiner, was a main-channel species. The channel shiner was only encountered in the lower half of the study area.

Based on IBI scores, environmental quality was variable but generally good over the entire study area (Table 6). For the 20 main-channel sites analyzed, mean IBI score was 67 with a rating of good, with a range of scores from 40 to 95 and a range of ratings from fair to excellent. Scores were not correlated with river mile, but were related to the presence of rock rip-rap on the bank. Sites with at least some rip-rap (5-35% of site length) had a mean score of 58 and a rating of fair, which was significantly lower ($t = 3.332$; $p = 0.0037$) than the mean of 75 and rating of good for sites without rip-rap. Of the 10 sites with rip-rap, four rated as fair and six as good, whereas of the 10 sites without rip-rap six rated as good and four as excellent. Thus, fish assemblage quality and, by inference, environmental quality did not change consistently over the length of the study area but were generally lower at sites with rip-rapped banks.

Discussion

The lower Wolf River supports a diverse fish fauna. Seventy-six species have been found in this river reach, 69 during this study. Most of these species are native inhabitants of the river, but some are likely present in the river only as strays from small tributaries and others have been introduced. Brassy minnow, northern redbelly dace, creek chub, and brook stickleback are native species characteristic of small streams and are usually absent from large rivers (Lyons 1996). In this study they were caught only near the mouths of small tributaries, so they were probably strays. Common carp and brown trout were both brought to Wisconsin waters in the late 1800s from Europe and have become widely established in the state, including the Wolf River drainage (Becker 1983). The brown trout is incapable of completing its life cycle in a river as warm as the lower Wolf, so its presence there is as a stray from a colder tributary or further upstream in colder reaches of the upper Wolf River. Muskellunge are native to Wisconsin, but not to the Wolf River drainage. They currently are widely stocked in Wisconsin waters including the Wolf. The origin of 10 species – shortnose gar, gizzard shad, speckled chub, river shiner, channel shiner, pugnose minnow, bullhead minnow, western sand darter, slenderhead darter, and river darter – is unclear. All are characteristic of large rivers in the Mississippi River basin but have distributions in the Lake Michigan basin that are essentially limited to the Fox-Wolf River drainage (in some cases also including lower Green Bay or its tributary the Menominee River; Lyons et al. 2000a). Becker (1976, 1983) suggested that at least some of these species may be non-native to the Fox-Wolf, having perhaps invaded the Lake Michigan basin from the Mississippi River basin only recently via a canal built in the 1800's between the Wisconsin River (Mississippi basin) and the upper Fox River at Portage. However, a regular flood connection between the Wisconsin and Fox rivers at Portage prior to construction of the canal provided a ready mechanism for natural colonization of these and other fishes from the Mississippi

basin over the last several thousand years, making them possibly native to the lower Wolf (Becker 1983; Lyons et al. 2000a).

The rich diversity of the fish fauna and the presence of at least seven rare fishes indicate that the Lower Wolf has great ichthyological value above and beyond its fisheries. Conservation of the rare fishes is particularly important. As mentioned, the lower Wolf River speckled chub population is the only one of its kind in the entire Great Lakes basin. The only Great Lakes basin populations of the western sand darter occur in the Wolf, Embarrass, Waupaca, and Menominee rivers (Lyons et al. 2000a). Of these four, the lower Wolf River appears to support the largest number of individuals (Lyons, unpublished data). The lake sturgeon occurs throughout the Great Lakes basin, but the Wolf River likely has the greatest reproduction of any river in the basin (Folz and Myers 1985). The pugnose minnow has been reported from the Lake Michigan basin only from the Fox-Wolf River drainage and from Wolf Lake in northeastern Illinois, where it no longer occurs (Becker 1976). Becker (1976, 1983) believed river redhorse to be extirpated from the Lake Michigan basin, but recent surveys confirm their presence in the lower Wolf (Fago 1992; Lyons et al. 2000a; this study), and Fox (Lyons et al. 2000a) rivers in Wisconsin, the St Joseph River in southwestern Michigan and north-central Indiana (Wesley and Duffy 1999), and the Muskegon River in west-central Michigan (O'Neal 1997). The channel shiner, although not rare in the Mississippi basin of Wisconsin (Lyons et al. 2000a), has its only population in the entire Great Lakes basin in the lower Wolf River. Earlier surveys (e.g., Fago 1992) may have confused channel shiners in the lower Wolf with the very similar mimic shiner, which also occurs there.

The habitat designations of species from this study generally agree with literature accounts of their habitat preferences. Of the five species limited to the upper half of the lower Wolf, three, northern hog sucker, banded darter, and blackside darter, are usually encountered only in rocky riffles and fast runs (Becker 1983; Lyons 1996). These two habitat types were rare outside of the upper part of the study area. Two of the species limited to the lower half, channel shiner and bullhead minnow, are characteristic of the largest rivers in the state and are rarely encountered in reaches with a watershed area of less than 1500 square miles (Lyons et al. 2000a, 2001; Lyons, unpublished data). Only the lower portion of the study area was this large. Many of the species designated as primarily using the main-channel in the lower Wolf, including sand shiner, channel shiner, northern hog sucker, silver redhorse, river redhorse, western sand darter, banded darter, and blackside darter, are riverine specialists that require flowing water habitats (Lyons et al. 2001). Conversely, most of the off-channel species, such as common carp, golden shiner, central mudminnow, northern pike, pumpkinseed, bluegill, largemouth bass, and yellow perch, are species of low-gradient streams with limited current and of lakes (Becker 1983; Lyons 1996). Much of the off-channel habitat in the lower Wolf was lake-like in character. Many of the species that used both main- and off-channel habitats, such as common shiner, emerald shiner, white sucker, and shorthead redhorse, are considered habitat generalists (Becker 1983; Lyons et al. 2000a).

Habitat type (main-channel vs. off-channel) was more important than longitudinal position in explaining the distribution of individual fish species and assemblages in the lower Wolf River, a finding that agrees with current ideas about the relative importance of longitudinal versus lateral processes in lowland rivers. Of the 40 common species, only 10 were limited to a particular longitudinal portion of the lower Wolf with the remainder found over most or all of the length of the study area. Conversely, 31 of the common species had a distribution pattern that favored either main- or off-channel habitats. For the electroshocking dataset, similarities among fish assemblages could be explained by habitat type but not by longitudinal position, whereas for the seining dataset, assemblage similarity was explained both by habitat type and by longitudinal position. Recent theories concerning the structure and function of large floodplain rivers postulate that physical, chemical, and biological characteristics often change more in moving a few hundred meters laterally from channel to floodplain habitats than they do in moving longitudinally up or down the channel for tens of thousands of meters (Junk et al. 1989). Consequently, biological assemblages are predicted to differ more between adjacent main- and off-channel aquatic habitats than between widely separated main-channel habitats. Findings for lower Wolf River fishes are consistent with this prediction.

Fish assemblage data document that the environmental quality of the lower Wolf River is generally good. This is likely due in large part to the intact floodplain, the absence of substantial point- or non-point-source pollution in the watershed, and the lack of dams or other major hydrologic works to fragment the river and modify habitat (Lyons et al. 2001). Most large warmwater rivers in the midwestern United States are far more degraded than the lower Wolf (e.g., Karr et al. 1985; Fremling et al. 1989), another indication of the great ecological value of the river. However, because IBI ratings average good rather than excellent, the environmental quality of the lower Wolf could perhaps be improved.

One human activity that is problematic in the lower Wolf River is rip-rapping of the river banks. Certainly some of this rip-rapping is necessary to protect important public works such as bridges or roadbeds, and rip-rapping has increased lake sturgeon spawning habitat (Folz and Myers 1985). However, IBI scores and fish assemblage quality along banks with rip-rap are significantly lower than scores and assemblages along natural banks, indicating that the net effect of rip-rapping on the river ecosystem may be negative. My field observations suggest that these fish assemblage and IBI differences are related to the relative amounts of large woody debris in the water along the two types of banks. Along natural banks, normal processes of bank erosion and lateral channel migration gradually undermine the root structure of bankside trees, eventually causing them to fall into the river (Gordon et al. 1992). This important natural phenomenon is most pronounced on the outside of bends, where erosive forces and channel migration are greatest. Downed trees provide excellent habitat for a wide range of species and typically support a high density and biomass of fish (Lyons et al. 2000b). However, along rip-rapped banks, erosion and channel migration are prevented, so natural recruitment of trees to the river is curtailed. Because rip-rapping is concentrated in areas where erosion (and thus tree recruitment) is highest, such as the outside of bends, relatively small amounts of rip-rapping – only 5-10% of bank length at some sites – can have disproportionately large effects on river habitat and hence river fish assemblages. The rip-rap itself does provide some habitat, particularly for species such as smallmouth bass and rock bass that favor rocky substrate. However, based on my observations, most rip-rap in the lower Wolf is out of the water at normal summer flows, and the small surface area of rocky habitat available to fish is usually much less than would have been provided by fallen trees. I recommend that future bank rip-rapping projects on the lower Wolf be critically examined to determine whether their benefits exceed their ecological costs.

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Table J-1. List of species captured from the lower Wolf River. Number of sites and fish refer to this study; species with a zero catch have been reported previously from the lower Wolf River but were not encountered in this study. Species followed by an “S” (seining) or an “E” (electrofishing) in parentheses were “common species” (encountered at more than 5% of the seining or electrofishing sites) and were used in quantitative analyses.

Common Name	Scientific Name	Number of sites	Number of fish
LAMPREYS	PETROMYZONTIDAE		
Silver Lamprey	<i>Ichthyomyzon unicuspis</i>	1	1
STURGEONS	ACIPENSERIDAE		
Lake Sturgeon	<i>Acipenser fulvescens</i>	3	3
GARS	LEPISOSTEIDAE		
Longnose Gar (E)	<i>Lepisosteus osseus</i>	9	11
Shortnose Gar	<i>Lepisosteus platostomus</i>	1	1
BOWFINS	AMIIDAE		
Bowfin (E)	<i>Amia calva</i>	12	17
HERRINGS	CLUPEIDAE		
Gizzard Shad (E, S)	<i>Dorosoma cepedianum</i>	18	309
MOONEYES	HIODONTIDAE		
Mooneye	<i>Hiodon tergisus</i>	0	0
MINNONS	CYPRINIDAE		
Common Carp (E)	<i>Cyprinus carpio</i>	28	168
Spotfin Shiner (E, S)	<i>Cyprinella spiloptera</i>	68	1936
Brassy Minnow	<i>Hybognathus hankinsoni</i>	1	2
Common Shiner (S)	<i>Luxilus cornutus</i>	9	25
Speckled Chub	<i>Macrhybopsis aestivalis</i>	1	1
Hornyhead Chub	<i>Nocomis biguttatus</i>	2	4
Golden Shiner (E, S)	<i>Notemigonus crysoleucas</i>	25	195
Emerald Shiner (E, S)	<i>Notropis atherinoides</i>	65	2625
River Shiner	<i>Notropis blennius</i>	3	4
Bigmouth Shiner	<i>Notropis dorsalis</i>	2	6
Blackchin Shiner	<i>Notropis heterodon</i>	0	0
Blacknose Shiner	<i>Notropis heterolepis</i>	2	2
Spottail Shiner	<i>Notropis hudsonius</i>	0	0
Rosyface Shiner	<i>Notropis rubellus</i>	4	10
Sand Shiner (E, S)	<i>Notropis stramineus</i>	37	2558
Weed Shiner	<i>Notropis texanus</i>	3	19
Mimic Shiner	<i>Notropis volucellus</i>	4	19
Channel Shiner (E, S)	<i>Notropis wickliffi</i>	23	482
Pugnose Minnow	<i>Opsopoeodus emiliae</i>	1	5

Table J-1 - Continued.

Common Name	Scientific Name	Number of sites	Number of fish
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Northern Redbelly Dace (S)	<i>Phoxinus eos</i>	5	13
Bluntnose Minnow (E, S)	<i>Pimephales notatus</i>	52	2077
Fathead Minnow (S)	<i>Pimephales promelas</i>	13	40
Bullhead Minnow (E, S)	<i>Pimephales vigilax</i>	15	430
Creek Chub	<i>Semotilus atromaculatus</i>	1	45
SUCKERS	CATOSTOMIDAE		
Quillback	<i>Carpiodes cyprinus</i>	2	2
White Sucker (E, S)	<i>Catostomus commersoni</i>	21	218
Lake Chubsucker	<i>Erimyzon sucetta</i>	0	0
Northern Hog Sucker (E, S)	<i>Hypentelium nigricans</i>	9	96
Spotted Sucker (E, S)	<i>Minytrema melanops</i>	30	123
Silver Redhorse (E, S)	<i>Moxostoma anisurum</i>	28	216
River Redhorse (E)	<i>Moxostoma carinatum</i>	3	5
Golden Redhorse (E)	<i>Moxostoma erythrurum</i>	18	74
Shorthead Redhorse (E)	<i>Moxostoma macrolepidotum</i>	31	206
Greater Redhorse (E)	<i>Moxostoma valenciennesi</i>	4	4
BULLHEAD CATFISHES	ICTALURIDAE		
Black Bullhead	<i>Ameiurus melas</i>	2	5
Yellow Bullhead	<i>Ameiurus natalis</i>	0	0
Brown Bullhead	<i>Ameiurus nebulosus</i>	1	1
Channel Catfish (E)	<i>Ictalurus punctatus</i>	15	32
Tadpole Madtom	<i>Noturus gyrinus</i>	1	1
Flathead Catfish	<i>Pylodictis olivaris</i>	2	2
PIKES	ESOCIDAE		
Northern Pike (E, S)	<i>Esox lucius</i>	36	109
Muskellunge	<i>Esox masquinongy</i>	2	2
MUDMINNOWS	UMBRIDAE		
Central Mudminnow (S)	<i>Umbra limi</i>	9	76
TROUTS	SALMONIDAE		
Brown Trout	<i>Salmo trutta</i>	0	0
TROUT-PERCHES	PERCOPSIDAE		
Trout-perch	<i>Percopsis omiscomaycus</i>	1	2
CODFISHES	GADIDAE		
Burbot	<i>Lota lota</i>	2	3
SILVERSIDES	ATHERINIDAE		

Table J-1 - Continued.

Common Name	Scientific Name	Number of sites	Number of fish
Brook Silverside	<i>Labidesthes sicculus</i>	1	2
STICKLEBACKS	GASTEROSTEIDAE		
Brook Stickleback	<i>Culaea inconstans</i>	3	3

TEMPERATE BASSES	PERCICHTHYIDAE		
White Bass (E)	<i>Morone chrysops</i>	4	4
SUNFISHES	CENTRARCHIDAE		
Rock Bass (E, S)	<i>Ambloplites rupestris</i>	27	105
Green Sunfish	<i>Lepomis cyanellus</i>	2	2
Green Sunfish X Unknown Sunfish	<i>Lepomis cyanellus x Lepomis sp.</i>	1	1
Pumpkinseed (E, S)	<i>Lepomis gibbosus</i>	19	69
Bluegill (E, S)	<i>Lepomis macrochirus</i>	50	197
Smallmouth Bass (E, S)	<i>Micropterus dolomieu</i>	29	221
Largemouth Bass (E, S)	<i>Micropterus salmoides</i>	33	95
White Crappie	<i>Pomoxis annularis</i>	0	0
Black Crappie (E, S)	<i>Pomoxis nigromaculatus</i>	19	50
PERCHES	PERCIDAE		
Western Sand Darter (S)	<i>Ammocrypta clara</i>	6	67
Iowa Darter	<i>Etheostoma exile</i>	3	3
Fantail Darter	<i>Etheostoma flabellare</i>	3	4
Johnny Darter (E, S)	<i>Etheostoma nigrum</i>	51	532
Banded Darter (E, S)	<i>Etheostoma zonale</i>	9	73
Yellow Perch (E, S)	<i>Perca flavescens</i>	28	98
Logperch (E, S)	<i>Percina caprodes</i>	13	20
Blackside Darter (S)	<i>Percina maculata</i>	9	68
Slenderhead Darter	<i>Percina phoxocephala</i>	4	4
River Darter	<i>Percina shumardi</i>	1	1
Walleye (E)	<i>Stizostedion vitreum</i>	15	43
DRUMS	SCIAENIDAE		
Freshwater Drum (E)	<i>Aplodinotus grunniens</i>	25	95

Table J-2 – Collection information for state-threatened and special-concern fishes encountered during this study.

Species	River Mile	Coordinates	Date	Habitat	Number
Threatened					
Speckled chub	96.2	44°43'56" N 88°33'59" W	1 June 2000	Main-channel sand flat	1
River redhorse	46.6	44°22'13" N 88°36'56" W	9 August 2000	Main-channel rip-rap bank	1
River redhorse	49.8	44°23'27" N 88°35'39" W	7 July 2000	Main-channel rip-rap bank	1
River redhorse	97.8	44°44'45" N 88°35'2" W	1 June 2000	Main-channel natural bank	3
Greater redhorse 16.9	No data	No data	5 Sept. 1997	Main-channel natural bank	1
Greater Redhorse 21.2		44°21'0" N 88°50'23" W	7 Sept. 2000	Main-channel natural bank	1
Greater redhorse 29.3		44°23'56" N 88°46'46" W	11 August 2000	Main-channel natural bank	1
Greater redhorse 33.1	No data	No data	9 Sept. 1998	Main-channel natural bank	1
Special concern					
Lake sturgeon	89.1	44°40'2" N 88°35'32" W	28 June 2001	Main-channel sand flat	1 juvenile
Lake sturgeon	96.2	44°43'56" N 88°33'59" W	1 June 2000	Main-channel sand flat	1 juvenile
Lake sturgeon	101.0	44°46'26" N 88°37'15" W	2 June 2000	Shawano Dam tailwater	1 adult
Weed shiner	38.2	44°21'41" N 88°40'48" W	10 August 2000	Weedy backwater	15
Weed shiner	63.0	44°30'19" N 88°34'38" W	27 Sept 2001	Main-channel sand-silt shore	1

Table J-2 – Continued.

Species	River Mile	Coordinates	Date	Habitat	Number
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Weed shiner	67.5	44°32'12" N 88°33'31" W	27 Sept 2001	Mouth of small slough	3
Pugnose minnow	22.8	44°21'57" N 88°49'17" W	10 August 2000	Marshy slough	5
Western sand darter	24.4	44°21'38" N 88°48'57" W	6 Sept. 2000	Main-channel sand shoreline	23
Western sand darter	43.9	44°22'0" N 88°38'3" W	9 August 2000	Main-channel sand shoreline	3
Western sand darter	51.0	44°23'55" N 88°35'6" W	7 July 2000	Main-channel sand shoreline	5
Western sand darter	80.6	44°37'23" N 88°37'59" W	28 June 2001	Main-channel sand shoreline	2
Western sand darter	91.2	44°40'55" N 88°34'49" W	31 May 2000	Main-channel sand shoreline	1
Western sand darter	96.2	44°43'56" N 88°33'59" W	1 June 2000	Main-channel sand flat	33

Table J-3 – Mean and range of the river mile (RM) of sites where common species were encountered..

Species	Electroshocking dataset			Seining dataset		
	Sites	Mean RM	Range RM	Sites	Mean RM	Range RM
Longnose gar	10	45.8	0.4-93.2	2	Insufficient data	
Bowfin	10	53.6	0.3-93.1	2	Insufficient data	
Gizzard shad	13	31.8	12.0-55.9	5	20.3	9.1-47.7
Common carp	27	43.5	0.4-101.0	1	Insufficient data	
Golden shiner	11	47.4	3.1-89.5	14	45.6	1.5-74.6
Spotfin shiner	19	53.5	12.0-97.9	49	54.5	9.1-101.0
Common shiner	1	Insufficient data		8	70.3	25.6-96.2
Emerald shiner	24	41.5	3.1-93.2	41	43.5	9.1-95.3
Sand shiner	8	70.9	52.6-97.9	29	58.7	10.3-101.0
Channel shiner	3	32.8	26.9-42.2	20	31.7	9.1-49.5
Northern redbelly dace	0	Insufficient data		5	90.0	73.4-101.0
Bluntnose minnow	13	57.5	17.0-97.9	39	47.4	9.1-101.0
Fathead minnow 2	Insufficient data			11	49.1	23.5-86.9
Bullhead minnow5	23.7	17.0-36.1		10	27.5	10.3-62.0
White sucker	6	52.9	12.0-93.2	15	52.2	18.3-90.1
Northern hog sucker	4	91.8	84.9-97.8	5	94.8	90.9-99.1
Spotted sucker	21	45.7	0.4-101.0	9	31.8	10.3-47.7
Silver redhorse	23	47.2	3.1-97.9	5	40.5	20.4-78.7
River redhorse	3	64.7	46.6-97.8	0	Insufficient data	
Golden redhorse 17	52.3	3.1-97.9	1	Insufficient data		
Shorthead redhorse	28	44.6	0.4-101.0	3	Insufficient data	

Table J-3 – Continued.

	Electroshocking dataset			Seining dataset		
	Sites	Mean RM	Range RM	Sites	Mean RM	Range RM

Species	Sites	Mean RM	Range RM	Sites	Mean RM	Range RM
Greater redhorse	4	25.2	16.9-33.1	0	Insufficient data	
Channel catfish	15	41.9	7.5-97.9	0	Insufficient data	
Northern pike	19	47.6	3.1-97.9	17	47.5	1.5-83.5
Central mudminnow	2	Insufficient data		7	51.0	35.0-73.4
White bass	4	18.2	3.0-29.3	0	Insufficient data	
Rock bass	21	53.4	1.9-101.0	6	65.1	8.5-99.2
Pumpkinseed	9	41.0	0.4-93.2	10	45.1	8.5-79.9
Bluegill	30	45.5	0.4-101.0	20	42.0	5.9-101.0
Smallmouth bass	21	49.6	1.9-101.0	8	44.5	5.9-92.4
Largemouth bass	15	39.9	1.9-93.2	18	37.7	1.5-83.5
Black crappie	12	42.4	3.1-93.2	7	50.2	22.9-99.7
Western sand darter	1	Insufficient data		5	59.2	24.4-96.2
Johnny darter	4	54.0	26.9-93.2	47	51.3	1.5-101.0
Banded darter	4	82.2	46.6-97.8	5	84.9	51.3-99.1
Yellow perch	18	42.4	0.4-93.2	10	38.9	10.3-56.5
Logperch	8	72.1	26.9-97.9	5	53.1	10.3-91.3
Blackside darter	2	Insufficient data		7	81.7	45.9-101.0
Walleye	15	52.7	3.1-97.9	0	Insufficient data	
Freshwater drum	25	48.0	1.9-101.0	0	Insufficient data	

Table J-4 – Type of habitat, either main- or off-channel, where common species most frequently occurred and were most abundant. “Both” indicates that there was no difference in occurrence or abundance between the two habitat types. An asterisk indicates that the number of occurrences was small and the chi-square test had low power.

Species	Electroshocking dataset		Seining dataset		Combined dataset
	Occurrence	Abundance	Occurrence	Abundance	Occurrence
Longnose gar	Both	Both	Insufficient data		Both
Bowfin	Both	Both	Insufficient data		Both
Gizzard shad	Both	Both	Both*	Both	Both
Common carp	Both	Off	Insufficient data		Both
Golden shiner	Both	Off	Off	Both	Off
Spotfin shiner	Main	Both	Both	Both	Both
Common shiner	Insufficient data		Both	Both	Both
Emerald shiner	Both	Both	Both	Both	Both
Sand shiner	Main*	Both	Both	Main	Main
Channel shiner	Main*	Main	Both	Both	Both
Northern redbelly dace	Insufficient data		Main*	Main	Main
Bluntnose minnow	Both	Both	Off	Both	Both
Fathead minnow	Insufficient data		Both	Both	Both
Bullhead minnow	Both*	Off	Both	Both	Both
White sucker	Both*	Both	Both	Both	Both
Northern hog sucker	Main*	Main	Main*	Main	Main
Spotted sucker	Both	Off	Both	Off	Off
Silver redhorse	Main	Main	Both*	Both	Main
River redhorse	Main*	Main	Insufficient data		Main*

Table J-4 – Continued.

Species	Electroshocking dataset		Seining dataset		Combined dataset
	Occurrence	Abundance	Occurrence	Abundance	Occurrence

Golden redbhorse	Main	Main	Insufficient data		Main
Shorthead redbhorse	Both	Both	Insufficient data		Both
Greater redbhorse	Main*	Main	Insufficient data		Main*
Channel catfish	Main	Both	Insufficient data		Main
Northern pike	Both	Both	Off	Both	Both
Central mudminnow	Insufficient data		Off*	Off	Off*
White bass	Main*	Main	Insufficient data		Main*
Rock bass	Main	Both	Both*	Both	Main
Pumpkinseed	Both	Both	Off	Both	Off
Bluegill	Both	Off	Off	Off	Off
Smallmouth bass	Main	Both	Both	Both	Main
Largemouth bass	Both	Both	Off	Both	Off
Black crappie	Main	Both	Off	Both	Both
Western sand darter	Insufficient data		Main	Main	Main
Johnny darter	Both*	Both	Both	Both	Both
Banded darter	Main*	Main	Main*	Main	Main
Yellow perch	Both	Off	Both	Both	Off
Logperch	Main	Main	Main	Main	Main
Blackside darter	Insufficient data		Main	Main	Main
Walleye	Main	Both	Insufficient data		Main
Freshwater drum	Main	Both	Insufficient data		Main

TableJ- 5 – Correlations between the CPUE of the common species and ordination axis scores for the non-metric multi-dimensional scaling analysis. Values greater than 0.33 and less than -0.33 are in bold type.

Species	Electroshocking dataset		Seining dataset	
	Axis 1	Axis 2	Axis 1	Axis2
Longnose gar	0.261	-0.209	Not included in analysis	

Bowfin	-0.003	0.417	Not included in analysis	
Gizzard shad	0.158	0.104	-0.207	0.205
Common carp	0.189	-0.110	Not included in analysis	
Golden shiner	-0.574	0.321	-0.022	0.367
Spotfin shiner	0.365	-0.481	-0.017	0.010
Common shiner	Not included in analysis		-0.188	0.116
Emerald shiner	0.594	0.236	-0.607	0.343
Sand shiner	0.164	-0.373	-0.447	-0.369
Channel shiner	0.219	0.054	-0.382	0.443
Northern redbelly dace	Not included in analysis		-0.020	-0.259
Bluntnose minnow	-0.059	-0.021	-0.252	0.489
Fathead minnow	Not included in analysis		-0.208	0.133
Bullhead minnow	0.215	0.233	-0.334	0.245
White sucker	-0.067	0.085	-0.395	0.019
Northern hog sucker	0.040	-0.407	-0.036	-0.410
Spotted sucker	-0.616	0.616	-0.221	0.384
Silver redhorse	0.608	-0.377	-0.132	0.045
River redhorse	0.180	-0.295	Not included in analysis	
Golden redhorse	0.414	-0.441	Not included in analysis	

Table J-5 – Continued.

Species	Electroshocking dataset		Seining dataset	
	Axis 1	Axis 2	Axis 1	Axis 2
Shorthead redhorse	0.033	-0.670	Not included in analysis	
Greater redhorse	0.224	0.107	Not included in analysis	
Channel catfish	0.099	-0.386	Not included in analysis	
Northern pike	-0.380	-0.009	0.446	0.331

Central mudminnow	Not included in analysis		0.027	0.134
White bass	0.097	0.274	Not included in analysis	
Rock bass	-0.020	-0.823	0.327	0.093
Pumpkinseed	-0.151	0.622	0.096	0.338
Bluegill	-0.190	0.402	-0.002	0.497
Smallmouth bass	0.094	-0.834	-0.110	0.123
Largemouth bass	-0.101	0.339	-0.008	0.423
Black crappie	0.125	0.096	-0.066	0.202
Western sand darter	Not included in analysis		-0.083	-0.048
Johnny darter	0.171	0.148	-0.268	0.381
Banded darter	0.045	-0.312	-0.004	-0.336
Yellow perch	-0.456	0.444	-0.283	0.154
Logperch	0.177	-0.454	-0.007	-0.200
Blackside darter	Not included in analysis		0.030	-0.021
Walleye	0.252	-0.207	Not included in analysis	
Freshwater drum	-0.013	-0.541	Not included in analysis	

Table J -6. Index of biotic integrity (IBI) scores for main-channel sites on the lower Wolf River. River mile indicates the downstream end of the site.

River mile	IBI Score	Rating	Rip-rap?	Year	Month	Day
3.0	75	Good	Yes	2001	June	29
11.9	70	Good	Yes	2000	Sept.	7
16.9	85	Excellent	No	1997	Sept.	5
21.2	80	Excellent	No	2000	Sept.	7
26.8	65	Good	Yes	2000	Sept.	6
29.3	70	Good	No	2000	August	11
33.1	60	Good	Yes	1998	Sept.	9
35.5	40	Fair	Yes	2000	August	10
42.1	50	Fair	Yes	2000	August	10
46.6	65	Good	Yes	2000	August	9
49.8	65	Good	Yes	2000	July	7
52.5	60	Good	No	2000	July	5
57.3	70	Good	No	2000	July	6
59.5	50	Fair	Yes	2000	July	6
65.4	40	Fair	Yes	2001	Sept.	27
76.0	60	Good	No	2001	June	28
84.9	75	Good	No	2001	June	28
91.2	85	Excellent	No	2000	May	31
93.1	75	Good	No	1997	Sept.	5
97.8	95	Excellent	No	2000	June	1

APPENDIX K

Coarse Filter Screening Objectives, Methods, and Results

Submitted by Fred Clark of Clark Forestry, Inc., December 15, 1999

Project Background

The Wisconsin Department of Natural Resources, Natural Heritage Inventory (NHI) is undertaking an ecological assessment of the Wolf River basin using a coarse filter approach. The objective of the assessment is to identify sites with high potential for occurrences of threatened, endangered and special concern species or natural communities, or sites of otherwise high conservation value. The primary emphasis was identification of potential occurrence quality natural communities. A related goal of the project was to create a cost-effective, and easily replicated process to identify sites using GIS, aerial photography and existing information sources, and compare the results of such a process to the results of an experts workshop, which was convened by the staff of the Northeastern region, with assistance from NHI on 12/3/99.

Budget and time constraints did not allow for ground truthing or field work to support the coarse filter process. It was assumed that the methods used in this process would result in missing many small areas and areas whose attributes could not be captured using existing information sources (see results and recommendations sections). Areas most likely to be missed would be small (<40 -80 acres) areas of significance, or areas with unique values that are not easily identified through existing data layers.

Methods

A. Information Resources Used

GIS Data Layers Provided by WDNR Geographic Services

- Wiscland Level I and Level II
- Hydrology
- Original Vegetation Cover
- 75 M. Elevation Model
- Land Type Association Coverage and Descriptions
- Ecological Landscapes
- State Lands

GIS Data Provided by NHI

- Element Occurrences (precise to within ¼ ¼ section)
- Natural Community descriptions
- 7.5 Minute Topographic Maps

Photography provided by WDNR Forestry – 1992-1997, 1:15,840, B/W IR

B. Phase One

Using existing occurrences of natural communities, we designed and refined queries using the Wisland coverage. The purpose of the first selection queries was to capture the majority of Natural Communities while excluding the majority of highly disturbed areas, which resulted in a manageable number of areas on which to perform photo-inspection.

Based upon the gross patterns of vegetation and landforms within the basin, the GMU was divided into three sub-units for purposes of analysis. Each sub-unit had its own unique criteria for phase-one filtering based on land form, vegetation patterns, and the relative significance of various habitats. For all of the sub-units the phase-one selection was based on multiple criteria designed to capture the following land attributes:

- Extensive habitat blocks based on polygon size
- Slopes and unique microhabitats based on topography
- Sites with likely to support relict natural communities based on original vegetation
- Sites with high management context based on proximity to State lands

C. Phase Two

All areas captured through queries in the phase one process were assessed using aerial photography and 7.5' USGS topographic maps. We used 1993-1997, 1:15,840 scale, black and white infra-red photography that was loaned by the WDNR Forestry Bureau. Locations and descriptions of existing natural communities were used to help truth photo work in each area.

Sites selected for final inclusion in phase-two process had at least one of the following characteristics:

- Extensive and contiguous habitat blocks with at least some significant areas of relatively intact, undisturbed habitat
- Areas of mature forest showing species and structural diversity.
- Extensive areas of wetland habitat with relatively natural drainage patterns and good buffering and protection from surrounding uplands.
- Multiple habitat mosaics showing little disturbance and apparently natural juxtaposition.
- Springs with good surrounding habitat and natural drainage pattern.
- Streams with intact watersheds, mostly buffered from natural vegetation.

Sites meeting these criteria were mapped on topographic maps (for an overview of all mapped sites see Map 3 in the main document). Information included a site boundary and point locations of unique areas that appeared to warrant special attention.

Following mapping, sites were described in a database. The database included the following fields: site number; site name (if known); TRS location; map name; photo numbers; site description; unique area description; disturbance factors description; and three level (Low-Medium-High) ranking for landscape context, ownership context and inspection priority. A recommendation for type of field survey (upland botanical, wetland botanical, aquatic, songbird and general) was also provided.

The following pages detail the criteria used for first and second phase selection in each of the three sub-units.

Site Selection - Southeast Quadrant

Description

Primarily agricultural matrix with small upland forest patches and more extensive wetlands surrounding the Wolf and tributaries. Generally level with little relief. Landforms are almost exclusively lake plains with some moraines and occasional bedrock features. Maps of all sites selected through the Coarse Filter Screening process are available in original form at the Bureau of Endangered Resources office.

Major Natural Communities

Shallow-hard-drainage lakes, Floodplain Forest, Northern Wet-Mesic, Northern Mesic, and Northern Dry-Mesic Forests. Numerous aquatic occurrences including Lake Sturgeon.

Criteria for Selection

Eco-Type*	WISCLAN D Class	1st Selection Criteria	2nd Selection Criteria
Conifer Forest	173	> 100 ac.	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Hdwd Forest	177, 183, 187, 190	> 200 ac., >20 Ac. w/ slopes >5°	15+” avg. dbh, presence of super-story white pine, significant size or buffering from natural features.
Mixed Upland Forest	190	> 60 ac., >20 Ac. w/ slopes >5°	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Emergent Wetland	211	> 300 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Lowland Shrub	217, 218	> 300 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Lowland Shrub – Conifer – Evergreen	219,220	> 20 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Swamp Hardwood	223	> 200 ac.	>15”+ avg. dbh, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Swamp Conifer	229	> 40 ac.	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Mixed Conifer/ Hdwd.	234	> 100 ac.	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Barren/ Hayland	150, 240	> 40 ac., >20 Ac. w/ slopes >5°	Warm Season Grasses Present
Streams		Forested > 1 Mile	To be developed
Forest and wetland types	173-190, 211-240	>40 acres and within 500M of a plant, bird or Natural Comm. EO	Same as for types above.

Site Selection - Southwest Unit

Description

Primarily interspersed agricultural and forest land with scattered wetlands which are more localized than in SE section. Many small tributaries and river headwaters drain to the East. Generally level with moderate relief from drumlins and morainal knolls. Landforms are pitted outwash interspersed with moraines and collapsed moraines with many drumlins. Maps of all sites selected through the Coarse Filter Screening process are available in original form at the Bureau of Endangered Resources office.

Major Natural Communities

Shallow-hard-drainage lakes, Floodplain Forest, Northern Wet-Mesic, Northern Mesic, and Northern Dry-Mesic Forests. Numerous aquatic occurrences including Lake Sturgeon.

Application of 1st selection criteria resulted in 87,970 acres or 9% of the unit.

Criteria for Selection

Eco-Type*	WISCLAN D Class	1 st Selection Criteria	2 nd Selection Criteria
Conifer Forest	173	> 40 ac.	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Hdwd Forest	177, 183, 187, 190	> 300 ac., >20 Ac. w/ slopes >5°	15+” avg. dbh, presence of super-story white pine, significant size or buffering from natural features.
Mixed Upland Forest	190	> 60 ac., >20 Ac. w/ slopes >5°	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Emergent Wetland	211	> 100 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Lowland Shrub	217, 218	> 100 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Lowland Shrub – Conifer – Evergreen	219,220	> 20 ac.	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Swamp Hardwood	223	> 200 ac.	>15”+ avg. dbh, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Swamp Conifer	229	> 200 ac.	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Mixed Conifer/Hdwd.	234	> 100 ac.	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Barren/Hayland	150, 240	> 40 ac., >20 Ac. w/ slopes >5°	Warm Season Grasses Present

Site Selection - North Quadrant

Description

Primarily forest land. Many small tributaries and river headwaters drain to the East. Generally level with moderate relief from drumlins and morainal knolls. Landforms are pitted outwash interspersed with moraines and collapsed moraines with many drumlins. Maps of all sites selected through the Coarse Filter Screening process are available in original form at the Bureau of Endangered Resources office.

Major Natural Communities

Shallow-hard-drainage lakes, Floodplain Forest, Northern Wet-Mesic, Northern Mesic, and Northern Dry-Mesic Forests.

Criteria for Selection

All state owned lands within the northern region were photo-inspected.

TABLE K-3		
Eco-Type*	WISCLAND Class	2 nd Selection Criteria
Conifer Forest	173	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Hdwd Forest	177, 183, 187, 190	15+” avg. dbh, presence of super-story white pine, significant size or buffering from natural features.
Mixed Upland Forest	190	15+” avg. dbh, presence of super-story white pine, presence of hemlock, significant size or buffering from natural features.
Emergent Wetland	211	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Lowland Shrub	217, 218	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Lowland Shrub – Conifer – Evergreen	219,220	Presence within wetland community complex, streams or navigable waters within unit, lakes and springs present. Natural drainage patterns.
Swamp Hardwood	223	>15”+ avg. dbh, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Swamp Conifer	229	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.
Mixed Conifer/ Hdwd.	234	>15”+ avg. dbh, white cedar present, presence within wetland community complex, streams or navigable waters within unit, lakes and springs present.

Results

A. Phase One

- In the SE sub-unit application of phase-one selection criteria resulted in 182,579 acres or 18.8% of the unit being selected for photo-interpretation.
- In the SW sub-unit application of phase-one selection criteria resulted in 90,464 acres or 11.2% of the unit being selected for photo-interpretation.
- In the North sub-unit, all State-owned lands (13,188 acres) and adjoining areas were inspected, resulting in over 5% of the unit being selected for photo-interpretation.

* Sites mapped and identified through the phase-two process were not strictly a sub-set of the Phase-one areas, but also included 'opportunistic' assessment of surrounding lands. Thus the acreage actually photo-inspected to develop the final set of mapped sites may have been 10-25% larger than the phase-one results.

B. Phase Two

A total of 135 sites were identified, mapped and described. A summary report was developed for each site and includes a map of the site and information on the location, land cover, unique resources, disturbance factors, landscape and ownership context, inspection needs, and inspection priorities. The full set of site summaries is available in original form at the Bureau of Endangered Resources office. Table K-4 on the following pages provides a summary of the above site information. Map #3 shows the location of all sites within the basin that resulted from the coarse filter screening process, as well as the expert site process described in the next appendix.

The average site size was 1,347 acres, ranging from 41 acres to 7,171 acres.

Summary Table of Final Site Selection

Sub - Unit	# of Sites	Acreage of Sites	% of Unit
Southeast	70	91,845	9.4
Southwest	55	76,559	9.5
North	10	13,350	2.3
Total	135	181,754	7.75% of Basin

Assessment and Recommendations

A. Comparison with Experts Sites

A systematic comparison of experts selected sites versus coarse filter derived sites has not been performed as of this writing, but general comparisons can be made. When compared to results of site selection by local experts, the coarse filter sites are generally larger and more terrestrial than the expert's sites. Experts identified a number of aquatic sites not identified through the coarse filter process. By comparison the coarse filter process identified very few sites based on aquatic features alone. The coarse filter process identified a large number of terrestrial sites which were either unknown or considered unimportant by experts. In many cases the limitations on detail inherent in the coarse filter approach made comparisons of coarse filter and expert sites difficult.

B. Improvements to the Coarse Filter Process

The results of coarse filter assessment performed under this project can be considered moderately successful, however there are several areas of potential improvement.

1). Increased Ground Truthing and Field Verification.

No direct ground-truthing was performed during the project, although field notes from botanists were used as a method of ground-truthing in a limited area. The lack of ground-truthing made precise identification and descriptions of many sites difficult. Even limited field verification of benchmark sites around the study area could be a productive way to increase accuracy of site descriptions. Windshield surveys of selected sites would help further filter out sites not meeting criteria for selection.

2). Increased landscape scale assessment prior to site selection

The amount of ecological assessment prior to site selection needs to be increased. This should include more detailed assessment of LTA's, Ecological Landscapes and their distinctive landforms and vegetation. This work should combine research on existing maps and narratives, together with a field tour to area for the staff who will be performing the mapping and photo-interpretation work.

3). Increased interviews with local experts.

On the Wolf project, we had little input from area 'experts', partly due to time constraints, and partly due to a desire to compare the results of the expert workshop against the un-biased coarse filter approach. This lack of outside input was also a limitation in selecting the best sites. Short of identifying individual sites, foresters, wildlife managers and others with extensive local knowledge could provide input on features of interest, landforms supporting priority community types, and other ecological tips that may be impossible to obtain from other means.

C. Other Approaches

Particularly in the northern part of the basin, use of the Wiscland coverage alone did not provide a sufficient means to pre-select sites for inspection. The size of polygons in predominantly forested areas is too large to allow for effective querying based on land cover type alone. Thus, in order for a GIS based coarse filter system to be effective, other means of classifying land using remote sensing needs to be developed. Tools to do this type of analysis in heavily forested areas would include Landsat and other visible and non-visible spectrum satellite images, small scale aerial photography, and the image analysis tools necessary to classify these images to identify desired features such as old-growth forest patches, wetland complexes, and other features of interest. The cost and feasibility of this process needs to be researched.

TABLE K-5
Coarse Filter Screening Sites

The information below was developed by Clark Forestry, Inc. upon completion of the Coarse Filter Screening and has not been field verified by Clark Forestry, Inc. or BER.

Site ID	Site Name	Acreage	Site Description	Threats/Disturbance factors	Landscape Context	Ownership Context	Inspection Priority	Ecological Landscape	Survey Type
FOR01	Bog Brook State Wildlife Area	550	Extensive bog surrounded by upland Northern hdwds comprised of pole and small saw timber. Site demonstrates moderate-steep slopes supporting transitions from bog to shrub wetland. Site follows Bog Brook. Included in Bog Brook State Wildlife Area.	Northern and western portions of site demonstrate past harvesting. Southern edge of Bogbrook Lake developed by gravel pits and harvesting. Areas following borders fragmented by access roads and harvesting.	MOD	HIGH	MOD	North Northeast Hills	AQ/UB
FOR02	Little Rice Lake	1621	Extensive bog with mixed swamp conifer/hdwd complex. Some mature hdwds in NE and along south shore of Little Rice Lake - otherwise uplands unexceptional. Included in Little Rice State Wildlife Area.	Extensive timber harvesting and land clearing in north edge of lake basin.	MOD	HIGH	MOD	North Northeast Hills	AQ/WB
LAN01		1094	Mixed upland hdwds with areas of second growth in addition to selection harvesting.	Site disrupted by pine plantations and agriculture. Past harvesting throughout area, while northern and western borders demonstrate less disturbance. Buffered along southern and northern edge by fragmented hdwds. Hwy F, Stoney and Orchard Rd. cross site.	MOD	LOW	LOW	South Northeast Hills	UB
LAN02	Demlow Lake State Fishery Area	954	Mixed swamp conifer/hdwds with upland hdwd inclusion. Site follows path of Mayking Crk, including Kennedy and Upper/Lower Demlow Lake. Potential to support Northern wet-mesic forest. Area demonstrates little disturbance.	Interior less disturbed as compared to borders. Site disrupted by farm inclusion and access roads. Hwy AA, Crestwood, and Orchard Rd. cross site.	MOD	HIGH	MOD	South Northeast Hills	GE
LAN03	Garski Flowage	474	Mixed swamp conifer/hdwd with upland hdwd inclusion. Follows Rabe Crk. and Garski flowage.	Slight disturbance by access roads, farm inclusion, and drainage history. Well buffered on east rim by Menominee Indian Reservation. Hill Rd. forms southern border. Areas excluded from site fragmented by pine plantations, and agriculture.	MOD	LOW	MOD	South Northeast Hills	GE
LAN04	Moose Lake	2484	Mixed swamp conifer/hdwds with upland hdwds forming majority of northern rim. Swamp and lowland hdwds follow Moose Lake and Red River closely. Perch Lake, Little W. Branch Wolf River, Mayking Crk., Sipes and Moose Springs included in site.	Roading, pine plantations and agriculture limit continuity. Well buffered along far east edge by Menominee Indian Reservation. Park, Crestwood, Riverside and Moose Lake Road cross site.	HIGH	MOD	MOD	South Northeast Hills	GE
LAN05		1491	Mixed upland hdwds bordered by swamp conifers along east rim. Majority well buffered by hdwds.	Eastern borders of hdwds indicate past harvesting by secondary growth, while lowland areas demonstrate disturbance by access roads and minor development. Railway bisects site. Areas excluded form site become disrupted by roading and farm inclusion.	HIGH	LOW	MOD	South Northeast Hills	UB
LAN06	Deneault Springs State Fishery Area	3144	Mixed swamp conifer/hdwds with upland hdwd inclusion. Site follows West Branch Red River with potential to support sedge meadow along river. Deneault Springs State Fishery Area included. Potential to support sedge meadow of reed canary and Carex along southern end of West Branch Red River.	Interior of site remains intact while borders and westcentral portions disrupted by pine plantations, agriculture, and roading. Hwy 47, Maple, Rollwoods, Christie and access roads present.	MOD	LOW	MOD	South Northeast Hills	GE
LAN07	Dollar Lake	418	Small mixed swamp conifer/hdwds. Dollar Lake present. Potential to support bog community.	Demonstrates little disturbance, however, poorly buffered as site encompassed by agriculture, pine plantation and roading.	LOW	LOW	HIGH	South Northeast Hills	WB
LAN08	Florence Lake	1383	Mxd swamp conifer/hdwds bordered by upland hdwds consisting of young poles and small sawtimber. Eastern border supports intact swamp conifers with dense canopy with lowland shrub wetland forming area's S. rim. McGee Creek and Florence Lake included.	Roading bisects site. Lowland areas intact while past harvesting and access roading disrupt portions of interior of hdwds. Agriculture forms majority of site's east border.	MOD	HIGH	LOW	South Northeast Hills	AQ/UB

Site ID	Site Name	Acreage	Site Description	Threats/Disturbance factors	Landscape Context	Ownership Context	Inspection Priority	Ecological Landscape	Survey Type
LAN09		748	Lowland shrub wetland in conjunction with mixed swamp conifer/hdws following Hunting River. Potential to support sedge meadow and alder thicket along Hunting River.	Old railroad grade and access roads disrupt site. Areas excluded demonstrate extensive harvesting and access roads.	MOD	HIGH	LOW	North Northeast Hills	AQ/WB
LAN10	Pickeral Creek	2247	Mixed swamp conifer/hdws with upland hdwd inclusion. Lowland shrub wetland following path of Wolf River. Potential to support sedge meadow along Spider Crk. Spider Crk. Flowage, Mud and Pickerel Creek included.	Lowland areas intact, while hdws indicate past harvesting along east border of Miniwakan Lake and in portions of interior. Access roads and Hwy U disrupt continuity. Areas excluded include areas of extensive agriculture, roading, and past harvesting.	MOD	HIGH	MOD	North Northeast Hills	AQ/WB
LAN11	Turtle Lake	1033	Upland hardwoods encompass Turtle Lake and small patches of lowland shrub wetland/swamp conifers. Wolf River forms east border. Potential to support hemlock along west rim of hdws.	Past harvesting in portions of interior, in addition to roading. Areas excluded fragmented by farm, past harvests, access roads, and pine plantations.	HIGH	HIGH	MOD	North Northeast Hills	GE
LAN12	Poor Farm Spring	2386	Upland hdws bordering mixed swamp conifer/hdws along Ninemile Crk. Lowland shrub wetlands with potential to support sedge meadow along Crk. Hdws forming west border indicate potential for hemlock inclusion. Site included in Nicolet National Forest.	Interior relatively intact with minor disturbance by access roading and past harvesting. Areas excluded demonstrate disturbance by extensive harvesting of aspen/hdws and access roading.	HIGH	HIGH	HIGH	North Northeast Hills	UB
LAN13		2197	Mxd. swamp conifer/hdws with upland hdwd inclusion following Wolf River. Areas of most potential closely border Wolf River, as site becomes quite disrupted as shift away from River. Wolf State Fishery Areas & Ninemile Crk included.	Access roads, railway, and agriculture follow site closely. Areas excluded demonstrate past harvesting and disturbance by access roading, pine plantations, and farm inclusion.	MOD	HIGH	LOW	South Northeast Hills	AQ
LAN14	Goto Lake	711	Upland hdws encompass Goto Lake while lowland shrub wetland forms southwestern border of lake. Mixed swamp conifer/hdws follow Deer Crk, including a small dense canopy of swamp conifers with potential to support tamarack, cedar and b.spruce along E.rim.	5th Avenue Rd, in addition to access rds along southern and eastern rims disrupt site. Subject to encroachment by agriculture, residential development, and past harvesting of hdws in portions of interior. Areas excluded demonstrate heavy past harvesting.	MOD	HIGH	MOD	South Northeast Hills	GE
MRN01		822	Mixed upland hdws neighboring swamp conifer/hdws. Smaller emergent/lowland shrub wetland along south border.	Site intact, and well buffered along western rim by Plover River while remaining borders subject to farm inclusion. Old Lake and South Pole Road disrupt site.	MOD	LOW	MOD	South Northeast Hills	WB
MRN02	Mayflower Lake, Mud Lake	1165	Emergent/lowland shrub wetland forms east border of Mud Lake, while swamp conifer inclusion (cedar, tamarack) in conjunction with red maple, and ash form majority of south rim. Potential to support sedge meadow along Mayflower Lake.	Interior of wetland intact while east portion of site subject to encroachment by agriculture, minor development, and access roads.	LOW	LOW	MOD	South Northeast Hills	WB
MRN03	Norrie Lake	1337	Lowland shrub wetland and swamp conifers with minor upland hdwd inclusion. Potential to support bog community. Go-To-It, and Norrie Lake included.	Site demonstrates past ditching and drainage. Followed closely by agriculture and roading. Railway bisects site in addition to pipeline.	LOW	LOW	LOW	South Northeast Hills	WB
MRN04	Bass Lake	996	Mixed swamp conifer/hdws with upland hdwd inclusion. Small areas of emergent/lowland shrub wetland forming south border of Bass Lake. McVay Brook, Bass, Lost and Muddy Lake included.	Site disjunct on account of agriculture, pine plantation and roading. Past harvesting follows farm inclusion borders. Access roads, Breske, and Bass Lake Rd bisect site.	LOW	MOD	MOD	South Northeast Hills	WB
MRN05		1479	Mixed swamp conifer/hdws with upland hdwd inclusion. Swamp conifers (cedar, tamarack, b.spruce) comprise majority of southwestern rim. Potential to support sedge meadow along path of Flume Creek.	Access roads disrupt western rim. Pine plantations and farm inclusion fragment site.	MOD	LOW	LOW	South Northeast Hills	GE
MRN06	Moen Lake	505	Swamp hdws form southwestern border of Moen Lake. Mixed upland hdwd/conifer inclusion neighboring mixed swamp conifer/hdws comprise eastern portions of site. Little Wolf River present.	Minimal disturbance-followed closely by small pine plantation, agriculture and roading. Fox Lane crosses northern rim of site. Excluded areas become fragmented by roading, and farm inclusion.	LOW	LOW	MOD	South Northeast Hills	UB
MRN07		1298	Emergent/lowland wetland encompassed by swamp conifer/hdws. Upland hdwd inclusion throughout portions. Swamp conifers form dense canopies (cedar, tamarack) comprising less than 40% of site.	Interior of site intact while borders poorly buffered. Roading bisects site. Areas excluded from site fragmented by past harvesting, farm inclusion, and roading.	MOD	LOW	MOD	South Northeast Hills	WB

Site ID	Site Name	Acreage	Site Description	Threats/Disturbance factors	Landscape Context	Ownership Context	Inspection Priority	Ecological Landscape	Survey Type
MRN08	Mud Lake	723	Mixed swamp conifer/hdws encompassing Mud Lake indicating potential to support bog community. Norrie Brook passes through site.	Slight buffering by hdws along northern rim while remainder poorly buffered. Old and active railways present. Hwy D and access roads disrupt site.	LOW	LOW	MOD	South Northeast Hills	WB
OUT01		981	Mixed swamp conifer/hardwoods enveloped by farmland. Site appears to support cedar, ash and maple. Northwest portions buffered by swamp conifer/hardwoods, while remaining borders represented by farm inclusion.	Channeled stream and roading bisect site. Overall poorly buffered.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB
OUT02		702	Mixed conifer/hardwood swamp enclosed by farm inclusion. Northern and southern portions maintain a sparse canopy cover. Area may support sedge meadow along southern rim.	Spencer Rd. runs east-west through entire site. Pipeline bisects southern rim. Overall poorly buffered	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
OUT03		447	Mixed conifer/hardwood swamp including community of Northern wet-mesic forest. Site buffered by continued swamp in the SW while remaining borders represent agriculture inclusion.	Site indicates drainage and ditching history. Soo Line intersects SW.	MOD	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB
OUT04		1390	Bottomland hardwood forest following the path of the Wolf River. Buffered by emergent wetland in southern portions while farmland accounts for remaining landscape buffers.	Areas following path of river closely demonstrate little disturbance, indicating more mature forest. Hwy M divides site running north-south.	MOD	LOW	HIGH	North Central Plains/Southeast Glacial Plains	WB/AQ /SB
OUT05		968	Bottomland hardwoods with wetland dispersed throughout. Site appears to support a majority of secondary growth along river. Site follows Wolf River, acting as a landscape buffer. Remaining area poorly buffered by agriculture.	Channeled streams adjoin site.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB/AQ
OUT06		1143	Portions of swamp conifers including tamarack, and spruce border wetland present. Swamp hardwoods comprise southern rim. Site has potential to support open bog in central portions of site.	Past drainage through southcentral area.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	WB
OUT07	Shakey Lake	356	Swamp conifer/hardwood forest encompassing an emergent wetland area which presents possibility of supporting sedge meadow. Natural community of possible significance includes Northern wet-mesic forest. Shakey Lake is positioned in center of site.	Site selected indicates relatively little disturbance.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	WB
OUT08		1347	Extensive bottomland hardwoods with interspersed shrub wetland and swamp conifers. Site follows the path of the Wolf River leaving portions open and with standing water.	Farm inclusion forms majority of borders. Hwy 168 divides site.	HIGH	HIGH	MOD	North Central Plains/Southeast Glacial Plains	AQ, SB
OUT09		1092	Swamp hardwoods following path of Black Creek. Swamp conifer comprise less than 20%. Areas along southwestern rim demonstrate secondary growth indicating past disturbance. Western border maintains more open shrub wetland appearance.	Continuation of hardwoods along southwest act as partial landscape buffer while remainder bordered by agriculture. Levees are present at both the northern and southern borders of the site.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	AQ
OUT10		669	Mixed swamp conifer/hardwoods enclosed by farmland. Site appears to support cedar, tamarack, black spruce, ash, and maple. Toad Creek bisects northern portions of site.	Access roads present in outlying borders following fragmented farmland. Central portions less disturbed.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB
OUT11	Mack State Wildlife Area	2781	Site selected is part of greater mixed swamp conifer/hardwood stand. Southern portions of site include more mature forest including cedar, red maple, and basswood, while central portions of site remain more open with young poplar.	Western Railway, Herman Road and access roads cross area. Site part of Mack State Wildlife Area. Levees exist on western border, while remaining borders consist of agriculture.	MOD	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	WB
OUT12	Deer Creek State Wildlife Area	1597	Shrub wetland in conjunction with conifer/hardwood wetland areas. Southwestern rim demonstrates potential to support open bog. Site part of the Deer Creek State Wildlife Area.	Relatively well buffered by bordering emergent/deciduous wetland. Channeled streams present throughout.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	WB
OUT13	Maine State Wildlife Area	1542	Shrub wetland encompassing sparse conifers comprise majority of site. The northern border includes deciduous wetland species with upland hardwood inclusion. Part of Maine State Wildlife Area.	Majority poorly buffered by farmland. Northern area indicates drainage history.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	WB

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OUT14	Outagamie State Wildlife Area	2705	Extensive monotypic bottomland hardwoods following the path of the Wolf River. Hardwood species predominately comprised of silver maple, ash, and swamp white oak. Western portion includes shrub wetland. Part of Outagamie SWA.	Closely bordered by farmland. Hwy M bisects western portion while levees neighbor northern border of site. Wetland area indicates past drainage. Remaining hardwoods maintain less disturbed community.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	SB
OUT15		89	Swamp conifer site maintaining a more closed stand of swamp conifers in central portions while the northwestern area remains relatively sparse.	Northern and western borders well buffered by hardwoods while remainder outlined by farmland. Site selected demonstrates low disturbance.	MOD	LOW	HIGH	North Central Plains/Southeast Glacial Plains	WB
OUT16		601	Hardwood swamp forest bordering Embarrass River. Site has potential to support Floodplain forest.	Closely bordered by agriculture.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	GE
POR01	Kranski Lake	2061	Mixed swamp conifer/hdws comprise majority of northern border while emergent/lowland shrub wetland forms southern portion. Some upland hdwd inclusion. Kranski Lake and Tomorrow river are included in area.	Past drainage and ditching in northcentral and southern portions, while roading, pine plantations, and farm inclusions follow borders. Hwy 66 divides portions.	LOW	LOW	MOD	South Northeast Hills	UB
POR02		52	Small area with potential to support Northern mesic forest with hemlock inclusion.	Western and eastern edges demonstrates past harvesting while interior remains intact with large canopy cover in northeast. Fragmented swamp conifer/hdws buffer majority, while Hwy Z forms south border.	MOD	LOW	MOD	South Northeast Hills	UB
POR03		744	Mixed swamp conifer/hdwd site with younger monotypic upland hdwd inclusion in northwest. Potential to support sedge meadow. Flume Crk. bisects site.	Linden Rd, access roads, and farm inclusion disrupt site.	LOW	HIGH	LOW	South Northeast Hills	GE
POR04		522	Potential to support Northern dry-mesic forest. Conifer inclusion greater than 50%. Two kettle bogs located within site.	Interior demonstrates little disturbance while borders disrupted by past harvesting and pine plantations along farmland. Slight buffering by upland hdws along north border. Sunset Lake Rd. and Hwy Z cross portions.	MOD	HIGH	HIGH	South Northeast Hills	UB
POR05	Sunset Lake	832	Upland hdws with conifer comprising approximately 30% of site. Sunset, Minister, Skunk, and Budberg Lake present. Past harvesting along borders and portions of interior. Potential to support Northern mesic forest dominated by maple with hemlock inclusion.	Fragmented by Boy Scout Camp, and roading. Site buffered by upland hdws along eastern borders with remaining areas subject to encroachment by access roads, and farm inclusion. Hwy T and Sunset Lake Rd. bisect site.	MOD	LOW	MOD	Central Sand Hills	AQ,UB
POR06		1072	Upland hdws bordering mixed swamp conifer/hdws. Waupaca River included in site. Potential to support Northern dry-mesic forest with conifer comprising 50% area. Although poorly buffered, area has little disturbance.	Fragmented by pine plantation, farm inclusion, and roading. Hwy D, Hwy DD and access roads disrupt site.	LOW	HIGH	LOW	Central Sand Hills	UB
POR07	Wolf Lake	204	Relatively young monotypic upland hdwd stand encompassing Wolf Lake and smaller ponds.	Past harvesting and agriculture along borders. Buffering by hdws on southern edge.	MOD	HIGH	MOD	Central Sand Hills	AQ,UB
POR08	Fountain Lake	1000	Upland hdws neighboring mixed swamp conifer/hdws following Emmons Crk. Emergent/lowland shrub wetland along path of Emmons Crk. Deans and Fountain Lake included in site.	Smaller monotypic forest canopies indicate past harvesting in portions of site. Farm inclusion, roading and pine plantations. Lake Stratton Rd. bisects portions.	LOW	HIGH	MOD	Central Sand Hills	AQ,UB
SHA01	Gardner Creek Hrwds.	995	Mature Northern Hardwoods on drumlins bordering Gardner Creek and west of Lower Red Lake. Swamp hardwood inclusion focused in the northeastern branch. Most of hardwoods located in Stockbridge-Munsee Indian Reservation.	Enclosed by farmland, and pine plantations with the exception of the Menomonee Forest buffering the sites eastern border. Access roads, Butternut road and Lower Lake road disrupt lower borders.	MOD	HIGH	MOD	South Northeast Hills	UB
SHA02	Loon Lake Swamp	541	Swamp conifers bordering Loon Lake with small ridge of mature Hemlock hardwood. Development surrounding site, but drainage appears intact.	Agriculture, development and Park Avenue intersect site.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB
SHA03	Spencer Creek Marsh	2369	Extensive mixed conifer/hardwood swamp with upland hardwood inclusions forming the lower rim as a landscape buffer. Stream headwaters include Mill and Spencer Creek. Majority of swamp conifers including cedar and tamarack are located in the northeast.	Past ditching and drainage present in the northeast. Site fragmented by roading and agriculture. Hwy 29 and Winkle Road cross site west-east, while Leopolis Road and Hwy U run north-south. Site SHA 04 forms southern border while remainder is agriculture.	MOD	LOW	MOD	South Northeast Hills	AQ,WB

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SHA04	Mill Creek Marsh	3628	Extensive hardwood swamp bordering large drumlin w/ mature hardwood forests on steep N, E and W slopes located primarily on the northern and southern borders. Stream headwaters present include Mill and Spencer Creek.	Agriculture forms interior areas excluded from site. Pine plantations, agriculture and roading disrupt site. Leopoldis, Old Shawano Road and Cedar lane cross site. Hwy 29 forms northern border, while agriculture forms east and west rims.	MOD	LOW	HIGH	South Northeast Hills	UB, SB
SHA05	Pella Swamp	2653	Mixed swamp conifer/hardwood with upland hardwood inclusions in central areas. Conifer cover focused in eastern border consisting of black spruce, tamarack, and cedar. Hydes creek intersects southern portion of site.	Western border of site relatively well buffered by continuous swamp hardwoods while eastern border consists of farmland.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	AQ, WB
SHA06		148	Small site comprised of mixed conifer/hdwd wetland with upland hardwood inclusion in northwest rim.	Some buffering by upland hardwood inclusion, while fragmented farmland encloses majority of site.	LOW	MOD	LOW	North Central Plains/Southeast Glacial Plains	WB
SHA07	Navarino Marsh	2436	Site part of greater wetland area. Site forms a shrub/deciduous wetland with Shioc River bisecting the eastern border. Sedge meadow present along southern rim. Part of Navarino SWA.	History of ditching and drainage in western and eastern area. Agriculture and pine plantations encompass majority of site.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	AQ, WB
SHA08	Navarino Marsh	4262	Shrub/hardwood wetland comprising majority of west with potential to support sedge meadow along northern border. Emergent wetland present throughout interior. Standing water throughout area as West Branch and Shioc River cross site.	Portions of site relatively fragmented by pine plantations and farm inclusion. Soo line bisects site.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	AQ, WB
SHA09		41	Potential to support Northern Mesic forest. Mature hdwds directly south of Menomonee Indian Reservation. Lake forms entire central portion with small conifer wetland along eastern border.	Little disturbance. Eastern border consists of farmland while remainder Menomonee Indian Reservation.	HIGH	LOW	HIGH	South Northeast Hills	GE
SHA10		334	Mixed hdwd forest with potential to support Southern mesic community.	Southern border demonstrates second growth as do portions of the western border enclosing the more mature forest. Area closely bordered by pine plantation, farm and Hillview, Leopoldis and Maple Ridge Roads.	LOW	LOW	MOD	South Northeast Hills	GE
SHA11		538	Mixed hdwd forest with swamp conifer inclusion on eastern border. Potential to support Northern dry-mesic forest along western edge. Majority of eastern border emergent-shrub wetland.	Majority of eastern and southern borders subject to past ditching and drainage. Entire site enclosed by agriculture. Northern border well buffered by hdwds.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	GE
SHA12	Baker Lake	4340	Predominantly emergent/lowland shrub wetland to the north with mixed swamp conifer/hdwd comprising remainder. Upland hdwd inclusion. Middle Branch Embarrass River, Cranberry, and Baker Lake present.	Site demonstrates past drainage and ditching throughout northern, and westcentral portions. Quite disjunct due to farm inclusion and roading. Access roads, Cherry, Cranberry, and Lake Drive Rd. interrupt site.	MOD	LOW	LOW	South Northeast Hills	WB
SHA14	Mattoon Swamp	3635	Mixed swamp conifer/hdwd with emergent/lowland shrub wetland inclusion along northwest border. Upland hdwd inclusion. Elmhurst Crk. and Mattoon Swamp included.	Southcentral interior less disturbed as compared to disjunct borders. Well buffered along northern rim by hdwds, while remaining surrounding areas become fragmented. Hwy 45, Hwy Z, and old railroad grade present.	MOD	LOW	MOD	South Northeast Hills	WB
SHA15		250	Small mature upland hdwd site neighboring mixed swamp conifer/hdwd.	Areas excluded demonstrate past harvesting in addition to farm inclusion. N.Branch Embarrass River forms southern rim while remaining edges poorly buffered.	LOW	LOW	MOD	South Northeast Hills	GE
SHA16		1533	Mixed swamp conifer/hdwd following Middle Branch Embarrass River. Swamp conifers (cedar and tamarack) comprise less than 30%. Potential to support sedge meadow along river.	Majority of site demonstrates little disturbance. Northern and eastern borders buffered by continuing mixed swamp. Elder Rd. intersects southern portions.	MOD	LOW	MOD	South Northeast Hills	GE
SHA17		2642	Mixed swamp conifer/hdwd neighboring upland hdwds. Potential to support sedge meadow along Logemanns Crk.	Majority of interior indicates little disturbance. Areas excluded demonstrate past harvesting in addition to fragmentation by agriculture. Access roads, Swamp Lane, Weasel Dam and Leopoldis Rd. disrupt site.	MOD	LOW	MOD	South Northeast Hills	GE

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SHA18		4487	Mixed hdwds in conjunction with mxd swamp conifer/hdwds. Potential to support sedge meadow along Cleveland Crk. S. Branch Embarrass River, Cleveland and Larsen Crks present.	Past harvesting along south and east rims, in addition to access roads. Although becomes more frag. by agriculture & roading, majority of borders buffered by mxd upland and continuous lowland hdwds. Hwy M and P, access roads, and Steinke Rd. disrupt site.	MOD	LOW	MOD	South Northeast Hills	UB
SHA19	Stockbridge-Munsee Indian Reservation	1450	Mixed upland hdwds with mxd swamp conifer/hdwds forming majority of south. Potential to support bog community. Site included in Stockbridge-Munsee Indian Reservation. Silver and Hennig Crk. present.	Site followed closely by agriculture, pine plantations and roading along west borders while portions of east part of Stockbridge-Munsee Reservation. Past harvesting in portions of north. Access roads, Evergreen and Stony Curve Rd. cross south rim.	MOD	MOD	MOD	South Northeast Hills	WB
SHA20		4119	Mixed swamp conifer/hdwds with upland hdwd inclusion. Site follows Embarrass River and Pony Creek.	Past harvesting of swamp conifers in northwest and of hdwds along borders of Hwy D. Additional disruption by access roads throughout interior, farm inclusion and Maple Lane Rd.	MOD	LOW	LOW	South Northeast Hills	GE
WAP01		828	Mixed upland hardwoods with oak present on two drumlins w/ 100' relief. Mostly mature forest with little evident harvesting. Farthest eastern rim may support Southern mesic forest. Minor pine inclusion.	Access roads present along western edge. Landscape buffering low, as all sides and interior borders of site consist of farm inclusion.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB
WAP02	Navarino SWA	7171	Extensive bottomland hardwoods comprised of silver maple, swamp white oak and ash, with mixed upland hardwoods following the path of the Wolf River. Southwestern portions demonstrate possibility of supporting Northern sedge meadow.	Site included in Navarino SWA. Hwy 156 crosses east-west.	HIGH	HIGH	MOD	North Central Plains/Southeast Glacial Plains	SB
WAP03	Marble Swamp	4418	Extensive swamp conifer complex w/ swamp hardwoods. Margin comprised of fragmented upland hardwood. Poorly buffered by farm inclusions on surrounding uplands. Site includes Shaw Creek and Mud Lake headwaters.	Site demonstrates past ditching and drainage throughout interior.	MOD	LOW	HIGH	North Central Plains/Southeast Glacial Plains	WB
WAP04	Symco Bottoms	254	Stretch of Little Wolf above Symco. Bottomland hardwoods mostly degraded and logged, with some mature portions with potential quality.	Borders of site comprised of pine plantation and agriculture.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WAP05	Blueberry Marsh	1643	Swamp hardwood/conifer complex with headwaters of Little Creek. Conifer cover more centralized with cedar, tamarack, and spruce dominating. Emergent wetland present in most western portions.	Roading, disturbance w/ apparent pasturing around margins and cutting in some parcels.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WAP06	Flynn Lake Swamp	3407	Extensive swamp hardwoods complex w/ conifer inclusions. Some mature upland forest inclusions. Site has potential to support Northern wet mesic forest in area west of Flynn Lake. Site contains headwaters of Maple Creek.	Tank Road and pipeline bisect western edge of site. Access roads present along borders following fragmented farmlands. Overall site demonstrates relatively little disturbance.	HIGH	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB, AQ
WAP07	Cedar Creek Headwaters	934	Conifer/hardwood swamp NE of New London. Site comprised of shrub wetland along base of Cedar Creek in addition to mixed hardwood/conifer uplands border. Site maintains a more open character.	Buelon Road crosses east-west. Site demonstrates relatively little disturbance throughout interior, while borders of site subject to encroachment by farmland.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	UB
WAP08	Wolf River State Fishery Area	1064	Bottomland hardwoods following Wolf River dominated by silver maple, elm, ash, and swamp white oak interspersed w/ upland forest ridges on riverine sand terraces. Emergent wetland present south of Hwy 54. Portions south of Hwy 54 are part of Mukwa SWA.	Mature hardwoods w/ little apparent disturbance. Railway crosses northernmost border. Site divided by Hwy 54.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	UB
WAP09	Mukwa State Wildlife Area, Shirttail Bend	479	Extensive bottomland hdwds. Mostly younger - monotypic stands bordering Wolf River dominated by silver maple in addition to elm, ash, and swamp white oak. Central eastern portion of site offers potential to maintain Floodplain forest.	Emergent wetland following the river show little disturbance as compared to areas bordering farm inclusion. Generally site demonstrates little disturbance. Site includes Little Wolf River and Shirttail Bend.	HIGH	HIGH	MOD	North Central Plains/Southeast Glacial Plains	SB

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WAP10	Mukwa State Wildlife Area	229	Swamp hdwds dominated by silver maple. Mature, good quality upland hdwd complex on ravine sand terraces w/ oak, aspen and oxbow wetlands. Site follows Wolf and Little Wolf River and included in Mukwa SWA.	Area well buffered with the exception of the western border which is followed closely by agriculture and roading. Overall site demonstrates little disturbance.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	UB, WB
WAP11		306	Small but intact wetland complex - primarily shrub w/ emergent wetland/sedge meadow and some swamp conifer located in central portion of site. Little disturbance with the exception of roading and residence positioned in W. border.	Site well buffered by Wolf River on western border while surrounding borders comprised of fragmented farmland with the exception of the northern edge comprised of hardwoods.	MOD	MOD	LOW	North Central Plains/Southeast Glacial Plains	WB
WAP12	Horseshoe Bayou	2407	Extensive hdwd bottoms, mostly harvested since 1980, or younger even-aged second growth. Central areas indicate potential to support Floodplain forest. Areas outlining Partridge Crop Lake may support Northern wet forest.	Few areas of mature forest. Site follows path of Wolf River with small intact wetland areas throughout. Overall well buffered with little disturbance.	HIGH	MOD	MOD	North Central Plains/Southeast Glacial Plains	SB
WAP13	Royalton Marsh	3240	Extensive emergent wetland-lowland shrub/sedge meadow complex N. of White Lake. Swamp conifer and upland forest margins.	Drainage and ditching apparent throughout but restoration potential appears good. Majority well buffered by White Lake while remainder subject to encroachment by pine plantation, channeled streams and farm inclusion. Marsh Road divides site.	HIGH	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB, SB
WAP14		548	Small shrub wetland/swamp conifer complex west of White Lake. Site appears to support cedar, tamarack, and spruce maintaining closed forest in central portions. Conifers enclosed by lowland shrub as buffer.	Little disturbance but poorly buffered.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WAP15		591	Two minor swamp conifer complexes maintaining dense canopy located west of Partridge Crop Lake. Swamp hardwoods and lowland shrub outline swamp conifers.	Poorly buffered but little apparent disturbance. Landing Road and farm inclusion partially separate site.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WAP16	Waupaca River Uplands	399	Small site comprised of upland hardwoods with some mature white pine superstory over wetland/sedge meadow. Site located east of Waupaca following Waupaca River.	Closely bordered by agriculture. Site demonstrates relatively little disturbance which may be attributed to its topography.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB, AQ
WAP17	Jenny Bayou	1535	Extensive sedge meadow, shrub wetland complex including swamp hardwoods in patches. Area west of Jenny Bayou may support Shrub-Carr. Majority of site follows Waupaca River leading into Jenny Bayou on Wolf River.	Some drainage but good restoration potential with some natural spring/creek drainages. Site buffered by surrounding swamp hardwoods but disrupted by pipeline and Soo line running NW-SW, River road intersecting northernmost edge, and access roads.	HIGH	MOD	HIGH	North Central Plains/Southeast Glacial Plains	UB, AQ
WAP18	Templeton Bayou	535	Bottomland hardwoods/emergent wetland complex with well developed riverine sand terraces along Wolf River. Hardwoods mostly mature with little disturbance history.	Area well buffered as majority enclosed by Wolf River following Templeton Bayou.	HIGH	MOD	HIGH	North Central Plains/Southeast Glacial Plains	UB, WB
WAP19	Freemont Station Swamp	1955	Emergent wetland-lowland shrub interspersed with swamp conifer complex indicating minor drainage history. Upland hdwd borders act as buffer, with Wolf River on western border.	Disturbance minimal with access road off farm inclusion forming remaining borders. Drainage and ditching history primarily in central portions.	MOD	MOD	LOW	North Central Plains/Southeast Glacial Plains	WB
WAP20	Caledonia Hardwoods	1457	Mostly mature upland hardwoods in several blocks of farm/residential matrix. Oak, mesic hardwoods and some pine inclusions.	Little cutting evident in blocks. Site subject to encroachment by residential and farm inclusion. Pines road and Hwy HH cross site running North while Soo line and Hwy H intersect NW-SE borders.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB
WAP21	Partridge Lake and Wetlands	2482	Emergent wetland complex with areas of swamp hardwoods bordering Partridge Lake.	West side shows drainage history and ditching. East side bordering Wolf River has very little disturbance and remarkable pothole mosaics.	HIGH	MOD	HIGH	North Central Plains/Southeast Glacial Plains	AQ, WB
WAP22		610	Small emergent wetland-lowland shrub, swamp hardwood/conifer complex located west of Partridge Lake. Conifer cover primarily in northeastern border of site forming dense canopy.	Little disturbance but poorly buffered while farmland, pine plantations and roading form borders of site.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WAP23		114	Mixed hardwoods with potential to support Northern mesic forest.	Area enveloped by fragmented farmland and pine plantations.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	GE

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WAP24		81	Small mixed deciduous site with conifer inclusion in mature canopy.	Site demonstrates past harvesting as second growth is present along borders.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB
WAP25		2799	Mixed swamp hdwd/conifer with lowland shrub and upland hdwd inclusion. Headwaters for South Branch Pigeon River and Geskey Crk. Site neighbors Keller Lake.	Overall, little disturbance in interior, however, site disjunct due to farm inclusion while Brewer Rd. and Hwy G bisect site.	MOD	LOW	LOW	South Northeast Hills	WB,UB
WAP26		3137	Upland hdwds with mxw swamp hdwd/conifer and lowland shrub wetland inclusion. Monotypic lowland hdwds outline shrub wetlands in south while upland hdwds form northern portions. Potential to support sedge meadow.	Several streams including Geskey Crk. cross site. Access roads, agriculture, Hwy J, Brewer Rd., and an old railroad grade disrupt site. Swamp hdwd/conifer form east border.	MOD	LOW	MOD	South Northeast Hills	WB,UB
WAP27	Mud Lake	5212	Extensive upland hdwds with mxw. swamp hdwd/conifer and shrub wetland inclusion. Spaulding and Comet Creek and Mud Lake included in site.	Site well buffered with minimal disturbance. Old railroad grade, Comet and Mud Lake road cross site.	HIGH	HIGH	HIGH	South Northeast Hills	UB
WAP28	Jackson Lake	127	Small swamp conifer site bordering Jackson Lake. Potential to support sedge meadow.	Little disturbance but lacking landscape buffers. Slight buffer by hdwds in north while Helgeson Rd. forms west border. Pine plantations and agriculture encompass remaining edges.	LOW	LOW	MOD	South Northeast Hills	
WAP29	Buck Lakes, Little Lake	1041	Mixed swamp conifer/hdwds encompassing Buck Lakes and Little Lake. South Branch Pigeon River included in site. Access roads present.	Past harvesting along borders of farm inclusions. Rooding, ditching, agriculture, and fish farm fragment site. Circle J Road crosses northern portions. Upland hdwds form landscape buffer along Little Lake.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	AQ, GE
WAP30		421	Mixed swamp conifer/hdwd encompassing small monotypic upland hdwds stand.	Well buffered by upland hdwds along northern and western borders. Excluded forested areas demonstrate past harvesting while remaining borders comprised of pine plantations, and agriculture.	MOD	LOW	LOW	South Northeast Hills	GE
WAP31		670	Mixed swamp conifer/hdwds. Branch of Flume Crk. included in site. Old railroad grade bisects site.	Southwestern portion of site indicates past harvest while interior of site intact. Upland hdwds-although majority demonstrate past harvests, form landscape buffer along northern and western edges while farm inclusion and roading form remaining borders.	MOD	LOW	LOW	South Northeast Hills	GE
WAP32		3837	Mixed swamp conifer/hdwds comprising majority of northern and eastern borders. Upland hdwd inclusion throughout interior and southern border. Lowland areas dominated by dense swamp conifer canopy supporting cedar, tamarack, and black spruce. Surrounding areas demonstrate past harvests. Area subject to encroachment by pine plantation & farm.	Whitcomb and North Fork Crk. included in site, in addition to Hwy E, and Stony Ridge Rd. Forested areas excluded demonstrate past disturbance by harvesting, and roading. Majority of site well buffered by upland hdwds.	MOD	MOD	MOD	South Northeast Hills	UB
WAP33		832	Upland hdwd with mixed swamp conifer/hdwd inclusion. Whitcomb and South Fork Crk. present on site. Potential to support Northern mesic forest. Neighboring area quite fragmented while interior unaffected.	Borders quite fragmented by agriculture, pine plantation and roading. Boelter Rd. crosses site.	LOW	HIGH	LOW	South Northeast Hills	UB
WAP34	Knutson Lake	1773	Emergent/lowland shrub wetland with upland hdwd inclusion comprising majority of southern unit. Northern portion supports mixed swamp conifer/hdwds. Potential to support fen community in northern portion. Lake Knutson and North Branch included in site.	Area demonstrates little disturbance within its interior. Buffering low, as borders are comprised of pine plantation, agriculture and roading. Hwy 161, Cozy Pine and Lake Knutson Road disrupt site.	LOW	LOW	MOD	South Northeast Hills	WB
WAP35		916	Mixed swamp conifer/hdwd with upland hdwd inclusion. Potential to support sedge meadow. Blake Crk. follows northern border. Potential to support sedge meadow. Unique area buffered by hdwds along its borders.	Fragmented by agriculture and minor development. Site indicates access roads, and past ditching in south, while northern portions less disturbed-however, both remain poorly buffered. Hwy 161 bisects site.	LOW	MOD	MOD	South Northeast Hills	GE
WAP36	Ogdensburg Pond	1186	Emergent/lowland shrub wetland in conjunction with mixed swamp conifer/hdwds. Emergent wetland follows path of	Interior demonstrates little disturbance while farm inclusion fragments south. Some past drainage in	LOW	LOW	LOW	South Northeast Hills	WB,AQ

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			Engibretson Crk. Ogdensburg included in site.	portions. Buffered by upland hdwds to north, while remaining borders subject to encroachment by pine plantations, agriculture, roads.					
WAP37		835	Mixed swamp conifer/hdwd with upland hdwd inclusion.	Site poorly buffered. Old railroad grade bisects site, in addition to past harvesting along southern and northeastern borders.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WAP38	Mud, Mynyard, Junction Lake	640	Swamp hdwds with upland hdwd inclusion. Lowland shrub wetland encompasses Mud Lake. Radley Creek, Mynyard and Junction Lake also included in site.	Agriculture fragments poorly buffered site. Pine plantations follow borders. Dayton, and Lake Stratton Rd. cross northern portion.	LOW	LOW	MOD	Central Sand Hills	GE
WIN01		3849	Emergent wetland with swamp hardwoods dispersed throughout. Wolf River and Pages Slough included in site bordering Lake Poygan. Location part of larger surrounding wetland area generally well buffered.	Little disturbance history with the exception of channeled water structures present in northcentral portions of site.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	AQ, WB
WIN02		1284	Lowland shrub-emergent wetland bordering Rat River. Swamp hardwoods common on western edge of site indicating potential to support floodplain forest.	Disturbance history indicates minimal ditching and drainage in southern rim of selected site, however outside of site cropping and disturbance more prominent. Western rim buffered by swamp hardwoods.	MOD	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB
WIN03		2275	Mixed swamp conifer/hardwoods following Rat River. Emergent wetland forms southern border of site. Potential to support Southern dry-mesic forest along westernmost border where hardwoods form more mature canopy.	Site indicates some drainage and ditching history in NW corner. Gravel pits on western border of site while Hwy M crosses north-south. Site well buffered by swamp hardwoods along northern edge while southern border agriculture.	HIGH	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	AQ, WB
WIN04		317	Emergent-shrub wetland bordered closely by farmland. Sparse swamp hardwood inclusion.	Drainage history in northern portion of site.	LOW	HIGH	LOW	North Central Plains/Southeast Glacial Plains	WB
WIN05		537	Emergent wetland bordering Lake Winneconne. Northern branch of site has potential to support wet prairie community.	North side demonstrates drainage history, while western portions are closely bordered by farm inclusion and residential.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WIN06		48	Small mixed hardwoods located west of Wolf River. Site has potential to support Northern dry-mesic forest.	Northwestern border indicates secondary growth while eastern portions remain less disturbed. Buffering poor as enclosed by agriculture and development.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WIN07		143	Small mixed hardwoods with conifer inclusion. Site has potential to support Northern dry-mesic forest. Overall site has poor landscape buffering.	Southern border maintains more mature canopy while northern borders demonstrate secondary growth. Encroachment by pine plantations, residential, roads.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WIN08		425	Swamp hardwoods following Wolf River. Swamp hardwoods make up northern and southern borders while central portions consist of shrub-emergent wetland.	Site indicates past ditching and drainage though entirety of wetland while hdwds along northern border demonstrate less disturbance. Closely bordered by agriculture and residential with the exception of the eastern border forming wetland.	LOW	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WSA01		469	Two swamp hdwd/conifer sites in conjunction with lowland shrub wetland. Rim of wetland area well buffered by hdwd.	Hwy I bisects southern portion while roading and farm inclusion divide stands. Remaining borders comprised of pine plantation. Site indicates some past ditching but minimal.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WSA02		655	Emergent wetland in combination with swamp conifer/hdwd. Mosquito creek crosses southern portions allowing for dispersed emergent wetland.	Majority of surrounding area and interior fragmented by farm inclusion and pine plantations. Eastern portions indicate past ditching and drainage while access roads disrupt northern border.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	GE
WSA03		854	Shrub wetland encompassing conifer wetland. Area northwest buffered by upland forest while remainder of site adjacent to agriculture. Alder creek crosses through northern rim.	Site demonstrates past ditching and drainage throughout interior and eastern border.	MOD	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB

Site ID	Site Name	Acreage	Site Description	Threats/Disturbance factors	Landscape Context	Ownership Context	Inspection Priority	Ecological Landscape	Survey Type
WSA04		1046	Mixed swamp conifer/hdwd wetland. Northeastern border of site maintains majority of swamp conifers, while eastern rim comprised of mixed swamp conifer/hdwd stand. Southern and eastern borders include emergent and shrub wetland.	Farmland and Alder Creek outline site. Site indicates past ditching and drainage in interior and along north/south borders.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	WB
WSA05		695	Deciduous/shrub wetland forming northern and southern rim. Mixed swamp conifer/hdws interspersed with emergent wetland forming eastern edge. A creek follows the eastern border draining into the Pine River.	Overall site disturbance is minimal. Site bordered by farm inclusion with the exception of the continuation of the shrub\conifer wetland directly south.	MOD	LOW	MOD	North Central Plains/Southeast Glacial Plains	UB
WSA06		1075	Shrub wetland encompassing conifer wetland. Site appears to support cedar, tamarack, and black spruce. Streams intersecting site merge with the Pine River located south.	Fragmented agriculture encompasses majority of site with the exception of its northern border forming a deciduous wetland. Hwy H intersects southern portion. Site indicates past ditching and drainage primarily along eastern border.	LOW	MOD	MOD	North Central Plains/Southeast Glacial Plains	WB
WSA07	Poygan Marsh	2182	Emergent wetland bordering Lake Poygan. Northern and Southern regions are adjacent to agriculture while western portions of the site join a lowland deciduous forest.	Site buffered by wetland forming western border. Past ditching and drainage more prevalent in southern portion.	LOW	HIGH	LOW	North Central Plains/Southeast Glacial Plains	WB
WSA08		683	Deciduous wetland adjacent to Lake Poygan following Pine River. Site has potential to support sedge meadow.	Disturbance of forest minimal along the western border. Some roading bisects site. Majority of surrounding area agriculture.	MOD	HIGH	MOD	North Central Plains/Southeast Glacial Plains	WB
WSA09		226	Swamp hardwoods with swamp conifer inclusion in central portions. Some upland hardwoods present along southwestern border but majority of rim forms bottomland hardwoods.	Site outlined closely by fragmented farmland and roading.	LOW	LOW	LOW	Central Sand Hills	GE
WSA10	Big Cedar Lake	1181	Mixed swamp hdws with swamp conifer (cedar, b.spruce, tamarack) dispersed throughout. Emergent/shrub wetland forms southwestern border with mixed swamp hdwd/conifer occupying the southeastern edge. Big Cedar Lake is positioned in northcentral.	Small younger monotypic stands along eastcentral border indicate past harvests. Disturbed upland hdws form southern edge, while remaining borders comprised of pine plantations, farm inclusion, roading, and channeling of water. Hwy TT crosses site.	LOW	LOW	LOW	Central Sand Hills	GE
WSA11	Gilbert Lake	1497	Swamp hardwoods with emergent/lowland shrub wetland and swamp conifer inclusion. Wetland occupies southwestern border and demonstrates little disturbance. Gilbert Lake, Fenrich Springs, Pine River, and Humphrey Crk. are included in site.	Few mature hdws present. Roading, pine plantations, and farm inclusion follow borders closely. Hwy K and other roads bisect site.	MOD	HIGH	MOD	Central Sand Hills	WB,GE
WSA12	Pine River	586	Narrow site comprised of swamp hdwd following Pine River with swamp conifer inclusion. Swamp conifers represent less than 30% of site. Lowland shrub/emergent wetland forms southern border. Site has potential to support sedge meadow.	Access roads disrupt site while remaining borders followed closely by pine plantations and farm inclusion.	LOW	HIGH	MOD	Central Sand Hills	AQ,UB
WSA13	Carpenter Creek	438	Swamp hardwood with swamp conifers patch forming a closed canopy. Emergent wetland follows path of Carpenter Crk. while lowland shrub wetland forms eastern edge.	Access roads and channeled water disrupt site. Ditching present in central portions. Subject to encroachment of agriculture and roading.	LOW	LOW	MOD	Central Sand Hills	WB
WSA14	Timon Lake	54	Two small swamp hdwd sites with possible marsh communities neighboring both lakes. Timon lake is included in site.	Site is divided by roads, has minimal buffering by pine plantations, and is bordered by access roads and farms.	LOW	LOW	LOW	Central Sand Hills	AQ, WB
WSA15	Kusel Lake	42	Small wetland with standing water forming north border while potential prairie community south of wetland. Kusel Lake follows south edge of site closely.	Buffering minimal as roading forms south border while young hdwd stand creates eastern edge.	LOW	LOW	LOW	Central Sand Hills	AQ
WSA16	Norwegian Lake	444	Lowland shrub wetland and mixed swamp hdwd/conifer encompassing Norwegian Lake. Swamp conifer inclusion dominates north border while lowland shrub wetland occupies eastcentral portions.	Ditching in wetland slight. Area poorly buffered but demonstrates little disturbance with the exception of the western border. Hwy G follows borders closely. Some access roads present.	MOD	LOW	MOD	Central Sand Hills	AQ, WB
WSA17	Willow Creek	694	Swamp hdws with conifer inclusion following Willow Creek. Emergent wetland present along creek.	Disturbance minimal-however, site subject to encroachment by pine plantations, roading, and farm inclusion. Hwy G crosses the western edge.	LOW	HIGH	MOD	Central Sand Hills	AQ,WB

Site ID	Site Name	Acreage	Site Description	Threats/Disturbance factors	Landscape Context	Ownership Context	Inspection Priority	Ecological Landscape	Survey Type
WSA18	Little Silver Creek	984	Emergent/lowland shrub wetland. Potential to support sedge meadow. Site follows path of Little Silver Creek.	Site demonstrates past ditching and drainage. Hwy EE and Hwy W cross site. Site poorly buffered.	LOW	MOD	LOW	Central Sand Hills	WB
WSA19	Porters Lake	1166	Mixed swamp conifer/hdwd- part of larger Wautoma Swamp, including Porters Creek and Porters Lake. Swamp conifer stand demonstrating little disturbance with hdwd landscape buffering.	Interior of site demonstrates little disturbance while access roads, farm inclusion, pine plantation and residence disrupt southwest border. Hwy W follows northern border closely.	MOD	LOW	MOD	Central Sand Hills	WB
WSA20	Mount Morris	100	Small site with potential to support Northern dry-mesic community on north slope. Part of Mount Morris.	Past harvesting occurring throughout interior. Younger monotypic hardwoods and pine plantations form borders.	MOD	MOD	MOD	Central Sand Hills	UB
WSA21		143	Small swamp conifer and emergent wetland. Standing water in portions. Neighboring Irogami and Silver Lake.	Disturbance minimal, however site subject to encroachment by agriculture, residence, and roading. Hwy 21 follows south edge while additional roading divides site. Some hdwd inclusion in wetland. Poor landscape buffering alone eastern border.	MOD	LOW	MOD	Central Sand Hills	WB
WSA22	Cedar Springs Creek	1483	Swamp hdwds with slight swamp conifer inclusion comprising less than 20% of stand. Fairly monotypic lowland hdwds with areas of upland hdwds inclusion. Lowland shrub wetlands present along Cedar Springs Crk.	Site subject to past harvesting and ditching in northeastern portions while interior demonstrates little disturbance. Hwy Q and additional roading disrupt site. Areas closely following, but excluded from site consist of agriculture and gravel pits..	MOD	HIGH	HIGH	North Central Plains/Southeast Glacial Plains	WB
WSA23	Willow Creek	999	Emergent/lowland shrub wetland with sparse swamp hdwd/conifer inclusion. Follows path of Willow Crk. Potential to support sedge meadow.	Site demonstrates ditching and drainage while access roads, farm inclusion, and residential development border site. Hwy 21 forms southern edge.	LOW	LOW	LOW	North Central Plains/Southeast Glacial Plains	WB

Table Legend

Site ID: Code includes County abbreviation and sequential numbering of all sites in each county. Expert site numbers start after the last Coarse Filter Screening site number.

Site Name: from USGS quadrangle maps; for internal reference only and may not be locally correct.

Landscape Context: HIGH - >75% buffering of highest quality portions; MOD – 25%-50% buffering of highest quality portions; LOW - <25% buffering of highest quality portions.

Ownership Context: HIGH – site adjoins or is partly State ownership; MOD – site is within one mile of State ownership; LOW – Site is more than one mile from State ownership.

Inspection Priority: HIGH – high likelihood of quality community or species element occurrences. MOD – moderate likelihood of quality community or species element occurrences; LOW – low likelihood of quality community or species element occurrences.

Ecological Landscape: Lists the ecological landscapes the site falls within.

Suggested Survey Type: AQ – aquatic communities; GE – general ecological; SB – songbird; UB – upland botanical; WB – wetland botanical.

Appendix L

Wolf River Basin Experts Workshop: A Pilot Approach

Submitted by: Anne Forbes, Facilitator/Consultant, *Partners In Place*

Contributor: Andy Galvin, Bureau of Endangered Resources

Introduction

The Wolf River Experts Workshop represented a pilot approach in the development of new avenues for collecting and assessing the biotic inventory information essential to the conservation of natural resources in Wisconsin and the mission of the Wisconsin Department of Natural Resources (WDNR). It was a team approach between WDNR's Bureau of Endangered Resources (BER) and Wolf River Basin Geographic Management Unit (GMU) and was designed to involve a wide range of individuals with information on the ecological resources in the basin. The collaborative effort represented by this approach took advantage of many sources of expert information and supported long-term awareness of the basin and its conservation needs. It helped to set a precedent for what WDNR hopes will be more pro-active, comprehensive, and effective approaches to basin-wide ecological inventory in the future.

Background

BER is charged with the inventory and analysis of biotic and ecological resources across Wisconsin. This task is a daunting one and presents many challenges due to the size of the state, the ecological complexity of the landscape, and the resources needed to compile meaningful inventory results and keep them current. Often, new inventory is accomplished when a specific project or problem rises to the forefront and information is needed almost immediately.

This was this situation in January of 1999 when BER staff received a request for biotic inventory information for the Wolf River Basin GMU. Three factors combined to create a challenging climate for the inventory:

1. The immense size of the basin;
2. The large amount of private land ownership, an indicator of limited existing inventory information in state records; and
3. An immediate need to supply information for WDNR planning projects in the Wolf River Basin GMU.

In an effort to meet the immediate needs for information and move towards a more proactive approach to inventory at the same time, a Design Team of BER and Wolf River Basin GMU staff collaborated on a workshop approach, using information from two different sources:

- Inventory information contributed by many different individuals (called *experts*) who have first-hand knowledge of ecologically significant sites "on-the-ground" (called *Expert Sites*).
- Inventory information compiled by technical experts, using satellite imagery and aerial photo interpretation to identify potentially significant ecological sites (called *Coarse Filter Screening Sites*).

At the workshop, participants worked together to compare the information from the two different inventory approaches and discuss priorities for future field inventory and resource conservation.

The following sections provide a summary of:

- The Workshop Design
- The Workshop Outcomes
 - Identifying the Experts
 - Collecting the Site Information
 - Conducting the Workshop
 - Evaluating the Workshop
- How Are the Results Being Used?
- An Eye to the Future: Successes to Carry Forward and Lessons Learned.

The Workshop Design

The Planning Steps

The Design Team of BER and Regional WDNR staff worked with a consultant to plan and conduct the Experts Workshop (see Attachment A for details on the Design Team and the workshop agenda). The steps in this process were to:

Step 1. Identify individual ‘experts’ who may have specialized knowledge of the ecologically significant sites in the Wolf River Basin.

Step 2. Collect, summarize, and map information on the Expert Sites and the Coarse Filter Screening Sites for use at the workshop.

Step 3. Conduct the Experts Workshop to assess the compiled information. The specific purposes of the workshop were to:

- a) Increase participants’ awareness of the ecological features of the Wolf River Basin as a whole and increase their understanding of, and support for, existing and future conservation needs.
- b) Examine the number, size, and pattern of sites identified by the ‘experts’ and compare these to sites identified by a separate coarse filter remote sensing inventory.
- c) Take a ‘first cut’ at working collaboratively to identify the most significant and most sensitive sites in the basin.

Step 4. Evaluate this pilot Experts Workshop approach for possible use in future inventory projects.

Who are the ‘experts’ ?

For this purpose, an ‘expert’ is any individual with specialized knowledge of the natural communities, rare plants and animals, aquatic invertebrates, and unique natural features of the Wolf River Basin. Experts include people from federal, state, and local agencies; Native American tribes; universities, colleges, and schools; nonprofit groups such as land trusts and environmental organizations; and private citizens. We sought participants from this diversity of backgrounds – from scientists to resource managers to amateur naturalists and bird watchers – hoping to include all those with specific local knowledge of the basin’s ecology and natural history. (See Attachment B for information on how the experts were identified and involved).

What is an ecologically significant area?

An ecologically significant area is one that contains important biodiversity components including, but not limited to, occurrences of rare plants or animals, well-functioning and intact natural communities, large unfragmented natural areas, potential connectivity sites, critical habitat areas, potential restoration sites, or other unique geological or natural features. Experts were invited to submit Site Information Forms and map locations for the sites they consider to be most significant in any of the above categories. (See Attachment C for a copy of the Site Information Form, Table L-1 for Expert site information, and Map 3 for the site locations).

What is Coarse Filter Screening?

The first step in the pilot project involved identifying Coarse Filter Sites. The objective of the Coarse Filter Screening was to identify sites with high potential for occurrences of rare species or high quality natural communities. Using various data sources and criteria established by BER staff, a consultant applied Geographic Information System (GIS) technology to interpret satellite imagery and aerial photographs and identify over 135 Coarse Filter sites. (See Appendix K for more information on the Coarse Filter Screening, Table K-5 for site information, and Map 3 for the site locations).

The Workshop Outcomes

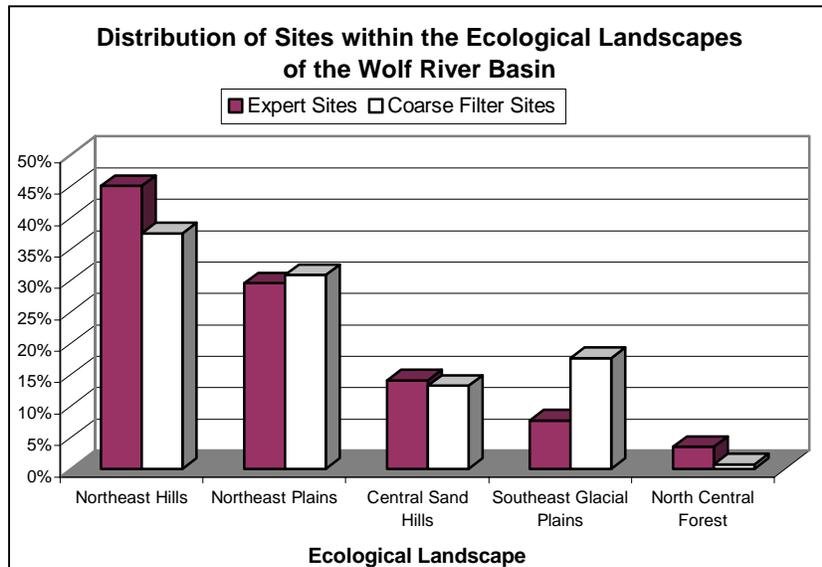
Step 1: Identify individual ‘experts’ who may have specialized knowledge of the ecologically significant sites in the Wolf River Basin.

The Design Team developed a list of 220 potential experts thought to have some specialized knowledge of the ecological resources within the Wolf River Basin. An introductory letter was sent to them requesting their input and assistance. Some recipients provided names of other possible experts who were later sent the letter. This looping process was used as a way to ensure that local knowledge was secured to the best extent possible. A total of 50 individuals responded self-identifying themselves as basin experts. A second letter was sent out to these 50 people requesting that they return information about sites they considered to be the most significant within the basin based on their expertise. A basin map and detailed site information forms were sent with the letter to assist in compiling information. Twenty individuals returned site information. (See Attachment B for more details on the process used to identify and involve the experts).

A total of 43 people participated in the Experts Workshop. Attendees included 20 individuals from the WDNR regions and field offices, 10 from WDNR central office, 6 from non-profit conservation or environmental groups, 1 from the Menominee Nation, 1 from U.W. Extension, 1 from the Wolf River Basin Partnership, 1 from U.W.- Superior, 1 from private business, and 2 individual citizens. In addition, of the 43 attendees:

- Twenty-one had previously self-identified themselves as experts.
- Thirteen provided site information prior to the workshop.
- Twenty-four work primarily in the Wolf River Basin.
- Twenty-two attended as participant/observers. Of these, 12 were familiar with the Wolf River Basin but did not consider themselves to have expert knowledge of ecological sites, and 10 attended out of interest in the workshop process and had little or no specialized knowledge of the Basin.

Step 2: Collect, summarize, and map information on the Expert Sites and the Coarse Filter Screening Sites for use at the workshop.



Expert site information was gathered over a three-month period, as described above and in Attachments B and C. Twenty experts identified a total of 142 sites within the basin (see Table K-1). Some sites overlapped others - this usually reflected a different type of information for the same area (e.g., breeding birds from one expert and rare plants from another).

A total of 135 non-overlapping Coarse Filter Screening sites were identified, described, and mapped in the months preceding the workshop, as described in Appendix K and Table K-5.

The above chart illustrates the distribution of Expert and Coarse Filter Screening sites within each of the ecological landscapes of the Wolf River Basin. The location of each site was mapped for use at the workshop (see Map 3), and a large poster-sized copy was printed for each small group of 7-8 people. The printed information on each site was compiled into 2 sets of spreadsheets, one for the Expert sites and one for the Coarse Filter Screening sites (site spreadsheets are included in Tables K-5 and L-1).

Step 3: Conduct the Experts Workshop to assess the compiled information.

The results are discussed in relation to each of the workshop's purposes:

- a) Increase participants' awareness of the ecological features of the Wolf River Basin as a whole and increase their understanding of, and support for, existing and future conservation needs.
 - The workshop succeeded in gathering a varied group of individuals who expanded their knowledge of the Wolf River Basin and participated in well-facilitated small groups.
 - On the whole, participants seemed to appreciate the opportunity to view the entire river basin and work in a small group with more varied expertise than they experience on an everyday basis.
 - The large poster-sized Wolf River Basin maps provided to each small group served as an effective communication tool, drawing people together and encouraging lively conversation.
 - The group of participants was less diverse than the Design Team hoped it would be, especially in terms of non-WDNR participation, and this may have limited the opportunity for some participants to expand their understanding. (Thirty of the 43 workshop attendees, or 70 percent, were WDNR employees).
 - Participants recognized that, with effective follow through, the workshop might represent a significant step towards future conservation efforts in the basin.

- b) Examine the number, size, and pattern of sites identified by the ‘experts’ and compare these to sites identified by a separate coarse filter remote sensing inventory.

Workshop attendees were separated into six small groups, according to their area of expertise within the ecological landscapes of the Wolf River Basin. They were asked to consider the following questions while reviewing the map and comparing the two sets of sites.

Small Group Question A. What do you notice about the number, size, and pattern of Sites located throughout the entire Basin? How does the location of Expert Sites compare/contrast to the Coarse Filter Screening sites?

- There are fewer expert sites in the northern part of the basin as compared to the southern part and as compared to the coarse filter sites.
- Expert sites include a disproportionate emphasis on river corridors as compared to the coarse filter sites.
- There is more information that could come from experts, especially for upland and forested areas in the southern part of the basin, additional river corridors and wetland sites, and across the northern part of the basin.

Small Group Question B. Are there areas not covered by either Expert or Coarse Filter Screening Sites, and where are they located?

- It was noted that the Coarse Filter Screening did not identify many sites in the northern and northeastern portion of the basin. Neither Expert nor Coarse Filter Screening sites were well represented in the northeast.
- Each small group made a list of specific areas within their assigned ecoregion where sites were not identified.

- c) To take a ‘first cut’ at working together to identify the most significant and most sensitive sites in the basin.

Each small group was asked to examine and compare all of the sites in their assigned ecological landscape (ecoregion) and recommend which are the most significant, according to criteria listed on Significance Ranking Worksheets (see Attachment D). Sites not identified by Experts or the Coarse Filter Screening but deemed important by the group were also included.

The small groups initially nominated 56 total sites, and by the end of the session, narrowed the list to 38 “Sites with High Potential for Conservation and Inventory.” (See Map 4 and Appendix H). These 38 high potential sites encompass 587,868 acres, or 25 percent, of the Wolf River Basin. The entire Menominee Indian Reservation was included as a single site, totaling 240,985 acres or 10 percent of the entire basin. Without the Menominee Indian Reservation, the remaining sites account for 246,883 acres, or 15 percent of the Basin. The sites were distributed within the ecological landscapes in the following manner:

- | | | | |
|---------------------------|---------|----------------------------|----------|
| - Northeast Hills – North | 7 sites | - Northeast Plains | 11 sites |
| - Northeast Hills – South | 11 | - Southeast Glacial Plains | 3 |
| - North Central Forest | 1 | - Central Sand Hills | 5 |

Only one of the small groups had time to start the next step, that of identifying the most sensitive sites, and this group only took the first step of listing the issues that might be involved in this type of assessment.

Step 4. Evaluate this pilot Experts Workshop approach for possible use in future inventory projects.¹

a) Was the workshop successful from the participants' perspectives?

Most participants felt that “the meeting was well planned and well facilitated and felt that their time was well spent.” Of 29 participants, 22 (76%) agreed with this statement, 5 (17%) were neutral, and 2 (7%) disagreed.

Even though the technical aspects of the workshop purposes were largely met (comparing the coarse filter and expert sites, and taking a first cut at identifying significant sites), participants were somewhat frustrated by not accomplishing more visible and detailed results.

Participants are interested in knowing about the results of the workshop and especially learning that it contributes to the conservation efforts in the basin in the long run.

And, many participants appreciated the effort put forth to plan and conduct the workshop, recognized that it is a first step, and encouraged those involved to keep the work going.

In the qualitative responses, many participants reported that they found the workshop personally satisfying for these kinds of reasons:

- They felt they benefited from learning about the Wolf River Basin as a whole.
- They found hope in the possibility that this work will help conserve the basin's resources.
- They enjoyed the interaction and opportunity to participate.
- They learned new things about the Wolf River Basin.
- They appreciated the wealth of knowledge in the room.
- The small groups were well facilitated and provided the opportunity to be well heard and to listen well to others.
- The large map of the Wolf River Basin with coarse filter and expert sites was clear and easy to use.

Although the most of participants reported that their time was well spent, many that felt that the experience was only somewhat or partly satisfying for a number of different reasons:

- Their small group lacked the expertise it needed to do the assigned small group work well.
- They wished they had clear, systematic criteria for evaluating the sites.
- They felt that the meeting records do not adequately reflect the depth and detail of knowledge shared in the small group conversations.
- Many experts who have important information to share were not present.

¹ Information from this section comes from written workshop evaluations that had both qualitative (open-ended questions) and quantitative (scaled responses) components and from BER and Design Team debriefings facilitated by the consultant.

- They felt that they needed to receive the information in advance of the meeting to be better prepared.
- They were frustrated by interactions in their small group.
- The spreadsheets of coarse filter and expert sites were difficult for some people to use.
- The room noise was distracting, and the room lighting made the map difficult for some to see.

A few participants were very dissatisfied for some of the above reasons, and also because:

- They did not find the workshop approach meaningful, personally or technically.
- They did not understand the purposes of the workshop.
- They felt that they did not have the personal expertise they needed.
- They did not learn anything they didn't know before.

Participants made a number of specific suggestions for what might have been done differently:

- Make sure that the group as a whole and each of the small groups have members with the expertise they need to do the work.
 - Some participants listed additional areas of expertise that were needed, and others suggested additional experts by name.
- Provide clear criteria or standards for evaluating sites.
- Keep a record of individuals' rich verbal contributions on the characteristics and value of the sites.
- Take steps to ensure that more local expert knowledge is in the room.
- Regarding the large basin map of coarse filter and expert sites:
 - Include more indicators to help participants orient themselves, e.g., roads, and cities.
 - Make the borders more distinct.
- Regarding the coarse filter and expert spreadsheets:
 - Color-code the coarse filter and expert packets.
 - Integrate the coarse filter and expert information.
 - Show who nominated each expert site and indicate who they are.

Although in the quantitative evaluation, about 70% of those responding agreed that the morning overview session was helpful, the qualitative responses drew some mixed comments.

- Some appreciated the morning presentations and found them worthwhile.
- Others suggested that it could be shortened and provided more overview than was needed to support participation.

Other parts of the quantitative evaluation revealed that:

- About 76% of the participants agreed that the large basin maps on each small group table at the workshop were clear and easy to use.
- About 70% agreed that the participant folders and other handouts provided the information needed to participate.
- About 68% agreed that their small group in Work Session 1 understood what was expected and was able to work effectively to complete the assigned tasks, and about 76% agreed that this was true for Work Session 2.
- About 63% agreed that the purposes of the workshop were clear.

- About 50% agreed that the spreadsheets with information on the Expert and Coarse Inventory Sites were clear and easy to use.
- About 46% agreed that the process for identifying people and groups with expert information on the Wolf River Basin was effective.
- About 23% agreed that there were enough “experts” with specific knowledge of the Wolf River Basin in their small group.

b) Was the workshop successful from the BER program and Design Team perspectives?

WDNR staff debriefings following the workshop confirmed that the workshop achieved its primary goals and agreed in general with the majority trends in the above participant evaluation. These staff debriefings also offered some additional perspectives:

- The workshop results are having some immediate benefits for the continuing field inventory as BER researchers and Wolf River Basin GMU field experts work together to select and find access to specific inventory sites.
- The workshop reinforced the Wolf River Bottomlands master planning approach to focus on the river corridor as a whole, rather on separate properties. Workshop results are also helping to provide the rationale for proposed project boundaries for the master plan.
- New approaches that combine Coarse Filter and Expert information will be among those essential to the inventory and assessment of large landscapes characterized by a matrix of public and private land ownership.
- The workshop approach allowed participants to work side-by-side with inventory scientists and gain appreciation of what is involved in the inventory process.
- While the workshop itself was successful, how it fit into the timing of the inventory process was of concern to staff. For example:
 - The workshop results would have been more useful if the workshop occurred at the beginning, rather than in the middle of the overall inventory project.
 - The Wolf River Bottomlands master planning open houses offered an opportunity to seek and involve more potential experts and local people. This opportunity could have been used more effectively if the timelines were better coordinated.
 - If the Experts had the Coarse Filter Screening results before they submitted their site information, more specific requests for on-the-ground verification and for additional sites could have been made.
- There is a tradeoff in the design of this kind of workshop between two equally important types of outcomes: those that build relationships between people and partner groups and those that result in technical assessments of detailed site information.
- The Coarse Filter sites appeared to provide BER staff with more accurate information to plan future inventory than the Significant Sites identified at the workshop because: there was previous experience with the Coarse Filter Screening methodology (whereas the entire expert site methodology was new); BER staff were involved in refining the criteria used for Coarse Filter work, the Coarse Filter sites are smaller and easier to field check; and the Coarse Filter Screening was more complete in its coverage of the entire basin.

How Are the Results Being Used?

Some of the workshop results are of immediate use as field inventories are continued in the Wolf River Basin and the Biotic Inventory and Analysis for the Wolf River Basin is completed. Other benefits will become apparent as the inventory is completed and updated over time, and the results are made available to help plan and conduct conservation planning and programs.

Specifically, the BER and Wolf River Basin GMU staff are using the results of the workshop to:

- Support effective collaboration between BER inventory scientists and GMU field staff to select and access inventory sites for the year 2000 field season.
- Complete an interim BER inventory and analysis and provide the results to the Wolf River Basin GMU staff as they:
 - Complete the upcoming State of the Basin report.
 - Undertake master planning for the cluster of Wolf River Bottomlands properties.
 - Provide the GMU Partnership Team with information.
 - Support the needs of other agencies, land trusts and other nonprofit groups, and private landowners in the basin.
- Continue to evaluate the effectiveness of the expert workshop approach to basin inventory and analysis over the long term as field inventories and the biotic inventory and analysis are completed and the results are applied to conservation activities in the basin.

An Eye to the Future: Successes to Carry Forward and Lessons Learned

The following is a summary of what was learned through this pilot Wolf River Basin Experts Workshop. It is hoped that this reflection will serve as a guide to future basin or large-scale biotic inventory projects where the combined knowledge of WDNR staff, local citizens, and other scientists and partners is sought.

What did we do that we led to our success? What would we do just the same another time?

- ▶ Use the Design Team approach – build the work on an effective collaboration between BER staff and the GMU staff in the regions.
- ▶ Use a perspective that includes the entire basin (or large landscape unit or ecoregion), and seek to create common understanding of its ecology and conservation needs.
- ▶ Use the Ecological Landscapes (ecoregion) boundaries to support consistency and understanding of this tool among WDNR staff and partners.
- ▶ Identify individuals who are skilled facilitators for the small group work sessions and provide them with a detailed orientation before the workshop.
- ▶ Use carefully designed work sessions that allow participants to work alongside BER staff and experience first-hand some of the thinking and challenges that go into a basin-wide inventory of this type.

- ▶ Provide each small group with its own poster-sized working copy of the large basin map showing Expert and Coarse Inventory Sites.
- ▶ Agree on clear workshop purposes that can be used to evaluate success.

What did we learn that we might we do differently another time?

- ▶ Improve the involvement of non-WDNR experts by allowing more time for this phase, doing more “loops of search” for experts and making more personal contacts. Employ a variety of strategies to:
 - locate experts
 - ask them to help identify other experts
 - seek site information
 - invite them to the workshop
- ▶ Expand Design Team membership to include representation of the range of participants being sought.
- ▶ Once experts are identified, seek more information on what encouraged or discouraged them to participate. For example:
 - Why, of the 42 self-identified experts, did only 20 return Site Information Forms?
 - Of the 220 potential experts, why did only 42 self-identify as having the expertise sought?
- ▶ Some individuals with important site information may not think of themselves as experts. Find ways to encourage participation that works through this barrier.
- ▶ Complete the Coarse Filter Screening before involving the experts to create more ease in asking individuals to provide on-the-ground details on the sites identified or for additional sites that were missed.
- ▶ Consider improvements to the morning overview session. Plan with these questions in mind:
 - What do participants absolutely need to know to participate in the small group work sessions?
 - How can we provide this in a way that recognizes diverse learning styles?
 - How can we provide this in a way that recognizes varied amounts of previous knowledge?
- ▶ Collect some of the rich conversation in the small group work sessions by adding a row to the Significant Sites Chart from Work Session 2 (see Attachment D). Here, participants would work together to describe in their own words the key attributes of the significant ecological sites they are nominating.
- ▶ Integrate the separate Coarse Filter and Expert spreadsheets, so there is only one easily referenced document for participants to access supporting data on all the sites.
- ▶ Clarify the most effective role at the workshop for the observer/participants who do not have specific expertise on the basin.
- ▶ Consider workshop design alternatives to address the tension between outcomes that build relationships between people and partners and outcomes that result in technical assessments of detailed site information.
 - For example, plan to host two separate events. The first might be an open house format, and the second a more intensive workshop. The first would build relationships among diverse people and partners with interest in the basin inventory, allow time for those with information

to gain confidence in the process, and position the Design Team to gather as much site information from as many different sources as possible. The second would involve those who are interested to help produce specific technical assessments and recommendations.

- ▶ In addition to the large landscape approach, consider applying this Expert Workshop approach to smaller geographic areas and hone in more intensively on identifying and working with people with local knowledge of the resources.

Attachment A. The Workshop Design and Agenda

The Design Team

A Design Team comprised of WDNR staff from the Wolf River Basin GMU, the Bureau of Endangered Resources (BER) in Madison, and a private consultant planned the workshop.

All members of the Design Team helped to:

- Agree on the workshop purposes
- Identify potential experts with knowledge of specific sites
- Review methods for collecting Site Information from those experts
- Review the agenda and letters of invitation
- Evaluate the workshop process and outcomes

The GMU staff took the lead to:

- Make local arrangements for meeting space and meals
- Locate equipment and supplies
- Line up small group facilitators
- Communicate with regional WDNR staff

BER staff were responsible to:

- Provide team leadership
- Compile all the Expert Site Information on spreadsheets and producing the Wolf River Basin map showing both expert sites and the coarse filter screening sites
- Contract with a consultant to design, facilitate, and report on the workshop

Wolf River Basin Experts Workshop

December 3, 1999

Purpose of the Workshop:

- ▶ Increase our common understanding of the ecological features of the Wolf River Basin
- ▶ Compare the results of the coarse filter screening with the information compiled from individual experts
- ▶ Take a 'first cut' at identifying the most significant and most sensitive sites in the basin
- ▶ Evaluate this pilot approach to basin inventory

Agenda

- 9:00 a.m. Welcome, Introductions, and Agenda Review
- 9:20 Overview
- a. Ecology of the Wolf River Basin
 - b. The Coarse Filter Screening Sites
 - c. The Expert Site Information
- 10:00 BREAK – move to assigned small groups
- 10:15 Work Session 1. A Profile of the Wolf River Basin as a Whole
- a. *What do you notice about the number, size, and pattern of Sites located throughout the entire Basin? How does the location of Expert Sites compare/contrast to the Coarse Filter Screening sites?*
 - b. *Are there areas not covered by either Expert or Coarse Filter Screening Sites, and where are they located?*
 - c. *For your assigned ecoregion: working with the map and spreadsheets, each person is asked to select one Site that you find especially interesting to "introduce" to your small group – and indicate why you chose it.*
- 11:45 LUNCH
- 12:30 p.m. Work Session 2. The Wolf River Basin by Ecoregion
- North – Northeast Hills
 - South – Northeast Hills
 - NE Plains/SE Glacial Plains
 - Central Sand Hills
- a. *What are the most significant sites in the basin – and why?*
 - b. *What are the most sensitive sites in the basin – and to what?*
- 2:00 BREAK
- 2:15 Clarifying the Next Steps
- a. Completing the inventory and adding to the NHI database
 - b. Using the results of the completed inventory and analysis
(State of the Basin, GMU Partnership, state property master planning, other)
- 2:45 Evaluation
- 3:00 Adjourn

Group Agreements

- ▶ Create space for everyone to participate
- ▶ Help keep us on topic and on time – use the *woodpile*
- ▶ Note and record different opinions; agreement is not essential
- ▶ Help evaluate this workshop approach

Attachment B. The Search for Local Knowledge: Involving the *Experts*

Identifying Potential Experts

The Design Team (See Attachment A) prepared an initial list of 220 ‘potential experts’ for the Wolf River Basin. An introductory letter was sent out asking the 220 people if they have specialized knowledge of ecologically significant sites in the Wolf River Basin, and/or if they know of others who do. Through this process, a total of 228 introductory letters were sent out within a 6 week time period.

Of the 228 contacts, 50 individuals responded to the letter self-identified themselves as having specialized knowledge. These included 31 individuals that work primarily outside of the basin and yet have expert knowledge about the basin. The breakdown of these individuals by affiliation and geographic area is:

Self-identified Experts by Affiliation:

• WDNR	21
• Non-profit organizations	10
• University/Extension	8
• Individuals/no affiliation noted	6
• County	2
• Business ²	
• Tribal	<u>1</u>
	50

Self-identified Experts by Geographic Area:

• Work primarily within Basin	19
• Work primarily outside Basin	<u>31</u>
	50

Requesting Site Information

A second mailing was sent to the 50 experts identified above requesting they provide information, based on their specialized knowledge, on the most ecologically significant sites within the basin. They received a detailed map of the basin and set of Site Information Forms (Attachment C) to return within a 2-week period. Twenty of these experts returned completed Site Forms and maps, providing information on 142 sites. The individuals included:

Experts Providing Site Info by Affiliation:

• WDNR	9
• Non –profit organizations	6
• University/Extension	2
• Individuals/no affiliation noted	2
• Business	1
• County	0
• Tribal	<u>0</u>
	20

Experts Providing Site Info by Geographic Area:

• Work primarily within Basin	9
• Work primarily outside Basin	<u>11</u>
	20

Attending the Workshop

Forty-three individuals attended the Wolf River Basin Workshop, including 21 that self-identified themselves as Experts and 22 that were participant/observers. Of the 21 self-identified experts, 13 sent in site information. The 22 participant/observers represented 8 Design Team members, 4 BER field staff, and 10 others attended due to interest in the workshop process (without specialized knowledge of sites in the Wolf River Basin).

Workshop Attendees by Affiliation:

• WDNR – Field Staff	20
• WDNR – Central Office	10
• Non-profit groups	6
• University/Extension	2
• Individuals/no affiliation noted	2
• Wolf R. Basin Partnership	1
• Business	1
• Tribal	1
• County	<u>0</u>
	43

Workshop Attendees by Geographic Area:

• Work primarily within Basin	24
• Work primarily outside Basin	<u>19</u>
	43

Attachment C. The Site Information Form

State of Wisconsin
 Department of Natural Resources
 P.O. Box 7921 ER/4, Madison WI 53707-7921

Wolf River Basin Site Information

Form # 1700-41 (10/99) Page 1 of 2

Notice: Completion of this form is voluntary. Data collected will be used to supplement the biotic inventory of the Wolf River Basin. Personal information collected on this form is intended to be used to contact you if WDNR staff require additional information and for no other purpose.

Site ID #

Site Name

Provider Name

Ecological Information Site Location

Type of Information (check all that apply):

Natural Community(ies): _____

Plant(s): _____

Animal(s): _____

Geologic Feature(s): _____

Other: _____

County: _____

T-R-S (to ¼ section): _____

USGS Quadrangle: _____

Habitat Type:

Upland Aquatic

grass, prairie wetland

forest stream, river

lake, pond

other: _____

Describe: _____

Describe the Significance of the Site:

Describe the Surrounding Land Use:

Describe possible threats or future changes:

Accuracy of Site Boundary:

¼ mile 1 mile 5 miles

Information Format

Information on this site is stored as:

Maps Database or Spreadsheet

Field Notes Journal/Article

Other _____

Estimated Size (acres): _____

Ownership: Public Private

Will You Attend the Workshop on Dec. 3?

Yes No

Please review the instruction sheet on the back for directions on how to fill out the Site Form. Two examples are also provided for your use. An electronic version of this form is available upon request. If you have any questions, please call Andy Galvin at 608-264-8968.

Additional information and comments about this site can be added to the back of the form.

Please Return Site Forms & map by November 5
 Thank you for your efforts

Site Form Directions

The following are descriptions of each of the categories on the Site Form. Please fill out the Site Forms to the best of your ability. We recognize that some categories may be left blank because information is not available, or the quantity of information is too large. In such cases, focus first on the Ecological Information and second on the Site Location. If you do not have some of the other detail, we will do our best to help fill it in as needed.

Site ID#: your first, middle and last name initials - site # in numerical order starting with 01. (i.e. Fred Joe Smith would put FJS-01, FJS-02, FJS-03, etc.)
Please be sure the site ID# is also on the map.

Site Name: provide a name that will distinguish it from all others. Base it on location first and the site's features second (i.e. Bear Creek Pines, Black Creek Marsh, Thornton Heron Rookery)

Provider Name: your name

Ecological Information

Type of Information: what information do you have about the natural communities, species and other significant resources that occur at the site? Check all that apply and provide specific names if available.

Significance of the Site: what is significant about the site that makes it one of the most important in the basin?

Threats and Changes: do you foresee any changes to the site that will threaten the ecology of the site (i.e. impending development, proposed project, change in land use, etc.)?

Site Location

County: name of County

T-R-S: all town-range-sections included in the site down to ¼ section if possible.

USGS Quadrangle: name of USGS 7.5 minute quadrangle

Habitat Type: based on the primary habitat types of the site, check all that apply. If possible, briefly describe associated plant species, soils, slope, etc.

Surrounding Land Use: is the site surrounded by forest, farm, developed areas, wetlands, etc.?

Accuracy of Boundary: what is the level of confidence in the ecological boundaries of the site as drawn on the map: are they accurate within ¼ mile, within 1 mile, or within 5 miles?

Estimated Size: in acres

Ownership: is the site publicly or privately owned?

Information Format

Information Format: how is the information on this site stored or documented?

Please note the information you provide will become public information. Please portray the information to a level you feel comfortable with. If you are interested in providing data to the NHI database, Heritage staff will work with you to more precisely define your information.

If you have any questions on how to fill out the Site Form or to identify sites on the map, please call Andy Galvin at 608-264-8968 for assistance.

Additional Comments about the Site:

TABLE L-1

Expert Sites

Information provided in Table L-1 was taken directly from the Site Information Forms provided by submitting experts and has not been field verified by BER

Site ID	Source	Site Name	Acres	Resources of Significance	Threats/Disturbance Factors	Ecol Info	Habitat	Surrounding Land Use	Ecological Landscapes	County	Ownership
FOR03	CM-09	Pickereel Lake SNA		Eagle and osprey nests		a	L		North Northeast Hills		
FOR03	GWD-02	Pickereel Lake SNA		Natural Area		nc			North Northeast Hills	Port	
FOR03	SAN-01	Pickereel Lake SNA	1299	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Forest, Langlade	
FOR04	RGE-11	Bog Brook SWA	800	Undeveloped; emergent communities	Development	nc, p, a	W, L	forest, houses	North Northeast Hills	Forest	Pub/Priv
FOR05	RGE-10	Shoe and Himley Lakes	400	Undeveloped lakes	Development	nc, p, a	W, L	forest, houses	North Northeast Hills	Forest	Pub/Priv
FOR06	RGE-09	Oak and Duck Lakes	100	Undeveloped lakes; rare and threatened plants	Crandon mine, Development	nc, p, a	W, L	forest, recreation, mining	North Northeast Hills	Forest	Private
FOR07	RGE-08	Pickereel Creek	1400	Cedar forest; mature pines	Logging, Crandon mine	nc, p, a	F, W, S	forest, recreation	North Northeast Hills	Forest, Langlade	Pub/Priv
FOR08	MM-11	Rice Lake Barrens		Black terns, trumpeter swan release		a	W, L		North Northeast Hills		
FOR10	RGE-03	Little Rice SWA	1500	Wild rice bed; waterfowl area; communities	Development	nc, p, a	W, S, L	forest, houses	North Northeast Hills	Forest	Pub/Priv
FOR11	RGE-02	Wolf River headwaters	5 miles	Undeveloped Wolf River area	Logging	nc, p, a	F, W, S	forest	North Northeast Hills	Forest	Pub/Priv
FOR12	MP-01	Pine Lake Area		Significant bird species	Crandon Mine	nc	F, W, L		North Northeast Hills	Forest	
FOR12	SAN-04	Pine Lake Area	1670	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Forest	
FOR13	RGE-01	Hiles Mill Pond	2500	Dam impounds a wetland with significant plant communities	None known	nc, p, a	W, S, L	forest (USFS)	North Northeast Hills	Forest	Pub/Priv
LAN15	RH-42	Garfield Rapids Forest		NM forest, sugar maple, basswood, hemlock	Logging, recreation, development	nc	F, S		South Northeast Hills	Langlade	
LAN16	SAN-06	Florence Lake	53	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		South Northeast Hills	Langlade	
LAN17	RH-44	Flora Spring Pond SNA (Area)		Spring pond w/ white cedar forest		nc, g	F, W, S		South Northeast Hills	Langlade	
LAN18	RH-43	Oxbow Rapids SNA		Spring seeps w/ WM forest		nc, g	F, W		South Northeast Hills	Langlade	
LAN19	CM-11	Sawyer Lake		Eagle nest		a	L		South Northeast Hills	Langlade	
LAN20	CM-02	Burnt Point Deer Yard		Deer yard		a	F, W, S		South Northeast Hills	Langlade	
LAN21	LJS-01	Baker Lake Area	300	Mature trees and ground cover; rare birds; glacial features	Logging	p, a, g	F	forest	North Northeast Hills	Langlade	Public
LAN22	RH-45	Fischer Lake		Undeveloped lake		nc, p	L		North Northeast Hills	Langlade	
LAN23	CM-03	Squaw Creek Deer Yard		Deer yard		nc, a	F, W, S		North Northeast Hills	Langlade	
LAN24	CM-13	Turtle Lake		Wild rice bed, eagle nest		p, a	F, W, S, L		North Northeast Hills		
LAN24	RH-46	Turtle Lake		Spring pond		nc	L		North Northeast Hills	Langlade	
LAN25	CM-07	Pickereel Creek Wolf R		Wild rice bed, eagle nest		nc, p, a	W, S		North Northeast Hills	Langlade	
LAN26	RGE-12	Pickereel Creek/Wolf River	600	Wild rice bed; emergent communities	Development	nc, p, a	W, S	forest, houses	North Northeast Hills	Langlade	Pub/Priv
LAN27	CM-14	Hunting River		Osprey nest		a	F, W, S		North Northeast Hills		
LAN27	RH-47	Hunting River		Springs, wild rice, alder thicket		nc, p	W, S		North Northeast Hills	Langlade	
LAN28	CM-10	Miniwakin Lake		Eagle nest		a	L		North Northeast Hills		
LAN28	MM-09	Miniwakin Lake		Trumpeter swan release sites		a	L		North Northeast Hills		
LAN28	RGE-13	Miniwakin Lake		Undeveloped lake; wild rice beds; emergent communities	Development	nc, p, a	W, L	forest, houses	North Northeast Hills	Langlade	Pub/Priv
LAN29	SAN-08	Loon Lake	45	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Langlade	
LAN30	CM-04	Spider Creek Deer Yard		Wild rice bed, eagle nest, deer yard		p, a	F, W, S		North Northeast Hills	Langlade	
LAN31	RGE-07	Spider Creek Wetland	5000	Large forested wetland	Logging	nc, p, a	W	forest, recreation	North Northeast Hills	Forest, Langlade	Pub/Priv
LAN32	SAN-07	Hollister Lake	41	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Langlade	
LAN33	MM-10	Spider Creek Flowage		Trumpeter swan release sites		a	L		North Northeast Hills		
LAN34	CM-08	Rolling Stone Lake		Eagle nest		a	L		North Northeast Hills		
LAN34	MP-02	Rolling Stone Lake		Black spruce-tamarack bog; significant bird species	Crandon Mine	nc, a			North Northeast Hills	Langlade	
LAN34	SAN-09	Rolling Stone Lake	672	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Langlade	

Site ID	Source	Site Name	Acres	Resources of Significance	Threats/Disturbance Factors	Ecol Info	Habitat	Surrounding Land Use	Ecological Landscapes	County	Ownership
LAN35	CM-05	Pickereel Creek Wolf R		Deer yard		nc, a	F, W, S		North Northeast Hills	Langlade	
LAN36	BER	Flora Spring Pond SNA		DNR State Natural Area					South Northeast Hills	Langlade	Public
LAN37	CM-01	Nine Mile Hill Bear Caves		Glacial landforms		nc, g	O		South Northeast Hills	Langlade	
LAN39	PS-01	Woods Flowage SFA	2000	Unique coldwater complex; trout, inverts		nc, a, g	F, W, S, L	forest, agr, recreation	South Northeast Hills	Langlade	Pub/Priv
MEN01	RH-30	Rice Lake Barrens		Barrens and dry ND forest, unique for basin		nc	G, F		North Central Plains/ Southeast Glacial Plains	Shawano, Menominee	
MEN02	RH-39	Gardner Creek Cedar		Old growth white cedar, bird diversity		nc, p	F, W		South Northeast Hills	Menominee	
MEN03	RH-40	Red River Island		Virgin white pine and NM forest		nc			South Northeast Hills	Menominee	
MEN04	RH-41	Menominee Creek		Old growth white cedar		nc	F, W		South Northeast Hills	Menominee	
MEN05	BRH-05	Menominee Indian Reservation		Many nesting birds, neotropical migrants	population growth, urban expansion	nc, p, a	F	forest	South Northeast Hills	Menominee	Tribal
MEN05	MM-07	Menominee Indian Reservation		Upland hardwood conifer forest, breeding birds		nc, p, a	F, W, S		South Northeast Hills		
MRN09	RH-36	Goto Lake Bog		NW forest and bog		nc	F, L		South Northeast Hills	Marathon	
MRN09	MJB-01	Norrie Bog	650	Intact varying-age spruce-tamarack bog; rare birds	Logging, cranberries?	nc, a	W, L	agr	South Northeast Hills	Marathon	Private
MRN10	RH-37	Camp Creek Bog		NW forest and bog		nc	W		South Northeast Hills	Marathon	
MRN11	RH-38	Comet Road Woods		Large patch of M forest, spring ephemerals		nc, p	F		South Northeast Hills	Marathon	
MRN12	MJB-02	Comet Creek Headwaters	550	Diverse forested lowland; Trees spp-rich; Blue-headed vireo	Logging	nc, a	W, S	forest, agr	South Northeast Hills	Marathon	Private
ONE01	SAN-03	Lower Post Lake	377	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Langlade	
ONE01	CM-06	Upper Post Lake		Wild rice beds		p	W		North Northeast Hills	Langlade	
ONE01	SAN-02	Upper Post Lake	757	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Northeast Hills	Langlade, Oneida	
ONE02	RGE-06	Wolf River North of Post Lake	1500	Undeveloped river; old growth forest; bird species	Development, logging	nc, p, a	W, S, L	forest, recreation	North Northeast Hills	Oneida	Pub/Priv
ONE03	MM-08	Lake Lucille		Trumpeter swan release sites		a	L		North Northeast Hills		
ONE03	RGE-05	Lake Lucille		Undeveloped lake; emergent communities; bird species	Development	nc, p, a	W, L	forest, houses, recr	North Northeast Hills	Oneida	Private
ONE04	RGE-04	Wolf River Rice Beds	2500	8 mile remote, wild area; rice beds; cedar forest	Development, logging	nc, p, a	F, W, S	forest, houses	North Northeast Hills	Forest, Oneida	Pub/Priv
OUT17	DDT-04	Black Otter Lake		Good bird habitat along abandoned railway trail and lake		nc, a	F, W, L		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT18	DDT-02	Hortonville Bog SNA (Area)		Neotropical migrant nesting area (Cerulean, Prothonotary warblers, etc)		nc, a	W		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT19	KK-03	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv
OUT20 OUT28	TAC-05	LaSage SWA	500	Spawning marsh area; Native American historic site	Neglect	nc, p, a, g, o	F, W, S, L	agr	North Central Plains/ Southeast Glacial Plains	Outagamie	Public
OUT21	MM-05	Embarrass River-New London		Heron, egret rookeries		a	F, W, S		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT22	KK-04	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv
OUT23	BRH-04	Bischoff Rd Wetlands		Shorebird stop-over, waterfowl feeding and nesting site	DOT management and mitigation	a	W	agr	North Central Plains/ Southeast Glacial Plains	Outagamie	Public
OUT24	DDT-01	Shiocton Waterfowl Areas		Spring waterfowl concentration; shorebirds	Lack of DOT, farmer's management	nc, a	W, S, O	agr	North Central Plains/ Southeast Glacial Plains	Outagamie	Pub/Priv
OUT25	KK-05	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv
OUT26	KK-06	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv
OUT27	KK-07	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv

Site ID	Source	Site Name	Acres	Resources of Significance	Threats/Disturbance Factors	Ecol Info	Habitat	Surrounding Land Use	Ecological Landscapes	County	Ownership
OUT28	BRH-02	Deltox Marsh		Waterfowl, shore and wetland bird breeding and feeding site	non-point pollution (agric.)	a	W, P	agr, wetl	North Central Plains/ Southeast Glacial Plains	Winnebago	Public
OUT29	RH-32	Shaky Lake SNA		Bog, rare plants, wood turtle		nc, p, a	W, L	agr, forest	North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT30	BER	Hortonville Bog SNA		DNR State Natural Area					North Central Plains/ Southeast Glacial Plains	Outagamie	Public
OUT30	MM-04	Hortonville Bog SNA		Bog, breeding bird area		nc, a	W		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT30	RH-33	Hortonville Bog SNA		Rare plants and animals		nc, p, a	W		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT31	DDT-03	Mack SWA		Neotropical migrant nesting area		nc, a	mixed		North Central Plains/ Southeast Glacial Plains	Outagamie	
OUT32	SJP-01	Mosquito Hill Nature Center	430	Undisturbed bottom land hardwoods; wild rice	Invasives	nc, p, a, g	F, L, O	forest, agr, houses		Outagamie	Public
POR09	GWD-01	Emmons Creek SFA		Karner Blue butterfly population	Succession, Invasives	a	P	forest, agr	Central Sand Hills	Port	Pub/Priv
POR09	RH-07	Emmons Creek SFA		Savanna restoration, Karner blue habitat		nc, a			Central Sand Hills	Portage, Waupaca	
POR10	RH-08	Wolf Lake Park		Lake, savanna	Recreational use	nc	G, L		Central Sand Hills	Portage	Public
POR11	RH-09	Silver Lake Area		Lake, savanna	Development, logging	nc	G, L		Central Sand Hills	Portage	Private
POR12	RH-10	Waupaca River Tributary		Streams, woods, seepage springs		nc, g	F, S		Central Sand Hills	Portage	
POR13	MP-04	Lake Emily Road		Endangered species (Karner Blue)	Development	nc, p, a	P		Central Sand Hills	Port	
POR14	JEK-03	Trout Creek		Trout spawning area; significant riparian area	Development	nc, p, a	S	agr, forest	Central Sand Hills	Waupaca, Port	Pub/Priv
POR15	RH-17	New Hope Pines SNA		Forest communities: SDM, NDM, NW	Development, logging	nc, p, a	F, W, S, L		South Northeast Hills	Portage, Waupaca	
POR17	GWD-04	New Hope Pines SNA		Natural Area		nc, p	F, S	forest, agr	South Northeast Hills	Port	
POR19	GWD-03	Richard Hemp SFA		Poncho and Tomorrow Rivers	Invasives, pollution		F, S		Central Sand Hills	Port	
POR19	MJB-03	Richard Hemp SFA	2000	Diverse stream corridor; many nesting birds	Logging, Invasives	nc, a	G, F, S, L	agr	Central Sand Hills	Port	Pub/Priv
SHA22	RH-27	Wolf River south of Navarino				nc, p, a	F, W, S		North Central Plains/ Southeast Glacial Plains	Shawano, Waupaca, Outagamie	
SHA23	RH-26	White Lake		Shallow marl lake, veg.		nc, p	L		North Central Plains/ Southeast Glacial Plains	Shawano	
SHA23	SG-01	White Lake	190	hardstem bulrush, cattail, coontail. Wildlife habitat	subdivision, water quality, vegetation removal	nc, p, a	W, L	agr, homes	North Central Plains/ Southeast Glacial Plains	Shawano	private
SHA24	RH-28	Lund's Cedar		White cedar stand, orchids?		nc, p	F, W		North Central Plains/ Southeast Glacial Plains	Shawano	
SHA25	RH-29	Jung Hemlock SNA		Old growth mesic forest		nc	F	agr	North Central Plains/ Southeast Glacial Plains	Shawano	
SHA26	RH-35	Tigerton Forest		NM forest, exposed bedrock		nc, g	F, S		South Northeast Hills	Shawano	
SHA27	MM-06	Wolf River south of Keshena		Breeding bird area		a	S		North Central Plains/ Southeast Glacial Plains	Shawano, Menominee	
SHA29	MP-03	Navarino SWA		Over 200 bird species; rare plants	Mismanagement	nc, p, a			North Central Plains/ Southeast Glacial Plains	Shawano, Waupaca	
SHA29	RH-25	Navarino SWA				nc, p, a	G, F, W, S		North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie	
WAP39	MM-03	Wolf River south of New London		Breeding bird area		a	F, W, S, L		North Central Plains/ Southeast Glacial Plains	Waupaca, Winnebago	
WAP40	RH-14	Lower Wolf River				nc, p, a	F, W, S, L		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP41	KK-01	Walleye Spawning Marshes		Known or historically identified walleye spawning areas	Development, changes in vegetation, changes in water flow (volume and direction)	nc, a, g	W, S, R	urban, agr, natural river bottomland	North Central Plains/ Southeast Glacial Plains	Shawano, Outagamie, Waupaca	Pub/Priv
WAP42	MWB-03	Templeton Bayou	10	Bald eagle nesting; marsh plants	Logging	p	W	forest, recreation	North Central Plains/ Southeast Glacial Plains	Waupaca	Private
WAP43	MWB-02	Big Cut Rookery	10	Blue heron rookery	Logging	nc, p	W, S	forest, recreation	North Central Plains/ Southeast Glacial Plains	Waupaca	Private
WAP44	MWB-01	Mukwa Indian Mounds	>1	Native American historic site		nc, o	W, S	forest, recreation	North Central Plains/	Waupaca	Private

Site ID	Source	Site Name	Acres	Resources of Significance	Threats/Disturbance Factors	Ecol Info	Habitat	Surrounding Land Use	Ecological Landscapes	County	Ownership
									Southeast Glacial Plains		
WAP45	RH-06	Radley Creek SNA		Shallow spring lake, emergent aqatics, breeding birds		nc, p, a	F, W		Central Sand Hills	Waupaca	
WAP46	TAC-03	Rasmussen Canal	40	Walleye spawning area	Siltation	nc, p, a, g	W, S	urban	North Central Plains/ Southeast Glacial Plains	Waupaca	Pub/Priv
WAP47	TAC-02	Cedar Creek Marsh	640	Large wetland filter area	Invasive plants	p, a, g	W, S	forest, agr	North Central Plains/ Southeast Glacial Plains	Waupaca	Private
WAP48	TAC-01	Cedar Creek Feeder	80	Endangered species	Development	nc, p, a	P, W, S, L	agr	North Central Plains/ Southeast Glacial Plains	Waupaca	Private
WAP49	RH-15	Flynn Lake		Bog, tamarack and spruce		nc, p	F, W, L		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP50	JEK-02	Little Wolf River		Bass fishery; significant riparian area; Native American historic site	Development, erosion & siltation, overharvest	nc, p, a, g	F, W, R	forest, agr	North Central Plains/ Southeast Glacial Plains	Waupaca	Private
WAP51	RH-16	Knutson Lake		Lake, tamarack and spruce		nc, p	W, L		South Northeast Hills	Waupaca	
WAP52	RH-19	Blake Creek Forest South Fork		Large patch of mature mesic forest		nc	F, W, S		South Northeast Hills	Waupaca	
WAP53	JEK-01	Griffin Creek	350	Griffin creek source; trout spawning area; significant riparian zone	Fragmentation, development	nc, p, a, g	mixed	forest, agr	South Northeast Hills	Waupaca	Private
WAP54	RH-24	Telloak's Hill SNA		Old-growth forest with rich ground layer		nc, p	F		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP55	RH-23	Shaw Creek Headwaters		Large patch of peatland and wetland forest		nc	W		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP56	SAN-05	Pigeon Lake	163	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP57	RH-20	Keller-Whitcomb Forest		Large patch of mature NW, NWM forest		nc, p	F, S		South Northeast Hills	Waupaca	
WAP58	RH-22	Buck Lake Bog		Bog lake with conifer forest		nc, p	F, W, L		North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP59	RH-18	Little Wolf River		Streams, inverts, forest communities: NM, NDM, NW	Logging	nc, p, a, g	F, W, S, L		South Northeast Hills		
WAP60	RH-21	Mud Lake Bog and Forest		Large patch of forest, many landforms	Logging	nc, p, g	F, W	agr	South Northeast Hills	Waupaca, Shawano	
WAP61	JEK-04	Tigerton Forest	4500	Unfragmented	Development (subdivision)	all	F, W, S, L		South Northeast Hills	Waupaca	Pub/Priv
WAP62	BER	Mud Lake - Radley Creek Savanna SNA		DNR State Natural Area					Central Sand Hills	Waupaca	Public
WAP63	BER	Pope Lake SNA		DNR State Natural Area					Central Sand Hills	Waupaca	Public
WAP64	RH-31	Poppy's Rock SNA		Prickly pear cactus		p			North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP65	BER	Mukwa Bottomland Forest SNA		DNR State Natural Area					North Central Plains/ Southeast Glacial Plains	Waupaca	Public
WAP67	RH-11	Skunk-Foster Lakes SNA		Hardwater seepage lakes	Development	g	L		North Central Plains/ Southeast Glacial Plains	Waupaca, Portage	
WAP68	RH-34	Myklebust Lake SNA		Hardwater lake and fen		nc	W, L		South Northeast Hills	Waupaca	
WAP69	BER	Mud Lake Bog SNA		DNR State Natural Area					South Northeast Hills	Waupaca	Public
WAP70	MWB-04	Mukwa SWA	1000	State Scientific Area; Walleye and sturgeon spawning grounds	Development	nc, p, a	F, W, S	agr, forest, houses	North Central Plains/ Southeast Glacial Plains	Waupaca	
WAP70	TAC-04	Mukwa SWA	1500	Sturgeon spawning area; waterfowl breeding site	Neglect	nc, p, a, g	F, W, S, L	urban, agr	North Central Plains/ Southeast Glacial Plains	Waupaca	Pub/Priv
WIN09	KO-01	Harpers Point, Lake Winneconne	80	Cattail, bulrush area	Development	nc, p	W, L	houses, urban	North Central Plains/ Southeast Glacial Plains	Winnebago	Pub/Priv
WIN10	RH-13	WIWASH Trail Prairies		Wet-mesic prairies, Prairie white-fringed orchid		nc, p	G		North Central Plains/ Southeast Glacial Plains	Winnebago	
WIN11	MM-01	Lakes Poygan and Winneconne		Breeding bird area, terns, gulls		a	L		North Central Plains/ Southeast Glacial Plains	Winnebago	
WIN12	BRH-01	Clark Wetlands	442	Carex stricta, Calamagrostis canadensis, wet meadow, Yellow rail migration	Fragmentation, non-point pollution (agric.)	p, a	W	agr	North Central Plains/ Southeast Glacial Plains	Winnebago	Private
WIN12	RH-12	Clark Wetlands		Sedge meadow, rare plants, diversity		nc, p	W		North Central Plains/ Southeast Glacial Plains	Winnebago	

Site ID	Source	Site Name	Acres	Resources of Significance	Threats/Disturbance Factors	Ecol Info	Habitat	Surrounding Land Use	Ecological Landscapes	County	Ownership
WIN13	BRH-03	Dale Rd wet woods		Wet woods, wetland songbirds nesting site		p, a	F, W	agr, wetl, res, DNR	North Central Plains/ Southeast Glacial Plains	Winnebago	Private
WSA24	SAN-11	Lake Morris	163	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		Central Sand Hills	Waushara	
WSA25	RH-02	Norwegian Lake		Savanna, oak/pine woods, hardwater lake, marl flats	Development	nc, p	G, F, L		Central Sand Hills	Waushara	
WSA26	RH-01	Badger Drive Hills		Savanna restoration		nc	G	agr	Central Sand Hills	Waushara	
WSA27	RH-03	Little Silver Creek Springs		Spring pond		nc	L		Central Sand Hills	Waushara	
WSA28	SAN-10	Lake Napowan	51	High floristic quality (Nichols 1999, J. Lake & Reservoir Mgmt.)		nc, p	L		Central Sand Hills	Waushara	
WSA29	RH-04	Timan Lake and Savanna		Savanna restoration, oak woods, hardwater lakes, Karner blue habitat	Development	nc, p, a	G, F, L		Central Sand Hills	Waushara	
WSA30	RH-05	Pine River		Floodplain forest, oak/white pine woods, spring ponds	Logging	nc	F, L		Central Sand Hills	Waushara	
WSA31	MM-02	Poygon Marsh SWA		Breeding bird area		a	W, L		Central Sand Hills	Waushara	
	MXM-01	Wolf River, Shiocton to Partridge Lake		River morphology, riparian zones and floodplain wetlands	Manipulation of floodplain morphology, flow	g	W, S	agr		Waupaca, Outagamie	Pub/Priv

Expert Site Table Legend

Site ID: Code includes County abbreviation and sequential numbering of all sites in each county. Expert site numbers start after the last Coarse Filter Screening site number.

Source: Code from original expert site submission prior to the Experts Workshop. Letter code includes initials of submitting expert.

Site Name: From name of most important geographical features of site.

Acres: Provided only if included on site information form by the submitting expert.

Ecol Info: Ecological Information provided on the site information form by the submitting expert: nc=natural community; p=plants; a=animal; g=geologic feature; o=other

Habitat: Provided on the site information form by the submitting expert: G=grassland; F=forest; W=wetland; S=stream; L=lake; O=other

Surrounding Land Use: Provided on the site information form by the submitting expert.

Ecological Landscape: Lists the ecological landscapes the site falls within.

Ownership: Provided only if included on site information form by the submitting expert.

Attachment D. Significance Ranking Sheets from Workshop Groups

Significant Ecological Sites in the Wolf River Basin North Northeast Hills – Group #1

Criteria	Site ID or Site Grouping							
	NNCF1= FOR 02,10,111 2,13	NNCF4= LAN 10,25,26 28,30, 31,33	NNCF5= LAN 11,24 (and W. River Corr. To Men. Line)	NNCF8= FOR 03	NNCF7= FOR 08	NNCF2= ONE 02,03.04	NNCF3= FOR05	NNCF6= Lawrence Lake
Coarse Filter and Expert Sites overlap and/or cluster	H	H	H	M	M	M	M	M
Large, unfragmented natural areas	H	H	M	L	H	H	H	H
Potential connectivity with other important sites	H	H	H	L	M	H	L	L
Critical habitat area for plants or animals	H	H	H	H	H	H	U	H
Uncommon or rare natural communities *	H	H	H	H	U	H	U	U
Uncommon or rare plants, animals, other features*	U	U	H	U	U	U	U	U
Well-functioning and intact natural communities	H	H	M	M	M	H	H	H
Potential natural community restoration	L	L	M	H	M	L	L	L

Significance: **H** = high **M** = medium **L** = low **U** = no information

* Please indicate if this information is from NHI Element Occurrences from the NHI or from Expert Site Information

Significant Ecological Sites in the Wolf River Basin
South Northeast Hills – Group #2

Criteria	Site ID or Site Grouping							
	Men. County – Stock Bridge	Tigerton Lumber 25-27 /60-61	Upper reaches Little Wolf – 59	New Hope Pines 14,15, 17	Gardner Dam Boy Scout Camp LAN15	SHA 18	SHA 20/17	WAP 57 K. W. Woods
Coarse Filter and Expert Sites overlap and/or cluster	H	H	Just expert	H	Just expert	H	H	H
Large, unfragmented natural areas	H	M	Narrow corridor	L	M	H	H	M
Potential connectivity with other important sites	H	H	H	H	H	H	H	M
Critical habitat area for plants or animals	H	?	U	H	U	H	M	U
Uncommon or rare natural communities *	H	H	U	U	U	M	M	H
Uncommon or rare plants, animals, other features*	H	H	M	U	U	M	M	M
Well-functioning and intact natural communities	H	U	M	L	H	M	M	H
Potential natural community restoration	Intact	H	H	H	Intact	L	L	M

Significance: **H** = high **M** = medium **L** = low **U** = no information

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Sensitivity of Sites in the Wolf River Basin
South Northeast Hills – Group #2

- Time allowed only for the identification of sensitivity issues for the sites in a general sense. The issues are:
 - a. Hwy. Expansion
 - b. 20-40's suburbanization, high rural land ownership
 - c. Deer (eating vegetation)
 - d. Beaver (flooding)
 - e. Crandon Mine
 - f. Hydrolic changes
 - g. Exotics: spotted knapweed, purple loosestrife, reed canary grass, and animals/parasites

Significant Ecological Sites in the Wolf River Basin
South Northeast Hills – Group #3

Criteria	Site ID or Site Grouping									
	SHA 04	SHA 12	SHA 18	SHA 20	LAN 13	LAN 20	LAN 15	LAN 08, 38	WAP 59	MRN 12
Coarse Filter and Expert Sites overlap and/or cluster	H	H	H	H	M	H	M	H	L	L
Large, unfragmented natural areas	M	L	H	H	M	M	M	M	M	M
Potential connectivity with other important sites	M	L	H	H	H	H	H	H	H	M
Critical habitat area for plants or animals	M	M	H	M	H	H	H	M	H	H
Uncommon or rare natural communities *	M	M	M	M	M	L	H	H	U	H
Uncommon or rare plants, animals, other features *	M	M	M	M	M	M	H	H	H	H
Well-functioning and intact natural communities	M	L	M	M	H	H	H	H	H	U
Potential natural community restoration	L	H	L	L	H	L	H	H	U	M
Inventory	***	*****	**	***	****	****	**	**	***	
Conservation	****	*****	**	***	***** *	***	**	*****	**	

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Significant Ecological Sites in the Wolf River Basin
South Northeast Hills – Group #3, p. 2

Criteria	Site ID or Site Grouping							
	WAP 26, 27	WAP 60,61	WAP 34,36	WAP 51,52				
Coarse Filter and Expert Sites overlap and/or cluster	H	H	H	H				
Large, unfragmented natural areas	H	H	M	M				
Potential connectivity with other important sites	H	H	M	M				
Critical habitat area for plants or animals	M	M	M	M				
Uncommon or rare natural communities *	U	U	U	U				
Uncommon or rare plants, animals, other features *	U	U	U	U				
Well-functioning and intact natural communities	H	H	H	H				
Potential natural community restoration	H	M	H	U				
Inventory	*	****		*				
Conservation			**	*				

Significance: **H** = high **M** = medium **L** = low **U** = no information

* Please indicate if this information is from NHI Element Occurrences from the NHI or from Expert Site Information

Significant Ecological Sites in the Wolf River Basin
Northeast Plains / Southeast Glacial Plains – Group #4

Criteria	Site ID or Site Grouping								
	SHA 07	OUT 07 OUT 29	OUT 06 OUT 30	WIN 01	WIN 12	MEN 01	WIN 13		
Coarse Filter and Expert Sites overlap and/or cluster	H	H	H	H	U	U	U		
Large, unfragmented natural areas	H	L	H	H	H	H	M		
Potential connectivity with other important sites	H	L	L	H	H	H	H		
Critical habitat area for plants or animals	H	H	H	H	H	H	H		
Uncommon or rare natural communities *	H	H	H	U	H	M	U		
Uncommon or rare plants, animals, other features *	H	H	H	H	H	H	U		
Well-functioning and intact natural communities	H	M	M	H	H	H	M		
Potential natural community restoration	U	U	U	U	U	U	U		
* Group feels need for inventory and protection (sensitive)	*	*	*	**	**		*		

Significance: **H** = high **M** = medium **L** = low **U** = no information

* Please indicate if this information is from NHI Element Occurrences from the NHI or from Expert Site Information

Significant Ecological Sites in the Wolf River Basin
Northeast Plains / Southeast Glacial Plains – Group #5

Criteria	Site ID or Site Grouping											
	WAP 39-48	WSA 07 WSA 31	WAP 49	OUT 21	OUT 13	OUT 32	OUT 30 OUT 06	SHA 29	SHA 23	Lower Little Wolf 01	Prairie Remna nt 01	OUT 07
Coarse Filter and Expert Sites overlap and/or cluster	H	H	H	L	L	H	H	H	L	U	U	H
Large, unfragmented natural areas	H	H	H/M	L	H	H	H	H	L	H	L	M
Potential connectivity with other important sites	H	M	H	H	L	H	M	H	L	H	L	L
Critical habitat area for plants or animals	H	H	H	H	H	H	H	H	H	H	H	H
Uncommon or rare natural communities *	H	L	H	L	H	M	H	H	L	H	H	H
Uncommon or rare plants, animals, other features *	H	H/M	H/M	L	H	H	H	H	H	H	H	H
Well-functioning and intact natural communities	M	M	H	L	H	H	H	H	M	M	L	H
Potential natural community restoration	H	H	H	L	L	L	L	M	L	H	H	L
* Future Needs for	**		**	**		*				*	**	*

Significance: H = high M = medium L = low U = no information

* Please indicate if this information is from NHI Element Occurrences from the NHI or from Expert Site Information

Significant Ecological Sites in the Wolf River Basin
Central Sand Hills – Group #6

Criteria	Site ID or Site Grouping						
	CHS 1 Emmons Creek	CHS 2 Wolf – Silverf	CHS 3 Pickeral Lake	CHS 4 Tomorrow River	CHS 5 Pine River	CHS 6 Sand Pr./Sav pot.	Cold water streams complex
Coarse Filter and Expert Sites overlap and/or cluster	H	M	L	L	H	N/A	N/A
Large, unfragmented natural areas	M	L	L	M	M	L	M
Potential connectivity with other important sites	H	L	L	M	M	L	H
Critical habitat area for plants or animals	H	L	H	M	M	H?	H?
Uncommon or rare natural communities *	L	L	L	H (NHI)	H (NHI)	H (NHI)	?
Uncommon or rare plants, animals, other features *	H	L	H	H	H	H	?
Well-functioning and intact natural communities							
Potential natural community restoration	H	L	L	H	?	H	H?
*Threats and Disturbance	M	H	H	H	?	H	H
*Statewide Importance	M	?	H	?	?	M	H

Significance: **H** = high **M** = medium **L** = low **U** = no information

- Please indicate if this information is from NHI Element Occurrences from the NHI or from Expert Site Information

Appendix M

Summaries of Sites with High Potential for Conservation and Inventory: Experts Workshop

Summary of Sites with High Potential for Conservation and Inventory

CSH01: Wolf/Silver Lakes	NEH 15: Little Wolf River
CSH02: Pickerel Lake – Portage County	NEH 16: Mud Lake Forest Headwaters
CSH03: Emmons Creek Area	NEH 17: Keller-Whitcomb Forest
CSH04: Pine River Area	NEH 18: New Hope Pines
CSH05: Cold Water Streams Complex	NEP01: Navarino State Wildlife Area
NCF01: Lawrence Lake	NEP02: White Lake
NEH 01: Upper Wolf – Pine Lake Area	NEP03: Maine State Wildlife Area
NEH 02: Upper Wolf – Lake Lucille	NEP04: Flynn Lake Bog
NEH 03: Mole Lake Indian Reservation	NEP05: S. Branch Wolf River
NEH 04: Spider Creek Area	NEP06: Lower Wolf River
NEH 05: Pickerel Lake – Forest County	NEP07: Lower Embarrass River
NEH 06: Himley/Shoe Lakes	NEP08: Hortonville Bog
NEH 07: Middle Wolf River	NEP09: Mosquito Hill Nature Center
NEH 08: Ninemile Rapids Area	NEP10: Shaky Lake
NEH 09: Florence Lake	NEP11: Dale Road Woods
NEH 10: Mattoon Swamp	SGP01: Wolf River State Wildlife Area
NEH 11: Baker Lake	SGP02: Clark Wetlands
NEH 12: Menominee and Stockbridge-Munsee Indian Reservations	SGP03: Poygan Marsh SWA
NEH 13: Pony/Logemanns Creeks	
NEH 14: South Branch Forest	

CSH01: Wolf/Silver Lakes

Acreage: 2,584
Expert Sites: POR10, POR11
Coarse Filter Sites: POR07

This site is located on the southwestern edge of the Wolf River Basin. The coarse filter screening described this site as a relatively young monotypic upland hardwood stand, encompassing Wolf Lake and smaller ponds. There was past harvesting and agriculture along the borders. Hardwoods buffer this site on the southern edge.

Experts identified this area as significant due to its role in savanna restoration, the existing lake area, and the habitat it provides for the federally endangered Karner blue butterfly. Development and logging are believed to be potential threats to this site.

CSH02: Pickerel Lake – Portage County

Acreage: 837
Expert Sites: POR18
Coarse Filter Sites: N/A

This site is located on the southwestern portion of the Wolf River Basin. Experts identified the site due to existing eagle and osprey nests and high floristic quality (Nichols 1999). The site encompasses the Pickerel Lake State Natural Area.

CSH03: Emmons Creek Area

Acreage: 17,151
Expert Sites: POR09, POR20, WAP63
Coarse Filter Sites: POR08

This site is located on the southwestern portion of the Wolf River Basin. The coarse filter screening identified upland hardwoods neighboring a mixed conifer/hardwoods swamp that follows Emmons Creek. There is an emergent/lowland shrub wetland along the path of Emmons Creek. Deans and Fountain Lake are included in this site. Smaller monotypic forest canopies indicate past harvesting in portions of the site. The site includes an agricultural inclusion, roads, and pine plantations.

Experts identified the site due to its Karner blue butterfly population. Potential threats include invasive plants and a loss of Karner habitat due to succession or other factors.

CSH04: Pine River Area

Acreage: 8,878
Expert: WSA30
Coarse Filter: WSA11, WSA12

This site is located on the southwestern side of the Wolf River Basin. The coarse filter screening identified two smaller sites within the larger Pine River Area boundary. The first includes swamp

hardwoods with an emergent/lowland shrub wetland and swamp conifer inclusion. A wetland occupies the southwestern border and demonstrates little disturbance, and a few mature hardwoods are present. Gilbert Lake, Fenrich Springs, Pine River, and Humphrey Creek are included here. Highway K and other roads bisect the site. The second coarse filter site is located to the south and comprised of swamp hardwoods following the Pine River with a swamp conifer inclusion (representing less than 30% of the area). A lowland shrub/emergent wetland forms the southern border. This area has the potential to support a sedge meadow. Roads, pine plantations and agricultural lands exist here.

Experts identified the Pine River Area because of its floodplain forest, oak/white pine woods, and spring ponds. Logging is believed to be a potential threat to this site.

CSH05: Cold Water Streams Complex

Acreage: 37,866
Expert Sites: WSA26
Coarse Filter Sites: N/A

This site is located on the southwestern border of the Wolf River Basin. Experts identified sites in this area as significant due to past savanna restoration and high quality streams.

NCF01: Lawrence Lake

Acreage: 327
Expert Sites: N/A
Coarse Filter Sites: N/A

This site was identified at the Wolf River Basin Experts Workshop as highly significant for its large, unfragmented natural vegetation. It is also believed to be a well-functioning and intact natural community with critical habitat for plants or animals.

NEH 01: Upper Wolf – Pine Lake Area

Acreage: 15,644
Expert Sites: FOR10, FOR11, FOR12, FOR13
Coarse Filter Sites: FOR02

This site is located in the northernmost part of the Wolf River Basin. The coarse filter screening described portions of this site as an extensive bog with mixed swamp conifer/hardwood complex. There are some mature hardwoods in the southern part and along the south shore of Little Rice Lake - otherwise the uplands are unexceptional. Part of this site includes Little Rice State Wildlife Area. Disturbance factors include extensive timber harvesting and land clearing on the north edge of the lake basin.

Experts identified sites in this area due to its wild rice beds, the waterfowl area, and natural communities. It was also believed significant because of the undeveloped character of land along the Wolf River. Significant bird species are found here. Hiles Mill Pond Dam impounds a wetland with significant plant communities. Potential threats may include development, logging, and impact from the Crandon Mine development.

NEH 02: Upper Wolf – Lake Lucille

Acreage: 10,509
Expert Sites: ONE01, ONE02, ONE03, ONE04
Coarse Filter Sites: N/A

This site is located in the northwestern part of the Wolf River Basin. Experts identified sites in this area because of its high floristic quality, the stretch of undeveloped river, and the presence of wild rice beds, old-growth forest, and diverse bird species. Trumpeter swan release sites are located here. There is an 8-mile remote wild area. The river is important here because of its morphology, riparian zones, and floodplain wetlands. Potential threats include development, logging, and manipulation of the floodplain morphology and flow.

NEH 03: Mole Lake Indian Reservation

Acreage: 3,045
Expert Sites: FOR08
Coarse Filter Sites: N/A

This site is located in the north-central part of the Wolf River Basin. Experts identified a portion of this area due to the presence of significant bird species including black terns and Trumpeter swans. A Trumpeter swan release site is located here.

NEH 04: Spider Creek Area

Acreage: 21,891
Expert: LAN25, LAN26, LAN28, LAN30, LAN31, LAN35
Coarse Filter: LAN10

This site is located in the northern part of the Wolf River Basin. The coarse filter screening described the southwestern portion of this area as a mixed conifer/hardwoods swamp with an upland hardwood inclusion. A lowland shrub wetland follows the path of the Wolf River. This portion of the area has potential to support sedge meadow along Spider Creek. The lowland areas along Spider Creek Flowage, Mud and Pickerel Creek are intact, while hardwoods indicate past harvesting along the east border of Miniwakan Lake and in portions of the interior. Access roads and Hwy. U disrupt the continuity of the forest.

Experts identified sites in this area as significant due to wild rice beds, eagle nests, deer yards, emergent aquatic communities, and large forested wetlands. Potential threats include development and logging.

NEH 05: Pickerel Lake – Forest County

Acreage: 3,121
Expert: FOR03
Coarse Filter: N/A

This site is located in the north-central part of the Wolf River Basin. Experts identified the area as significant due to the presence of eagle and osprey nests.

NEH 06: Himley/Shoe Lakes

Acreage: 1,094
Expert: FOR05
Coarse Filter: N/A

This site is located in the northeastern border of the Wolf River Basin. Experts identified the area as significant due to presence of large undeveloped lakes. Potential threats include development.

NEH 07: Middle Wolf River

Acreage: 11,182
Expert: NEH07
Coarse Filter: LAN11

This site is located in the northern part of the Wolf River Basin. The coarse filter screening identified one site within the northern portion of the area that includes an upland hardwoods and encompasses Turtle Lake and small patches of lowland shrub wetland/swamp conifers. The Wolf River forms the east border of the smaller site. There is the potential to support hemlock along the western rim of the hardwoods. There was past harvesting in portions of the interior. Areas outside of the coarse filter site are fragmented by agricultural lands, past timber harvests, access roads, and pine plantations.

Experts identified the area as significant due to its extensive forest characteristics, which include northern mesic forest composed of sugar maple, basswood, and hemlock. Squaw Creek deer yard is also located here. There are wild rice beds and eagle nests present. Potential threats include logging, recreation, and development.

NEH 08: Ninemile Rapids Area

Acres: 5,767
Expert: LAN18, LAN20, LAN38
Coarse Filter: LAN13

This site is located in the northern part of the Wolf River Basin. The coarse filter screening identified the river corridor within this area as a mixed conifer/hardwoods swamp with an upland hardwood inclusion following the Wolf River. The areas of highest ecological potential closely border the Wolf River, as the area becomes quite disrupted with access roads, timber harvesting, pine plantations, a railway, and agricultural lands as it shifts away from the River. Wolf River State Fishery Area and Ninemile Creek are located here.

Experts identified sites in this area as significant due to its spring seeps and wet-mesic white cedar forest. Burnt Point Deer Yard is also found at this site.

NEH 09: Florence Lake

Acres: 1,409
Expert: LAN16, LAN39
Coarse Filter: LAN08

This site is located in the northern part of the Wolf River Basin and follows the boundaries of coarse filter site LAN08. NEH09 is described as a mixed conifer/hardwoods swamp bordered by upland hardwoods consisting of young poles and small sawtimber. The eastern part supports intact swamp conifers with a dense canopy, with lowland shrub wetland forming the area's southern rim. McGee Creek and Florence Lake are included. Roads bisect this site. The lowland areas are intact, and past harvesting and access roads disrupt portions of the interior of the hardwoods. Agriculture forms a majority of the site's east border.

Experts identified sites in this area as significant due to high floristic quality, its unique coldwater complex, trout and invertebrates.

NEH 10: Mattoon Swamp

Acres: 3,635
Expert: N/A
Coarse Filter: SHA14

This site is located in the west-central part of the Wolf River Basin and follows the boundaries of coarse filter screening site SHA14. It is a mixed conifer/hardwoods swamp with an emergent/lowland shrub wetland inclusion along the northwest border. Upland hardwoods are included, as well as Elmhurst Creek and Mattoon Swamp. The south-central interior is less disturbed compared to disjunct borders. It is well buffered along the northern rim by hardwoods. The remaining surrounding lands are fragmented. Hwy. 45, Hwy. Z, and an old railroad grade are present.

NEH 11: Baker Lake

Acres: 4,340
Expert: N/A
Coarse Filter: SHA12

This site is located in the west-central part of the Wolf River Basin and follows the boundaries of a coarse filter screening site SHA12. An emergent/lowland shrub wetland forms a majority of the northern part of this site, in conjunction with a mixed conifer/hardwoods swamp comprising the remainder. Upland hardwoods are included. The Middle Branch Embarrass River, Cranberry, and Baker Lakes are found within this site boundary. The site demonstrates past drainage and ditching throughout northern and west-central portions. This site is quite disjunct due to a farm inclusion and roads. Access roads and Cherry, Cranberry, and Lake Drive Roads interrupt the site.

NEH 12: Menominee and Stockbridge-Munsee Indian Reservations

Acres: 240,985
Expert: N/A

Coarse Filter: SHA17, SHA20

The reservations, particularly the Menominee Indian Reservation, contain the largest block of mature, essentially unfragmented, hemlock-hardwoods forest in Wisconsin. Other highly significant natural features include lakes, streams, springs, and extensive undisturbed conifer swamps.

NEH 13: Pony/Logemanns Creeks

Acres: 18,634
Expert: N/A
Coarse Filter: SHA17, SHA20

This site is located in the west-central part of the Wolf River Basin and encompasses two coarse filter screening sites. The southern portion of NEH13 consists of a mixed conifer/hardwoods swamp neighboring upland hardwoods. It has the potential to support sedge meadow along Logemanns Creek. A majority of the interior indicates little disturbance. The areas excluded demonstrate past harvesting in addition to fragmentation by agriculture. Access roads, Swamp Lane, Weasel Dam and Leopold Road disrupt the site.

The upper part of NEH13 includes a mixed conifer/hardwoods swamp with an upland hardwood inclusion. This part of the site follows the Embarrass River and Pony Creek. There was past harvesting of swamp conifers in the northwest part and of hardwoods along the border of Hwy. D. There is additional fragmentation by agricultural lands, Maple Lane Road, and by access roads throughout the interior.

NEH 14: South Branch Forest

Acres: 4,487
Expert: N/A
Coarse Filter: SHA18

This site is located in the west-central part of the Wolf River Basin and encompasses one coarse filter screening site. SHA18 consists of mixed hardwoods in conjunction with a mixed swamp conifer/hardwoods. It has the potential to support sedge meadow along Cleveland Creek. The South Branch Embarrass River, Cleveland and Larsen Creeks are located here. There are access roads and evidence of past harvesting along the south and east rims. Although this site becomes more fragmented by agriculture and roads. The majority of the site is buffered by mixed upland and continuous lowland hardwoods. Highways M and P, access roads, and Steinke Road disrupt this site.

NEH 15: Little Wolf River

Acres: 7,813
Expert: WAP59
Coarse Filter: N/A

This site is located in the west-central part of the Wolf River Basin. It was identified by experts as a high potential site because of its streams, presence of rare invertebrates, and large, intact forest communities (northern mesic, northern dry-mesic, and northern wet). Fragmentation of the large forested area from logging was identified as a threat to this site.

NEH 16: Mud Lake Forest Headwaters

Acres: 22,536
Expert: WAP60, WAP61, WAP69
Coarse Filter: WAP25, WAP26, WAP27

This site is located on the west-central part of the Wolf River Basin. The coarse filter screening described three contiguous sites. WAP25 is a mixed swamp hardwood/conifer with lowland shrub and upland hardwoods inclusions. The site contains the headwaters for South Branch Pigeon River and Geskey Creek and neighbors Keller Lake. Overall there is little disturbance in the interior; however, the site is broken up due to farm inclusion. WAP26 consists of upland hardwoods with mixed swamp hardwood/conifer and lowland shrub with wetland inclusion. The monotypic lowland hardwoods outline shrub wetlands in the south, while upland hardwoods form the northern portions. This has the potential to support a sedge meadow. A swamp hardwood/conifer forms the east border. Several streams, including Geskey Creek, cross this site. Access roads, agricultural land, Hwy. J, Brewer Road, and an old railroad grade fragment this site. WAP27 consists of an extensive upland hardwoods with mixed swamp hardwood/conifer and shrub wetland. Spaulding and Comet Creeks and Mud Lake are located here. The site is well buffered with minimal disturbance. An old railroad grade and Comet and Mud Lake Roads cross this site.

Experts identified sites in this area as significant due to the large unfragmented patch of forest and diverse landforms. Potential threats to this site include logging and subdivision development. Mud Lake Bog State Natural Area is located in this area.

NEH 17: Keller-Whitcomb Forest

Acres: 3,586
Expert: WAP57
Coarse Filter: WAP30, WAP33

This site is located on the west-central part of the Wolf River Basin. The coarse filter screening identified two sites, consisting of two parts. WAP30 is in the western portion of this site and is a mixed swamp conifer/hardwood encompassing a small monotypic upland hardwood stand. This site is well buffered by upland hardwoods along the northern and western borders, though they exhibit past harvesting, while the remaining borders are comprised of pine plantations and agriculture. WAP33, located in the eastern portion of the site, includes an upland hardwood forest with mixed swamp conifer/hardwoods included. Whitcomb and South Fork Creek are located here. The site has the potential to support a northern mesic forest. The neighboring area is quite fragmented while the interior is unaffected. The borders are quite fragmented by agriculture, a pine plantation and roads. Boelter Road crosses this site.

Experts identified portions of this area as significant due to the large patch of mature northern wet and northern wet mesic forest.

NEH 18: New Hope Pines

Acres: 43,672
Expert: POR14, POR15, POR17, POR19, WAP53
Coarse Filter: POR02, POR03, POR04, POR05

Experts identified sites in this area as significant due to the trout spawning and significant riparian areas. It consists of important forest communities, especially older dry-mesic pine-oak forest. This site includes New Hope Pines State Natural Area and Richard Hemp State Fishery Area. Potential threats to this site include fragmentation, development, invasives, pollution and logging.

This site is located on the western side of the Wolf River Basin. The coarse filter screening identified four smaller areas within the larger site boundary of New Hope Pines. POR02 is located on the western edge of this site and has a small area with the potential to support a northern mesic forest with hemlock inclusion. The western and eastern edges demonstrate past harvesting, while the interior remains intact with high canopy cover in the northeast. A fragmented conifer/hardwoods swampbuffer a majority, while Hwy. Z forms the south border.

POR03 is on the northern part of this site. It is a mixed swamp conifer/hardwood site with younger monotypic upland hardwood inclusion in the northwest. It has the potential to support a sedge meadow. Flume Creek bisects this site. Linden Road, access roads, and farm inclusion disrupts this site.

POR04 is in the central part of this site. It has the potential to support a northern dry-mesic forest. The conifer inclusion is greater than 50 percent. Two kettle bogs are located within the site. The interior demonstrates little disturbance, while the borders are disrupted by past harvesting and pine plantations along farmland. There is slight buffering by upland hardwoods along the north border. Sunset Lake Road and Hwy. Z cross portions of this site.

POR05 is located in the central part of New Hope Pines. It consists of upland hardwoods with conifers, comprising approximately 30 percent of the site. Sunset, Minister, Skunk, and Budberg Lakes are present. There has been past harvesting along the borders and in portions of the interior. It has the potential to support a northern mesic forest dominated by maple with hemlock inclusion. It is fragmented by a Boy Scout Camp and roads. The site is buffered along the eastern borders by upland hardwoods, with remaining areas subject to encroachment by access roads and farm inclusion. Hwy. T. and Sunset Lake Road bisect the site.

NEP01: Navarino State Wildlife Area

Acres: 17,355
Expert: SHA22, SHA29
Coarse Filter: SHA07, SHA08, WAP02

This site is located on the east-central part of the Wolf River Basin. The coarse filter screening identified three distinct areas. SHA07 is located in the northern part of Navarino State Wildlife Area and is part of a greater wetland area. It forms a shrub/deciduous wetland with the Shioc River bisecting the eastern border. Sedge meadow is present along the southern rim. There is a history of ditching and drainage in the western and eastern area. Agriculture and pine plantations encompass a majority of the site. SHA08 is located in the southern half of Navarino SWA and comprising of a shrub/hardwood wetland with the potential to support a sedge meadow along the northern border. There is an emergent wetland present throughout the interior. There is standing water throughout the area, as the West Branch and Shioc River cross the site. Portions of the site are relatively fragmented by pine plantations and farm inclusion. A Soo railroad line bisects the site. WAP02 is located along the Wolf River on the western side of Navarino SWA, and is an extensive bottomland hardwoods comprised of silver maple, swamp white oak and ash with mixed upland hardwoods. The southwestern portions demonstrate the possibility of supporting northern sedge meadow. Highway 156 crosses the site east to west.

Experts identified the area because it is a state wildlife area that is home to over 200 bird species and harbors rare plants.

NEP02: White Lake

Acres: 174
Expert: SHA23
Coarse Filter: N/A

This site is located on the east-central part of the Wolf River Basin, due east of Navarino State Wildlife Area. It was selected as an expert site because of the shallow marl lake and vegetation.

NEP03: Maine State Wildlife Area

Acres: 1,571
Expert: N/A
Coarse Filter: OUT13

This site is located in the east-central portion of the Wolf River Basin and follows the boundaries of coarse filter site OUT13. A shrub wetland encompassing sparse conifers comprises a majority of this site. The northern border includes deciduous wetland species with upland hardwood inclusion. A majority of this site is poorly buffered by farmland. The northern area indicates drainage history.

NEP04: Flynn Lake Bog

Acres: 3,471
Expert: WAP49
Coarse Filter: WAP06

This site is located in the lower central portion of the Wolf River Basin and follows the boundaries of coarse filter site WAP06. It is an extensive hardwoods complex with conifer inclusions. There are some mature upland forests included. It has the potential to support a

northern wet mesic forest in the area west of Flynn Lake. The site contains the headwaters of Maple Creek. Tank Road and a pipeline bisect the western edge. Access roads are present along the borders, following fragmented farmlands. Overall, the site demonstrates relatively little disturbance.

Experts identified a portion of the site because of the significance of the bog, tamarack forest, and spruce stands found here.

NEP05: S. Branch Wolf River

Acres: 3,283
Expert: N/A
Coarse Filter: N/A

This site was identified at the Wolf River Basin Experts Workshop as highly significant because of the presence of unique species due to the changing substrate in this section of the South Branch of the Wolf River.

NEP06: Lower Wolf River

Acres: 33,992
Expert: WAP39, WAP40, WAP41, WAP46, WAP47, WAP48, WAP65, WAP70
Coarse Filter: WAP09, WAP10, WAP11, WAP12, WAP15, WAP17, WAP18, WAP19, WAP21

The Lower Wolf River site is a conglomeration of several sites identified both by experts and through the coarse filter screening inventory, many of which overlap. Located in the lower central portion of the Wolf River basin, this stretch of the Wolf River is one of the most important ecological areas of the basin.

The coarse filter screening process identified many different sites within this area. Cedar Creek Headwaters, located in the northern part of the Lower Wolf River site, is a conifer/hardwood swamp northeast of New London. The site is comprised of shrub wetland along the base of Cedar Creek, in addition to a mixed hardwood/conifer uplands border. The site maintains a more open character. Buelong Road crosses east-west. The site demonstrates relatively little disturbance throughout the interior, while borders of this site are subjected to encroachment by farmland.

The Wolf River State Fishery Area, located in the northern part of the Lower Wolf River site, contains bottomland hardwoods following the Wolf River, dominated by silver maple, elm, ash, and swamp white oak interspersed with upland forest ridges on riverine sand terraces. There is an emergent wetland present south of Hwy. 54. Portions south of Hwy. 54 are part of Mukwa SWA. There are mature hardwoods with little apparent disturbance. A railway crosses the northernmost border. The site is divided by Hwy. 54.

The Shirttail Bend of the Mukwa State Wildlife Area contains extensive bottomland hardwoods. Monotypic, mostly younger stands border the Wolf River which are dominated by silver maple in addition to elm, ash, and swamp white oak. The central eastern portion of site offers the

potential to maintain a floodplain forest. An emergent wetland following the river shows little disturbance as compared to areas bordered by farm inclusions. In general, this site demonstrates little disturbance.

Portions of Mukwa State Wildlife Area, adjacent to Shirttail Bend and following the Wolf and Little Wolf Rivers, contain swamp hardwoods dominated by silver maple. There is a mature, good quality upland hardwood complex on ravine sand terraces with oak, aspen and oxbow wetlands. The area is well buffered with the exception of the western border, which is followed closely by agriculture and roads. Overall, this site demonstrates little disturbance.

The east-central part of the Lower Wolf River site contains a small but intact wetland complex - primarily shrub with emergent wetland/sedge meadow and some swamp conifer located in central portion of site. There is little disturbance with the exception of roads and residence positioned in western border. The site is well buffered by the Wolf River on western border, while surrounding borders are comprised of fragmented farmland with the exception of the northern edge (which is comprised of hardwoods).

Horseshoe Bayou, located in the center of the Lower Wolf River site contains extensive hardwood bottoms (mostly harvested since 1980) or younger even-aged second growth. The central areas indicate the potential to support a floodplain forest. Areas outlining Partridge Crop Lake may support a northern wet forest. There are few areas of mature forest. The site follows the path of the Wolf River with small intact wetland areas throughout. Overall this site is well buffered with little disturbance.

The west-central edge of the Lower Wolf River site includes two minor swamp conifer complexes maintaining a dense canopy, located west of Partridge Crop Lake. The swamp hardwoods and lowland shrubs outline the swamp conifers. It is poorly buffered but with little apparent disturbance. Landing Road and a farm inclusion partially separate the site.

Jenny Bayou, located in the south-central part of the Lower Wolf River site consists of an extensive sedge meadow/shrub wetland complex including swamp hardwoods in patches. The area west of Jenny Bayou may support shrub-carr. A majority of the site follows the Waupaca River, leading into Jenny Bayou on the Wolf River. There is some drainage but good restoration potential with some natural spring/creek drainages. The site is buffered by surrounding swamp hardwoods but disrupted by pipeline and a Soo line running NW-SW, River Road intersecting at the northernmost edge, and access roads.

Templeton Bayou, located in the south-central part of the Lower Wolf River site and adjacent to Jenny Bayou consists of a bottomland hardwoods/emergent wetland complex with well developed riverine sand terraces along Wolf River. The hardwoods are mostly mature with little disturbance history evident.

Fremont Station Swamp, located in the southeastern portion of the Lower Wolf River site is an emergent wetland-lowland shrub interspersed with swamp conifer complex that indicates minor drainage history. There is some upland hardwood inclusion on the borders that act as a buffer, while the Wolf River forms a western border. Disturbance is minimal with access road from a

farm forming the remaining borders. The drainage and ditching history is primarily in the central portions.

Finally, Partridge Lake and Wetlands, located in the southernmost part of the Lower Wolf River site is an emergent wetland complex with areas of swamp hardwoods bordering Partridge Lake. The west side shows a drainage and ditching history. The east side bordering the Wolf River has very little disturbance and remarkable pothole mosaics.

Experts also identified many areas within this site as significant. Numerous areas are historical or known walleye and sturgeon spawning grounds. Large wetlands serve as filters for groundwater. The entire river corridor is known to have high diversity of breeding birds, including rare species. Other rare animals and plants have been identified in this area as well. Potential threats include development, changes in vegetation, changes in water flow (volume and direction), siltation, invasive plants.

NEP07: Lower Embarrass River

Acres: 12,218
Expert: OUT21, OUT24
Coarse Filter: N/A

This site is located in the south-eastern part of the Wolf River Basin. Experts identified sites in this area as significant due to the wildlife features, including the presence of herons and egret rookeries. It has a spring waterfowl concentration and many shorebirds. Potential threats include management by the Department of Transportation and agricultural landowners.

NEP08: Hortonville Bog

Acres: 3,080
Expert: OUT30
Coarse Filter: OUT06

This site is located in the southeastern part of the Wolf River Basin and contains the Hortonville Bog State Natural Area. Portions of the site consist of swamp conifers, including tamarack, and spruce bordering more open wetland. Swamp hardwoods comprise the southern rim. This site has the potential to support an open bog in the central portions. There was some past drainage through the south-central area. Experts identified the area as significant because it harbors a number of rare plants and animals, and is an important breeding bird area.

NEP09: Mosquito Hill Nature Center

Acres: 986
Expert: OUT19, OUT32
Coarse Filter: OUT05

This site is located in the south-central portion of the Wolf River Basin. It consists of bottomland hardwoods with wetlands dispersed throughout. A majority of this site appears to support secondary growth forest along the river. The forest borders the Wolf River, acting as a landscape

buffer. The remaining area is poorly buffered from agriculture. Channeled streams adjoin the site.

Experts identified the site as significant because it includes known or historically identified walleye spawning areas. It also contains an undisturbed bottomland hardwoods and wild rice beds. Potential threats include development, changes in vegetation, invasives, and changes in water flow (volume and direction).

NEP10: Shaky Lake

Acres: 220
Expert: OUT29
Coarse Filter: OUT07

This site is located in the southeastern part of the Wolf River Basin and contains Shaky Lake State Natural Area. According to the coarse filter screening, the site consists of a swamp conifer/hardwood forest encompassing an emergent wetland area, including a sedge meadow. An additional natural community of possible significance includes a northern wet-mesic forest. Shaky Lake is positioned in center of the site. This site indicates relatively little disturbance. Experts identified the site because of the bog and the presence of rare plants and animals.

NEP11: Dale Road Woods

Acres: 358
Expert: WIN13
Coarse Filter: N/A

This site is located in the southeastern part of the Wolf River Basin and follows the boundaries of expert site WIN13. The site surrounds a tributary of the Rat River and includes wetlands that support a high diversity of songbirds.

SGP01: Wolf River State Wildlife Area

Acres: 3,921
Expert: WAP39, WIN11
Coarse Filter: WIN01

This site is located in the southeastern part of the Wolf River Basin and follows the boundaries of the coarse filter screening site WIN01. It consists of an emergent wetland with swamp hardwoods dispersed throughout. The Wolf River and Pages Slough are included in the site bordering Lake Poygan. The location of part of the larger surrounding wetland area is generally well buffered. There is little disturbance history with the exception of channels and water control structures present in the north-central portions of the site.

Experts identified two sites in this area as significant, because of significant breeding birds.

SGP02: Clark Wetlands

Acres: 780

Expert: WIN12
Coarse Filter: N/A

This site is located in the southeastern part of the Wolf River Basin and follows the boundaries of expert site WIN12. It was identified due to the presence of *Carex stricta*, *Calamagrostis canadensis*, wet meadow. It also is a yellow rail migration site. Potential threats include fragmentation, non-point source pollution from agriculture, and hydrologic disruption.

SGP03: Poygan Marsh SWA

Acres: 6,809
Expert: WSA31
Coarse Filter: WSA07, WSA08

This site is in the bottom central part of the Wolf River Basin and encompasses the Poygan Marsh State Wildlife Area. It was identified as an expert site due to its significance in breeding birds.

The coarse filter screening identified two sites. WSA07 is located in the southwest portion of the site and is an emergent wetland bordering Lake Poygan. Northern and southern regions are adjacent to agricultural land while western portions of the site adjoin a lowland deciduous forest. The site is buffered to the west by wetland. Past ditching and drainage are more prevalent in the southern portion. WSA08 is located in the northwest portion of the site and contains swamp hardwoods following the Pine River. Swamp hardwoods make up the northern and southern borders, while central portions consist of a shrub-emergent aquatic wetland. This site indicates past ditching and drainage through the entire wetland, while the hardwoods along the northern border demonstrate fewer past disturbances. It is closely bordered by agriculture and residential areas, with the exception of the eastern border that is wetland.

Appendix N.1

Natural Communities Found Within the Lower Wolf Bottomlands Natural Resources Area

Occurrences of the recognized WNHIP natural communities listed below have been documented in the Wolf River basin. The list is followed by short descriptions of each wetland and terrestrial community type as it occurs within the Lower Wolf River Bottomland Natural Resources Area (NRA).

The community descriptions also include information on the status, distribution, and significance of each within the basin. Natural communities are not provided designations for federal or state protection status (NA = not applicable).

Common Name	State Rank ¹	Global Rank ¹	Last observation
Emergent aquatic	S4	G4	2000
Emergent aquatic - wild rice	S3	G?	2000
Floodplain forest	S3	G3?	2001
Hardwood swamp	S3	G4	1999
Lake--oxbow	SU		1978
Lake--shallow, hard, drainage	SU	GU	1979
Lake--shallow, hard, seepage	SU	GU	1987
Northern dry forest	S3	G3?	1978
Northern dry-mesic forest	S3	G4	1999
Northern mesic forest	S4	G4	1999
Northern sedge meadow	S3	G4	2000
Northern wet forest	S4	G4	1983
Northern wet-mesic forest	S3S4	G3?	2001
Open bog	S4	G5	1999
Sand prairie	S2		1999
Shrub-carr	S4	G5	2000
Southern dry-mesic forest	S3	G4	1999
Southern hardwood swamp	S2	G4?	2001
Southern mesic forest	S3	G3?	2000
Southern sedge meadow	S3	G4	2001
Southern tamarack swamp (rich)	S3	G3	2000
Spring pond	S3	GU	1981
Stream--fast, hard, cold	S4	GU	1981
Tamarack (poor) swamp	S3	G4	1999
Wet prairie	SU	G3	1984

1. See Appendix Q for an explanation of the NHI ranking system.

Forest Communities:

Floodplain Forest

This is a lowland hardwood forest community that occurs along larger rivers, that flood periodically, extensive stands occur along the Wolf and Embarrass rivers within the NRA. The best development occurs along large rivers in southern Wisconsin, but this community is also found in the north. In the NRA, silver maple is the most common canopy dominant especially on the lower terraces, while swamp white oak is dominant in some stands on more elevated terraces. Frequent canopy associates include green ash, basswood and bur oak, while cottonwood, river birch and balsam poplar important species elsewhere in Wisconsin, are absent. American elm (*Ulmus americana*) a former canopy dominant or co-dominant in some stands before it's loss due to Dutch elm disease, was a frequent associate in the subcanopy and sapling layers. Prevalent or characteristic herbs of lower Wolf River system stands include Virginia wild-rye (*Elymus virginicus*), wood nettle (*Laportea canadensis*), sedges (*Carex lupulina*, *Carex muskingumensis*) cardinal flower (*Lobelia cardinalis*), fowl manna grass (*Glyceria striata*), cut-grass (*Leersia* spp.) calico aster (*Aster lateriflorus*), sensitive fern (*Onoclea sensibilis*) and in disturbed areas reed canary (*Phalaris arundinacea*). Buttonbush (*Cephalanthus occidentalis*) is a locally dominant shrub and that forms dense thickets on the margins of oxbow lakes, sloughs and ponds within the forest. Lianas such as Virginia creepers (*Parthenocissus* spp.), grapes (*Vitis* spp.), Canada moonseed (*Menispermum canadense*), and poison-ivy (*Toxicodendron radicans*) which can be quite common in this community type are relatively unimportant here.

Southern Hardwood Swamp (This community partly includes the **Southern Wet-Mesic Forest** of the Curtis classification.)

This is a deciduous forested wetland community type found in insular basins with seasonally high water tables. It is best developed in glaciated southeastern Wisconsin. Within the NRA the composition of this community varies with successional stage and level of past site disturbance. Swamp white oak, bur oak, silver maple and green ash may dominate the later successional, closed canopy sites, while earlier successional and disturbed sites often have low canopy cover and most frequently small diameter trees including cottonwood, green ash, red and silver maple. Standing dead trees may be common and these disturbed sites usually have high shrub cover of dogwood (*Cornus* spp.) willow (*Salix* spp.) prickly ash (*Xanthoxylum americanum*) and in some areas monotypic stands of the invasive exotic reed canary grass (*Phalaris arundinacea*).

Southern Tamarack Swamp (rich) (formerly called Tamarack Fen)

This forested wetland community type is a variant of the Tamarack Swamp, but occurs south of the Tension Zone within a matrix of "southern" vegetation types. . Stands in the lower wolf river basin study area, though rare, are typical in composition. Poison-sumac (*Toxicodendron vernix*) and alder (*Alnus rugosa*) are a dominant understory shrubs. Successional stages and processes are not well understood but fire, windthrow, water level fluctuations, and periodic infestations of larch sawfly are among the important dynamic forces influencing this community. Groundwater seepage influences the composition of most if not all stands. Where the substrate is especially springy, skunk cabbage (*Symplocarpus foetidus*), marsh marigold *Caltha palustris*), sedges, and a variety of mosses may carpet the forest floor. Drier, more acid areas or stands may support an ericad and sphagnum dominated

groundlayer. Important or characteristic species include sphagnum moss spp, bluejoint grass (*Calamagrotis canadensis*), (*Carex lasiocarpa*), marsh fern (*Thelypteris palustris*), (*Bidens cernua*), cinnamon and royal fern (*Osmunda cinnamomea* and *O. regalis*), red maple (*Acer rubrum*), winterberry (*Ilex verticillata*), swamp raspberry (*Rubus pubescens*) and jewelweed (*Impatiens capensis*).

Tamarack (poor) Swamp (formerly called Tamarack Swamp, this is a split from Curtis' **Northern Wet Forest**)

In the lower wolf river basin this weakly to moderately minerotrophic conifer swamp community is dominated by a densely stocked closed canopy of tamarack (*Larix laricina*) and black spruce (*Abies mariana*) and a frequently dense understory of shrubs and saplings including ericads (*Vaccinium* spp., *Gaylussacia*, and *Chamaedaphne*), regenerating tamarack and black spruce, poison sumac (*Toxicodendron vernix*) and black chokeberry (*Aronia melanocarpa*). The understory is more diverse than in Black Spruce Swamps and includes more nutrient-demanding species such as winterberry holly (*Ilex verticillata*). The bryophytes include many genera other than *Sphagnum*. In areas of spring seepage within these stands, skunk-cabbage (*Symplocarpus foetidus*) is a common understory inhabitat. These seepage stands have been separated out as a distinct type or subtype in some nearby states and provinces. The flora of this community is more northern in its overall affinities than that of the Southern Tamarack swamp. Important or characteristic in the lower wolf study area stands include *Sphagnum* spp., cotton-grass (*Eriophorum* sp), (*Carex oligosperma*) (*Smilicina trifolia*) beggar's ticks (*Bidens* spp.), crested shield fern (*Dryopteris cristata*), and paper birch (*Betula papyrifera*).

Northern Wet-mesic Forest (White Cedar Swamp)

This forested minerotrophic wetland is dominated by white cedar (*Thuja occidentalis*), and occurs on relatively nutrient rich, neutral to alkaline substrates. In the NRA stands typically occur on mucky soils with springy areas, black and green ash (*Fraxinus nigra* and *F. pennsylvanica*), tamarack (*Larix laricina*) and paper birch (*Betula papyrifera*) as the most common associates. The understory varies from sparse to rich depending upon the site condition and history. Cedar regeneration is virtually absent. Important or characteristic herb species include sedges (such as *Carex disperma*, *C. leptalea*, and *C. trisperma*), orchids (e.g., *Platanthera obtusata*, *Listera cordata*), other herbs such as goldthread (*Coptis trifolia*), fringed polygala (*Polygala pauciflora*), and naked miterwort (*Mitella nuda*), and trailing sub-shrubs such as twinflower (*Linnaea borealis*) and creeping snowberry (*Gaultheria hispidula*). A number of rare plants occur more frequently in the cedar swamps than in any other habitat. This community is currently uncommon in the study area though it is likely that some stands of disturbed hardwood swamp were formerly this type.

Hardwood Swamp (this is a split from Curtis' **Northern Wet-Mesic Forest**)

These are floristically northern deciduous forested wetlands that occur along lakes, smaller streams, or in insular basins in poorly drained morainal landscapes. This community type is rare in the NRA, where only one stand is documented. The dominant tree species in that stand is black ash (*Fraxinus nigra*), with red maple (*Acer rubrum*), paper birch (*Betula papyrifera*) and bur oak (*Quercus macrocarpa*) as associates. Standing dead trees are common. Yellow birch, and (formerly) American elm (*Ulmus americana*) may be important in other regions but were unimportant here. These stands also featured a diverse sparse to dense shrub layer of winterberry holly (*Ilex verticillata*), poison sumac (*Toxicodendron vernix*), nannyberry (*Virburnum lentago*), slender and pussy willow (*Salix petiolaris*, *S. discolor*). The herbaceous layer is sedge dominated, with tussock and bottlebrush sedge (*Carex stricta* and *C. comosa*) most prevalent. Other characteristic herbs included beggar's ticks (*Bidens frondosus*), marsh-marigold (*Caltha palustris*), swamp loosestrife (*Lysimachia thyrsiflora*), nightshade

(Solanum dulcamara), bog clearweed (Pilea fontana), American water-horehound (Lycopus americanus) and duckweed (Lemna spp.)

Northern Mesic Forest

This forest complex covered the largest acreage of any Wisconsin vegetation type prior to European settlement. Sugar maple (Acer saccharum) is dominant or co-dominant in most stands, while hemlock (Tsuga canadensis) was the second most important species, sometimes occurring in nearly pure stands with white pine (Pinus strobus). Beech (Fagus grandifolia) can be a co-dominant with sugar maple in the counties near Lake Michigan and as far west as the Wolf River basin. The groundlayer varies from sparse and species poor (especially in hemlock stands) with woodferns (especially Dryopteris intermedia), bluebead lily (Clintonia borealis), clubmosses (Lycopodium spp.), and Canada mayflower (Maianthemum canadense) prevalent, to lush and species-rich with diverse, dense spring ephemeral displays. After old-growth stands were cut, trees such as quaking and bigtoothed aspens (Populus tremuloides and P. grandidentata), white birch (Betula papyrifera), and red maple (Acer rubrum) became and still are important in many second-growth Northern Mesic Forests. Several distinct associations within this complex warrant recognition as communities, and draft abstracts of these are currently undergoing review. Within the NRA, sugar maple is the overwhelming dominant in most stands, including those that have been selectively logged or maintained as sugar bushes, while beech, hemlock, basswood, red oak and white ash are frequent associates. Yellow birch a frequent associate in more northern stands, is of very low importance here. Northern mesic forests reach their southern range limits in this area.

Northern Dry-mesic Forest

Mature stands of this type are rare in the study area. The surveyed sites invariably had a history of logging. Dominants are white and red pines (Pinus strobus and P. resinosa), mixed with red oak (Quercus rubra) and red maple (Acer rubrum). Aspen (Populus spp.), paper birch (Betula papyrifera) and other oaks (Q. macrocarpa, Q. alba, and Q. ellipsoidalis) are additional associates. The shrub layer, where well developed, includes hazelnuts (Corylus spp.), blueberries (Vaccinium spp.), huckleberry (Gaylussacia baccata) raspberries (Rubus spp.), maple-leaved viburnum (Viburnum acerifolium), witch-hazel (Hamamelis virginianum) wintergreen (Gaultheria procumbens), and partridge-berry (Mitchella repens). Dominant herbs included bracken fern (Pteridium aquilinum), wild sarsaparilla (Aralia nudicaulis), Pennsylvania sedge (Carex pensylvanica), Canada mayflower (Maianthemum canadense), starflower (Trientalis borealis) and large-leaved aster (Aster macrophyllus). Stands usually occur on sandy loams, sands or sometimes rocky soils.

Southern Dry-mesic Forest***Note: NRA example is very unrepresentative of the type**

Typically red oak (Quercus rubra) is a common dominant tree of this upland forest community type. White oak (Q. alba), basswood (Tilia americana), sugar and red maples (Acer saccharum and A. rubrum), and white ash (Fraxinus americana) are also important. The herbaceous understory flora is diverse and includes many species listed under Southern Dry Forest plus jack-in-the-pulpit (Arisaema triphyllum), enchanter's-nightshade (Circaea lutetiana), large-flowered bellwort (Uvularia grandiflora), interrupted fern (Osmunda claytoniana), lady fern (Athyrium filix-femina), tick-trefoils (Desmodium glutinosum and D. nudiflorum), and hog peanut (Amphicarpaea bracteata). To the detriment of the oaks, mesophytic tree species are becoming increasingly important under current management practices and fire suppression policies.

Southern Mesic Forest

Mature stands of this upland forest community are rare within the NRA. They occur on rich, well-drained soils in uplands, or on higher rarely flooded terraces along rivers and streams. The dominant

tree species is sugar maple (*Acer saccharum*), but basswood (*Tilia americana*) and red oak (*Quercus rubra*) may be co-dominant. Many other trees are found in these forests including ashes, beech, and members of the walnut family (Juglandaceae). On relatively undisturbed sites with high canopy closure, the understory is typically open (sometimes brushy with prickly ash where there is a past history of grazing) and may support lush continuous carpets of spring ephemerals. Characteristic herbs of stands in the NRA include spring-beauty (*Claytonia virginica*), maiden hair fern (*Adiantum pedatum*), trout-lilies (*Erythronium* spp.), toothworts (*Dentaria* spp.), bloodroot (*Sanguinaria canadensis*), wild blue phlox (*Phlox divaricata*), mayapple (*Podophyllum peltatum*), and Virginia waterleaf (*Hydrophyllum virginianum*). Though most stands noted in the Lower Wolf Basin were small and isolated, several adjoin the extensive forested floodplains of the lower Wolf and Embarrass Rivers. Past grazing and logging has affected the composition and structure of most, if not all, surveyed stands.

Shrub Communities:

Alder Thicket

These wetlands are dominated by thick growths of tall shrubs, especially speckled alder (*Alnus incana*). Among the common herbaceous species are Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), several asters (*Aster lanceolatus*, *A. puniceus*, and *A. umbellatus*), boneset (*Eupatorium perfoliatum*), rough bedstraw (*Galium asprellum*), marsh fern (*Thelypteris palustris*), arrow-leaved tearthumb (*Polygonum sagittatum*), and sensitive fern (*Onoclea sensibilis*). This type is common and widespread in northern and central Wisconsin, but also occurs in the southern part of the state. Alder thickets were not a survey priority in this study, but this community can be important for rare species such as the wood turtle (*Clemmys insculpta*) and bog bluegrass (*Poa paludigena*).

Open Bog

Open bogs are uncommon in the study area. These non-forested bogs are acidic, low nutrient, northern Wisconsin peatlands dominated by sphagnum mosses that occur in deep layers, often with pronounced hummocks and hollows. Ericaceous shrubs are important in this community and a good diversity of this group was found in the NRA stands including bog laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), labrador tea (*Ledum groenlandicum*), blueberries and cranberries (*Vaccinium oxycoccus* and *V. myrtilloides*). As with examples of this type elsewhere, stands in the study area have relatively low vascular herb diversity and are dominated by only a few species, such as few-seeded sedge (*Carex oligosperma*), and cotton-grasses (especially *Eriophorum spissum*). While vascular plant diversity is low in open bogs it includes characteristic and habitat distinctive specialists. Trees are absent or achieve very low cover values, as this community is closely related to and intergrades with Muskeg. Stands south of the tension zone are referred to as **Bog Relicts**.

Shrub-carr

Few examples of this community type of been surveyed in the study area although many are present. This type is common and widespread in southern Wisconsin and it also occurs in northern Wisconsin. Throughout its range in the state, this wetland community is dominated by tall shrubs such as red-osier dogwood (*Cornus stolonifera*), meadow-sweet (*Spiraea alba*), and various willows (e.g., *Salix discolor*, *S. bebbiana*, *S. gracilis* and *S. petiolaris*). Canada bluejoint grass (*Calamagrostis canadensis*) is often very common. Associates are similar to those found in Alder Thickets and tussock-type Sedge

Meadows In the study area only one example was surveyed and it is willow and alder dominated (Alnus rugosa, Salix discolor, and S. petiolaris), with poison sumac (Toxicodendron vernix) and bog birch (Betula pumila) also prevalent. Sedges dominate the herb layer (Carex lacustris, C. lasiocarpa and C. stricta) and bluejoint is also prevalent, cattails (Typha latifolia) and purple loosestrife (Lythrum salicaria) are common as well. On disturbed sites reed canary grass (Pharalis arundinacea) may become the dominant herb. Long period of fire suppression and hydrologic disruption have increased shrub-carr, usually at the expense of sedge meadow, wet prairie, and hardwood swamp communities.

Herbaceous Communities:

Sand Prairie (or Dry Prairie)

Native stands of this prairie community type are rare within the study area. Restored sites (where planting has augmented existing prairies or created new ones) are present but the only documented remnant example of this dry grassland community is a disturbed site supporting a mix of native prairie species and weeds. In this stand raspberry clones (*Rubus* spp.) are common, and sweetfern (*Comptonia peregrina*) is scattered throughout. The herb layer is somewhat sparse and relatively evenly distributed among bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pennsylvanica*), little and big bluestem (*Schizachyrium scoparium*, *Andropogon gerardii*), hawkweeds (*Hieracium aurantiacum* and *H. piloselloides*) field sage-wort (*Artemisia caudata*), and the weeds, smooth brome (*Bromus inermis*), sheep sorrel (*Rumex acetosella*), knapweed (*Centaurea maculosa*) and sagewort (*Artemisia absinthium*). In Wisconsin, at least some stands are barrens remnants now lacking appreciable woody cover, though extensive stands may have occurred historically on broad level terraces along the Mississippi, Wisconsin, Black, and Chippewa Rivers.

Emergent Aquatic

This community type is fairly common in the NRA, occurring in marsh, lake, and riverine habitats with permanent standing water. They are dominated by robust emergent macrophytes, in pure stands of single species or in various mixtures. The most frequent and overwhelming dominant is broad-leaved cattail (*Typha latifolia*) especially on sites disturbed by ditching and subsequent diking. Locally, on lake edges, in bayous and abandoned oxbow lakes, other species are dominant, co-dominant or prevalent including, giant reed (*Phragmites australis*), bulrushes (particularly *Scirpus fluviatilis*, and *S. validus*), common bur-reed (*Sparganium eurycarpum*), sedges (*Carex lacustris* and *C. stricta*) pickerelweed (*Pontederia cordata*), and arrowheads (*Sagittaria* spp.). Shrub and tree cover are low, though buttonbush (*Cephalanthus occidentalis*) was sometimes reported in surveyed stands.

Emergent Aquatic - Wild Rice

The NRA stands of wild rice marsh occur in abandoned oxbows of the Wolf River and in the sheltered waters of marshy lakes and estuaries. Some of these were undoubtedly planted. This community is an emergent macrophyte type, with wild rice (both *Zizania aquatica* and *Z. palustris* dominated beds are present) as the predominant species, open water areas of stands typically include submergent aquatic beds. Additional emergent associates differ between sites in the study area, and include common water-plantain (*Alisma plantago-aquatica*), arrowheads (*Sagittaria* spp.), river bulrush (*Scirpus fluviatilis*), common reed (*Phragmites australis*) and water-parsnip (*Sium suave*). The substrate usually consists of poorly consolidated, semi-organic sediments. Water fertility is low to moderate, and current is slow or absent. Wild rice beds have great cultural significance to native peoples, and are important wildlife habitats.

Northern Sedge Meadow

This open wetland community is dominated by sedges and grasses. There are several common subtypes, all of which occur in the study area: Tussock meadows, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); Broad-leaved sedge meadows, dominated by the robust sedges (*Carex lacustris* and/or *C. rostrata*); and Wire-leaved sedge meadows, dominated by woolly sedge (*Carex lasiocarpa*). Associates vary between stands in the study area and include bog panicled sedge (*Carex diandra*), marsh bellflower (*Campanula aparinoides*) the bulrushes (*Scirpus validus* and *S. cyperinus*), marsh fern (*Thelypteris palustris*) joy-pye-weed (*Eupatorium*

maculatum), tufted loosestrife (Lysimachia thyrsiflora), and manna grasses (Glyceria spp.). These meadows may intergrade with shrub-carr, alder thickets and bog communities, and while shrubs maybe present in this community their coverage is usually low, willows (Salix spp.), bog birch (Betula pumila), and meadowsweet (Spirea alba) are the most frequent species. In some disturbed areas and edges, reed canary (Phalaris arundinacea) and purple loosestrife (Lythrum salicaria) are invading these meadows. Several relatively large stands were documented within the lower Wolf Basin.

Submergent Aquatic

This herbaceous aquatic macrophyte community occurs in lakes, ponds, and rivers, and is common mostly occurring in small patches, within the NRA. Small stands have generally been treated as inclusions within other community types (particularly both emergent marsh types). Submergent macrophytes often occur in deeper water than emergents, but there is considerable overlap. Dominants include various species of pondweeds (Potamogeton spp.) along with waterweed (Elodea canadensis), slender naiad (Najas flexilis), eel-grass (Vallisneria americana), and species of water-milfoil (Myriophyllum) and bladderworts (Utricularia). In the NRA, stands are best developed in the sheltered waters of marshy lake edges and abandoned oxbows, along the main stem of the Wolf river. Beds of american lotus (Nelumbo lutea), a species that is rare in the inland waters of Wisconsin, occur in the protected waters of northern Lake Poygan.

Southern Sedge Meadow

Widespread in southern Wisconsin, this open wetland community is most typically dominated by tussock sedge (Carex stricta) and Canada bluejoint grass (Calamagrostis canadensis). Carex lanuginosa, lake sedge (Carex lacustris) and bulrushes (Scirpus spp.) may also be dominants or associates within the lower wolf basin study area. Common associates are water-horehound (Lycopus uniflorus), panicled aster (Aster simplex), blue flag (Iris virginica), Canada goldenrod (Solidago canadensis), spotted joe-pye-weed (Eupatorium maculatum), broad-leaved cat-tail (Typha latifolia), and swamp milkweed (Asclepias incarnata). Reed canary grass (Phalaris arundinacea) may be dominant in grazed and/or ditched stands. Ditched stands can succeed quickly to Shrub-Carr. In the NRA undisturbed stands are rare, as this type has been frequently impacted by ditching, draining and diking.

Wet Prairie

This is a rather heterogeneous tall grassland community that shares characteristics of prairies, Southern Sedge Meadow, Calcareous Fen and even Emergent Aquatic communities. The Wet Prairie's more wetland-like character can mean that sometimes very few true prairie species are present. Many of the stands assigned to this type by Curtis are currently classified as Wet-Mesic Prairies. The dominant graminoids are Canada bluejoint grass (Calamagrostis canadensis), cordgrass (Spartina pectinata), and prairie muhly (Muhlenbergia glomerata), plus several sedge (Carex) species including lake sedge (C. lacustris), water sedge (C. aquatilis), and woolly sedge (C. lanuginosa). Many of the herb species are shared with Wet-Mesic Prairies, but the following species are often prevalent: New England aster (Aster novae-angliae), swamp thistle (Cirsium muticum), northern bedstraw (Galium boreale), yellow stargrass (Hypoxis hirsuta), cowbane (Oxypolis rigidior), tall meadow-rue (Thalictrum dasycarpum), golden alexander (Zizia aurea), and mountain-mint (Pycnanthemum virginianum). This prairie type is very rare within the study area, and the remnant stands examined were small and somewhat degraded.

Primary Communities:

None identified to date in the Lower Wolf River Bottomlands Natural Resources Area.

Miscellaneous Cover Types:

Aspen Forest – Forests or thickets composed primarily of trembling aspen (Populus tremuloides). Aspen stands can also be composed wholly or partially of bigtooth aspen (P. grandidentata) or balsam poplar (P. balsamifera). Because this cover type can and does occur on a wide variety of sites, there are few, if any, consistent associates.

Red Pine Plantation – Monotypic stands of planted red pine (Pinus resinosa) are present, though not common in the southeastern portion of the basin. Most, though not all plantings, are on dry sites with sandy soils.

CRP Grassland – The purpose of this federal program is to provide semi-permanent cover for wildlife and achieve increased erosion control.

Reed canary grass meadow – The aggressive Eurasian genotype of this grass (Phalaris arundinacea) can dominate open wetlands, replacing or excluding native species. Heavy grazing, cultivation, siltation, and ditching are among the factors that can facilitate its spread. Formerly it was planted as forage for farm animals and for erosion control purposes.

Appendix N.2

Natural Communities Found Outside of the Lower Wolf Bottomlands Natural Resources Area

Generalized descriptions of recognized NHI natural community types present in the Wolf River Basin that are not documented within the Lower Wolf River Bottomlands Natural Resources Area (Epstein et al 2002).

Forests

Southern Dry Forest

Oaks are the dominant species in this upland forest community of dry sites. White oak (*Quercus alba*) and black oak (*Quercus velutina*) are dominant, often with admixtures of red and bur oaks (*Q. rubra* and *Q. macrocarpa*) and black cherry (*Prunus serotina*). In the well-developed shrub layer, brambles (*Rubus* spp.), gray dogwood (*Cornus racemosa*), and American hazelnut (*Corylus americana*) are common. Frequent herbaceous species are wild geranium (*Geranium maculatum*), false Solomon's-seal (*Smilacina racemosa*), hog-peanut (*Amphicarpaea bracteata*), and woodland sunflower (*Helianthus strumosus*). This community type is uncommon in the Wolf River Basin.

Northern Wet Forest

These weakly minerotrophic conifer swamps, located in the North, are dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Jack pine (*Pinus banksiana*) may be a significant canopy component in certain parts of the range of this community complex. Understories are composed mostly of sphagnum (*Sphagnum* spp.) mosses and ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Ledum groenlandicum*), and small cranberry (*Vaccinium oxycoccos*) and sedges such as (*Carex trisperma* and *C. paupercula*). The Natural Heritage Inventory has split out two entities, identified (but not strictly defined) by the two dominant species (see **Black Spruce Swamp** and **Tamarack (Poor) Swamp**). Many stands of this wetland forest type have been surveyed in the Wolf River Basin, though all but one site was last visited in the early 1980's. These older records are site based and generally lack detailed descriptive data, making their classification as this type preliminary.

Savanna/Woodlands

Oak Barrens

Black oak (*Quercus velutina*) is the dominant tree in this fire-adapted savanna community of xeric sites, but other oaks may also be present. Common understory species are lead plant (*Amorpha canescens*), black-eyed susan (*Rudbeckia hirta*), round-headed bush clover (*Lespedeza capitata*), goat's rue (*Tephrosia virginiana*), june grass (*Koeleria cristata*), little bluestem (*Schizachyrium scoparium*),

flowering spurge (*Euphorbia corollata*), frostweed (*Helianthemum canadense*), false Solomon's-seals (*Smilacina racemosa* and *S. stellata*), spiderwort (*Tradescantia ohioensis*), and lupine (*Lupinus perennis*). Distribution of this community is mostly in southwestern, central, and west central Wisconsin, it rare in the Wolf River Basin.

Pine Barrens

This savanna community is characterized by scattered jack pines (*Pinus banksiana*), or less commonly red pines (*P. resinosa*), sometimes mixed with scrubby Hill's and bur oaks (*Quercus ellipsoidalis* and *Q. macrocarpa*), interspersed with openings in which shrubs such as hazelnuts, (*Corylus* spp.) and prairie willow (*Salix humilis*) and herbs dominate. The flora often contains species characteristic of "heaths" such as blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), bearberry (*Arctostaphylos uva-ursi*), American hazelnut (*Corylus americana*), sweet fern (*Comptonia peregrina*), and sand cherry (*Prunus pensylvanica*). Also present are dry sand prairie species such as june grass (*Koeleria macrantha*), little bluestem (*Schizachyrium scoparium*), silky and sky-blue asters (*Aster sericeus* and *A. azureus*), lupine (*Lupinus perennis*), blazing-stars (*Liatris aspera* and *L. cylindracea*), and western sunflower (*Helianthus occidentalis*). Pines may be infrequent, even absent, in some stands in northern Wisconsin and elsewhere because of past logging, altered fire regimes, and an absence of seed source. Stands of this barrens community are rare in the Wolf River Basin.

Shrub communities

Muskeg

Muskegs are cold, acidic, sparsely wooded northern peatlands with **composition** similar to the Open Bogs (*Sphagnum* spp. mosses, *Carex* spp., and ericaceous shrubs), but with scattered stunted trees of black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Plant diversity is typically low, but the community is important for a number of boreal bird and butterfly species, some of which are quite specialized and not found in other communities. This community type is uncommon in the NRA. Portions of Hortonville Bog SNA have the characteristic structure and composition of this community.

Herbaceous upland communities

Dry Prairie

This grassland community occurs on dry, often loess-derived soils, usually on steep south or west facing slopes or at the summits of river bluffs with sandstone or dolomite near the surface. Short to medium-sized prairie grasses: little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), hairy grama (*B. hirsuta*), and prairie dropseed (*Sporobolus heterolepis*), are the dominants in this community. Common shrubs and forbs include lead plant (*Amorpha canescens*), silky aster (*Aster sericeus*), flowering spurge (*Euphorbia corollata*), purple prairie-clover (*Petalostemum purpureum*), cylindrical blazing-star (*Liatris cylindracea*), and gray goldenrod (*Solidago nemoralis*). Stands on gravelly knolls in the Kettle Moraine region of southeastern Wisconsin and along the St. Croix River on the Minnesota – Wisconsin border may warrant recognition, at least at the subtype level. Stands of this dry type are very rare in the Wolf River Basin.

Herbaceous wetland communities

Calcareous Fen

An open wetland found in southern Wisconsin, often underlain by a calcareous substrate, through which carbonate-rich groundwater percolates. The flora is typically diverse, with many calciphiles. Common species are several sedges (*Carex sterilis* and *C. lanuginosa*), marsh fern (*Thelypteris palustris*), shrubby cinquefoil (*Potentilla fruticosa*), shrubby St. John's-wort (*Hypericum kalmianum*), Ohio goldenrod (*Solidago ohioensis*), grass-of-parnassus (*Parnassia glauca*), twig-rush (*Cladium mariscoides*), brook lobelia (*Lobelia kalmii*), boneset (*Eupatorium perfoliatum*), swamp thistle (*Cirsium muticum*), and asters (*Aster* spp.). Some fens have significant prairie or sedge meadow components, and intergrade with those communities. Stands of this fen type are uncommon in the Wolf River Basin, and restricted to its southern half.

Coastal Plain Marsh

Sandy to peaty-mucky lakeshores, pondshores, depressions, and ditches in and around the bed of extinct glacial Lake Wisconsin may harbor assemblages of wetland species including some which are significantly disjunct from their main ranges on the Atlantic Coastal Plain. There is often a well-developed concentric zonation of vegetation. Frequent members of this community are sedges in the genera *Cyperus*, *Eleocharis*, *Fimbristylis*, *Hemicarpha*, *Rhynchospora* and *Scirpus*; rushes (*Juncus* spp.); milkworts (*Polygala cruciata* and *P. sanguinea*), toothcup (*Rotala ramosior*), meadow-beauty (*Rhexia virginica*), grass-leaved goldenrod (*Euthamia graminifolia*), hardhack (*Spiraea tomentosa*), lance-leaved violet (*Viola lanceolata*), and yellow-eyed grass (*Xyris torta*). Stands of this marsh community are rare in the Wolf River Basin.

Poor Fen

This acidic, weakly minerotrophic peatland type is similar to the Open Bog, but can be differentiated by higher pH and nutrient availability, as well as floristics. *Sphagnum* (Sphagnum spp.) mosses are common but don't typically occur in deep layers with pronounced hummocks. Floristic diversity is higher than in the Open Bog and may include white beak-rush (*Rhynchospora alba*), pitcher-plant (*Sarracenia purpurea*), sundews (*Drosera* spp.), pod grass (*Scheuchzeria palustris*), and the pink-flowered orchids (*Calopogon tuberosus*, *Pogonia ophioglossoides*, and *Arethusa bulbosa*). Common sedges are (*Carex oligosperma*, *C. limosa*, *C. lasiocarpa*, *C. chordorrhiza*), and cotton-grasses (*Eriphorum* spp.). Stands of this peatland fen community are uncommon in the Wolf River Basin.

Wet-Mesic Prairie

This herbaceous grassland community is dominated by tall grasses including big bluestem (*Andropogon gerardii*), Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), and Canada wild-rye (*Elymus canadensis*). The forb component is diverse and includes azure aster (*Aster oolentangiensis*), shooting-star (*Dodecatheon meadia*), sawtooth sunflower (*Helianthus grosseserratus*), prairie blazing-star (*Liatris pycnostachya*), prairie phlox (*Phlox pilosa*), prairie coneflower (*Ratibida pinnata*), prairie docks (*Silphium integrifolium* and *S. terebinthinaceum*), late and stiff goldenrods (*Solidago gigantea* and *S. rigida*), and culver's-root (*Veronicastrum virginicum*). Only a few tiny remnants were documented, in the extreme southern part of the basin.

Geological features/Primary communities

Bedrock Glade

These are xeric, sparsely vegetated level to sloping bedrock exposures with very thin, often discontinuous soils. The rock types vary from quartzite (Baraboo Hills, McCaslin Mountain), to basalt (lower St. Croix River valley), to granite (northeastern Wisconsin). The flora can include prairie, savanna, or barrens components, some at their northern range limits. Trees and shrubs are sparse and may include pines, oaks, and cherries. Xerophytic pteridophytes such as rusty woodsia (Woodsia ilvensis) and rock spikemoss (Selaginella rupestris) are characteristic, as are lichens and mosses. Rock glades occur along the Wolf River north of Shawano, but are rare in the Wolf River Basin.

Dry Cliff (**Exposed Cliff** of Curtis' community classification)

These dry vertical bedrock exposures occur on many different rock types, which may influence species composition. Scattered pines, oaks, or shrubs often occur. However, the most characteristic plants are often the ferns, common polypody (Polypodium vulgare) and rusty woodsia (Woodsia ilvensis), along with herbs such as columbine (Aquilegia canadensis), harebell (Campanula rotundifolia), pale corydalis (Corydalis sempervirens), juneberry (Amelanchier spp.), bush-honeysuckle (Diervilla lonicera), and rock spikemoss (Selaginella rupestris). Few stands of this community are known from the Wolf River Basin. However, cliff communities have not been targets of any recent inventory efforts in the Wolf River Basin.

Inland Beach

The beaches of inland lakes that experience enough water level fluctuation to prevent the development of a stable shoreline forest or other community may, instead support a specialized biota adapted to sandy or gravelly littoral habitats. The shorelines of such lakes (usually seepage lakes) may be subject to fluctuations of as much as several meters over a few years or decades. The alternation of high and low periods maintains populations of the beach specialists over time, including some rare species of unusual geographic affinity such as the Atlantic Coastal Plain of the eastern United States. Several important stands, with rare species documented, occur in the southwest Wolf River Basin.

Moist Cliff (**Shaded Cliff** of the Curtis community classification)

This "micro-community" occurs on shaded (by trees or the cliff itself because of aspect), moist to seeping mossy, vertical exposures of various rock types, most commonly sandstone and dolomite. Common species are columbine (Aquilegia canadensis), the fragile ferns (Cystopteris bulbifera and C. fragilis), wood ferns (Dryopteris spp.), rattlesnake-root (Prenanthes alba), and wild sarsaparilla (Aralia nudicaulis). The rare flora of these cliffs vary markedly in different parts of the state; Driftless Area cliffs might have northern monkshood (Aconitum noveboracense), those on Lake Superior, butterwort (Pinguicula vulgaris), or those in Door County, green spleenwort (Asplenium viride). Few stands of this community are known from the Wolf River Basin. However, cliff communities have not been targets of any recent inventory efforts in the Wolf River Basin.

Appendix O

Rare Vascular Plants of the Wolf River Basin

The Wisconsin Natural Heritage Inventory lists 68 rare plant species in the Wolf River Basin. Listed below, these include 8 WI Endangered species, 12 WI Threatened species, and 48 Special Concern species. There are two federally listed plants, prairie white-fringed orchid and Fassett's locoweed. Prairie white-fringed orchid is a globally imperiled (G2) species whereas Fassett's locoweed is a critically imperiled variety of a globally secure species (G5T1). Three other Wolf River plant species are considered rare or local across their range (G3, G3G4), and the remaining 61 tracked plant species are considered globally secure (G4, G5).

Many of the plants on this list are associated with wetlands and lake margins. Others grow in upland forests, and several species grow in prairies and savannas.

The vicinity of the proposed Crandon Mine holds a large proportion of the documented rare plant occurrences in the Wolf River Basin. At least 19 of the 68 rare plant *species* in the Wolf River Basin are found around Crandon. An even larger proportion of rare plant *sites* is concentrated there. This reflects the intensive botanical efforts made in that area over the last 40 years and especially in the last 8 years. Some of the rare plant sites around Crandon are on property owned by the mining company, but a great number more are on adjacent County and National forest lands.

Botanists have also paid special attention to land within the Chequamegon-Nicolet National Forest in the last 20 years. Our database shows 9 rare species in the Wolf River Basin portion of the forest. In particular, the wetlands surrounding Kohlhoff Lakes boast 5 rare species. These wetlands are partly owned by private individuals.

The Wolf River Basin portion of Menominee County has supported populations of at least 11 rare species in a wide variety of vegetative communities. Unfortunately, many of those plants grew in the vicinity of Legend Lake, which is now owned by a large number of individuals and has been developed for lake front recreation. Menominee County seems to be especially important for *Medeola virginiana*, which suffers intensive deer herbivory in most other parts of its Wisconsin range.

Plant Summaries

Each of the 68 rare plant species documented in the Wolf River Basin are listed and described below. The descriptions are listed in alphabetic order according to scientific name (written in italics) and include each species' geographic distribution, legal status in Wisconsin, and management considerations. The state and federal protection status listed in the table below and the element ranks listed with each species paragraph are defined on the first pages of the Wisconsin Natural Heritage Working List (see Appendix Q).

The dates when the species were last observed vary greatly across the list. Recently observed plant populations are more likely to be extant than those that were reported many decades ago. Nonetheless, old records often represent persisting populations that simply haven't received recent botanical attention. Recent inventory efforts have been concentrated in limited areas of the Wolf River Basin, with a focus on public lands in the southeastern portion of the basin.

Table O-1: Rare Plant Species of the Wolf River Basin

Scientific Name	Common Name	Lastobs Year	State Status	Federal Status
<i>Adlumia fungosa</i>	climbing fumitory	1963	SC	
<i>Amerorchis rotundifolia</i>	round-leaved orchis	1998	THR	
<i>Arabis missouriensis</i> var <i>deamii</i>	Deam's rockcress	1965	SC	
<i>Arethusa bulbosa</i>	swamp-pink	1995	SC	
<i>Asclepias ovalifolia</i>	dwarf milkweed	2000	THR	
<i>Asclepias purpurascens</i>	purple milkweed	1984	END	
<i>Bartonia virginica</i>	yellow screwstem	1916	SC	
<i>Botrychium mormo</i>	little goblin moonwort	2001	END	
<i>Botrychium oneidense</i>	blunt-lobe grape-fern	1994	SC	
<i>Calylophus serrulatus</i>	Yellow evening primrose	1915	SC	
<i>Calypso bulbosa</i>	fairy slipper	1994	THR	
<i>Cardamine pratensis</i> *	cuckooflower	2001	SC	
<i>Carex assiniboinensis</i>	Assiniboine sedge	2001	SC	
<i>Carex formosa</i> *	handsome sedge	2001	THR	
<i>Carex gynocrates</i> *	northern bog sedge	2000	SC	
<i>Carex sychnocephala</i>	many-headed sedge	2000	SC	
<i>Carex tenuiflora</i>	sparse-flowered sedge	2000	SC	
<i>Carex vaginata</i>	sheathed sedge	1994	SC	
<i>Ceratophyllum echinatum</i>	prickly hornwort	1982	SC	
<i>Corallorhiza odontorhiza</i>	autumn coral-root	2000	SC	
<i>Cypripedium arietinum</i>	ram's-head lady's-slipper	2001	THR	
<i>Cypripedium candidum</i>	small white lady's-slipper	1992	THR	
<i>Cypripedium parviflorum</i>	small yellow lady's-slipper	2001	SC	
<i>Cypripedium reginae</i> *	showy lady's-slipper	2000	SC	
<i>Deschampsia cespitosa</i>	Tufted hairgrass	1940	SC	
<i>Diplazium pycnocarpon</i>	glade fern	2001	SC	
<i>Elatine triandra</i>	longstem water-wort	1994	SC	
<i>Eleocharis olivacea</i>	capitate spikerush	1977	SC	
<i>Eleocharis quadrangulata</i>	squarestem spikerush	Unknown	END	
<i>Eleocharis quinqueflora</i>	few-flower spikerush	1977	SC	
<i>Eleocharis robbinsii</i>	Robbins spikerush	1982	SC	
<i>Epilobium palustre</i>	marsh willow-herb	1994	SC	
<i>Equisetum palustre</i>	marsh horsetail	1994	SC	
<i>Equisetum variegatum</i>	variegated horsetail	1994	SC	
<i>Glycyrrhiza lepidota</i>	wild licorice	1915	SC	
<i>Juncus vaseyi</i>	Vasey's rush	1916	SC	
<i>Liatris spicata</i>	marsh blazing star	2000	SC	
<i>Lithospermum latifolium</i>	American gromwell	2000	SC	
<i>Littorella americana</i>	American shore-grass	1931	SC	

Scientific Name	Common Name	Lastobs Year	State Status	Federal Status
<i>Malaxis brachypoda</i>	white adder's-mouth	2000	SC	
<i>Medeola virginiana</i> *	Indian cucumber-root	2001	SC	
<i>Minuartia dawsonensis</i>	rock stitchwort	1965	SC	
<i>Opuntia fragilis</i>	brittle prickly-pear	2000	THR	
<i>Oxytropis campestris</i> var <i>chartacea</i>	Fassett's locoweed	2000	END	LT
<i>Penstemon pallidus</i>	pale beardtongue	1965	SC	
<i>Phegopteris hexagonoptera</i> *	broad beech fern	2001	SC	
<i>Platanthera dilatata</i>	leafy white orchis	1995	SC	
<i>Platanthera flava</i> var <i>herbiola</i>	pale green orchid	1970	THR	
<i>Platanthera hookeri</i>	Hooker's orchis	1916	SC	
<i>Platanthera leucophaea</i>	prairie white-fringed orchid	2000	END	LT
<i>Platanthera orbiculata</i> *	large roundleaf orchid	1931	SC	
<i>Potamogeton confervoides</i>	algae-like pondweed	1994	THR	
<i>Psilocarya scirpoides</i>	long-beaked baldrush	2000	THR	
<i>Ranunculus gmelinii</i>	small yellow water crowfoot	1994	END	
<i>Ribes hudsonianum</i>	northern black currant	2001	SC	
<i>Scirpus torreyi</i>	Torrey's bulrush	1994	SC	
<i>Talinum rugospermum</i>	prairie fame-flower	2000	SC	
<i>Thalictrum revolutum</i>	waxleaf meadowrue	2000	SC	
<i>Trillium nivale</i>	snow trillium	2000	THR	
<i>Triglochin maritima</i> *	common bog arrow-grass	2001	SC	
<i>Utricularia purpurea</i>	purple bladderwort	1982	SC	
<i>Utricularia resupinata</i>	northeastern bladderwort	1994	SC	
<i>Vaccinium cespitosum</i>	dwarf huckleberry	1994	END	
<i>Vaccinium vitis-idaea</i> ssp <i>minus</i>	mountain cranberry	1994	END	
<i>Valeriana sitchensis</i> ssp <i>uliginosa</i>	marsh valerian	2000	THR	
<i>Verbena simplex</i>	narrow-leaved vervain	1979	SC	
<i>Viburnum cassinoides</i>	northern wild-raisin	1973	SC	
<i>Viola rostrata</i>	long-spur violet	1979	SC	

Protection Categories: **State Status:** END=endangered; THR=threatened; SC=special concern. **Federal Status:** Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened.

* there are also occurrences located within the Lower Wolf River Bottomlands Natural Resources Area inventory area

Climbing Fumitory (*Adlumia fungosa*) – Special Concern S3 G4

This delicate, sprawling vine grows from rocky substrates in forest gaps, often those left by disturbance such as fire or wind-throw. It grows in the northeastern quarter of the United States, ranging from Maine to Minnesota, and south to Tennessee and North Carolina. Of the 40 populations documented in Wisconsin, one falls within the Wolf Basin and that is a site in Menominee County that was last observed in 1963.

Conservation Concerns: Dispersal between ephemeral habitat patches.

Round-leaf Orchis (*Amerorchis rotundifolia*) – WI Threatened S1 G5

This plant ranges from Alaska to Greenland and as far south as Washington County, Wisconsin. The 14 Wisconsin populations have been found in cold, neutral bogs and coniferous forests north of the Tension Zone. One population is known to have died off,

and 4 haven't been verified in the last 20 years. In 1998, a botanist photographed round-leaf orchis on private property in Marathon County within the Wolf River Basin.

Conservation Concerns: Wetland drainage or flooding; loss of habitat due to logging and attendant loss of canopy cover and soil disturbance. Poaching by orchid fanciers.

Deam's Rockcress (*Arabis missouriensis* var. *deamii*) – Special Concern S3 G4G5QT3?Q

Across its range in Vermont, New York, Michigan, Indiana, Missouri, and Wisconsin, this herb is known from a wide range of open, well-drained habitats. In Wisconsin, Deam's rockcress typically grows in dry, sunny borders of open woods over gravel, rocks, or sand. The six sites within the Wolf River Basin are scattered through 4 counties and have not been verified for more than 20 years.

Conservation Concerns: Succession in barren habitat; trampling in the course of recreation; mining.

Swamp Pink (*Arethusa bulbosa*) – Special Concern S3 G4

This orchid has a single brilliant rose-purple flower, and is endemic to the boreal and north-temperate parts of eastern North America. It grows in deep sphagnum moss substrates in open bogs and floating mats (often around lakes), peaty acidic sedge meadows, and partial canopy gaps in coniferous swamps. Wisconsin's largest populations are along the shore of Lake Superior in areas of extensive bogs in Bayfield and Ashland counties, both along mainland and in the Apostle Islands National Lakeshore. Botanists have documented four sites, most recently in 1995, within the Wolf River Basin, including 2 in the vicinity of the proposed Crandon Mine (Hemlock Creek and Rolling Stone Wetlands) and 2 sites on the Nicolet National Forest (Windfall Lake and Kohlhoff Lakes).

Conservation Concerns: Wetland draining or flooding; poaching by orchid fanciers.

Dwarf Milkweed (*Asclepias ovalifolia*) – WI Threatened S3 G5?

This perennial flower grows in prairies and oak-pine barrens. It is endemic to the central U.S. and adjacent Canada. Dwarf milkweed is known in Wisconsin from over 50 sites in sand and oak barrens areas, mostly in the central and northwestern parts of the state. In the early 20th Century, several populations were scattered throughout the southern part of Wisconsin, but all of the southern populations appear to have died off. In the Wolf River Basin, there are two documented populations, including one near Warington Lake, in southeastern Oconto County.

Conservation Concerns: Succession and weed invasion in unmanaged barren habitats.

Purple Milkweed (*Asclepias purpurascens*) – WI Endangered S2 G4G5

This perennial flower is known from dry habitats from New Hampshire to Wisconsin and south to Oklahoma and Virginia. In Wisconsin, it almost always grows in canopy gaps in deciduous woodlands, although it is also known from prairie. The 55 known occurrences lie in the southern half of the state, and the majority of recently verified occurrences fall in the southwestern fifth of the state. Our populations tend to be very small (less than 50 plants), isolated, and vulnerable with very few protected sites. In the Wolf River Basin,

purple milkweed is only documented from a roadside prairie remnant near Wild Rose (Waushara County 1984).

Conservation Concerns: Road expansion and maintenance; loss of habitat due to succession.

Yellow Screwstem (*Bartonia virginica*) – Special Concern S3 G5

This herb of the eastern U.S. and Canada grows in seasonally wet, periodically disturbed, sandy-peaty ditches. Less common habitats include acidic sphagnum woods, poor fens, and even moist riverbanks. Botanists have documented yellow screwstem in 14 Wisconsin counties, with a profusion of recent sites in the former bed of Glacial Lake Wisconsin in the central part of the state. Within the Wolf River Basin, botanists collected yellow screwstem in Shawano and Waushara counties in the 1910's.

Conservation Concerns: Succession; conversion of habitat to cranberry bogs; seems to require specific disturbance regime.

Little Goblin Moonwort (*Botrychium mormo*) – WI Endangered S2S3 G3

This inconspicuous fern grows in deciduous forests in northern Minnesota, Wisconsin, and Michigan. With the possible exception of an unverified report in Quebec, it is unknown from anywhere else. It seems to prefer mature maple-basswood forests, although it also grows in younger stands and in stands that include some hemlock or other species. After it was discovered on the proposed Crandon Mine site, botanists devoted extraordinary efforts to finding more of the ferns at other sites. In 1994 and 1995, surveyors more than doubled the number of known *B. mormo* sites in deciduous forests. Now there are 63 documented sites, and almost all of them have been verified in the 1990s. There are 17 documented occurrences, most recently from 2001, in the Wolf River Basin, and they are strongly clustered in the vicinity of the proposed Crandon Mine. It is unclear whether this cluster and the corresponding paucity of records west of there reflect the actual abundance of *B. mormo* or rather the concentration of botanical efforts around Crandon.

Conservation Concerns: Intensive logging and attendant loss of canopy cover and soil disturbance.

Blunt-lobe Grape-fern (*Botrychium oneidense*) – Special Concern S2 G4Q

This fern grows in moist, shady, acidic woods and swamps from New Brunswick to Minnesota and south to the Smoky Mountains. Fifteen documented sites are scattered across northern Wisconsin, with 5 occurring in the Wolf River Basin. Four of those are near the proposed Crandon Mine, and one was reported in 1978 from Waupaca County, near the Trout Nace Creek State Fishery Area.

Conservation Concerns: Uncertain.

Yellow evening primrose (*Calylophus serrulatus*) – Special Concern S3 G5

This small forb grows mostly in dry prairie and plains from western Michigan, Wisconsin, and Minnesota to Alberta and south to Illinois, Arkansas, Texas, Arizona, and Chihuahua. Many of the approximately 20 records in Wisconsin are on steep bluff prairies along the Mississippi and lower St. Croix rivers and on cedar glades. The species has occasionally been found in moister prairies. The only record is from 1915 in

Waushara County, and the location information is imprecise so the occurrence might not be in the Wolf River Basin.

Conservation Concerns: Uncertain. Loss of limited habitat due to land use conversion.

Fairy Slipper (*Calypso bulbosa*) – WI Threatened S3 G5

This circumboreal orchid is common in the Pacific Northwest. In the Great Lakes region, fairy slipper lives in mature cedar and mixed-conifer swamps. Most of the 46 known Wisconsin populations have been very small, and 31 have been verified in the last 20 years. Within the Wolf River Basin, there are two populations on the Nicolet National Forest and 3 more near the proposed Crandon Mine site.

Conservation Concerns: Vulnerable to habitat changes, including water level increase or decrease; loss of habitat due to logging.

Cuckooflower (*Cardamine pratensis*) – Special Concern G5 S3

This circumboreal herb lives in calcareous marshes and swamps as far south as northern Indiana. Botanists report it from the eastern third of Wisconsin. Cuckooflower has been documented from 45 sites in Wisconsin, of which 22 have been verified in the past 20 years. As of 2001, there are 6 documented populations in the Wolf River basin, including 4 in the planning area. In 1999, Andy Clark, BER botanist, documented this flower from Shaky Lake SNA and the Mukwa and Wolf River state wildlife areas. In 1949, it was reported from a bog along what was formerly known as Beasley Lake (now called Chain o' Lakes), which has since been heavily developed.

Conservation Concerns: Wetland draining or flooding; lake shore development.

Assiniboine Sedge (*Carex assiniboinensis*) - Special Concern S3 G4G5

This distinctive stoloniferous sedge grows in rich woods, thickets, and shores from southern Manitoba to Wisconsin, Iowa, and South Dakota. In Wisconsin, it grows predominantly in floodplain forests. We have 25 documented sites, of which 20 have been verified within the last 20 years. Within the Wolf River Basin, it is known from a total of 5 locations including the Menominee Reservation and 3 sites in the vicinity of the proposed Crandon Mine.

Conservation Concerns: Loss of habitat due to intensive logging; disruption of seasonal flooding patterns.

Handsome Sedge (*Carex formosa*) – WI Threatened S2 G4

Botanists know this sedge from scattered deciduous forests of varying composition from northern New England to North Dakota. In Wisconsin, it grows in damp or wet woods and thickets of a few eastern counties, totaling about a dozen sites. There have been four populations documented in the planning area of the Wolf River Basin, with the most recent in 2001, including populations near Mukwa and Wolf River Bottoms-Lasage Unit state wildlife areas. In 1949, it was reported from Appleton, but that is downstream from the focus area of this report.

Conservation Concerns: Uncertain.

Northern Bog Sedge (*Carex gynocrates*) – Special Concern S2 G5

This circumboreal sedge ranges as far south as Pennsylvania, Michigan, Minnesota, and Utah. Northern bog sedge lives in sphagnum bogs and cedar swamps, and has been documented from about 20 sites in northern and eastern Wisconsin. Nine of those sites fall within the Wolf River Basin, including Argonne Swamp and Roberts Lake on the Nicolet National Forest, 3 spots in the vicinity of the proposed Crandon Mine site, and a cedar swamp near New London (1931). Two populations have been verified in the planning area, most recently in 2000.

Conservation Concerns: Wetland drainage or flooding; disruption of groundwater flow.

Many-headed Sedge (*Carex sychnocephala*) – Special Concern S2 G4

Scattered in a range from New York to Saskatchewan and south to Missouri, this peculiar sedge's rarity may be largely due to its ecological restriction to sandy or mucky, drying lake or river shores. In Wisconsin, botanists have reported it growing on sandy and/or marly shores of 13 lakes. Within the Wolf River Basin, there are 4 reported occurrences with the most recent in 2000.

Conservation Concerns: Lake shore development; water level stabilization; eutrophication.

Sparse-flowered Sedge (*Carex tenuiflora*) – Special Concern S3 G5

A circumboreal species that ranges as far south as Maine, New York, Michigan, and Minnesota, *C. tenuiflora* has been found at over forty Wisconsin sites, primarily in northeastern part of the state. It grows in sphagnum bogs, conifer swamps, and on peaty shores. Within the Wolf River Basin, it has been documented from 7 sites including Kohlhoff Lakes and Argonne Swamp on the Nicolet National Forest and 4 spots in the vicinity of the proposed Crandon Mine site.

Conservation Concerns: Wetland drainage or flooding.

Sheathed Sedge (*Carex vaginata*) – Special Concern S1 G5

This wide-ranging polar sedge reaches the southern extent of its range in Maine and northern New York, Michigan, Wisconsin, Minnesota, Saskatchewan, and British Columbia. Our 26 sites are concentrated in the northeastern counties and in Douglas County, and most of them have been recently verified. Its habitat consists of conifer swamps, fenny bogs, and alder thickets. Botanists documented 5 sites in the vicinity of the proposed Crandon Mine in 1994.

Conservation Concerns: Wetland draining or flooding; disruption of groundwater flow.

Prickly Hornwort (*Ceratophyllum echinatum*) – Special Concern S2 G4?

Found in quiet waters throughout much of North America, botanists are uncertain about the status of this plant. It may be truly rare or merely overlooked because of its similarity to the common coontail (*C. demersum*). Botanists have collected prickly hornwort at 21 spots in northern and central Wisconsin, and verified nine of them in the last 20 years. The only documented site within the Wolf River Basin is from 1982 at Pine Lake in Menominee County.

Conservation Concerns: Disruption of habitat as a result of recreational activities; alteration of water quality.

Autumn coral-root (*Corallorhiza odontorhiza*) – Special Concern S3 G5

Autumn coral-root ranges from Maine and Vermont south to Georgia, westward to Mississippi and through Ohio and Michigan to Wisconsin, Iowa, and Missouri. It can be found in rich deciduous woods, mostly beech-sugar maple, or in mixed hardwood forests under oaks. Occasionally, it is found in pine plantations in sandy soils. Of the 42 documented sites in Wisconsin, botanists have verified 30 in the last 20 years. Most of the sites are in southern Wisconsin. In 2000, botanists in the Wolf River Basin located a population.

Conservation Concerns: Loss of habitat due to intensive timber management; orchid poaching.

Ram's-head Lady's-slipper (*Cypripedium arietinum*) – WI Threatened S1 G3

Known from Quebec and Manitoba south to Minnesota and New York, this orchid appears rare everywhere except northern Michigan. It grows in cool places on subacid or neutral soils. Best known from old white cedar swamps, the species also grows in boreal woodlands on red clay and cedar or pine forests on sand. Of the 26 documented Wisconsin sites, botanists have verified 17 in the last 20 years. Only in Door and Vilas counties do some populations appear vigorous. In the Wolf River Basin, botanists documented ram's-head from Center Swamp (Outagamie County, 1928), Lebanon Swamp (Waupaca County, 1931), and an additional site in 2001.

Conservation Concerns: Wetland drainage or flooding; heavy logging resulting in altered or destroyed habitat; poaching by orchid fanciers.

Small White Lady's-slipper (*Cypripedium candidum*) – WI Threatened S3 G4

Rare or threatened through most of its range, this orchid grows from New York and New Jersey southward to Pennsylvania, westward through the Great Lakes states, Missouri, and Nebraska. It grows in marl bogs, fens, lake shores, wet prairies, and sedge meadows, sometimes persists while being shaded out during succession. In Wisconsin, the 77 sites are concentrated in the southeastern quarter; the Wolf River Basin is on the northern edge of the range of *C. candidum* in the state. The two known sites in the Wolf River Basin are in Winnebago County along the Oshkosh-Larsen trail.

Conservation Concerns: Succession; invasive species; wetland draining or flooding; lowered water table; poaching by orchid fanciers.

Small Yellow Lady's-slipper (*Cypripedium parviflorum*) – Special Concern S3 G5

The global distribution of this orchid is unclear due to taxonomic disagreements among the authorities. Some consider this taxon merely a variety of the more common large yellow lady's-slipper, and others elevate it to the full species status. Small yellow lady's-slipper has been reported from northern portion of the eastern U.S. in several habitats, particularly in limy areas, including tamarack swamps and woods in the southern portions of the range and white cedar swamps in the north as well as wet meadows, wet prairies, and fens. In Wisconsin, the small yellow lady's-slipper has been reported from over 70 locations, mostly in the southeast portion of state. However, 40 of these records are

historical, and their current status is unknown. Most recent records have come from cedar swamps and other limy areas in northwest Wisconsin. There are 4 known sites within the Wolf River Basin and the most recent location was documented in 2001.

Conservation Concerns: Deer herbivory; any activities that disrupt canopy or hydrologic regime; poaching by orchid fanciers.

Showy Lady's-slipper (*Cypripedium reginae*) – Special Concern S3 G4

Cypripedium reginae occurs mainly in southeastern Canada and the northeastern U.S. where it grows in semi-open calcareous swamps and fens and occasionally in open wetlands and wet woods. While it has been reported from nearly 100 sites throughout Wisconsin, about one-half of those records are historical. The most recent reports are from the northeastern part of the state. Fifteen occurrences are within the Wolf River Basin, with observation dates ranging from 1916 to 2000. The observations were made in the Nicolet National Forest, the Menominee Reservation, near the proposed Crandon mine site, and other locations. One population was reported in the planning area in 2000.

Conservation Concerns: Deer herbivory; wetland flooding or draining and other hydrologic disruptions; poaching by orchid fanciers.

Tufted hairgrass (*Deschampsia cespitosa*) – Special Concern S3 G5

Tufted hairgrass is a circumboreal species that lives in wet or boggy ground and ranges south to New Jersey, West Virginia, North Carolina, Illinois, Minnesota, and Arizona. The approximately 33 documented occurrences of this species are scattered across Wisconsin in fens, sandstone and dolomite splash pools on the Great Lakes, springs, marly bog pools, and cedar swamps. The only occurrence in the Wolf River Basin was documented in 1940 in Waushara County. The location information was imprecise so the record might not actually be within the Basin.

Conservation Concerns: Wetland flooding or draining; habitat conversion.

Glade fern (*Diplazium pycnocarpon*) – Special Concern S2 G5

This species lives in cool woods and on talus slopes from southern Quebec to Ontario and Minnesota and south to Florida and Louisiana. In Wisconsin, it is most commonly found in rich mesic deciduous forests with dolomite near the surface. Glade fern has been documented at about 18 sites in Wisconsin, and botanists have verified 9 populations in the past 20 years. In 2001, one population was verified in the Wolf River Basin.

Conservation Concerns: Loss of habitat due to land conversion or intensive timber management.

Longstem Water-wort (*Elatine triandra*) – Special Concern S1 G5

This aquatic plant grows in shallow water and shores from Wisconsin west to Alberta and south to northern Mexico. Of the 3 documented Wisconsin populations, only one, at Oak Lake (near the proposed Crandon Mine site), has been verified in the last 20 years.

Conservation Concerns: Siltation, eutrophication, and hydrologic disturbance.

Capitate Spikerush (*Eleocharis olivacea*) – Special Concern S2 G5

Known from the Great Lakes region and the Atlantic coastal plain, this plant grows on floating mats and lake shores on a variety of soil types. Of the 9 documented Wisconsin occurrences, only 1 has been verified in the last 20 years. In the Wolf River Basin, the only occurrence is a collection with an unknown date from Mud Lake Bog in Waupaca County.

Conservation Concerns: Lake shore development.

Squarestem Spikerush (*Eleocharis quadrangulata*) – WI Endangered SH G4

Growing in shallow water from Massachusetts to Florida and west to Texas and Missouri, Wisconsin lies at the northwest corner of the range of this species. No botanists have documented squarestem spikerush in Wisconsin for several decades. An article from 1939 reported it from Shawano Lake. The only two other historic populations in Adams and Walworth counties are presumed extirpated.

Conservation Concerns: Uncertain but probably altered water quality and lake shore development.

Few-flower Spikerush (*Eleocharis quinqueflora*) – Special Concern S2 G5

This plant ranges from Newfoundland, across the Great Lake region to Minnesota, and as far south as Illinois and Indiana. It grows on damp calcareous shores, ledges, and in swamps. It is known from 15 sites in the eastern half of Wisconsin. Botanists have confirmed 3 of them in the last 20 years. Two sites within the Wolf River Basin occur at Mud Lake Bog in Waupaca County (1977) and Kusel Lake in Waushara County (1935).

Conservation Concerns: Lake shore development.

Robbins Spikerush (*Eleocharis robbinsii*) – Special Concern S3 G4G5

This species ranges from along the Atlantic coast inland to the western Great Lakes. Its habitat consists of sandy-mucky shorelines and marshy bogs. It grows as an emergent aquatic plant in lakes and ponds. There are about 18 records of this species in the northwestern and east-central parts of the state. However, most of the occurrences of Robbins spikerush are from Oneida and Vilas counties. In the Wolf River Basin, one population was reported in the Menominee Reservation's Pine Lake, and another lies just east at Warington Lake.

Conservation Concerns: Lake shore development.

Marsh Willow-herb (*Epilobium palustre*) – Special Concern S2 G5

This circumboreal species ranges as far south as Pennsylvania, Wisconsin, Colorado, and Nevada. This species of low, wet ground has been reported from scattered localities throughout the state, with most occurrences in the northwest and northeast. The three known sites within the Wolf River Basin were all confirmed in 1994 near the proposed Crandon Mine site. Of the 33 Wisconsin populations, 26 have been confirmed in the last 20 years.

Conservation Concerns: Wetland drainage or flooding.

Marsh Horsetail (*Equisetum palustre*) - Special Concern S3 G5

Marsh horsetail is a circumboreal species that extends as far south as Pennsylvania, Illinois, North Dakota, and Washington. It grows in river and lake shores as well as sedge meadows and swamps. Sites are scattered around Wisconsin, with a concentration in Bayfield County. Botanists have reported 24 Wisconsin occurrences, including 7 in the last 20 years. In 1994, botanists collected it in Lincoln Cedar Swamp, near the proposed Crandon Mine site.

Conservation Concerns: Wetland flooding or draining.

Variegated Horsetail (*Equisetum variegatum*) – Special Concern S3 G5

This circumboreal species extends as far south as Pennsylvania, Illinois, Minnesota, and Colorado. Variegated horsetail grows on moist or seasonally wet open habitats along Wisconsin's eastern and northern fringe. Botanists have reported 44 Wisconsin occurrences, including 31 in last 20 years. In 1994, botanists collected the species in Hemlock Creek Hardwoods near the proposed Crandon Mine site.

Conservation Concerns: Trampling from recreational activities; lowered water table.

Wild Licorice (*Glycyrrhiza lepidota*) – Special Concern S2 G5

This flower is widespread through the western US and adjacent Canada, reaching its eastern edge in Wisconsin. It grows in moist prairies and on rocky, disturbed ground. It appears that some of Wisconsin's populations are native, and others are the result of human introduction in railroad materials. Botanists consider the one population in the Wolf River Basin from Shawano County (1915) to be introduced, and therefore not warranting protection.

Conservation Concerns: Uncertain.

Vasey's Rush (*Juncus vaseyi*) – Special Concern S3 G5?

This rush grows in wet-mesic prairies, sedge meadows, and other open, moist habitats across Canada and the northern U.S. Botanists have documented 38 occurrences in Wisconsin, of which 33 are in Douglas County. The one known occurrence within the Wolf River Basin was along a railroad between Shawano and Cecil and was last observed in 1916.

Conservation Concerns: Uncertain.

Marsh blazing star (*Liatris spicata*) – Special Concern S2S3 G5

This species occurs in wet meadows and other moist, open habitats from New York to Michigan and southeastern Wisconsin south to Florida and Louisiana. It is found occasionally west to Wyoming and New Mexico. In Wisconsin, the preferred habitat for marsh blazing star is moist, sandy calcareous prairies. Of the 34 documented occurrences in Wisconsin, 22 have been verified in the past 20 years. In Wisconsin, marsh blazing star primarily occurs in the far southeast corner of the state but there is one record along the Oshkosh-Larsen trail in Winnebago County.

Conservation Concerns: Loss of habitat due to land conversion; herbicide drift.

American gromwell (*Lithospermum latifolium*) – Special Concern S3 G4

American gromwell ranges from New York to Minnesota, south to West Virginia, Tennessee, and Missouri. Across its range, the species is generally found in dry wood and thickets. It is most commonly found in southern Wisconsin in upland hardwood forests, often with dolomite near the surface. The species has been documented 72 times, with 48 of those in the past 20 years including one site in the Wolf River Basin.

Conservation Concerns: Loss of habitat due to intensive logging or succession.

American Shore-grass (*Littorella americana*) – Special Concern S2 G5

In North America, this plant is restricted to southeastern Canada to northern New York, Minnesota, and Wisconsin. All of the known extant sites in Wisconsin of this species are in Vilas and adjacent northeast Forest counties. Also a very few other historical, occurrences have been reported from other parts of state. In the Wolf River Basin, a botanist reported *L. americana* from Shawano Lake in 1931.

Conservation Concerns: Probably very sensitive to water chemistry and clarity.

White adder's-mouth (*Malaxis brachypoda*) – Special Concern S3 G4Q

This circumboreal orchid ranges as far south as New Jersey, Pennsylvania, Illinois, Minnesota, Colorado, and California. Across its range, white adder's-mouth grows in damp woods and bogs. In Wisconsin, it has been found in neutral or calcareous conifer or black ash swamps. The species has been documented 49 times in Wisconsin, mostly in the northeast quarter, and 31 of those have been verified in the past 20 years including one in the Wolf River Basin in 2000.

Conservation concerns: Loss of habitat due to intensive timber management.

Indian cucumber-root (*Medeola virginiana*) – Special Concern S3 G5

This forest lily has yellow-green flowers and grows in rich woods from Nova Scotia to Wisconsin, and south to Virginia and northern Missouri. In Wisconsin, its distribution closely matches that of beech (*Fagus grandiflora*), which also reaches the western edge of its range in our eastern counties. In the narrow band where Indian cucumber root grows, its populations are sometimes large (scattered through miles of forest), but intense deer browse may be limiting its reproduction. Botanists have verified 21 of Wisconsin's 57 documented *Medeola* occurrences in the last 20 years. Twenty reports are from scattered points across the Wolf River Basin with 7 populations documented in the planning area boundary, most recently in 2001.

Conservation Concerns: Deer herbivory; intensive forestry management.

Rock Stitchwort (*Minuartia dawsonensis*) – Special Concern S2 G5

This forb ranges from New Foundland to Minnesota, Alaska, and British Columbia. It grows on cliffs and sandy or rocky prairies and woodlands. Historically known from 20

sites in Wisconsin south of the Tension Zone, botanists have verified 12 occurrences in the last 20 years. In 1965, a botanist collected a single specimen a few miles south of Mukwa State Wildlife Area, which is the only known site within the Wolf River Basin.

Conservation Concerns: Loss of habitat due to succession; mining.

Brittle prickly-pear (*Opuntia fragilis*) – WI Threatened S3 G4G5

Wisconsin is at the eastern limit of this range of this species, which is centered on the Great Plains and Rocky Mountains. In Wisconsin, it is found on dry sandy barrens and thin-soiled bluffs in the central sands and west-central counties. Of the 42 documented Wisconsin sites, 24 have been verified in the last 20 years. In the Wolf River Basin, botanists have documented it from 2 sites, most recently in 2000. Poppy's Rock (Waupaca County, 2000) and the Pine River Cemetery (Waushara County, 1972).

Conservation Concerns: Loss of habitat due to succession; mining; trampling associated with recreational activities; invasive species.

Fassett's Locoweed (*Oxytropis campestris* var. *chartacea*) – WI Endangered US Threatened S1 G5T1

This purple-flowered member of the pea family grows in the open sand around a few lakes in Wisconsin and nowhere else in the world. In the last 20 years, botanists have reported it from 6 lakes in central Wisconsin and 2 in Bayfield County. One of the former, Pickerel Lake, is a State Natural Area, and falls within the Wolf River Basin.

Conservation Concerns: Trampling due to recreational activities; invasion species.

Pale Beardtongue (*Penstemon pallidus*) – Special Concern S2 G5

This forb grows in dry to dry-mesic prairies and open woods from Maine to Minnesota and south to Arkansas. Historically, botanists have documented pale beardtongue from 16 spots around Wisconsin, but none of them have been verified since 1971. In 1965, a botanist collected pale beardtongue south of Pine River in Waushara County.

Conservation Concerns: Loss of habitat due to succession or destruction.

Broad beech fern (*Phegopteris hexagonoptera*) – Special Concern S2S3 G5

This fern grows in rich hardwood or mixed conifer-hardwood forests from Quebec and Maine to Ontario and Minnesota, south to northern Florida and Texas. Thirteen of the twenty known occurrences in Wisconsin have been documented since 1985, including one in the planning area in the Wolf River Basin from Outagamie County in 2001.

Conservation Concerns: Uncertain. Avoid activities that might promote erosion.

Leafy White Orchis (*Platanthera dilatata*) – Special Concern S3 G5

This orchid species ranges from Greenland and Iceland to Alaska and northeastern Asia, south to New York, Pennsylvania, Ohio, Iowa, New Mexico, and California. It grows in spring-fed bogs, fens, semi-open conifer swamps, and along shore lines. There are about 35 records of this species in Wisconsin although many of them are historical and haven't

been verified in recent years. Most of the state's occurrences are from northeast Wisconsin, including a recent report from Kohlhoff Lake on the Nicolet National Forest and a 1931 specimen from Lebanon Swamp, located just north of Mukwa State Wildlife Area.

Conservation Concerns: Wetland drainage or flooding; disruption of groundwater flow.

Pale Green Orchid (*Platanthera flava* var. *herbiola*) – WI Threatened S2 G4T4Q

This orchid ranges from Nova Scotia down to North Carolina and out to the western Great Lakes region. It is rare in many states within its range. It grows in wet acidic spots such as sandy ditches, wet prairies, alder thickets, and openings in floodplain forests. Botanists have documented it from 36 spots around Wisconsin, including 15 that have been verified in the last 20 years. In the Wolf River Basin, we have a 1970 report from private property in northeastern Waushara County.

Conservation Concerns: Uncertain.

Hooker's Orchis (*Platanthera hookeri*) – Special Concern S3 G5

This perennial flower grows in woods from Nova Scotia to Minnesota and south to Indiana and Illinois, and is most abundant near the Great Lakes. It grows mainly in coniferous woods on sandy or humus-rich soils. Of the 58 reported sites in Wisconsin, 19 have been confirmed in the last 20 years. In 1916, a botanist collected Hooker's orchis at Briarton, near the present-day Navarino Wildlife Area.

Conservation Concerns: Loss of habitat due to intensive forest management; development; poaching by orchid fanciers.

Prairie White-fringed Orchid (*Platanthera leucophaea*) – WI Endangered US Threatened S1 G2

This orchid's lacy spires of white flowers are found only in wet prairies east of the Mississippi. It has been devastated by habitat destruction, and faces more difficulty due to the sparseness of its pollinators, which are hawk moths. It is not secure anywhere in its range. Although most of its range falls south of the Wolf River Basin, it grows in 4 spots along the Oshkosh-Larsen trail in Winnebago County.

Conservation Concerns: Loss of habitat due to wetland draining and flooding, land use conversion, and succession; herbicide drift from adjacent agriculture production; pollinator loss; invasive species; poaching by orchid fanciers.

Large Roundleaf Orchid (*Platanthera orbiculata*) – Special Concern S3 G5?

This species occurs throughout Canada and much of the northern and mountainous U.S. It inhabits dry to wet conifer forests, conifer-hardwood forests, and hardwood forests and swamps. Most recent reports of the species in Wisconsin are along Lake Superior and along Lake Michigan in Door County. Inland reports are almost entirely historical. In the Wolf River Basin, reports from the early decades of the 20th Century cite two spots in the Menominee Reservation and another from Cedar Creek Bog in Waupaca County. One record from 1931 is in the planning area.

Conservation Concerns: Wetland draining or flooding; conversion from conifer to hardwood forest; intensive logging; poaching by orchid fanciers.

Algae-like Pondweed (*Potamogeton confervoides*) – WI Threatened S2 G4

Occurring in southeastern Canada and northeastern U.S., this is a submerged aquatic species of soft water lakes and ponds. It appears uncommon throughout its range. In Wisconsin, records are mostly from the northeast, although there is a historical record from Juneau County. One population at Duck Lake in Forest County falls within the Wolf River Basin and is near the proposed Crandon Mine.

Conservation Concerns: Changes to water quality or hydrology.

Long-beaked Baldrush (*Psilocarya scirpoides*) – WI Threatened S1 G4

This emergent annual grows on wet sandy soil in marshes, on the borders of sloughs and lakes, and in peaty wetlands. The core of its range is the Atlantic Coastal Plain, but it has disjunct occurrences in Michigan, Indiana and Wisconsin. In Wisconsin, botanists have reported 6 locations in the central sand counties, of which 3 fall within Wolf River Basin: Scout Lake (2000) and Mud Lake in Waushara County (1978) and Long Lake Marsh in Waupaca County (1932).

Conservation Concerns: Changes to water quality or hydrology.

Small Yellow Water Crowfoot (*Ranunculus gmelinii*) – WI Endangered S1 G5

This aquatic buttercup grows in a variety of wet habitats from central Alaska to Newfoundland and south as far as Iowa. It is rare in all of our neighboring states, and only thinly scattered through northern Wisconsin, with a concentration of sites in northern Douglas County. In 1994, botanists reported small yellow water crowfoot growing in a stream near the proposed Crandon mine site.

Conservation Concerns: Hydrologic disturbances; disturbances associated with recreational activities.

Northern Black Currant (*Ribes hudsonianum*) – Special Concern S3 G5

This shrub grows in seepy spots within calcareous swamps. Known throughout Canada, it ranges to the northern parts of the western U.S. and the western Great Lakes region as far south as Iowa. Our records indicate that northern black currant is uncommon but widely distributed in northern Wisconsin. 47 of the 63 documented occurrences have been confirmed in the last 20 years. There are eleven reports from the Wolf River Basin, with clusters in the Nicolet National Forest and the area around the proposed Crandon Mine.

Conservation Concerns: Wetland flooding or drainage; cutting white cedar resulting in loss of habitat.

Torrey's Bulrush (*Scirpus torreyi*) – Special Concern S2S3 G5?

This emergent plant forms colonies in quiet, shallow water from New Brunswick to Manitoba and south as far as Virginia and Missouri, leaving Wisconsin near the center of its range. In addition to the rarity of Torrey's bulrush in Wisconsin, it is also rare in Michigan, Indiana, Illinois, and Minnesota. Of the 24 Wisconsin occurrences, 6 have been confirmed in the last 20 years. Half of those are on Little Sand Lake in the Crandon Mine project area.

Conservation Concerns: Hydrologic changes; shoreline development.

Prairie Fame-flower (*Talinum rugospermum*) – Special Concern S3 G3G4

Prairie fame-flower is restricted to the central U.S., ranging from northwest Indiana, to Minnesota, Nebraska, and Kansas. In Wisconsin it is found scattered throughout the western and southern parts of the state in sand barrens, dry prairies, and dry oak woodlands. Wisconsin might have the largest number of populations in the world, with a total of 51 sites, all but 2 confirmed recently. There is one 2000 record from the Wolf River Basin.

Conservation concerns: May require periodic disturbance (it is often found in very old sandy road ruts), but cannot survive repeated, frequent trampling or vehicle traffic; vulnerable to fire suppression and succession due to high requirements for sun.

Waxleaf Meadowrue (*Thalictrum revolutum*) – Special Concern S2 G5

This odorous herb grows from Ontario to Wisconsin and south to Florida. Wisconsin botanists have found it in wet prairies and sedge meadows. Of the 26 Wisconsin occurrences, 8 have been confirmed in the last 20 years. There have been 4 collections, all from Winnebago County, from the Wolf River Basin.

Conservation Concerns: Wetland flooding or drainage.

Common Bog Arrow-grass (*Triglochin maritima*) – Special Concern S3 G5

This circumboreal species occurs south into the northeastern U.S. into our region where it is found in fens, marshes and bogs. Many of the sites occur in southeast Wisconsin and are protected on fens. However, roughly 50% of these occurrences are based on historical records. Farther north in the state, the species occurs along Lake Michigan and Lake Superior and inland in the northeast. There are 4 known occurrences in the Wolf River Basin, including the one occurrence within the planning area, found at Kohlhoff Lake in the Nicolet National Forest in 2000.

Conservation Concerns: Wetland flooding or drainage; altering groundwater hydrology

Snow Trillium (*Trillium nivale*) WI Threatened S3 G4

Snow trillium grows in rich moist forests from western Pennsylvania and West Virginia to Minnesota, southern South Dakota, western Nebraska, and Missouri. It is one of the earliest blooming plants, often flowering in early April. In Wisconsin, there have been 48 documented occurrences of which 34 have been verified in the past 20 years. Most of the populations are in the west-central and eastern 2 tiers of the state. There was one population documented in 2000 in the Wolf River Basin.

Conservation Concerns: Loss of habitat due to intensive forest management; herbivory from deer; poaching by spring wildflower fanciers.

Purple Bladderwort (*Utricularia purpurea*) – Special Concern S3 G5

This submerged aquatic plant occurs in southeast Canada and the eastern U.S. in soft water lakes and ponds. In Wisconsin, it has been collected about 25 times, mostly in the

northern part of the state with a concentration in the lake district around Northern Highland–American Legion State Forest. In the 1980s, botanists documented one population in Menominee County and another in Oconto County.

Conservation Concerns: Shoreline development and associated loss of habitat; disruption of hydrology; alteration of water quality.

Northeastern Bladderwort (*Utricularia resupinata*) – Special Concern S3 G4

Utricularia resupinata is found in southeastern Canada and the eastern U.S. It inhabits the edges of lakes and ponds where its stems grow just beneath the surface of the water in muddy, sandy substrate at or near the shoreline. Occurrences are scattered across Wisconsin's northern counties with a concentration in the lake district around Northern Highland–American Legion State Forest. Of the four occurrences in the Wolf River Basin, 2 are in the Crandon area, one site is in a vacation home area on the Menominee Reservation, and the last is in Oconto County.

Conservation Concerns: Shoreline development and associated loss of habitat; disruption of hydrology; alteration of water quality.

Dwarf Huckleberry (*Vaccinium cespitosum*) – WI Endangered S1 G5

This shrub grows across the boreal regions of North America, reaching as far south as the Colorado Rockies and, historically, Wisconsin Dells. Of the 11 known Wisconsin sites, 6 have been confirmed in the last 20 years. Botanists surveying the Crandon Mine project area found a population on private land in 1994.

Conservation Concerns: Loss of habitat due to succession in unmanaged barren habitats.

Mountain Cranberry (*Vaccinium vitis-idaea* ssp. *minus*) – WI Endangered S1 G5T5

Botanists have found this circumboreal shrub only a few times in Wisconsin. In the last 20 years, only 3 sites have been verified, one of them in the Wolf River Basin. In 1994, botanists surveying the Crandon Mine project area found a substantial population at a wetland along Swamp Creek.

Conservation Concerns: Wetland flooding or draining.

Marsh Valerian (*Valeriana sitchensis* ssp. *uliginosa*) – WI Threatened S1 4G5T4

This herb grows in calcareous wetlands, especially in fens and openings in cedar swamps. Ranging from northern New England and Ontario to the upper Midwest, Wisconsin marks its western extent. Of the 19 documented Wisconsin occurrences, 15 have been verified in the last 20 years. There are 5 records from the Wolf River Basin, including two recently recorded populations the Crandon Mine project area in addition to 2 older reports from Waupaca and Outagamie counties.

Conservation Concerns: Wetland flooding or draining.

Narrow-leaved Vervain (*Verbena simplex*) – Special Concern S1 G5

Narrow-leaved vervain is a species of dry soils of woods, fields, rocky places, and roadsides ranging from Ontario, Vermont, and Massachusetts to Minnesota and south to Florida and Texas. Of the 8 documented populations in Wisconsin, only 2 have been

verified in the past 20 years. Most of the occurrences have been in the southern half of the state. There is one 1979 record from Winnebago County in the Wolf River Basin.

Conservation concerns: Uncertain

Northern Wild-raisin (*Viburnum cassinoides*) – Special Concern S2 G5

Northern wild-raisin grows in swampy or sandy soil from Newfoundland to Manitoba and south along the Appalachian Mountains to Alabama. This shrub is at the western edge of its natural range in eastern Wisconsin. The state has only 5 locations, and none of them have been verified since 1976. In the Wolf River Basin an occurrence at Tranquil Wetland in Waupaca County was documented in 1973.

Conservation Concerns: Uncertain.

Long-spur Violet (*Viola rostrata*) - Special Concern S2 G5

This herb grows in rich, mesic woods from Quebec south to Georgia and west as far as central Wisconsin. Here, it seems closely allied with beech trees. A 1973 collection from a pasture near Kinney Lake in Waupaca County is the only current Wisconsin population off of the Door Peninsula. There are 26 other known occurrences in Wisconsin, 13 of them verified in the last 20 years.

Conservation Concerns: Logging might dry or reduce important humus layer.

Appendix P

Rare Animals of the Wolf River Basin

The Wisconsin Natural Heritage Inventory lists 178 rare animals in the Wolf River Basin. These include nine WI Endangered species, 20 WI Threatened species, and 149 Special Concern species. Only one animal, a land snail (*Catinella gelida*) is considered imperiled globally (G2), although another 15 Wolf River basin species are considered rare or local throughout their range (G3). The remaining rare species are considered secure (G4-G5) or global status is unknown. From the perspective of the state of Wisconsin, 18 species from the basin are critically imperiled (S1), 74 species are imperiled (S2), 71 species are rare or uncommon (S3). The remaining 15 species are either secure (S4), of unknown status (SU) or extirpated (SX), but are tracked at some level by NHI.

Aquatic habitats are considered critical for 51 percent of the rare species found in the basin. Other important habitats for rare species in the basin are wetlands, harboring 17 percent of the taxa, northern forests with 14 percent, pine/oak barrens with 9 percent, southern forests with 7 percent, grasslands with 6 percent and oak savanna with 2 percent.

As a result of inventory work conducted in the 1999-2000 field seasons and subsequent literature review, a number of invertebrates were added to the NHI Working List. Most of these were aquatic insects.

Inventory coverage in the basin has been uneven in terms of species or species groups covered, chronology and geography. For example, as with rare vascular plants, an enormous amount of survey work was conducted in the vicinity of the proposed Crandon mine, but comparable work has not been basin-wide. The Lower Wolf River and several major tributaries have been systematically sampled for mussels, fish and aquatic insects, but other portions of the basin and other aquatic habitats have not. The efforts of the NHI in the 1999 field season were concentrated in the lower Wolf River Basin and on state properties and were basin wide in 2000. The upshot is that care need to be taken in generalizing about distribution patterns of rare species in the basin (as well as the state).

With consideration of the above, some patterns of rare species occurrences do seem apparent. Several species like the bald eagle, osprey, northern goshawk, etc. are largely confined to the continuously forested northern part of the basin. Many species are strongly associated with the Wolf River corridor. Many of these are restricted to the northern or southern portions of the basin.

Animal Summaries

This appendix lists each of the rare animal species known to occur within the Wolf River basin and provides information on conservation status and species management. For each of the animals, the state and federal protection status is listed in the table below and the element rank (denoting its rarity in Wisconsin and throughout its range) is listed with each species paragraph. The status and ranking codes are defined on the first pages of the Wisconsin Natural Heritage Working List (see Appendix Q).

Table P-1: Rare Animal Species of the Wolf River Basin

Scientific Name	Common name	Last obs Year	State Status	Federal Status
<i>Accipiter gentilis</i>	Northern goshawk	2000	SC/M	
<i>Acipenser fulvescens</i>	Lake sturgeon	2001	SC/H	
<i>Acris crepitans blanchardi</i>	Blanchard's cricket frog	1991	END	
<i>Aeshna tuberculifera</i>	Black-tipped damer	2000	SC/N	
<i>Aeshna verticalis</i>	Green-striped damer	1985	SC/N	
<i>Agabetes acuductus</i>	A hydrophilid beetle	2000	SC/N	
<i>Agabus bicolor</i>	A predaceous diving beetle	1999	SC/N	
<i>Agabus inscriptus</i>	A predaceous diving beetle	1999	SC/N	
<i>Agabus wasastjerna</i>	Predaceous diving beetle	2000	SC/N	
<i>Alasmidonta marginata</i>	Elktoe	1995	SC/H	
<i>Alasmidonta viridis</i>	Slippershell mussel	1991	THR	
<i>Ammodramus henslowii</i>	Henslow's sparrow	2000	THR	
<i>Aphredoderus sayanus</i>	Pirate perch	1970	SC/N	
<i>Ardea herodias</i>	Great blue heron	2001	SC/M	
<i>Baetisca obesa</i>	A mayfly	1999	SC/N	
<i>Boloria eunomia</i>	Bog fritillary	2000	SC/N	
<i>Botaurus lentiginosus</i>	American bittern	2001	SC/M	
<i>Brachycercus prudens</i>	A caenid mayfly	1999	SC/N	
<i>Buteo lineatus</i>	Red-shouldered hawk	2000	THR	
<i>Callophrys henrici</i>	Henry's elfin	1990	SC/N	
<i>Catinella gelida</i>	A land snail	1997	SC/N	
<i>Celina hubbelli</i>	A predaceous diving beetle	1999	SC/N	
<i>Chlidonias niger</i>	Black tern	2001	SC/M	
<i>Chlosyne gorgone</i>	Gorgone checker spot	2000	SC/N	
<i>Cicindela lepida</i>	Little white tiger beetle	2000	SC/N	
<i>Cicindela patruela huberi</i>	A tiger beetle	2000	SC/N	
<i>Cicindela patruela patruela</i>	A tiger beetle	2000	SC/N	
<i>Cionella morseana</i>	Appalachian pillar	1997	SC/N	
<i>Circus cyaneus</i>	Northern harrier	2001	SC/M	
<i>Clemmys insculpta</i>	Wood turtle	2000	THR	
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	1984	SC/M	
<i>Copelatus glyphicus</i>	Predaceous diving beetle	2000	SC/N	
<i>Coturnicops noveboracensis</i>	Yellow rail	1994	THR	
<i>Cymbiodyta acuminata</i>	A water scavenger beetle	1999	SC/N	
<i>Cymbiodyta minima</i>	A water scavenging beetle	1999	SC/N	
<i>Dendroica cerulea</i>	Cerulean warbler	2000	THR	
<i>Diadophis punctatus edwardsii</i>	Northern ringneck snake	1998	SC/H	
<i>Dubiraphia bivittata</i>	A dubiraphia riffle beetle	2000	SC/N	
<i>Empidonax vireescens</i>	Acadian flycatcher	2000	THR	
<i>Emydoidea blandingii</i>	Blanding's turtle	2001	THR	
<i>Enallagma anna</i>	River bluet	1986	SC/N	
<i>Enallagma traviatum</i>	Slender bluet	2000	SC/N	
<i>Enochrus consortus</i>	A water scavenging beetle	2000	SC/N	
<i>Enochrus perplexus</i>	A water scavenger beetle	2000	SC/N	
<i>Enochrus sayi</i>	A water scavenging beetle	1999	SC/N	
<i>Epioblasma triquetra</i>	Snuffbox	2001	END	
<i>Erimyzon oblongus</i>	Creek chubsucker	UNK	SC/N	
<i>Erimyzon sucetta</i>	Lake chubsucker	1981	SC/N	
<i>Erynnis lucilius</i>	Columbine dusky wing	1991	SC/N	
<i>Erynnis persius</i>	Persius dusky wing	1994	SC/N	
<i>Etheostoma clarum</i>	Western sand darter	2001	SC/N	
<i>Etheostoma microperca</i>	Least darter	1979	SC/N	
<i>Euphyes bimacula</i>	Two-spotted skipper	1994	SC/N	
<i>Euphyes dion</i>	Dion skipper	2000	SC/N	
<i>Falcipecten canadensis</i>	Spruce grouse	1989	THR	
<i>Fundulus diaphanus</i>	Banded killifish	1995	SC/N	
<i>Gallinula chloropus</i>	Common moorhen	2001	SC/M	

Scientific Name	Common name	Last obs Year	State Status	Federal Status
<i>Glyphyalinia rhoadsi</i>	Sculpted glyph	1997	SC/N	
<i>Gomphurus externus</i>	Plains clubtail	1999	SC/N	
<i>Gomphurus lineatifrons</i>	Splendid clubtail	2000	SC/N	
<i>Gomphurus ventricosus</i>	Skillet clubtail	1999	SC/N	
<i>Gomphus viridifrons</i>	Green-faced clubtail	1999	SC/N	
<i>Graphoderus manitobensis</i>	A predaceous diving beetle	1999	SC/N	
<i>Gyrinus impressicollis</i>	A whirlygig beetle	2000	SC/N	
<i>Haliaeetus leucocephalus</i>	Bald eagle	1992	SC/FL	LT,PD
<i>Haliphus canadensis</i>	A crawling water beetle	1999	SC/N	
<i>Haliphus leopardus</i>	A crawling water beetle	2000	SC/N	
<i>Haliphus pantherinus</i>	A crawling water beetle	2000	SC/N	
<i>Hebrus buenoi</i>	A velvet waterbug	2000	SC/N	
<i>Hebrus burmeisteri</i>	A velvet waterbug	1999	SC/N	
<i>Helocombus bifidus</i>	A water scavenging beetle	1999	SC/N	
<i>Hemidactylum scutatatum</i>	Four-toed salamander	2000	SC/H	
<i>Hemileuca sp 3</i>	Midwestern fen buckmoth	1974	SC/N	
<i>Hesperia comma</i>	Laurentian skipper	2000	SC/N	
<i>Hesperia leonardus leonardus</i>	Leonard's skipper	2000	SC/N	
<i>Hesperocorixa semilucida</i>	A water boatman	2000	SC/N	
<i>Hetaerina titia</i>	Dark rubyspot	1999	SC/N	
<i>Hydrobius melaenum</i>	A water scavenging beetle	2000	SC/N	
<i>Hydrochara leechi</i>	A water scavenger beetle	1999	SC/N	
<i>Hydrochara spangleri</i>	A water scavenger beetle	2000	SC/N	
<i>Hydrometra martini</i>	A water measurer	2000	SC/N	
<i>Hydroporus badiellus</i>	A predaceous diving beetle	1999	SC/N	
<i>Hydroporus vittatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Hydropsyche bidens</i>	A caddisfly	1999	SC/N	
<i>Ilybius discedens</i>	A predaceous diving beetle	1999	SC/N	
<i>Ilybius ignarus</i>	Diving beetle	2000	SC/N	
<i>Ilybius incarinatus</i>	A predacious diving beetle	2000	SC/N	
<i>Isoperla bilineata</i>	A perlid stonefly	1999	SC/N	
<i>Isoperla lata</i>	A perlid stonefly	1996	SC/N	
<i>Isoperla marlynia</i>	A perlid stonefly	1999	SC/N	
<i>Isoperla richardsoni</i>	A perlid stonefly	1999	SC/N	
<i>Ixobrychus exilis</i>	Least bittern	2000	SC/M	
<i>Laccobius agilis</i>	A water scavenging beetle	2000	SC/N	
<i>Laccobius reflexipennis</i>	A predaceous beetle	2000	SC/N	
<i>Lepomis megalotis</i>	Longear sunfish	1979	THR	
<i>Lestes inaequalis</i>	Elegant spreadwing	2000	SC/N	
<i>Lestes vigilax</i>	Swamp spreadwing	2000	SC/N	
<i>Liodessus cantralli</i>	Cantrall's bog beetle	1999	SC/N	
<i>Liodessus flavicollis</i>	A predacious diving beetle	2000	SC/N	
<i>Lioporeus triangularis</i>	A predaceous diving beetle	1999	SC/N	
<i>Luxilus chrysocephalus</i>	Striped shiner	UNK	END	
<i>Lycaeides idas nabokovi</i>	Northern blue butterfly	1994	END	
<i>Lycaeides melissa samuelis</i>	Karner blue butterfly	2001	SC/FL	LE
<i>Lycaena dorcas</i>	Dorcas copper	2000	SC/N	
<i>Lycaena epixanthe</i>	Bog copper	2001	SC/N	
<i>Lythrurus umbratilis</i>	Redfin shiner	1979	THR	
<i>Macrochilo bivittata</i>	An owlet moth	1994	SC/N	
<i>Macrhybopsis aestivalis</i>	Shoal chub	2000	THR	
<i>Matus bicarinatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	1984	SC/M	
<i>Meropleon ambifuscum</i>	Newman's brocade	1994	SC/N	
<i>Microtus ochrogaster</i>	Prairie vole	1898	SC/N	
<i>Moxostoma carinatum</i>	River redhorse	2000	THR	
<i>Moxostoma valenciennesi</i>	Greater redhorse	2000	THR	
<i>Nannothemis bella</i>	Elfin skimmer	1990	SC/N	
<i>Napaeozapus insignis</i>	Woodland jumping mouse	1995	SC/N	
<i>Neoscutopterus hornii</i>	A predaceous diving beetle	1999	SC/N	

Scientific Name	Common name	Last obs Year	State Status	Federal Status
<i>Nepa apiculata</i>	A water scorpion	2000	SC/N	
<i>Neurocordulia yamaskanensis</i>	Stygian shadowfly	1999	SC/N	
<i>Notropis anogenus</i>	Pugnose shiner	1979	THR	
<i>Notropis texanus</i>	Weed shiner	2001	SC/N	
<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	1984	THR	
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	2001	SC/M	
<i>Oeneis jutta</i>	Jutta arctic	2000	SC/N	
<i>Ophiogomphus carolus</i>	Riffle snaketail	2000	SC/N	
<i>Ophiogomphus howei</i>	Pygmy snaketail	1999	THR	
<i>Ophisaurus attenuatus</i>	Western slender glass lizard	1989	END	
<i>Opsopoeodus emiliae</i>	Pugnose minnow	2000	SC/N	
<i>Palaemonetes kadiakensis</i>	Mississippi grass shrimp	2001	SC/N	
<i>Pandion haliaetus</i>	Osprey	2001	THR	
<i>Paracloeodes minutus</i>	A small minnow mayfly	1992	SC/N	
<i>Parametelus chelififer</i>	A primitive minnow mayfly	1993	SC/N	
<i>Pelocoris femorata</i>	A creeping water bug	1999	SC/N	
<i>Pentagenia vittigera</i>	An ephemerid mayfly	1992	SC/N	
<i>Perisoreus canadensis</i>	Gray jay	1994	SC/M	
<i>Phyciodes batesii</i>	Tawny crescent spot	2000	SC/N	
<i>Picoides arcticus</i>	Black-backed woodpecker	1994	SC/M	
<i>Pieris virginiana</i>	West virginia white	1995	SC/N	
<i>Plauditus cestus</i>	A small minnow mayfly	2000	SC/N	
<i>Plebejus saepiolus</i>	Greenish blue	1994	SC/N	
<i>Pleurobema sintoxia</i>	Round pigtoe	1997	SC/H	
<i>Poanes massasoit</i>	Mulberry wing	2000	SC/N	
<i>Poanes viator</i>	Broad-winged skipper	2000	SC/N	
<i>Pompeius verna</i>	Little glassy wing	1991	SC/N	
<i>Procambarus acutus</i>	White river crawfish	2000	SC/N	
<i>Protonotaria citrea</i>	Prothonotary warbler	2000	SC/M	
<i>Pseudiron centralis</i>	A heptageniid mayfly	1999	SC/N	
<i>Rallus elegans</i>	King rail	2000	SC/M	
<i>Rana catesbeiana</i>	Bullfrog	1986	SC/H	
<i>Ranatra nigra</i>	A water scorpion	2000	SC/N	
<i>Reithrodontomys megalotis</i>	Western harvest mouse	1976	SC/N	
<i>Rhantus sinuatus</i>	A predaceous diving beetle	2000	SC/N	
<i>Satyrodes eurydice fumosa</i>	Smokey eyed brown	1994	SC/N	
<i>Schinia bina</i>	Bina flower moth	1996	SC/N	
<i>Schinia indiana</i>	Phlox moth	1992	END	
<i>Simpsonaias ambigua</i>	Salamander mussel	1992	THR	
<i>Somatochlora forcipata</i>	Forcipate emerald	2000	SC/N	
<i>Somatochlora incurvata</i>	Warpaint emerald	2000	END	
<i>Sorex arcticus</i>	Arctic shrew	2000	SC/N	
<i>Sorex hoyi</i>	Pigmy shrew	1995	SC/N	
<i>Sorex palustris</i>	Water shrew	1995	SC/N	
<i>Sperchopsis tessellatus</i>	A water scavenging beetle	2000	SC/N	
<i>Spermophilus franklinii</i>	Franklin's ground squirrel	1990	SC/N	
<i>Spharagemon marmorata</i>	Northern marbled locust	1999	SC/N	
<i>Stenelmis antennalis</i>	A riffle beetle	1999	SC/N	
<i>Stenelmis bicarinata</i>	A riffle beetle	1999	SC/N	
<i>Stenelmis fuscata</i>	A riffle beetle	1999	SC/N	
<i>Sterna forsteri</i>	Forster's tern	2000	END	
<i>Strix nebulosa</i>	Great gray owl	1995	SC/M	
<i>Stylogomphus albistylus</i>	Least clubtail	1994	SC/N	
<i>Stylurus notatus</i>	Elusive clubtail	2000	SC/N	
<i>Stylurus scudderii</i>	Zebra clubtail	1999	SC/N	
<i>Trachyrhachys kiowa</i>	Ash-brown grasshopper	1999	SC/N	
<i>Triaenodes nox</i>	A caddisfly	2000	SC/N	
<i>Trimerotropis maritima</i>	Seaside grasshopper	1999	SC/N	
<i>Tritogonia verrucosa</i>	Buckhorn	1995	THR	
<i>Tyto alba</i>	Barn owl	1981	END	

Scientific Name	Common name	Last obs Year	State Status	Federal Status
<i>Wormaldia moesta</i>	A caddisfly	1980	SC/N	

Aquatic Invertebrates

black-tipped darner (*Aeshna tuberculifera*) - Special Concern, S3

Brief Description: A large deep blue dragonfly with abdominal segment 10 black.

Distribution: Canada, north-central and northeastern U.S.

Habitat: Larvae are in shallow densely vegetated ponds, including acid bog ponds, peaty acidic lakes, possibly streams. Adults range widely in adjacent areas.

State Records: Adults have been collected rarely but widely in northern and central to south central WI. Factors limiting distribution in WI are not known.

Wolf River Basin Records: 2 records from 2000 and 1985.

Conservation Concerns: Fish stocking, shoreline modifications water quality degradation, water level alterations.

green-striped darner (*Aeshna verticalis*) - Special Concern, S3

Brief Description: A large clear winged dragonfly with bright blue and gray markings.

Distribution: Northeastern to midwestern U.S. and southern Canada.

Habitat: Larvae in wetlands with shallow or very limited water and occasionally in cattail marshes. Adults range widely in surrounding areas.

State Records: Widely scattered from northwest to southeast part of the state with no records in the southwest.

Wolf River Basin Records: 1 record from 1985.

Conservation Concerns: Wetland alterations.

a predaceous diving beetle (*Agabetes acuductus*) - Special Concern, S2S3

Brief Description: A medium-sized (7 mm) reddish brown aquatic beetle with numerous short, deep scratches on its back.

Distribution: Ranges from southern Quebec and southern Ontario south to Florida and west to Wisconsin.

Habitat: Shaded, deciduous woodland pools, found amongst dense leaf litter, and river sloughs.

State Records: Newly added to working list, known from 12 counties throughout the state.

Wolf River Basin Records: 3 county records in study area. One new in 2000.

Conservation Concerns: Unknown.

a predaceous diving beetle (*Agabus bicolor*) - Special Concern, S3

Brief Description: A medium-sized (8 mm), black, streamlined aquatic beetle.

Distribution: Across Canada, WI, Upper Peninsula of MI, and Northeastern U.S. Fairly common in northern third of WI, but rare elsewhere in the state.

Habitat: Most found with Sphagnum in black spruce – tamarack swamps. Few in sedge – cattail marshes and shallow ponds.

State Records: Burnett to Marinette Counties; only 3 collection records for the remainder of the state scattered from Shawano, Chippewa, and Washington counties.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations.

a predaceous diving beetle (*Agabus inscriptus*) - Special Concern, S2S3

Brief Description: A medium-sized (6.5 mm), black, streamlined aquatic beetle.

Distribution: Across Canada, Great Lakes states, also MT and CO. Rare to uncommon statewide.

Habitat: Most found with in stillwater habitats usually containing Sphagnum.

State Records: Fifteen sites statewide.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations.

a predaceous diving beetle (*Agabus wasastjernae*) - Special Concern, S2?

Brief Description: A medium-sized (6.5 mm), black, streamlined aquatic beetle.

Distribution: Across Canada, WI, Upper Peninsula of MI, and Maine. Found only in northern WI.

Habitat: Small sphagnum ringed pools, usually in, or adjacent to, forest.

State Records: Newly added to the working list, 6 county records documented in the state.

Wolf River Basin Records: Only one record occurs in the study area.

Conservation Concerns: Unknown.

elktoe (*Alasmidonta marginata*) - Special Concern, S4

Brief Description: A freshwater mussel with fragile, inflated, and quadrate shaped shell. Shell color is yellowish-brown with numerous broad green rays speckled with dark green dots. Length to 4 inches (10.2cm).

Distribution: In the U.S. it is distributed in the Ohio-Mississippi River and Susquehanna River systems. In Canada it is in the Great Lakes – St. Lawrence system from Lake Huron to the Ottawa River.

Habitat: Medium-sized streams in gravel or mixed sand and gravel.

State Records: Known from 25 waterbodies in Wisconsin. Only common in St. Croix County.

Wolf River Basin Records: 7 records all from 1988.

Conservation Concerns: Increased sedimentation, impoundment.

slippershell mussel (*Alasmidonta viridis*) - Threatened, S2

Brief Description: A freshwater mussel with a light yellow, green, or brown, sometimes with green rays shell. Length 1.8 inches (4.6 cm) or less.

Distribution: Upper Mississippi River drainage; Ohio, Cumberland, and Tennessee Rivers; lower and middle sections of the St. Lawrence River system.

Habitat: Usually found buried in sand or fine gravel in shallow water or small streams. Also occurs along lake shores on a sand bottom.

State Records: Extant populations known from the Embarrass, Little Suamico, Meeme, Mukwonago, Mullet, Pensaukee, Pigeon, and Wolf Rivers plus Kelly Brook. Species may be found again in waters where currently only historical records

Wolf River Basin Records: 3 records from the late 1980s to the early 1990s.

Conservation Concerns: Because it inhabits small streams and headwaters, this mussel is particularly vulnerable to siltation and pollution from runoff. Habitat protection and water quality improvements would benefit this species. Increased development along waterways in southeastern and northeastern WI is of great concern to the continued existence of this species.

a mayfly (*Baetisca obesa*) - Special Concern, S2

Brief Description: An aquatic insect whose larvae are stout (10 mm), with a large carapace-like shield, and 3 tails. Adults are inconspicuous, have large wings, and live for only a day or so.

Distribution: Rare; previously known only from lower Wisconsin River and the St. Croix River.

Habitat: Medium to large sand bottomed rivers.

State Records: Only 18 collections from a handful of populations, there are 3 recent records from eastern WI.

Wolf River Basin Records: 7 records ranging between 1999 and 1979.

Conservation Concerns: Water level modifications; dredging, bank alterations.

a Caenid mayfly (*Brachycercus prudens*) - Special Concern, S?

Brief Description: A small (5 mm) mayfly with square gills and cone-like tubercles on the head. Adults are small, inconspicuous, and usually live only a few hours.

Distribution: Known from AL, KS, IN, IL, WI, and Saskatchewan.

Habitat: Large rivers.

State Records: There are 12 county records in the state, most in the southwestern quarter, but also Price, Marinette, and Waupaca.

Wolf River Basin Records: Waupaca Co. records occur in the study area and are from 1999.

Conservation Concerns: Uncertain.

a predaceous diving beetle (*Celina hubbelli*) - Special Concern, S2S3

Brief Description: A small (4 mm) yellowish to brown aquatic beetle with a tapered posterior end.

Distribution: Eastern North America. Uncommon south of a line from St. Croix to Sheboygan counties; absent elsewhere.

Habitat: Shallow cattail habitats where they pierce cattails to obtain oxygen.

State Records: Thirteen sites in southern two-thirds of state.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Wetland alterations.

a predaceous diving beetle (*Copelatus glyphicus*) - Special Concern, S3?

Brief Description: A small (5 mm) yellowish brown aquatic beetle with 10 narrow, longitudinal grooves on its back.

Distribution: Occurs throughout the eastern North America, and in California and Oregon. Uncommon statewide.

Habitat: Found in a variety of lentic habitats, including both temporary and permanent ponds. The most common habitat being shallow water over a dense mat of decaying leaves.

State Records: New to the working list, known from 14 counties, mainly in western WI.

Wolf River Basin Records: One record occurs in the study area.

Conservation Concerns: Unknown.

a water scavenger beetle (*Cymbiodyta acuminata*) - Special Concern, S3

Brief Description: A small (4.5 mm) brown to black aquatic beetle.

Distribution: Across Canada and northern U.S. Fairly common in northern two thirds of state. It is uncommon in the southern third of the state.

Habitat: Shallow ponds, marshes, and swamps.

State Records: At least 23 county records known.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Water level modifications.

a water scavenging beetle (*Cymbiodyta minima*) - Special Concern, S3

Brief Description: A small (3.5 mm) brown aquatic beetle.

Distribution: Across southern Canada, northern and eastern U.S. Uncommon statewide.

Habitat: Shallow ponds, marshes, and swamps, and margins of streams.

State Records: At least 32 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Water level modifications.

a *Dubiraphia* riffle beetle (*Dubiraphia bivittata*) - Special Concern, S3

Brief Description: A small (3 mm), dark aquatic beetle with broad, longitudinal yellow stripes.

Distribution: Southern Canada, WI, IL, IN, OH, NY. Uncommon south of a line from LaCrosse to Outagamie counties; rare in Burnett and Vilas counties; apparently absent elsewhere.

Habitat: Plants and submerged wood in medium to large rivers and adjacent sloughs, marshes, and ponds.

State Records: At least 21 populations are thought to exist in the state. Several recent records from eastern WI.

Wolf River Basin Records: 3 records from 1999-2000.

Conservation Concerns: Shoreline modifications, flow modifications.

river bluet (*Enallagma anna*) - Special Concern, S2

Brief Description: A moderate sized robust damselfly with predominantly black and blue coloration. Larvae are very difficult to identify.

Distribution: Western U.S. plus Wisconsin and Illinois.

Habitat: Larvae confined to slow streams and rivers and sometimes are associated with springs or spring fed streams in Wisconsin.

State Records: Known from 2 streams in 2 SE Wisconsin counties and from one stream in Waupaca County.

Wolf River Basin Records: 1 older record from 1986.

Conservation Concerns: Uncertain.

slender bluet (*Enallagma traviatum*) - Special Concern, S1S2

Brief Description: A black and blue slender damselfly.

Distribution: South-central and eastern U.S. and eastern Canada.

Habitat: Usually found in permanent lakes and ponds with abundant emergent vegetation.

State Records: 2 records from eastern WI.

Wolf River Basin Records: 1 recent record from 2000.

Conservation Concerns: Uncertain.

a water scavenging beetle (*Enochrus consortus*) - Special Concern, S3

Brief Description: A medium-sized (7.5 mm) brown aquatic beetle with yellowish margins around the pronotum.

Distribution: Eastern North America. Uncommon in the southern third of the state; rare elsewhere.

Habitat: Ponds, marshes, margins of lakes and streams.

State Records: At least 24 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 5 recent records from 1999-2000.

Conservation Concerns: Water level modifications.

a water scavenging beetle (*Enochrus perplexus*) - Special Concern, S2?

Brief Description: A small (5 mm) black aquatic beetle.

Distribution: Scattered localities throughout North America. Rare statewide.

Habitat: Most found in ponds.

State Records: New to the working list, at least 15 population exist throughout the state.

Wolf River Basin Records: One record is in the study area. Recorded in 2000.

Conservation Concerns: Uncertain.

a water scavenging beetle (*Enochrus sayi*) - Special Concern, S3

Brief Description: A small (4.5 mm) brown aquatic beetle.

Distribution: Eastern North America. Uncommon in the southern half (Pierce to Shawano counties); absent in the northern half.

Habitat: Ponds; most have been collected at blacklight traps.

State Records: At least 15 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Water level modifications.

snuffbox (*Epioblasma triquetra*) - Endangered, S1

Brief Description: A triangular-shaped freshwater mussel; relatively thick for its size, yellow or yellowish green with green rays, blotches, or chevron markings. Length 2.5 inches (6.4 cm).

Distribution: Mississippi River drainage; western New York west to Nebraska and Kansas, north to Minnesota, south to northern Alabama.

Habitat: Medium to large, clear rivers in gravel riffles.

State Records: Known from the Embarrass, St. Croix, Wolf, and Little Wolf Rivers.

Wolf River Basin Records: 4 records from 1995.

Conservation Concerns: Habitat destruction and river pollution have resulted in declines. Restriction of dredging, impoundments, sand and gravel mining, and navigational improvements would benefit this

species. The development of fish runways to facilitate the movement of host species through or around dams could also help to protect this species.

plains clubtail (*Gomphurus externus*) - Special Concern, S2

Brief Description: A large black and yellow dragonfly with the tip of the abdomen broadly flared (clubtail).

Distribution: Known previously only from the southern and western parts of the state.

Habitat: Large silty rivers.

State Records: At least 10 populations are known in the state. One recent record from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Unknown. This is a southern species that is more tolerant of silt than most members of the genus.

splendid clubtail (*Gomphurus lineatifrons*) - Special Concern, S3

Brief Description: A large blackish and yellow dragonfly, males with a prominent club that is narrower than the thorax. No yellow spot on top of club.

Distribution: Centered in the Midwest, extending to some of the northern Southern states, western northeastern states, and Mid-Atlantic States.

Habitat: Larvae in medium to large fast-flowing streams with good water quality. Adults usually found within a mile of larval sites.

State Records: 22 records, mostly in the northern counties, except for the 2 records in the central sands region.

Wolf River Basin Records: 4 records from 1999.

Conservation Concerns: Increased sedimentation, impoundments.

skillet clubtail (*Gomphurus ventricosus*) - Special Concern, S3

Brief Description: A large black and yellow dragonfly, males with the tip of the abdomen broadly flared (clubtail).

Distribution: Distributed widely across the northern half of the state. Generally upstream of the fall-line.

Habitat: Larvae in moderate sized fast clean rivers. Adults usually within a mile of breeding sites.

State Records: 34 records are known in the northern half of the state.

Wolf River Basin Records: 3 records from the late 1990s.

Conservation Concerns: Flow modifications; shoreline alterations. Moderately sensitive to siltation.

green-faced clubtail (*Gomphus viridifrons*) - Special Concern, S3

Brief Description: A medium sized black and yellow dragonfly, males with the tip of the abdomen moderately flared for a clubtail.

Distribution: Distributed widely across the northern half of the state. Generally upstream of the fall-line.

Habitat: Larvae in moderate sized fast clean rivers. Adults usually within a mile of larval sites.

State Records: 40 records are known in the northern half of the state.

Wolf River Basin Records: 6 records, the most recent in 1999 and the least in 1925.

Conservation Concerns: Flow modifications; shoreline alterations. This species is moderately sensitive to siltation.

a predaceous diving beetle (*Graphoderus manitobensis*) - Special Concern, S2S3

Brief Description: A large (14 mm) dark aquatic beetle with bold dark and light transverse band around head.

Distribution: Known from Manitoba, WI, and IA. Uncommon in south of a line from Pepin to Manitowoc counties; absent elsewhere.

Habitat: Large sedge and cattail marshes.

State Records: About 10 populations known from the southern part of the state.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations

a whirligig beetle (*Gyrinus impressicollis*) - Special Concern, S2?

Brief Description: A whirligig beetle, that is black, streamlined, and oval in shape (7.5 mm in length).

Distribution: Quebec, Ontario, Manitoba, WI, MI. Found only in northwestern WI.

Habitat: Often found on the surface of ponds, marshes, and lakes, and rarely in streams.

State Records: New to the working list, only 6 populations documented in the state.

Wolf River Basin Records: 2 records occur in the study area and both are from 2000.

Conservation Concerns: Uncertain.

a crawling water beetle (*Haliphus canadensis*) - Special Concern, S2

Brief Description: A small (4 mm) aquatic beetle that is yellowish with black splotches.

Distribution: Across Canada and the northern U.S. Uncommon in the eastern third of the state; absent elsewhere.

Habitat: Ponds and lakes.

State Records: At least 10 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Water level modifications.

water beetle (*Haliphus leopardus*) - Special Concern, S1S3

Brief Description: A small (4 mm) aquatic beetle that is yellowish with black splotches.

Distribution: Quebec, and North- and Southeastern United States.

Habitat: Ponds and sloughs.

State Records: Newly added to the working list, 7 published county records (10 individuals), with 4 additional northern county records known.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Uncertain.

a crawling water beetle (*Haliphus pantherinus*) - Special Concern, S2S3

Brief Description: A small (4 mm) aquatic beetle that is yellowish with black splotches.

Distribution: Throughout eastern U.S. Uncommon throughout the state.

Habitat: Ponds, lakes and stream margins.

State Records: 14 county records and 9 more recently documented throughout the state.

Wolf River Basin Records: 11 records from 1999-2000.

Conservation Concerns: Shoreline modifications, flow modifications.

a velvet waterbug (*Hebrus buenoi*) - Special Concern, S1?

Brief Description: A tiny (2 mm) dark aquatic insect that lives on the surface of the water.

Distribution: Found in eastern two-thirds of U.S. Rare in WI.

Habitat: Found in emergent zone and sediments at waters edge.

State Records: New to the working list, only 1 population mapped in the state.

Wolf River Basin Records: Only state record occurs in the study area, was last observed in 2000.

Conservation Concerns: Uncertain.

a velvet waterbug (*Hebrus burmeisteri*) - Special Concern, S2S3

Brief Description: A tiny (2 mm) dark aquatic insect that lives on the surface of the water.

Distribution: Eastern two thirds of U.S. and Mexico. Rare statewide; apparently absent in the northwest part of the state. Distribution could be misleading because this species is probably under-represented in samples do to its small size.

Habitat: Shallow lentic habitats.

State Records: At least 14 populations estimated to occur in the state. One recent record from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Water level modifications, shore alterations.

a water scavenging beetle (*Helocombus bifidus*) - Special Concern, S3

Brief Description: A medium-sized (7 mm) black aquatic beetle with narrow yellowish margins.

Distribution: Uncommon statewide.

Habitat: Shallow lentic habitats; most were single specimen collections.

State Records: At least 33 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Water level modifications.

a water boatman (*Hesperocorixa semilucida*) - Special Concern, S3

Brief Description: A medium-sized (7.5 mm) aquatic insect with yellow and black longitudinal stripes along the body and transverse stripes around the head.

Distribution: Known from WI, IL, and MI. Uncommon south of a line from Trempealeau to Shawano counties. Absent elsewhere.

Habitat: Ponds in the spring, larger rivers to overwinter.

State Records: At least 11 populations are estimated to occur in the state. Three recent records from eastern WI.

Wolf River Basin Records: 2 records from 1999-2000.

Conservation Concerns: Water level modifications, dredging, bank alterations.

dark rubyspot (*Hetaerina titia*) - Special Concern, S1S2

Brief Description: A smokey dark colored large damselfly.

Distribution: Previously known only from the southern edge of the state.

Habitat: Warmwater streams. Larvae climb on vegetation.

State Records: Only known from two waterbodies previously. Recent records from eastern WI extend the range north and east considerably.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Unknown, but possible sensitive to shoreline modifications.

a water scavenging beetle (*Hydrobius melaenum*) - Special Concern, SU

Brief Description: A medium-sized (9 mm) dark aquatic beetle.

Distribution: Widespread in WI.

Habitat: Under banks of small, spring-fed streams.

State Records: At least 18 records thought to exist.

Wolf River Basin Records: 2 records from 2000.

Conservation Concerns: Uncertain.

a water scavenger beetle (*Hydrochara leechi*) - Special Concern, SU

Brief Description: A large (17 mm), dark aquatic beetle.

Distribution: Occurs from PA to ND and south to NM.

Habitat: Basically unknown. Single specimen found in heavily vegetated swamp.

State Records: 2 records from eastern WI; only current record is from Wolf Basin.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Uncertain.

a water scavenging beetle (*Hydrochara spangleri*) - Special Concern, S3?

Brief Description: A large (18 mm), dark aquatic beetle.

Distribution: Ranges from WI to OH and south to FL and TX.

Habitat: Shallow floodplains of rivers.

State Records: 11 populations are found in the southern half of the state, most west in west-central and southwest.

Wolf River Basin Records: 2 records from 2000.

Conservation Concerns: Uncertain.

a water measurer (*Hydrometra martini*) - Special Concern, S3

Brief Description: A small (10 mm), very narrow and inconspicuous aquatic insect similar to a walking stick in appearance. These unusual bugs walk on the water surface in areas of protective vegetation.

Distribution: Northern U.S. Uncommon statewide.

Habitat: Protected ponds, sloughs, other lentic sites.

State Records: At least 19 populations are estimated to occur in the state. Three recent records from eastern WI.

Wolf River Basin Records: 7 records from 1999-2000.

Conservation Concerns: Water level modifications, shore alterations.

a predaceous diving beetle (*Hydroporus badiellus*) - Special Concern, S3?

Brief Description: A tiny (2.5 mm), dark aquatic beetle.

Distribution: Across Canada, WI, Upper Peninsula of MI and Northeastern U.S. Common in northern third of WI, but rare elsewhere in the state.

Habitat: Sites containing Sphagnum moss.

State Records: Common in Polk to Marinette Counties; only 10 collection records for the remainder of the state scattered from Jefferson and Shawano counties in the east to Douglas and Jackson counties in the west.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations, mousing.

a predaceous diving beetle (*Hydroporus vittatus*) - Special Concern, S3

Brief Description: A small (4.5 mm), light colored aquatic beetle with 3 broad, dark, longitudinal stripes.

Distribution: North-central portion of North America, from WY to OH, and southern Canada. Uncommon statewide.

Habitat: Most collections are from small to medium sized streams, also adjacent pond and spring ponds.

State Records: 34 county records across the state.

Wolf River Basin Records: 2 records from 1999-2000.

Conservation Concerns: Wetland alterations, stream bank modification, flow modifications.

a caddisfly (*Hydropsyche bidens*) - Special Concern, S2

Brief Description: An aquatic insect in which the larva builds a net adjacent to its tube-like retreat. Adults are similar to moths in appearance.

Distribution: Uncommon in lower Wisconsin, Black, Chippewa, St. Croix and Wolf Rivers. They are absent elsewhere.

Habitat: On submerged wood in large sandy rivers.

State Records: At least 11 populations are known in the state. One recent record from eastern WI.

Wolf River Basin Records: 4 records from 1999.

Conservation Concerns: This species is fairly intolerant of organic pollution. Water level modifications and shoreline alterations are also a concern.

a predaceous diving beetle (*Ilybius discedens*) - Special Concern, S3

Brief Description: A medium-sized (8 mm) dark aquatic beetle.

Distribution: Across Canada, western Great Lakes states, and northeastern U.S. Common in northern third of state; rare elsewhere.

Habitat: Sphagnum swamps with black spruce and tamarack.

State Records: Mainly northern WI from Polk to Marinette counties. Three records from central WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations, mousing.

diving beetle (*Ilybius ignarus*) - Special Concern, S3

Brief Description: A medium-sized (9 mm) dark aquatic beetle.

Distribution: Northeastern North America from New Brunswick to IL. Uncommon in southern two-thirds

of state; rare in the northern third and apparently absent in the northwest.

Habitat: Marshes, pond and swamps.

State Records: Uncommon to rare statewide.

Wolf River Basin Records: 5 records from 1999-2000.

Conservation Concerns: Wetland alterations.

a predaceous diving beetle (*Ilybius incarinatus*) - Special Concern, S3S4

Brief Description: A medium-sized (9 mm) streamlined aquatic beetle with red to reddish brown coloration.

Distribution: Found in the region around the Great Lakes, east to Nova Scotia and south to Washington, D.C., and Tennessee.

Habitat: Found in emergent sedges around temporary and permanent ponds and also in large cattail marshes.

State Records: New to the working list, 19 county records; very rare northern third, uncommon central third, fairly common southern third.

Wolf River Basin Records: A few county records.

Conservation Concerns: Unknown.

a Perlid stonefly (*Isoperla bilineata*) - Special Concern, S2S3

Brief Description: An aquatic insect (stonefly).

Distribution: Common in western and southwestern WI; rare or absent elsewhere.

Habitat: Large rivers.

State Records: An estimated 20 populations are thought to occur in the state. Two recent records from eastern WI.

Wolf River Basin Records: 3 records from 1999.

Conservation Concerns: This species is moderately intolerant of organic pollution. Water level modifications and shoreline alterations are also a concern.

a Perlid stonefly (*Isoperla lata*) - Special Concern, SU

Brief Description: A stonefly; adults are dark brown with a narrow pronotal stripe and pale areas near the eyes.

Distribution: Eastern Canada to MN and south to Tennessee.

Habitat: Cold high quality trout streams.

State Records: 4 records from northern and eastern WI.

Wolf River Basin Records: 1 record from 1996.

Conservation Concerns: Uncertain.

a Perlid stonefly (*Isoperla marlynia*) - Special Concern, S3

Brief Description: An aquatic insect (stonefly).

Distribution: Uncommon in northern third of state; rare in Juneau, Crawford and Green counties; apparently absent elsewhere.

Habitat: Large rivers.

State Records: An estimated 13 populations are thought to occur in the state. One recent record from

Waupaca county.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: This species is moderately intolerant of organic pollution. Water level modifications and shoreline alterations are also a concern.

a Perlid stonefly (*Isoperla richardsoni*) - Special Concern, S3

Brief Description: An aquatic insect.

Distribution: Uncommon in northern half of state; absent in southern third and extreme northern part of the state.

Habitat: Large rivers.

State Records: At least 25 populations are known in the state. Three recent records from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: This species is highly intolerant of organic pollution. Water level modifications and shoreline alterations are also a concern.

a water scavenging beetle (*Laccobius agilis*) - Special Concern, S2S3

Brief Description: A very small (3 mm) mottled aquatic beetle.

Distribution: Across Canada and northern U.S. Rare to uncommon statewide.

Habitat: Ponds, spring ponds and seeps, margins of streams.

State Records: At least 16 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 3 records from 1999-2000.

Conservation Concerns: Water level modifications; dredging.

a predaceous beetle (*Laccobius reflexipennis*) - Special Concern, S1S2

Brief Description: A very small (3 mm) mottled aquatic beetle.

Distribution: Across Canada, and eastern U.S. to WY. Very rare statewide.

Habitat: Margins of streams; ponds.

State Records: Previously only 2 collections known. One recent record from eastern WI.

Wolf River Basin Records: 2 records from 1999-2000.

Conservation Concerns: Water level modifications; dredging, riparian alterations.

elegant spreadwing (*Lestes inaequalis*) - Special Concern, S2S3

Brief Description: An elongate brilliant metallic green damselfly.

Distribution: Eastern U.S. and Canada.

Habitat: Ponds, lakes, and slow streams with ample emergent vegetation and usually heavily wooded shorelines.

State Records: 4 records from the southern half of the state.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Shoreline alterations.

swamp spreadwing (*Lestes vigilax*) - Special Concern, S3

Brief Description: A large slender dark green damselfly.

Distribution: Eastern and central U.S. and Canada.

Habitat: Boggy ponds and lakes, swamps, slow backwater streams, and other acid waters.

State Records: 7 records from southern and eastern WI.

Wolf River Basin Records: 3 records from 2000.

Conservation Concerns: Uncertain.

Cantrall's bog beetle (*Liodesmus cantralli*) - Special Concern, SU

Brief Description: A tiny (<2 mm) brown aquatic beetle.

Distribution: Central Canada, WI and MI.

Habitat: small ponds to large marshes, and within Sphagnum mats of fens.

State Records: 3 current records from eastern WI (Shawano, Vernon, and Dodge counties).

Wolf River Basin Records: 1 new record from 1999 in Outagamie Co.

Conservation Concerns: Uncertain.

a predaceous diving beetle (*Liodesmus flavicollis*) - Special Concern, S3?

Brief Description: A tiny (<2 mm) aquatic beetle with a bold checkerboard pattern.

Distribution: Found from southern Quebec, Ontario and Manitoba to Florida and northern Texas.

Habitat: Usually found in algal mats in relatively deep water. Most are clear-water pools or ponds have sandy substrates.

State Records: New to the working list, 15 county records documented.

Wolf River Basin Records: New county record from Winnebago Co.

Conservation Concerns: Unknown.

a predaceous diving beetle (*Lioporeus triangularis*) - Special Concern, SU

Brief Description: A small (4 mm) aquatic beetle with a checkerboard pattern.

Distribution: From NY to WI and south to FL.

Habitat: A big river species that lives on wood and under banks over a sand bottom.

State Records: Collected from five sites in four counties.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Uncertain.

a predaceous diving beetle (*Matus bicarinatus*) - Special Concern, S2S3

Brief Description: A streamlined, medium-sized (8 mm) reddish brown aquatic beetle.

Distribution: Eastern North America. Uncommon in south half of state (Buffalo to Manitowoc counties), apparently absent elsewhere.

Habitat: Ponds and marshes in association with large streams.

State Records: At least 15 populations known from the southern part of the state.

Wolf River Basin Records: 3 records from 1999-2000.

Conservation Concerns: Wetland alterations.

elfin skimmer (*Nannothemis bella*) - Special Concern, S3

Brief Description: A delicate little (ca 2cm) clear-winged dragonfly. Appearance changes with age. Small thorax, thinly clad with rather long whitish hairs. Legs black.

Distribution: Ontario and Quebec Canada, Alaska, and the eastern half of the U.S.

Habitat: Shallow water wetlands, usually with sphagnum or other underwater vegetation.

State Records: Collected from 7 waterbodies in Wisconsin.

Wolf River Basin Records: 1 record from 1990.

Conservation Concerns: Uncertain.

a predaceous diving beetle (*Neoscutoperus hornii*) - Special Concern, S1S3

Brief Description: A large (15 mm) black aquatic beetle.

Distribution: Across Canada, WI and MI. Fairly common in northern half of the state (north of Marathon county) and apparently absent elsewhere.

Habitat: Swamps and bogs, usually containing Sphagnum.

State Records: Twenty to 100 populations are thought to exist in the state. Recent records from Vilas and Outagamie

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Wetland alterations.

a water scorpion (*Nepa apiculata*) - Special Concern, SU

Brief Description: A dark brown, strongly flattened aquatic insect, that looks like a dead leaf. Adults are 17 mm long with a short 'tail' (breathing tube).

Distribution: Eastern distribution in North America and is quite scarce in the Great Plains region.

Habitat: Lentic or lotic in dense aquatic vegetation.

State Records: 9 county records known to exist.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Uncertain.

Stygian shadowfly (*Neurocordulia yamaskanensis*) - Special Concern, S3

Brief Description: A pale golden yellow and brown medium sized dragonfly.

Distribution: Widely distributed in northern half of the state; local elsewhere.

Habitat: Larvae in rapid, moderate to large, warm-water streams with abundant submerged boulders or cliff face. Adults fly only at dusk.

State Records: Known from 25 waterbodies statewide except SE WI.

Wolf River Basin Records: 2 records from 1991 and 1999.

Conservation Concerns: Unknown, but possibly sensitive to sedimentation.

riffle snaketail (*Ophiogomphus carolus*) - Special Concern, S3

Brief Description: A small greenish dragonfly, striped with brown, and wings clear.

Distribution: Found in northern and eastern United States and southern and eastern Canada.

Habitat: Shallow stony riffles in woodland streams.

State Records: 32 documented populations, all in the northern third of the state. Most are current populations.

Wolf River Basin Records: 1 population in the Wolf River.

Conservation Concerns: Unknown.

pygmy snaketail (*Ophiogomphus howei*) - Threatened, S3

Brief Description: A small black and yellow dragonfly with a stout body. Basal portion of hind wings with a yellow wash.

Distribution: Widely distributed in a band across the northern half of the state.

Habitat: Middle sections of rapid warmwater streams with abundant gravel substrate. Adults apparently forage and perch on the stream-side forest canopy.

State Records: Known from 27 waterbodies in the state.

Wolf River Basin Records: 5 records from 1999.

Conservation Concerns: Sensitive to sedimentation and possibly to stream side openings in the forest canopy.

Mississippi grass shrimp (*Palaemonetes kadiakensis*) - Special Concern, S1S3

Brief Description: A translucent shrimp with a slight pinkish, yellowish, or tannish hue over the entire body.

Distribution: Fresh waters of central United States, west of the Alleghenies from the Great Lakes south to the Gulf Coast.

Habitat: Found among aquatic vegetation in sluggish regions of lotic systems.

State Records: Found primarily in the Mississippi River, but has also been found in the St. Croix and the Wolf River.

Wolf River Basin Records: Possibly a disjunct population (established subsequent to introduction).

Conservation Concerns: Unknown.

a small minnow mayfly (*Paracloeodes minutus*) - Special Concern, S1?

Brief Description: A tiny aquatic insect (4 mm). The adult mayfly is very short lived.

Distribution: Occurs throughout much of the U.S.

Habitat: Large, deep, warm streams where there is strong current and fine sands.

State Records: A few records on the lower Wisconsin River and one record from the Wolf River basin

Wolf River Basin Records: 1 record from 1992.

Conservation Concerns: Hydrologic alterations related to dam operation.

a primitive minnow mayfly (*Parametetus chelifera*) - Special Concern, S1?

Brief Description: A small (10 mm) aquatic insect with large, plate-like gills on the abdomen. The adult mayfly is very short lived.

Distribution: Known from northern parts of Canada, and only WI in the U.S.

Habitat: Medium sized, warm streams with moderate to fast flow.

State Records: Populations are known from the St. Croix and Wolf rivers in Burnett and Outagamie counties.

Wolf River Basin Records: 1 record from 1993.

Conservation Concerns: Uncertain

a creeping water bug (*Pelocoris femorata*) - Special Concern, S2S3

Brief Description: A medium-sized (9 mm), mottled colored, egg-shaped aquatic insect.

Distribution: Found in eastern two-thirds of U.S. Uncommon south of Sauk and Dane counties (4 specimens from Juneau county) and apparently absent elsewhere.

Habitat: Spring ponds, backwaters and impoundments of streams.

State Records: At least 7 populations are estimated to occur in the state. Two recent records from eastern WI.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Water level modifications; shore alterations.

an Ephemerid mayfly (*Pentagenia vittigera*) - Special Concern, S2?

Brief Description: An aquatic insect (20 mm) whose immatures (larvae) burrow in clay-bottomed streams and have feathery gills on the abdomen. The adult mayfly has large wings, but is very short lived.

Distribution: Central North America from TX and FL northward into WI and Manitoba.

Habitat: Warm water streams with clay substrates

State Records: Dane, Grant, Green, Richland, and Rock counties in southern WI, and the Wolf River in Waupaca County.

Wolf River Basin Records: 1 record from 1992.

Conservation Concerns: Uncertain

a small minnow mayfly (*Plauditus cestus*) - Special Concern, S2

Brief Description: A tiny (4 mm) mayfly; the abdomen is pale colored, with 1 darkly colored segment. Adults are inconspicuous and short lived.

Distribution: Widespread in North America.

Habitat: Medium to large streams.

State Records: Twelve populations are estimated to be in the state. One recent record from eastern WI.

Wolf River Basin Records: 2 records from 1999-2000.

Conservation Concerns: Water level modifications; dredging, bank alterations.

round pigtoe (*Pleurobema sintoxia*) - Special Concern, S3

Brief Description: A highly variable freshwater mussel; relatively large, rounded or elongate, chestnut or brown, with a shallow beak cavity. Length to 4 inches (10.2 cm).

Distribution: Found throughout most of the Mississippi – Missouri river systems in the U.S. Found in Lake Erie, and tributaries of Lake Erie and Lake St. Clair in southwestern Ontario.

Habitat: Medium to large rivers in mud, sand, or gravel.

State Records: Known from 24 waterbodies in Wisconsin

Wolf River Basin Records: 4 records from 1988-1991.

Conservation Concerns: Increased sedimentation, impoundment.

white river crayfish (*Procambarus acutus*) - Special Concern, S3?

Brief Description: Adults are tan, orange, or scarlet in color on top, lighter in color on the sides.

Distribution: Northeast along coastal plain and piedmont to New England, and the Mississippi River Drainage.

Habitat: Widely tolerant, in most lentic situations in range and in sluggish streams.

State Records: Known from 16 counties, mainly in the southeastern corner. 3 populations in the state documented in 2000, all from the Wolf River Basin.

Wolf River Basin Records: Three state records are in the study area.

Conservation Concerns: Unknown.

a Heptageniid mayfly (*Pseudiron centralis*) - Special Concern, S3

Brief Description: A medium-sized aquatic insect whose immature form (larva) is flattened and burrows in sand bottomed streams and the adult mayfly is very short lived.

Distribution: Extreme western and southern WI and a disjunct cluster of populations in the Lower Wolf River basin.

Habitat: Large sand bottomed rivers where larvae occur in shallow (6 inches) to deep (4 feet) water on shifting sand bars.

State Records: Known from 8 streams in 7 counties.

Wolf River Basin Records: 2 records from 1999.

Conservation Concerns: Factors that would alter natural flow regime of large rivers such as hydroelectric dam operations.

a water scorpion (*Ranatra nigra*) - Special Concern, S2

Brief Description: A large (30 mm) brown, narrow aquatic insect that looks similar to a walking stick, but has a long, posterior breathing tube.

Distribution: Eastern half of U.S. Rare to uncommon statewide.

Habitat: Large, deep lentic sites, and rivers.

State Records: 52 collections made, rare south of Lincoln county.

Wolf River Basin Records: 3 records from 2000.

Conservation Concerns: Water level modifications; shore alterations.

a predaceous diving beetle (*Rhantus sinuatus*) - Special Concern, S3

Brief Description: A streamlined, medium-sized (9 mm) black aquatic beetle.

Distribution: Across Canada, and northern U.S. Uncommon statewide.

Habitat: Mostly in sedge or cattail marshes, often with Sphagnum. Almost all specimens were taken in bottle traps which suggests nocturnal behavior.

State Records: At least 30 populations are thought to exist in the state. Recent records from Outagamie County.

Wolf River Basin Records: 4 records from 1999-2000.

Conservation Concerns: Wetland alterations.

salamander mussel (*Simpsonaias ambigua*) - Threatened, S2S3

Brief Description: A freshwater mussel, with a yellow or brown, smooth, fragile, elongate, and thin shell. Length to 2 inches (5.1 cm).

Distribution: It is known from the Lake St. Clair, Lake Huron, and Lake Erie drainages; and from the Ohio River System, the Cumberland River System (Red River, Kentucky), and the upper Mississippi River System (Illinois, Iowa, Wisconsin, Missouri and Arkansas).

Habitat: Found in medium to large rivers on mud or gravel bars but more common under flat slabs of rock, stones, or in ledges of underwater cliff faces.

State Records: Known from the Chippewa, Embarrass, Eau Claire, south fork of the Flambeau, Lemonweir, Mississippi, St. Croix, Wisconsin, and the Wolf Rivers.

Wolf River Basin Records: 2 records from the late 1980s to the early 1990s.

Conservation Concerns: Due to the specificity of the host species, the mudpuppy (*Necturus maculosus*), protection of mudpuppies and their habitats is particularly important.

forcipate emerald (*Somatochlora forcipata*) - Special Concern, S2S3

Brief Description: A medium sized darkly colored dragonfly with metallic reflections. Thick growth of brownish hairs cover thorax. A stripe of sides appear as two conspicuous, similar, roundish-oval spots of pale yellow.

Distribution: Canada, New England, and some northern Midwest states.

Habitat: Small spring fed woodland streams and pools.

State Records: Only collected from three counties in Wisconsin. There have been collections from nine sites in two counties in the 1980s and 1990s.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Water level fluctuations.

warpaint emerald (*Somatochlora incurvata*) - Endangered, S2

Brief Description: A medium sized slender and elongate metallic brown dragonfly.

Distribution: A modest total known range from Cape Breton Island, west to northern Michigan, south to Massachusetts.

Habitat: Habitat is bogs, fens, and heaths. Wisconsin larval habitat is Central Poor Fen with sphagnum moss.

State Records: 17 records, all but one in the west-central portion of the state. The other record from Langlade county.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Potential threats of habitat degradation from harvesting of peatmoss and fuel peat, cranberry farming, broadcast toxic pollution, and water level alteration leading to inundation or desiccation of the habitat.

a water scavenging beetle (*Sperchopsis tessellatus*) - Special Concern, S2S3

Brief Description: A medium-sized (7 mm), brown mottled aquatic beetle.

Distribution: Eastern North America. Rare in the western 3/4th of the state (Florence to Dane counties); not known from the eastern quarter.

Habitat: Small, cool streams, usually with sand.

State Records: Twenty to 25 populations are estimated to be in the state. A few recent records from eastern WI.

Wolf River Basin Records: 4 records from 1999-2000.

Conservation Concerns: Water level modifications; dredging, bank alterations.

a riffle beetle (*Stenelmis antennalis*) - Special Concern, SU

Brief Description: A small (3 mm), dark aquatic beetle with narrow, longitudinal yellow stripes.

Distribution: Mainly Southeastern U.S. and the immediate Mississippi River drainage basin. Common in Burnett county; rare to locally common at a few sites in central WI; absent elsewhere.

Habitat: Submerged wood in large sandy rivers.

State Records: At least 13 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Shoreline modifications, flow modifications.

a riffle beetle (*Stenelmis bicarinata*) - Special Concern, S3

Brief Description: A small (3.5 mm), dark aquatic beetle with narrow, longitudinal yellow stripes.

Distribution: Much of eastern North America. Common in northwest WI; rare in northern half of state (Buffalo to Outagamie counties); absent in southern half.

Habitat: Submerged wood in large sandy rivers.

State Records: At least 32 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 3 records from 1999.

Conservation Concerns: Shoreline modifications, flow modifications.

a riffle beetle (*Stenelmis fuscata*) - Special Concern, S2

Brief Description: A small (3.5 mm), dark aquatic beetle.

Distribution: Mainly Southeastern U.S. and the immediate Mississippi River drainage basin. Rare along a linear distribution from Iowa to Oconto counties.

Habitat: Submerged wood in large sandy rivers.

State Records: At least 11 populations are thought to exist in the state. Recent records from eastern WI.

Wolf River Basin Records: 5 records from 1999.

Conservation Concerns: Shoreline modifications, flow modifications.

least clubtail (*Stylogomphus albistylus*) - Special Concern, S3

Brief Description: A tiny black and yellow dragonfly with a pronounced widening near the end of the abdomen (clubtail).

Distribution: Restricted to high gradient streams in the northern third of the state.

Habitat: Larvae burrow in clean sand and gravel in small to moderate sized high gradient cool to warm water streams.

State Records: Known from 23 streams in 13 counties

Wolf River Basin Records: 1 record from 1989.

Conservation Concerns: Probably sensitive to sedimentation and impoundments.

elusive clubtail (*Stylurus notatus*) - Special Concern, S2S3

Brief Description: A medium sized blackish dragonfly with yellow markings and an elongate body.

Distribution: Widely distributed in the western half of the state.

Habitat: Larvae live in depositional sand in lower sections of larger warm-water streams. Adults are seldom seen or collected because of their habit of patrolling open river channels away from the shore and perching well up in trees.

State Records: 20 records known from 14 waterbodies in the state.

Wolf River Basin Records: 9 records from the 1990s.

Conservation Concerns: Sensitive to sedimentation and possibly to stream-side openings in the forest canopy.

zebra clubtail (*Stylurus scudderi*) - Special Concern, S3

Brief Description: A large black and yellow dragonfly with end of abdomen widely expanded in males. Yellow rings on black abdomen distinguish it from other large Clubtails.

Distribution: Global Range - Eastern Canada and U.S.

Habitat: Larvae in cool sandy streams (trout streams) in forested habitats.

State Records: Known from 13 WI counties in the heavily forested northern part of the state with a pocket in Jackson County. Factors limiting distribution in WI are not known.

Wolf River Basin Records: 2 records from the 1990s.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

a caddisfly (*Triaenodes nox*) - Special Concern, S1S3

Brief Description: An aquatic insect whose larvae are whitish, 10 mm long, and have 2 dark parallel stipes on their light-colored head and prothorax. They build spiral cases of small strips of vegetation. Adults are moth-like insects with long antennae.

Distribution: Mainly northern in distribution from New Brunswick to Ohio to Manitoba, along with AL, GA, and FL.

Habitat: Ponds, lake shores, and generally slow-flowing areas of streams and rivers.

State Records: New to the working list, only 2 populations documented in the state.

Wolf River Basin Records: 2 records from 2000.

Conservation Concerns: Uncertain.

buckhorn (*Tritogonia verrucosa*) - Threatened, S2

Brief Description: A freshwater mussel, with a brown or black elongate shell, moderately large, heavy, and has many pustules. Length to 8 inches.

Distribution: Mississippi River drainage; southeast in streams draining into the Gulf of Mexico from the Alabama River systems, west to central Texas.

Habitat: Inhabits fairly deep water on a sand or mud bottom. Also found in riffles and in shallow water (1-3m) of smaller streams.

State Records: Known from the Mississippi, Black, upper and lower Wisconsin, White, St. Croix, Baraboo, Chippewa, Eau Claire, Pecatonica, and Wolf Rivers.

Wolf River Basin Records: 1 record from 1995.

Conservation Concerns: Habitat destruction and river pollution have resulted in declines. Restriction of dredging, impoundments sand and gravel mining, and navigational improvements would benefit this species. The development of fish runways to facilitate movement around dams.

a caddisfly (*Wormaldia moesta*) - Special Concern, SU

Brief Description: Larvae of this aquatic insect are whitish and about 10 mm long. They build silken tube-like catchnets. Adults are inconspicuous moth-like insects.

Distribution: It occurs from NY to GA, and northwest to WI.

Habitat: Small, cold, rapid streams.

State Records: New to the working list, at least 6 populations from 6 counties are known in the state (Sauk, Price, Forest, Florence, Marinette, Brown).

Wolf River Basin Records: 1 record from 1980.

Conservation Concerns: Uncertain.

Birds

Northern Goshawk (*Accipiter gentilis*) - Special Concern, S2N,S2B

Brief Description: Large gray to brown hawk with pale stripe over eye.

Distribution: Circumboreal.

Habitat: Locally remote tracts of forest. These are typically hardwood, hardwood/conifer, or upland conifer stands and have not been recently managed. Nests in young stands are rare. Good numbers of prey animals such as medium-sized birds and mammals near nesting areas are required as well. Doesn't do well in areas dominated by red-tailed hawks or

State Records: Wisconsin status uncertain. Reportedly declining in the NE. Nests typically reported from northern third of the state. Several nests are known from central WI. A few locations have been recently reported from east central WI as well. A study by WDNR is currently underway to determine nesting density in WI.

Wolf River Basin Records: 5 recent breeding populations documented.

Conservation Concerns: Logging, including clear cutting, thinning, and selective harvesting; increased accessibility to humans due to road building; trails, etc.

Henslow's Sparrow (*Ammodramus henslowii*) - Threatened, S2S3B,SZN

Brief Description: A small bird (sparrow). Characterized by large flat head, large gray bill, and short tail. The head, nape, and most of the central crown stripe are olive-colored, with the wings extensively dark chestnut. The breast is finely

Distribution: Central and eastern U.S.

Habitat: Open fields and meadows with grass interspersed with weeds or shrubby vegetation, especially in damp or low-lying areas.

State Records: 33 records scattered throughout the state, except for the northern third.

Wolf River Basin Records: 3 records from 2000.

Conservation Concerns: Decline apparently is related to loss of habitat due to encroaching urbanization, successional change to shrubland or forest, and use for row-crop agriculture.

Great Blue heron (*Ardea herodias*) - Special Concern, S3B,SAN

Brief Description: A large wading bird (heron).

Distribution: Breeds southeastern Alaska and southern Canada to southern Mexico.

Habitat: Freshwater marshes, along lakes, rivers, bays, lagoons, fields, and meadows. Nests commonly high in trees in swamps and forested areas, less commonly in bushes, or on ground, and rock ledges. Often nests with other herons.

State Records: 51 rookeries are documented in the state. They occur throughout the state, but are the great blue herons are mapped to the northern and eastern portions of the state.

Wolf River Basin Records: 2 recent breeding populations occur in the study area.

Conservation Concerns: Populations generally are stable or increasing in most areas.

American Bittern (*Botaurus lentiginosus*) - Special Concern, S3B,SZN

Brief Description: A stocky medium sized heron with a black neck stripe and outer wing blackish in flight.

Distribution: Eastern and central U.S.

Habitat: Marshy reedy lakes, wet meadows, and sedge meadows.

State Records: Occurs statewide, but local in the southwest, and declining in the southeast. Declining steadily overall in past 15 years. Most recent records are from inventories conducted for state forest master plans in the NW, NE and WC parts of the state.

Wolf River Basin Records: 6 records from the late 1990s to present.

Conservation Concerns: Shoreline development, wetland alteration, disturbance, recreational boating, or alteration of water quality.

Red-shouldered Hawk (*Buteo lineatus*) - Threatened, S1N,S3S4B

Brief Description: A large broad-winged hawk with rufous shoulders and black tail with narrow white stripes.

Distribution: Eastern and central U.S. and southeastern Canada.

Habitat: Extensive woodlands with frequent ponds, wooded river bottoms, and timbered swamps.

State Records: Range is statewide. 310 records total.

Wolf River Basin Records: 39 records, all last observed in 2000.

Conservation Concerns: Fragmentation of large forest blocks, stand thinning.

Black Tern (*Chlidonias niger*) - Special Concern, S3B,SZN

Brief Description: A small tern with a dark, sooty gray body.

Distribution: Breeds from the northern U.S. up through middle Canada.

Habitat: Freshwater marshes and lakes.

State Records: Range is statewide. 44 records total.

Wolf River Basin Records: 15 populations observed between 2001 and 1984.

Conservation Concerns: Water level manipulations, nest depredation.

Northern Harrier (*Circus cyaneus*) - Special Concern, S2N,S3B

Brief Description: A medium sized thin bird of prey, pale-gray to brown to cinnamon in color, always with a white patch on rump.

Distribution: Holarctic

Habitat: Forages in open habitats. Nests on ground on hummocks in large treeless areas such as meadows, shrub carrs, grasslands, sedge meadows, tall marsh, etc.

State Records: In WI statewide, but rare in heavily forested or plowed landscapes. Rare in the south.

Wolf River Basin Records: 2 records, 1 from 2001 and 1 from 1994.

Conservation Concerns: Succession of grasslands, activities that disturb the ground during the nesting season, activities that concentrate ground predators, wetland alteration, or direct disturbance.

Yellow-billed Cuckoo (*Coccyzus americanus*) - Special Concern, S3B,SZN

Brief Description: Slim sinuous look, brown back, and plain white breast. Rufous in wings, large white spots at tips of black tail feathers, and yellow lower mandible on the slightly curved bill.

Distribution: South Canada to Mexico, West Indies.

Habitat: Woodlands, thickets, farms, and orchards.

State Records: Occurs statewide, mainly distributed in southern and western counties.

Wolf River Basin Records: 1 record from 1984.

Conservation Concerns: Uncertain.

Yellow Rail (*Coturnicops noveboracensis*) - Threatened, S1B,SZN

Brief Description: A small buff colored rail with a short greenish bill. A white wing patch is visible in flight.

Distribution: Breeds locally from the northern central U.S. through Canada.

Habitat: Extensive grassy freshwater marshes and meadows with little shrub encroachment.

State Records: Known from eleven counties since 1935. Probably less than fifty breeding pairs now, primarily on four WDNR managed sites. Breeding difficult to document.

Wolf River Basin Records: 1 record from 1994.

Conservation Concerns: Small population size and isolation. Threats to current and potential habitat, especially fragmentation, succession, and impoundment.

Cerulean Warbler (*Dendroica cerulea*) - Threatened, S2S3B,SZN

Brief Description: A small songbird with breeding males recognized by blue back, white undersides and a narrow dark neck stripe.

Distribution: Eastern and central U.S.

Habitat: Large stands of mesic hardwoods and floodplain forest.

State Records: Uncommon and largely restricted to the southern two thirds of the state with occasional breeding season records in the northern third. Has been expanding its range northward. 77 records.

Wolf River Basin Records: 15 populations, all last observed in 2000.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Management practices that result in seasonal disturbance of nesting habitat. Rangeland, this species has undergone a 70% decline since 1966, mostly occurring between 1966 and 1979.

Acadian Flycatcher (*Empidonax virescens*) - Threatened, S2S3B,SZN

Brief Description: A small bird (flycatcher). Olive above, with yellow eye ring, two buffy or whitish wing bars; very long primaries.

Distribution: Middle and eastern U. S.

Habitat: Key habitat requirements are moist deciduous forests with a moderate understory, generally near a stream.

State Records: 34 records occur in the southern half of the state.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: The primary threat to this species, as with other neotropical migrants, is habitat degradation and fragmentation (and therefore indirectly, cowbird parasitism and nest depredation).

Spruce Grouse (*Falcipennis canadensis*) - Threatened, S1S2B,S1S2N

Brief Description: A dusky grouse. Males have a black breast and a red skin comb above the eyes. Females are thickly barred. Both sexes have a rusty band on the tip of the tail.

Distribution: Canada and far northern U.S.

Habitat: Conifer forests, muskegs, etc.

State Records: Restricted to the northern third tier of counties. Observations are infrequent.

Wolf River Basin Records: 1 record from 1989.

Conservation Concerns: Misidentification by hunters, loss of conifer forests.

Common Moorhen (*Gallinula chloropus*) - Special Concern, S3B,SZN

Brief Description: A henlike, dark bird. In adults, the head and neck are black, the back brownish-olive, and the underparts slate, with a white streak on the flanks. The bill is red with a yellow tip, and there is a red forehead shield. Feet are large and yellow in adults, dusky in juveniles, which are paler and browner than adults.

Distribution: Breeds from central California, northern New Mexico, Texas, Kansas, Iowa, southern Wisconsin, southern Ontario, New England, and Nova Scotia south through most of South America.

Habitat: Freshwater marshes, canals, quiet rivers, lakes, ponds, primarily in areas of emergent vegetation and grassy borders. Infrequently flies. Nests usually among marsh plants over water, occasionally in shrub in or near water. Builds nestlike platforms on which to brood young.

State Records: 7 populations documented in the Southeastern portion of the state. All populations are from the 1990s to current.

Wolf River Basin Records: 4 populations in the lower end of the basin, all from 2000 and 2001.

Conservation Concerns: Local declines are occurring due to degradation and loss of wetlands.

Bald Eagle (*Haliaeetus leucocephalus*) - Special Concern, S2N,S3B

Brief Description: A very large bird of prey with dark back and undersides. Head white or dark in immature. Adults unmistakable with snowy white heads and tails.

Distribution: North American in distribution. In eastern U.S. generally northern or coastal.

Habitat: Sites with large area of clear surface water. Typically in forested lake complexes or along larger streams in WI.

State Records: Around 700 nesting records concentrated in northern third of the state with scattered outliers in the western, southern and central portions.

Wolf River Basin Records: 24 records from 1992.

Conservation Concerns: Logging, shoreline development, wetland alteration, disturbance, recreational, boating, or alteration of water quality, toxic compounds.

Least Bittern (*Ixobrychus exilis*) - Special Concern, S3B,SZN

Brief Description: The smallest member of the heron family, the least bittern ranges between 28-36 cm in length. Bitterns also have a laterally compressed trunk and short legs. The head is slightly crested. Whitish, highly visible lines border the scapular feathers. The crown and back of the female is purple-chestnut, whereas those of the male are black.

Distribution: Very large range (southern Canada to South America) and common in many areas.

Habitat: Nest in freshwater wetlands with dense, tall growths of emergent vegetation interspersed with open water.

State Records: 16 recent records in the central and northern portions of the state

Wolf River Basin Records: 7 records from 2000.

Conservation Concerns: Jeopardized by draining, filling, and degradation of marshes and probably by environmental contaminants and unnaturally high densities of predators such as raccoons (Evers 1992). May be negatively impacted by high water levels in the Great Lakes (Sandilands and Campbell 1988).

Red-headed Woodpecker (*Melanerpes erythrocephalus*) - Special Concern, S3B,SZN

Brief Description: Entire head is red. Back solid black, white rump. Large square white patches are conspicuous on the Distribution: East of the Rockies from south Canada to Gulf States. Partial migrant in the north.

Habitat: Mature oak woodlots preferred. Also found in groves, farm country, orchards, shade trees in towns, and large scattered trees.

State Records: Most prevalent in southwestern and central regions.

Wolf River Basin Records: 1 record from 1984.

Conservation Concerns: Uncertain.

Yellow-crowned Night-heron (*Nyctanassa violacea*) - Threatened, S1B,SZN

Brief Description: A stocky heron with a straight, stout, all-dark bill; breeding adult has buffy-white crown, black face with white cheek patch, gray under parts, and long white head plumes; juvenile has dusky upper parts with fine white streaks and spots, and dark-streaked under parts.

Distribution: Found in central U.S. and Canada.

Habitat: Swamps and river bottomlands.

State Records: 7 records in the 1980s from the Southwestern corner of the state.

Wolf River Basin Records: 1 record from 1984.

Conservation Concerns: Threats include disturbance and loss/degradation of nesting and foraging habitat. Probably susceptible to reduced reproductive success caused by pesticide contamination.

Black-crowned Night-heron (*Nycticorax nycticorax*) - Special Concern, S2B,SZN

Brief Description: A medium-sized wading bird with a short neck, short legs, and a stout, straight, pointed bill. Breeding adults have a black crown and back, with white hindneck plumes, gray wings, and white to grayish underparts.

Distribution: Breeds from Washington, southern Idaho, Saskatchewan, Michigan, and Nova Scotia south to southern South America, including Antilles; also Hawaii.

Habitat: Marshes, swamps, wooded streams, shores of lakes, ponds. Roosts by day in swampy woodland. Eggs are laid in a platform nest in groves of trees near swamps, marsh vegetation, clumps of grass on dry ground, orchards, and in many other situations. Nests usually with other heron species.

State Records: 45 documented populations in the state, mostly concentrated in the South East corner and the Door peninsula.

Wolf River Basin Records: 1 population from 2001.

Conservation Concerns: Human disturbance of nesting colonies may inhibit laying and increase nest abandonment, egg depredation, and nestling mortality.

Osprey (*Pandion haliaetus*) - Threatened, S3S4B,SZN

Brief Description: A nearly eagle-sized bird of prey with dark back and white undersides. Head white with dark line through eye.

Distribution: Nearly cosmopolitan. In eastern U.S. generally northern or coastal.

Habitat: Sites with large area of clear surface water. Typically in forested lake complexes or along larger streams in WI.

State Records: Nesting population restricted to northern third of the state with scattered outliers in the west and central portions.

Wolf River Basin Records: 31 populations last observed in 1992.

Conservation Concerns: Logging, shoreline development, wetland alteration, disturbance, recreational, boating, or alteration of water quality, toxic compounds.

Gray Jay (*Perisoreus canadensis*) - Special Concern, S3B,SZN

Brief Description: A large fluffy gray bird of the northern woods. Larger than a robin with a black patch across the back of the head and a white forehead.

Distribution: Boreal forests of North America.

Habitat: Boreal forests of spruce and fir. Also uses white cedar. Uncommon in pines and hardwoods.

State Records: Uncommon and largely restricted to the northern fifth of the state with occasional breeding season observations elsewhere.

Wolf River Basin Records: 2 records from 1994.

Conservation Concerns: Conversion of spruce/fir/cedar dominated forests to hardwoods. Management practices that result in seasonal disturbance of nesting habitat.

Black-backed Woodpecker (*Picoides arcticus*) - Special Concern, S2B,SZN

Brief Description: Solid black back and barred sides. Males have yellow caps.

Distribution: Far northern north central and northeastern U.S. and Canada.

Habitat: Fir and spruce boreal forests, tamarack bogs, jack pine forests.

State Records: Year round resident of the northern third tier of counties. Can be found occasionally throughout the state, but largely absent from the driftless area.

Wolf River Basin Records: Only documented in the basin matrix.

Conservation Concerns: Uncertain.

Prothonotary Warbler (*Protonotaria citrea*) - Special Concern, S3B,SZN

Brief Description: A small bird with entire head and breast deep yellow, almost orange. Wings blue-gray; no bars. Females duller than males.

Distribution: Great Lakes area to the Gulf States in the U.S.

Habitat: River bottomlands, and swamps.

State Records: Mainly distributed in southwest and south-central Wisconsin, north along the Mississippi River. Numerous scattered records from the mid part of the state along the Wolf River. Most of the 26 records occurred in 2000.

Wolf River Basin Records: 23 populations, all last observed in 2000.

Conservation Concerns: Logging, shoreline modification.

King Rail (*Rallus elegans*) - Special Concern, S2B,SZN

Brief Description: A large rusty colored rail with a long slender bill.

Distribution: Breeds locally from Kansas, eastern Nebraska, Iowa, and Minnesota east across the northern

U.S. and southern Ontario to southern New England, south to southern Texas, southern Louisiana, central Mississippi, central Alabama and southern Florida.

Habitat: Freshwater marshes, upland-wetland marsh edges, ricefields or similar flooded farmlands, shrub swamps. Nest is an elevated platform, often with a canopy and ramp, attached to plants growing in shallow water (0-25 cm) or placed in a tussock or other waterside vegetation.

State Records: 4 populations documented in the state. All but one are recent (late 1990s to 2001).

Wolf River Basin Records: 2 populations documented in the lower Wolf portion of the basin. Both records are from 2000.

Conservation Concerns: Decline in Midwest has been due to habitat destruction and drainage of wetlands. Perhaps environmental contaminants and unnaturally high densities of predators such as raccoons also have negatively impacted populations.

Forster's Tern (*Sterna forsteri*) - Endangered, S2B,SZN

Brief Description: Similar to Common Tern, but primaries lighter than the rest of the wing. Tail grayer, bill more orange. Frosty wing tips. In fall and winter they have a black mask through eye and ear (not around nape).

Distribution: Western Canada, western U.S., and central Atlantic coast to Tamaulipas. Numerous disjunct breeding populations in the Great Lakes region.

Habitat: Nests in marshes, also found in lakes, bays, beaches, and oceans.

State Records: Distributed along Lake Superior, the Mississippi River, Lake Michigan, and inland SW from Green Bay.

Wolf River Basin Records: 3 records between 1984 and 2000.

Conservation Concerns: Wetland draining, fluctuating water levels, predators, loss of emergent aquatic vegetation.

Great Gray Owl (*Strix nebulosa*) - Special Concern, S1B,SZN

Brief Description: Largest North American owl. Dusky gray, heavily striped lengthwise on the underparts. Round-headed, without ear tufts, the strongly lined facial disks are very large proportionately, dwarfing the yellow eyes.

Distribution: Boreal forests of the northern hemisphere.

Habitat: Dense conifer forests, adjacent meadows, bogs.

State Records: Records widespread and scattered, vast majority from the northern half of the state.

Wolf River Basin Records: 1 record from 1995.

Conservation Concerns: Uncertain.

Barn Owl (*Tyto alba*) - Endangered, S1B,S1N

Brief Description: A medium-sized owl with white heart-shaped face, dark eyes, no ear tufts, and long-legs.

Distribution: Nearly worldwide in tropical and temperate regions, near the northern limits of its range in the U.S. halfway up the state of Wisconsin.

Habitat: Woodlands, groves, farms, barns, towns, and cliffs.

State Records: Uncommon, 29 scattered records, but majority from far southern WI.

Wolf River Basin Records: 2 records from the late 1970s and the early 1980s.

Conservation Concerns: Uncertain.

Fish

lake sturgeon (*Acipenser fulvescens*) - Special Concern, S3

Brief Description: Large, heavy, torpedo shaped fish. Short snout, conical. Lower lip with two lobes. Barbels on lower snout, smooth, 4. Upper lobe of tail fin pointed without threadlike (filamentous) extension.

Distribution: Great Lakes Region, large Mississippi River tributaries south to southern Arkansas, large portion of Canada.

Habitat: Inhabits large rivers and lakes. It lives in shoal water in the Great Lakes. Inland it shows a preference for the deepest midriver areas and pools.

State Records: Occurs in the Mississippi, Lake Michigan, and Lake Superior drainages. It has been introduced into lakes where natural reproduction does not occur. It is common in the Menomonee River, lower Wolf River, Lakes Poygan and Winnebago, Lake Wisconsin (Lake Wisconsin), St. Croix River to Gordon Dam. It is uncommon to rare in the lower Wisconsin River, Mississippi River, the Madison lakes, and Lakes Michigan and Superior.

Wolf River Basin Records: 55 records between 1980 and 1991. John Lyons also reports 3 observations in the study area in 2000 and 2001.

Conservation Concerns: Illegal harvest.

pirate perch (*Aphredoderus sayanus*) - Special Concern, S2S3

Brief Description: A small fish with a stout body, slightly compressed laterally, elevated at base of dorsal fin; caudal peduncle thick. Mouth large, oblique, with lower jaw projecting. Back dark olive to black; side lighter; belly yellowish. Two narrow, vertical bars separated by a pale interspace at base of caudal fin. Dorsal and caudal fins slate colored, other fins more lightly pigmented.

Distribution: Great Lakes Region, Mississippi River basin, southeastern U.S., Mid-Atlantic States.

Habitat: Oxbows, overflow ponds, sloughs, marshes, ditches, and the pools of low gradient streams. It is found over sand, or over soft, muck bottoms covered with organic debris. Frequently it is associated with brush piles or dense aquatic vegetation. Prefers quite water, seldom in sluggish or stronger current.

State Records: Occurs in Mississippi River and Lake Michigan drainage basins, where it reaches the northern limit of its distribution. The principal population centers are the lower Wisconsin River and its tributaries, and the Des Plaines River watershed.

Wolf River Basin Records: 1 older record from 1970.

Conservation Concerns: Uncertain.

lake chubsucker (*Erimyzon sucetta*) - Special Concern, S3

Brief Description: Body moderately deep, slightly compressed; tapered at both ends. Snout tapered to blunt point, mouth subterminal, slightly oblique. Scales square in appearance, with both dorsal and ventral edges straight and parallel to one another. Back olive brown; sides lighter and more yellow; belly olive yellow. Scales prominently dark edged. Fins olive to slate colored.

Distribution: Great Lakes Region, Mississippi River basin, Southeastern U.S.

Habitat: Lakes, oxbow lakes, and sloughs of large rivers and quiet streams. It is frequently associated with dense vegetation over bottoms composed of sand or silt mixed with organic debris.

State Records: Occurs in the Mississippi River and Lake Michigan drainage basins. In the former, it is

confined mainly to the lower Wisconsin River and its tributaries and the upper Rock River and Illinois-Fox River watersheds. This species reaches the northern limit of distribution in the Wolf River system of the Lake Michigan drainage basin.

Wolf River Basin Records: 6 older records from the mid 1970s to the early 1980s.

Conservation Concerns: Uncertain.

western sand darter (*Etheostoma clarum*) - Special Concern, S3

Brief Description: A small, slender, almost cylindrical, pallid fish with a distinct opercular spine.

Distribution: Spotty distribution in streams from Wisconsin and Kentucky to Texas and Mississippi.

Habitat: Usually in medium and large rivers; most common in slight to moderate current over sandy bottom, though also known from areas of gravel or silt. Also recorded from quiet margins of drainage canals and shallow backwaters. Buries in sand.

State Records: 12 state records, all in medium/large rivers in the western half of the state.

Wolf River Basin Records: 4 records from 1979-1994. John Lyons reported 6 observations in 2000-2001.

Conservation Concerns: Habitat degradation is considered to be the primary cause of decline (siltation, impoundments, channelization, etc.).

least darter (*Etheostoma microperca*) - Special Concern, S3

Brief Description: Adults 1.5-2" in length, compressed laterally. Olive -brown back and sides with scattered dark brown specks and zigzag markings, series of small dusky blotches on sides and four short dusky bars radiating from the eye.

Distribution: Great Lakes region, Mississippi River valley as far south as Oklahoma.

Habitat: Weedy portions of lakes and clear streams with sluggish flow.

State Records: Scattered records throughout the state, generally avoids the unglaciated region, and not reported since 1935 from the Lake Superior drainage basin. Bulk of records in southeastern Wisconsin and the Wolf River system.

Wolf River Basin Records: 6 older records from the 1970s.

Conservation Concerns: Statewide abundance trends uncertain. Appears to have recently disappeared from several rock county locations. This species is relatively sensitive to environmental perturbations such as watershed and shoreline

banded killifish (*Fundulus diaphanus*) - Special Concern, S3

Brief Description: Adults between 2-2.5". Body is light olive on the back and sides and yellow-white below with 12 - 20 narrow vertical bars on the body.

Distribution: Northeastern U.S. and far southeastern Canada. Great Lakes region west to eastern North and South Dakota.

Habitat: Shoal waters and estuaries of large lakes. Quiet backwaters and sections of slow current in medium to large streams. Prefers open broad, sandy shallows during the warm season.

State Records: All modern records from the eastern half of Wisconsin.

Wolf River Basin Records: 8 older records from the mid 1970s.

Conservation Concerns: Species declining in southern Wisconsin, and has been extirpated at several sites. Shoreline development and modification of littoral-zone habitats are probably major factors.

longear sunfish (*Lepomis megalotis*) - Threatened, S2

Brief Description: Thin, deep-bodied sunfish. Opercular "ear flap" flexible and much elongated in adults. Black olive to rusty brown, sides lighter, breast and belly yellow to orange red. Back and sides with specks of yellow, orange, emerald and blue.

Distribution: A broad swath from western New England southwest to the Mexican border. Populations in the western Great Lakes regions are apparently isolated.

Habitat: Prefer clear, shallow, moderately warm, still water of streams, rivers or lakes over rubble, gravel and sand with moderate aquatic vegetation.

State Records: Occurs in three widely separated population centers, in southeastern, east-central, and northwestern Wisconsin. Populations in former strongholds in southeastern Wisconsin appear to be declining. Specimens have been found in other river systems, but they are infrequently collected, and are often *Lepomis* sp. hybrids.

Wolf River Basin Records: 2 older records, 1 from 1926 and 1 from 1979.

Conservation Concerns: Hybridization in small populations is a concern. They are intolerant to turbid water from heavy agriculture within their range. They resemble other sunfish; they are often caught and kept by young anglers.

striped shiner (*Luxilus chrysocephalus*) - Endangered, S1

Brief Description: Resemble related, more common shiners but differ in having large predorsal scales (fewer than 17). Heavily pigmented tip of chin and numerous parallel dark lines on the sides converging at the mid-back rather than a mid-dorsal stripe and one or two lateral dark stripes. Green or blue dorsally, sides blue silver, belly white silver. Prominent mid-dorsal, broad and slate colored stripe.

Distribution: Great Lakes Region extending south almost to the Gulf of Mexico, and west to central Oklahoma.

Habitat: Clear to slightly turbid waters, shallow water over gravel, rubble, boulders, silt, or sand. Often seen in dense aquatic vegetation.

State Records: Fox River watershed and the Milwaukee River and tributaries.

Wolf River Basin Records: 2 records.

Conservation Concerns: Range appears to be shrinking, may be due to a combination of increasing siltation, turbidity, and temporary drying of small creeks during late summer. Agricultural pollution along rivers should be minimized.

redfin shiner (*Lythrurus umbratilis*) - Threatened, S3

Brief Description: A small, deep-bodied, thick-skinned, whitish shiner (fish) with small, closely crowded predorsal scales. Snout bluntly pointed. Black bluish gray dorsally, sides and belly silvery.

Distribution: Great Lakes Region extending south almost to the Gulf of Mexico, and west to central Oklahoma.

Habitat: Found occasionally in clear water, but more often in turbid areas at depths of 4-60 inches (0.1-1.5m) over silt, gravel, and rubble. Occur in pool areas of low-gradient, medium size streams.

State Records: Of the state's 73 records, none are in the last 20 years. At the northern limit of its range in the Mississippi River and Lake Michigan drainage basins. Disjunctly distributed in the southern half of Wisconsin.

Wolf River Basin Records: 6 records from 1979.

Conservation Concerns: During most of the year they are tolerant of siltation, but they require clear water during spawning, which may factor into their scant occurrence.

shoal chub (*Macrhybopsis hyostoma*) - Threatened, S2S3

Brief Description: A fish approximately 7.6 cm in length. *Macrhybopsis tetranema*, *M. hyostoma*, *M. marconis*, and *M. australis* formerly were included in *M. aestivalis* (gravel chub) but were recognized as distinct species by Eisenhour (1997) with the Wisconsin population now being called shoal chub. A fish approximately 7.6 cm in length.

Distribution: Widespread in the Mississippi River basin and in streams of the western Gulf Slope of the United States.

Habitat: Usually found in large, low gradient, small to large rivers: over broad shallow riffles over sand or mud.

State Records: 20 populations found mostly in the Mississippi and Wisconsin rivers. All but one were last observed in 1980

or before.

Wolf River Basin Records: John Lyons reported the first observation in this basin in 2000.

Conservation Concerns: Uncertain.

river redhorse (*Moxostoma carinatum*) - Threatened, S2S3

Brief Description: Body moderately stout, usually round, often quite compressed in adult males; ventral line curved. Mouth ventral and horizontal; lips deeply plicate, folds almost always smooth, papillae absent; lower lip much broader than upper lip. Back bronze olive; sides and belly yellowish, brassy or browned. Caudal and dorsal fins red, lower fins orange to reddish orange. Scales usually with dark spots at their anterior exposed bases.

Distribution: Great Lakes Region extending south to the northern border of Texas, and west to central Kansas.

Habitat: Prefers large rivers and the lower portions of their main tributaries. It inhabits reservoirs, pools, and moderate to swift water over clear gravel and rubble. Seldom encountered in deeper waters with mud, silt, or sand bottoms.

State Records: Most collections are from the late 1970s/early 1980s from the major Wisconsin rivers. Collected from the Mississippi, St. Croix, Yellow, Chippewa, Wisconsin, Sugar, Rock, Fox, Black, Wolf, and Apple Rivers.

Wolf River Basin Records: 2 records from the early 1980s. John Lyons reported 3 observations in 2000.

Conservation Concerns: Uncertain.

greater redhorse (*Moxostoma valenciennesi*) - Threatened, S2S3

Brief Description: Largest of the redhorses (*Moxostoma* spp.). Somewhat compressed body, red tail, rows of dark spots on back and sides, large mouth and full lips. Back brown olive, sides golden, belly whitish. Adult size: 18 inches.

Distribution: Great Lakes region of the U.S. and Canada.

Habitat: Clear waters of small to large sized rivers, reservoirs and large lakes at depths of less than 3 feet (1m) over sand, gravel or boulders.

State Records: Widely scattered records from the Mississippi River and Lake Michigan drainage basins. Recent records from southeastern Wisconsin in the Illinois River drainage.

Wolf River Basin Records: 7 records from the mid 1990s back to 1926. John Lyons also reports 4 observations in the study area between 1997 and 2000.

Conservation Concerns: Sensitive to chemical pollutants and turbidity. Carp control programs may also be a threat.

pugnose shiner (*Notropis anogenus*) - Threatened, S2S3

Brief Description: Slender, fragile minnow with small and almost vertical upturned mouth, giving a distinctive pugnose appearance. Large eyes. Silvery with yellow cast dorsally, sides and belly silvery. Lead-colored lateral stripe extending from a small dark spot on base of tail, along sides and through eye. Adult length: 1.8 inches.

Distribution: Great Lakes region of the U.S west to eastern North Dakota.

Habitat: Prefer clear, weedy shoals of glacial lakes and streams of low gradient over sand, mud, gravel or marl. Characteristic vegetation includes pondweed, water milfoil, elodea, eelgrass, coontail, bullrush and filamentous algae.

State Records: Majority of records from far northwestern Wisconsin and southeastern Wisconsin. Apparently extirpated from the Rock River drainage. Recently found in the Manitowish River system.

Wolf River Basin Records: 7 older records from 1963-1971.

Conservation Concerns: Loss of littoral zone macrophyte communities and lakeshore development.

weed shiner (*Notropis texanus*) - Special Concern, S2S3

Brief Description: A small, moderately robust, slightly compressed shiner (fish). Mouth terminal, oblique, tip of upper lip extending to level of midpupil. Eye large. Back olive green with brassy tinge; silvery on sides, belly whitish. Lateral stripe extends through eye.

Distribution: Great Lakes Region, Mississippi River Basin, and Gulf of Mexico states.

Habitat: Sloughs, lakes, and the quiet or sluggish sections of medium-sized streams and larger rivers.

State Records: Mississippi River and Lake Michigan drainage basins. Uncommon in lower Wisconsin River, in the Mississippi River, and in the lower portion of their tributaries. Populations are widely disjunct. At northern limits of its range in WI.

Wolf River Basin Records: 11 older records from 1979. John Lyons reported 3 observations in 2000-2001.

Conservation Concerns: Apparently extremely sensitive to environmental deterioration or changes, although the factors causing this are not known.

pugnose minnow (*Opsopoeodus emiliae*) - Special Concern, S3

Brief Description: Adults 2.5" in length. Body color is straw-brown dorsally changing to silvery-yellow on the sides and belly, body is crosshatched in appearance, very blunt snout which is rounded in appearance with small mouth that is nearly vertical.

Distribution: Southeastern U.S. west to eastern Texas, north, following the Mississippi River Valley to central Wisconsin.

Habitat: Pugnose minnows prefer clear, vegetated water, where there is sluggish current. Backwater sloughs, lowland lakes, and connecting streams along the Mississippi flood plain offer ideal habitat.

State Records: Two widely separated population centers within the Mississippi River drainage basin. Found in backwaters of the Mississippi River, within the Red Cedar system of Dunn and Washburn Counties, and isolated areas of the southernmost tier of counties.

Wolf River Basin Records: 5 records from the 1970s and early 1980s. John Lyons reported 1 observation in 2000.

Conservation Concerns: Appears to be intolerant of excessive turbidity and siltation.

Mammals

prairie vole (*Microtus ochrogaster*) - Special Concern, S2

Brief Description: A vole with grayish to dark brown with a good mixture of tawny-tipped hairs. Head and body 3 ½ - 5 inches (89-127 mm), tail 1 – 1 2/5 inches (25-36 mm), weight 1 – 1 ½ ounces (28-42 g).

Distribution: Southwestern Canada south through Oklahoma, east to Ohio.

Habitat: Dry grassy areas along fence lines and in open fields; sandy prairies and slopes, especially if weed or grass grown; abandoned farm fields; seldom in sparsely wooded areas. Preferable habitat seems to be native prairie sod, of which there is little left in the State. It avoids marshes and wet places.

State Records: Southern and southwestern parts of the state, all known populations south of the tension zone.

Wolf River Basin Records: 1 historic museum record from 1898.

Conservation Concerns: Uncertain.

woodland jumping mouse (*Napaeozapus insignis*) - Special Concern, S2S3

Brief Description: Bright yellowish sides, brownish back, white belly, large hind feet, and a long white-tipped tail. Head and body 3 3/5-4 inches (91-102 mm), tail 5-6 1/5 inches (127-157 mm), weight 7/10-1 1/10 ounces (20-30) g.

Distribution: Northeastern Canada south to the northern Great Lakes Region, northeastern U.S., extending south along the Appalachian Mountain range.

Habitat: Forested or brushy areas near water, wet bogs, stream borders.

State Records: Scattered records from the northern half of the state, not known from Door County.

Wolf River Basin Records: 6 records from 1995.

Conservation Concerns: Uncertain.

western harvest mouse (*Reithrodontomys megalotis*) - Special Concern, S2

Brief Description: A small slender mouse with relatively large ears and prominent eyes. Tail length a trifle less than that of head and body, and about four times the length of the hind foot. Tail bicolor, with dark brown hair above, and dirty whitish below. Upper parts buffy brown, sides more clearly buff, and under parts white or nearly so. Feet white. Head and body 2 4/5 – 3 inches (71-56 mm), tail 2 – 2 3/5 inches (51-66 mm), 1/5 – 1/3 ounces (5-9 g).

Distribution: California and Mexico north to Washington, east to eastern Illinois.

Habitat: More or less open grassy places; neglected fields overgrown with grasses or sedges, weedy and grassy borders of cultivated tracts.

State Records: Most known occurrences are from the southwestern and south-central part of the state. Limits of range in the state are unknown.

Wolf River Basin Records: 1 record from 1976.

Conservation Concerns: Uncertain.

arctic shrew (*Sorex arcticus*) - Special Concern, S2

Brief Description: One of the most brilliantly colored and attractive shrews. The back, sides, and belly all contrast. In winter, tricolored, with back nearly black; in summer dull brown. Head and body 2 ¾ -3 inches (70-76mm), tail 1 ¼ - 1 2/3 inches (31-42 mm). Weight ¼ - 1/3 ounce (7-9 g).

Distribution: Canada and Alaska south into the northern Midwest states.

Habitat: Tamarack and spruce swamps. Sometimes in alder or willow marshes, rarely in leatherleaf-sphagnum bogs.

State Records: Mostly in the northern half of the state. Scattered records from the southern half of the state.

Wolf River Basin Records: 11 records from 1995-2000.

Conservation Concerns: Uncertain.

pigmy shrew (*Sorex hoyi*) - Special Concern, S3

Brief Description: A shrew with upperparts between sepia and brown, undersides smoke gray, tinged with light buff. Tail darkening toward the tip. By weight, probably the smallest living mammal, about the weight of a dime. Eyes: tiny black beads. Nose: pointed and long. Head and body 2 - 2 ½ inches, tail 1 - 1 2/5 inches (35-36 mm), weight 1/10 - 1/7 ounces

Distribution: Canada and Alaska south through northeastern U.S. and the Great Lakes Region, extending south along the Appalachian range.

Habitat: Among debris and heavy vegetation in woods, clearings, and meadows, particularly those grown to high grass. Avoiding swampy or excessively wet areas, though can be found in cold sphagnum or tamarack bogs.

State Records: 41 records scattered across the state.

Wolf River Basin Records: 9 records from 1995.

Conservation Concerns: Uncertain.

water shrew (*Sorex palustris*) - Special Concern, S2

Brief Description: A large (3-3.5") blackish-grey shrew, with underside paler, sometimes silvery. Stiff hairs along the sides of the feet distinguish from other Midwest shrews. Head and body 3 1/5 - 3 ½ inches (81-89 mm), tail 2 ½ - 3 inches (64-76 mm), weight 1/3 - ½ ounces (9-14 g).

Distribution: Northern U.S. and Canada. Extends south in the U.S. along the Rockies and the Appalachian Mountains.

Habitat: Marshes, bogs, and cold, small streams with cover along the banks.

State Records: Not common anywhere within range. Collected infrequently in the northern third tier of counties.

Wolf River Basin Records: 5 records between 1974 and 1995.

Conservation Concerns: Sensitive to water quality changes.

Franklin's ground squirrel (*Spermophilus franklinii*) - Special Concern, S2S3

Brief Description: A large, grayish ground squirrel with a tawny overwash on the back and the rump. Belly nearly as dark as back, tail fairly long. Much larger and darker than any ground squirrel in area. Head and body 9-10" (22.9-25.4 cm), tail 5-6" (12.7-15.2 cm), weight 10-25 oz (284-709 g).

Distribution: Central Indiana west through the Nebraska, south through Kansas, northwest into Canada.

Habitat: Dense grassy and shrubby near-dry marshland; dense marsh grass bordering sloughs, grassy borders of tamarack bogs; fields of grain and along old fencelines, sometimes in woods if sufficient undercover present.

State Records: Generally ranging in the southern and western parts of the state, but records from along lake Superior and from far southeastern Wisconsin exist.

Wolf River Basin Records: 1 record from 1990.

Conservation Concerns: Sheltering cover of tall grass or other herbage is a necessary condition.

Reptiles and Amphibians

Blanchard's cricket frog (*Acris crepitans blanchardi*) - Endangered, S1

Brief Description: A small tree frog (ca 1") with moist skin, warts on the dorsal surface, and the ventral surface in granular. Hind limbs are long in comparison to body size. Toes are extensively webbed, and the terminal discs are scarcely larger than the digits.

Distribution: Northern Mexico/southern northeast through central Ohio, north to central Wisconsin, west to southeastern New Mexico.

Habitat: Marshes along rivers and river floodplains, fens and low prairies usually near permanent water bodies or flowing water in open country. They prefer open mud flats and banks of streams where there is abundant emergent vegetation.

State Records: Historically it was widely distributed across the southern half for the state.

Wolf River Basin Records: 4 older records, the most recent observation was in 1983. A single frog heard in 2000 may have been introduced.

Conservation Concerns: Population has diminished rapidly. Reason for decline is unclear, but there is evidence that this species cannot survive under polluted conditions.

wood turtle (*Clemmys insculpta*) - Threatened, S3

Brief Description: A medium sized semi-terrestrial turtle with the upper shell sculptured into concentric ridges and grooves similar in appearance to wood grain.

Distribution: Canada, north central and northeastern U.S.

Habitat: Restricted to forested areas along fast moving streams. Nests in nearby open sand or gravel.

State Records: Essentially statewide. Rare in the southwest and east-central portions, absent in the southeast.

Wolf River Basin Records: 19 populations last observed between 2000 and 1982.

Conservation Concerns: Lack of secure nesting habitat. Road kills. Harvesting for pet trade and or human consumption. Water quality degradation. Disturbance of nesting areas during incubation period. High densities of mammalian nest predators. Management opportunities might include protection of traditionally used nest sites.

northern ringneck snake (*Diadophis punctatus edwardsii*) - Special Concern, S3?

Brief Description: A slender snake with a yellow, cream, or orange neck ring and bright yellow, orange, or occasionally red belly. The underside is free of markings or may be marked with an irregular row of black spots. Spots are more common where this subspecies intergrades with the prairie ringneck snake (*Diadophis punctatus arnyi*). The neck ring may be interrupted, obscure, or occasionally absent. Adults are 12-15" long.

Distribution: This subspecies ranges from far southeastern Canada and northeastern U.S. west to northeastern Minnesota and south to northern Alabama.

Habitat: Northern Ringneck Snakes prefer to live in moist areas in forests, grasslands, cut over areas, rocky wooded hillsides, or ledges along streams. They are most often seen under flat rocks, logs, or the loose bark of dead trees. They are believed to be highly fossorial.

State Records: Specimens verified from twenty-six counties, distributed mainly north of the tension zone. Populations from the southern central and southeastern counties are believed to be extirpated. This subspecies apparently does not extend into the driftless area.

Wolf River Basin Records: 5 records from the late 1990s.

Conservation Concerns: Uncertain.

Blanding's turtle (*Emydoidea blandingii*) - Threatened, S3

Brief Description: Medium size turtle with a bright yellow underside of its neck. Its head, tail, and limbs are blue-black, while the underside of its shell (or plastron) is yellow, with brown or black splotches, and is hinged. Its upper shell (or carapace) is usually black speckled with yellow, or horn colored and mottled with brown.

Distribution: Great Lakes Region extending west through Iowa. Disjunct population in Massachusetts, and southeastern New Hampshire and Maine.

Habitat: A semi-aquatic turtle that prefers open, grassy marshes containing shallow water, but will move to ground adjacent to water to forage or bask.

State Records: Ranges across most of the state in appropriate habitat, except for far northern tier of counties. 177 records.

Wolf River Basin Records: 36 populations last observed in 2000 and 2001.

Conservation Concerns: Uncertain.

four-toed salamander (*Hemidactylium scutatum*) - Special Concern, S3

Brief Description: A small brown to rich red-brown terrestrial salamander with the underside porcelain white with irregular black flecks. Four rather than five toes on the hind feet distinguish this from all other terrestrial WI salamanders.

Distribution: Found in the eastern U.S. and southeastern Canada.

Habitat: Requires moist, mature, usually deciduous forest with high quality leaf litter and an abundance of downed wood in advanced stages of decomposition. These forests must also contain appropriate breeding sites, which are typically woodland ponds or seeps with abundant mosses. Nesting habitat is usually in sphagnum moss mounds directly adjacent to shallow fresh cool water.

State Records: There are about 40 records for the state from twenty-two counties, but most of those from southern WI are old and need to be verified. As a result, this species was recently added to the NHI Working List as status undetermined.

Most recent records are from inventories conducted for state forest master plans in the NW, NE and WC parts of the state. The recent discovery of their breeding habitat has resulted in many of these new records.

Wolf River Basin Records: 5 records from the early 1980s to the mid 1990s.

Conservation Concerns: Timber harvesting practices resulting in increased light and decreased humidity, canopy openings or reduced downed wood, wetland modification (draining, impoundment, dredging), or alteration of water quality.

western slender glass lizard (*Ophisaurus attenuatus*) - Endangered, S2

Brief Description: A lizard with a snake-like appearance with a long tan, brown, or bronze cylindrical body with no limbs, pointed snout, and narrow head. A dark brown to black stripe runs along the middle of the back from head to tail. Two additional stripes run immediately above the lateral groove and four narrow stripes run below the groove. Unlike a true snake it has eyelids and external ear openings, plus the ability to shed part of its tail. Average total length 18-24 inches, although they may reach 36 inches, two-

thirds of, which may be tail.

Distribution: South central U.S. from southern Texas north through most of Indiana. Disjunct population in west-central Wisconsin.

Habitat: Oak savannas, sand prairies, old fields, and pine barrens in central Wisconsin.

State Records: There are 45 records from a band of central Wisconsin counties extending from LaCrosse County in the west to Waushara County in the east.

Wolf River Basin Records: 2 records from 1989 and 1973.

Conservation Concerns: Urban and agricultural development have contributed to their decline.

bullfrog (*Rana catesbeiana*) - Special Concern, S3

Brief Description: Largest North American frog. Plain or nearly plain green above, or with a netlike pattern of gray or brown on a green background. No dorsolateral ridges on trunk.

Distribution: Eastern and central North America. Introduced widely outside their range.

Habitat: A wide variety of wetlands and vegetated edges of open water bodies.

State Records: Widely distributed and scattered throughout the state in appropriate habitat. Widely introduced, and it is difficult to distinguish natural populations from introduced ones.

Wolf River Basin Records: 1 record from 1986.

Conservation Concerns: Uncertain.

Terrestrial Invertebrates

bog fritillary (*Boloria eunomia*) - Special Concern, S3

Brief Description: A fritillary butterfly with a nonmetallic white pattern on the undersides; with a submarginal row of black outlined, white spots.

Distribution: Canada, Alaska, western montane and northern most portions of U.S.

Habitat: Open bogs with cranberry and other ericaceous components.

State Records: Known from 46 sites in seven Wisconsin counties in the 1980s and 1990s. Previously collected in one additional county in the 1970s. All collections have been made in far northern Wisconsin.

Wolf River Basin Records: 7 records from the late 1990s to present.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known site.

Henry's elfin (*Callophrys henrici*) - Special Concern, S2

Brief Description: Small and brown butterflies, with a straight white line at the top of the ventral forewing.

Distribution: Has a wide range, but is rare through-out. Found in Quebec and south to Florida and Texas, and west to Michigan, Wisconsin, Nebraska, Kansas, and Missouri.

Habitat: Pine barrens. Host plants possibly are Vacciniums and or maple-leaved viburnum in Wisconsin.

State Records: 12 records in the state, half in the 1990s, all in the northern half of the state.

Wolf River Basin Records: 1 record from 1990.

Conservation Concerns: Uncertain.

a land snail (*Catinella gelida*) - Special Concern, S1S2

Brief Description: A very small terrestrial snail.

Distribution: Known from very few sites in South Dakota, Iowa, and Wisconsin.

Habitat: Appears to be restricted to moist, soil covered ledges in Wisconsin.

State Records: There are 14 records, all from east central Wisconsin.

Wolf River Basin Records: 1 record from 1997.

Conservation Concerns: Uncertain.

gorgone checker spot (*Chlosyne gorgone*) - Special Concern, S3

Brief Description: Underside hindwing of butterfly with zigzag pattern of alternation brown and white bars and scallops.

Distribution: Midwest and southern U.S. and south-central Canada. Basically a broad area of the continental interior of the U.S. west of the Appalachians and east of the Rockies.

Habitat: Prairies, open ridges, glades in deciduous woods, waste areas. Hostplants: Helianthus, Ambrosia, Iva, and Viguiera spp.

State Records: There are 38 known records from the state, most in the southern half of the state.

Wolf River Basin Records: 4 records from the 1990s to 2000.

Conservation Concerns: Uncertain.

little white tiger beetle (*Cicindela lepida*) - Special Concern, S2S3

Brief Description: A small tiger beetle, 10-11 mm in length, brown background with greatly expanded white markings so beetle often appears mostly white.

Distribution: Central Plains, SW to Arizona, NE to New York and Eastern Coast.

Habitat: In WI sandy areas, blowouts and dunes. Also reported from beaches and streamsides.

State Records: 13 state records, all post 1970 and in the central to south-central part of the state.

Wolf River Basin Records: 1 record from 2000.

Conservation Concerns: Tree planting or other sand blow stabilization practices and general succession from bare soil to vegetation.

a tiger beetle (*Cicindela patruela huberi*) - Special Concern, S3

Brief Description: A large tiger beetle with muddy green to brown to black coloration as opposed to the bright green of the more northern *C. patruela patruela*.

Distribution: Endemic subspecies to central WI.

Habitat: Semi open pine barrens or dry oak woodlands where open ground exists, such as along trails.

State Records: 79 records in the state, mostly from the central portion.

Wolf River Basin Records: 9 records from 1965 to 2000.

Conservation Concerns: The main threat to this species is habitat destruction due to deforestation and fire suppression (ecological succession eliminates some habitats).

a tiger beetle (*Cicindela patruela patruela*) - Special Concern, S2

Brief Description: A large tiger beetle with bright green coloration as opposed to the muddy green to brown to black of the *C. patruela huberi*.

Distribution: This subspecies is endemic to central Wisconsin and reaches it's northern and eastern range

limit in the Wolf River basin.

Habitat: Open jack-pine and or dry oak woodlands where open ground exists, with an understory of bracken fern, ericaceous shrubs, lichens and dry mosses. Typical sites are along fire lanes through medium aged jack-pine woods.

State Records: 15 populations are documented in the state. They occur mostly north of the tension zone.

Wolf River Basin Records: 6 current populations are found in the study area.

Conservation Concerns: The main threat to this species is habitat destruction due to deforestation and fire suppression (ecological succession eliminates some habitats).

Appalachian pillar (*Cionella morseana*) - Special Concern, S2

Brief Description: A very small terrestrial snail.

Distribution: Scattered records throughout eastern North America excluding most of the far south. Mainly found in the upper Great Lakes Region and along the Appalachian range.

Habitat: Usually found in moist upland woods. Rarely found on the surface of the leaf litter.

State Records: There are 6 known occurrences, all in the northern half of the state.

Wolf River Basin Records: 1 record from 1997.

Conservation Concerns: Uncertain.

columbine dusky wing (*Erynnis lucilius*) - Special Concern, S2

Brief Description: Upperside forewing with brown patch at end of cell relatively indistinct. Underside hindwing with marginal and submarginal rows of pales spots very distinct. Difficult to distinguish from other species of the "Persius" complex.

Distribution: The Great Lakes region and northeastern U.S.

Habitat: Ravines or gullies in rich deciduous or mixed woods or their edges.

State Records: There are 12 known records, from eight counties, the majority from southwestern Wisconsin.

Wolf River Basin Records: 1 record from 1991.

Conservation Concerns: Uncertain.

Persius dusky wing (*Erynnis persius*) - Special Concern, S2

Brief Description: A dusky wing butterfly. Forewing with patch at end of cell more gray than brown. Male forewing with numerous raised white hairs.

Distribution: The Great Lakes region and northeastern U.S., along the West Coast from southern U.S. border north to Alaska. Absent from a large part of the central U.S.

Habitat: Open areas, marshes, seeps, and sand plains. Hostplant: Lupinus, Salix, and Populus spp.

State Records: There are 23 known records, from nine counties, the majority from the central sand region of the state.

Wolf River Basin Records: 2 records from the early 1990s.

Conservation Concerns: Uncertain.

two-spotted skipper (*Euphyes bimacula*) - Special Concern, S2S3

Brief Description: A skipper butterfly. Forewings pointed. Fringe white. Upperside of male forewing with limited tawny patch; female dark, forewing with two pale spots. Underside of hindwing orange-brown.

Veins paler.

Distribution: Northeast, upper Midwest, and east coast of U.S.

Habitat: Wet sedge meadows, marshes, and bogs. Hostplant sedges: *Carex trichocarpa*, assoc. with *C. stricta*.

State Records: There are 10 known records, from 8 counties, mostly from the eastern third and southern half of the state.

Wolf River Basin Records: 2 records, 1 from 1989 and 1 from 1994.

Conservation Concerns: Uncertain.

dion skipper (*Euphyes dion*) - Special Concern, S3

Brief Description: A variable species. Upperside of male forewing with restricted orange. Hindwing dark brown with broad orange streak. Underside of hindwing red-brown or orange-brown with two yellow-orange rays, one through cell and the second above anal fold.

Distribution: Eastern half of U.S. excluding much of New England, the Florida peninsula, and the Appalachian mountain range.

Habitat: Open marshes, bogs, and swamps.

State Records: There are 27 known records, the majority from the southern third of the state and counties bordering Lake Michigan.

Wolf River Basin Records: 8 records from the 1990s and 2000s.

Conservation Concerns: Uncertain.

sculpted glyph (*Glyphyalinia rhoadsi*) - Special Concern, S2

Brief Description: A very small terrestrial snail.

Distribution: Northern Wisconsin and Michigan, New England, and south along the Appalachian range. Scattered other records along the east coast of North America.

Habitat: Generally found in leaf litter in upland woods.

State Records: There are 5 records, from 3 counties, for this species. All from east-central WI.

Wolf River Basin Records: 1 record from 1997.

Conservation Concerns: Uncertain.

Midwestern fen buckmoth (*Hemileuca sp 3*) - Special Concern, S3S4

Brief Description: A large, day-flying moth with light gray to black wings with yellow to white markings. WI populations have been referred to in the past as *H. maia* and *H. nevadensis*.

Distribution: Known from NE Indiana to Michigan and Wisconsin, and NE Ohio, and NW Pennsylvania.

Habitat: In WI, found in bogs and fens and oak barrens. Reported feeding on willow, oak, bog bean, and purple loosestrife.

State Records: 7 records occur throughout the state, half are recent occurrences.

Wolf River Basin Records: 1 record from 1974 just outside the basin boundary, but due to this species habitat preference it is probable that it also occurs within the basin.

Conservation Concerns: Uncertain.

Laurentian skipper (*Hesperia comma*) - Special Concern, S2

Brief Description: A skipper.

Distribution: Found throughout the northern U.S. and Canada.

Habitat: Generally found in forests confined to openings.

State Records: 14 populations documented in the northern tier of the state. All populations are from the late 1980s to present.

Wolf River Basin Records: 8 current populations found in the northern tip of the study area.

Conservation Concerns: Unknown.

Leonard's skipper (*Hesperia leonardus leonardus*) - Special Concern, S3

Brief Description: A rich, tawny orange butterfly with thick black margins.

Distribution: Scattered in small colonies from New England and Ontario, west to Kansas, and south as far as Florida.

Habitat: Localized populations in damp meadows, open fields, and roadsides. Hostplants are a wide variety of grasses.

State Records: 8 records in the south and central portions of the state.

Wolf River Basin Records: 5 records from the mid 1990s to 2000.

Conservation Concerns: Uncertain.

northern blue butterfly (*Lycaeides idas nabokovi*) - Endangered, S1

Brief Description: Nearly indistinguishable from the Karner Blue Butterfly (*Lycaeides melissa samuelis*). Male is purple blue on the upper wings, the female is gray-brown with some blue near the body. The underside of the wings are dull gray speckled with black spots and the hind wing has a band of orange crescents inside blue spots along the entire margin. Adult wingspan about 1.15-1.45 inches (30-36 mm).

Distribution: Western and central Canada, south into the U.S. in Minnesota and Wisconsin, and a few states in the West.

Habitat: Only found in association with its larval host plant, dwarf bilberry (*Vaccinium caespitosum*). Host plant occurs in small patches beneath scattered pine on deep, sandy soil in association with bracken, sweet fern, and strawberry.

State Records: About half a dozen records in 5 northeastern counties.

Wolf River Basin Records: 2 records, one from 1994 and a historic one from 1921.

Conservation Concerns: Host plant is also state endangered. Timber harvest, planting and piling of logs should be avoided on the few sites supporting populations. Timber harvest in the general area should be discouraged during the time when puddling male

Karner blue butterfly (*Lycaeides melissa samuelis*) - Special Concern, S2S3

Brief Description: A bluish, sexually dimorphic butterfly. Underside of both wings with continuous black subterminal line. Red-orange submarginal row broken into separate spots.

Distribution: Isolated populations from Wisconsin east to central New York and southern New Hampshire.

Habitat: Pine/oak barrens. Lupine is a required larval food plant.

State Records: There are approximately 300 records of this species from WI. The vast majority from the central sands region of the state, ranging NW through Burnett County.

Wolf River Basin Records: 37 records, all but one are recent.

Conservation Concerns: Barrens and dry forest management, ATV use, utility and road maintenance. Management in WI is largely overseen by the U.S. Fish and Wildlife Service's Habitat Conservation Plan.

dorcas copper (*Lycaena dorcas*) - Special Concern, S2

Brief Description: Sexually dimorphic. Upperside of male has blue-purple iridescence. Female is brown with limited light areas. Red-orange border on hindwing limited to a few spots.

Distribution: Mainly a Canadian species, ranges south into the northern Great Lakes region.

Habitat: Brushy old fields, fringes of bogs, open areas near streams.

State Records: There are 18 records, from 7 counties, of this species. All records from far northern counties.

Wolf River Basin Records: 4 records from 1988-1994.

Conservation Concerns: Loss and drainage of wetlands with shrubby cinquefoil.

bog copper (*Lycaena epixanthe*) - Special Concern, S2S3

Brief Description: A small butterfly with upper side purple iridescent in males, mouse gray brown in females, underside pale tan or white and hindwing with tiny black spots and a zigzag red-orange border.

Distribution: Great Lake area of U.S. and Canada and northeastern U.S.

Habitat: Open bogs with cranberry and other ericaceous components. Hostplant: *Vaccinium* spp.

State Records: Known from 46 sites in WI, mostly in the northern third of the state.

Wolf River Basin Records: 11 recent records from the mid 1990s to 2001.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known site.

an owlet moth (*Macrochilo bivittata*) - Special Concern, S3

Brief Description: A noctuid moth.

Distribution: Widespread from New Brunswick to Manitoba and south into northern tier of US states, especially Maine.

Habitat: Habitats seem to be sedge meadows, apparently usually circumneutral to calcareous.

State Records: 4 populations documented from the mid 1990's to present, are in the central portion of the state, except for one in Douglas County.

Wolf River Basin Records: 1 population documented in the mid 1990s.

Conservation Concerns: Probably impacted by massive indiscriminate spraying for spruce budworm in Maine, at least formerly.

Newman's brocade (*Meropleon ambifuscum*) - Special Concern, S3

Brief Description: A nocturnal moth.

Distribution: Midwest to Connecticut.

Habitat: Virtually nothing known about this apparently rare species. Congeners bore in grasses or sedges and knowing which species this uses might improve inventory success.

State Records: 15 of the 16 state records occur in the southern half of the state.

Wolf River Basin Records: 1 record from 1994.

Conservation Concerns: Uncertain.

jutta arctic (*Oeneis jutta*) - Special Concern, S3

Brief Description: A butterfly variable in coloration. Above, gray-brown. Both wings with yellow-orange

submarginal band (usually interrupted). Variable number of small eyespots, more on forewing than hindwing.

Distribution: Holarctic. In North America the northern Great Lakes region, and south along the western montane region.

Habitat: Black spruce and sphagnum bogs and central poor fens. Seems to like small wooded islands in setting of open bog or fen. Hostplant sedges: *Eriophorum*, *Carex*, and *Juncus* spp.

State Records: Known from 43 sites in the 1990s, all from eleven far northern Wisconsin counties.

Wolf River Basin Records: 9 records from the mid 1990s to 2000.

Conservation Concerns: Increased sedimentation, water quality degradation, mossing, and water level alterations.

tawny crescent spot (*Phyciodes batesii*) - Special Concern, S3

Brief Description: Antennal knobs black and white. Upperside of males darker than the two pearl crescents with forewing postmedian band pale orange, contrasting with orange submarginal band. Hindwing of male with yellow-tan ground, that of female with submarginal row of black points.

Distribution: Appalachian Mountain range, Great Lakes Region, west along the northern tier of U.S. states extending into the southern half of Canada.

Habitat: Moist meadows and pastures, dry rocky ridges.

State Records: Known from 13 occurrences in seven far northern counties.

Wolf River Basin Records: 6 records from the 1990s and 2000.

Conservation Concerns: Uncertain.

West Virginia white (*Pieris virginiensis*) - Special Concern, S2

Brief Description: Wings translucent. Forewing rounded. Underside of hindwing veins indistinctly lined with brown or brown-gray.

Distribution: Great Lakes Region, western New England, south along the Appalachian Mountain range.

Habitat: Moist, rich, deciduous woodlands or mature mixed woods.

State Records: There are 16 records, all records are from 5 far northern counties.

Wolf River Basin Records: 8 records from the early to mid 1990s.

Conservation Concerns: Groundlayer disturbance in northern mesic forests. Restricted by distribution of larval food plant *Dentaria* sp.

greenish blue (*Plebejus saepiolus*) - Special Concern, SU

Brief Description: Sexually dimorphic. Upperside of males green-blue, females brown with blue at base. Underside gray-white with postbasal and submarginal rows of irregular black spots.

Distribution: Almost all of Canada, western North America, south into the northern Great Lakes region and northern Maine.

Habitat: Stream edges, bogs, roadsides, open fields.

State Records: There is only one known occurrence in the state.

Wolf River Basin Records: 1 record from 1994.

Conservation Concerns: Uncertain.

mulberry wing (*Poanes massasoit*) - Special Concern, S3

Brief Description: A butterfly with rounded wings. Black with tiny (male) or slightly larger (female) spots. Underside hindwing with large irregular yellow central patch.

Distribution: Coastal southern New England and upper mid-Atlantic states. Great Lakes region extending west into southern Minnesota, northern Iowa, and the eastern edge of the Dakotas.

Habitat: Freshwater marshes or bogs. Hostplant sedge: *Carex stricta*.

State Records: There are 45 records, widely scattered, but absent from northern and far western WI.

Wolf River Basin Records: 10 records from the 1990s and 2000.

Conservation Concerns: Wetland loss, alteration.

broad-winged skipper (*Poanes viator*) - Special Concern, S3

Brief Description: Large rounded wings. Forewing primarily dark with small cream spots and small yellow-orange area. Hindwing primarily orange with black border. Veins black lined.

Distribution: Upper Midwest along the great lakes, Atlantic coast from New England to Florida, and Gulf Coast states. Largely absent from the interior of the Midwest/mid-Atlantic states.

Habitat: Freshwater and brackish marshes.

State Records: There are 18 records, all from southern and east-central counties.

Wolf River Basin Records: 16 records from the 1990s and 2000.

Conservation Concerns: Wetland loss, alteration.

little glassy wing (*Pompeius verna*) - Special Concern, S1?

Brief Description: Black or black brown. Upperside: Male forewing with black stigma with several transparent white spots above and below, including a large one below end of stigma. Female with square transparent spot at end of cell.

Distribution: Eastern, Southern (excluding the Florida peninsula), and Midwestern U.S., mostly east of the Mississippi.

Habitat: Grassy (usually moist) areas near shaded wood edges.

State Records: There are 8 records from eight counties, ranging all over the state from Douglas to Grant to Waukesha

Wolf River Basin Records: 1 record from 1991.

Conservation Concerns: Uncertain.

smokey eyed brown (*Satyroides eurydice fumosa*) - Special Concern, S2

Brief Description: Brown. Forewing with eyespots in submarginal row approximately equal, usually touching or in chainlike sequence. Five eyespots on the underside of the hindwing submarginal row.

Distribution: Northeastern U.S., Great Lake Region, northern Midwest, and adjacent Canada.

Habitat: Freshwater marshes, sedge meadows, slow-moving streams or ditches.

State Records: There are 7 records, from 4 counties. Most records are from far northern WI.

Wolf River Basin Records: 5 records from 1994.

Conservation Concerns: Wetland alteration, forestry and development.

bina flower moth (*Schinia bina*) - Special Concern, S2S3

Brief Description: A pale olive, fuzzy, wedge-shaped, day-flying moth; front-wings with rose purple shading and lighter outer edges; hind wings black with a large yellow spot.

Distribution: Mostly southern U.S. with a population in WI.

Habitat: Pine barrens, old fields?.

State Records: One record from the western edge of the Wolf Basin and other records from northern WI.

Wolf River Basin Records: 1 record from 1996.

Conservation Concerns: Host plant unknown.

phlox moth (*Schinia indiana*) - Endangered, S2?

Brief Description: A striking, purple, medium-sized moth.

Distribution: Reported from Indiana, Illinois, North Carolina, Arkansas, Texas, Nebraska, Wisconsin, Minnesota, and Michigan. Only Wisconsin, Minnesota, and Michigan currently report having populations.

Habitat: Roadsides, scrub-oak pine barrens and prairies with *Phlox pilosa*, the larvae's food plant.

State Records: There are 22 records from 5 counties, most from the central sands region of the state.

Wolf River Basin Records: 1 record from 1992.

Conservation Concerns: Roadside maintenance.

northern marbled locust (*Spharagemon marmorata*) - Special Concern, S2S3

Brief Description: A locust with basal area of hind-wings yellow, with broad outer dark band. Overall body color variable. Pale bands on forewing do not cross the wing.

Distribution: Wisconsin's subspecies ranges from Minnesota east into southern Canada and New England, and south along the Atlantic Coast through New Jersey.

Habitat: Variable within range. Often on bare sand or open scrub, in Michigan it was found among bracken fern and blueberry in an open forest. Often associated with lichens in open habitats.

State Records: There are 10 records from five counties. Mostly in the west-central portion of the state with one outlier in Shawano county.

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Barrens and sand blow management (see *Cicindela lepida*).

ash-brown grasshopper (*Trachyrhachys kiowa*) - Special Concern, S2

Brief Description: A grasshopper with hind-wings variable in color. A technical key is needed to distinguish this species.

Distribution: Southwestern Canada south to central Mexico, and in the U.S. from California east to Virginia.

Habitat: Bare gravelly ground.

State Records: There are only 4 known records from the state. Three from the central sands and one from Waupaca

Wolf River Basin Records: 1 record from 1999.

Conservation Concerns: Barrens, sand blow alterations. (see *Cicindela lepida*).

seaside grasshopper (*Trimerotropis maritima*) - Special Concern, S2

Brief Description: Populations along the Great Lakes are yellowish. Identification of the species only possible with technical guides.

Distribution: Widespread in eastern, central, and southern U.S., west to eastern Arizona, north to

Wisconsin and Ontario.

Habitat: Usually along sandy shores.

State Records: There are 2 known records from the state.

Wolf River Basin Records: 1 record from 1998.

Conservation Concerns: Uncertain.