

EXEMPLARY SITES

These Primary Coastal Wetland Sites are among the best coastal wetlands near Wisconsin's Great Lakes and would be good candidates for use in a publicly distributed document showcasing Wisconsin's coastal wetland "jewels." This list is not intended to exclude any of the other Primary Sites as being less important. See the site descriptions for more information.

- Chiwaukee Prairie
- Kohler-Andrae Dunes
- Point Beach
- Northeast Coast – Door Peninsula
- Newport State Park – Mink River
- Shivering Sands
- Red Banks Glades
- West Shore of Green Bay (collectively of high significance or Peshtigo Harbor could be highlighted, followed by Oconto Marsh and Great Lakes marsh)
- St. Louis River Estuary (collectively of high significance).
- Stockton Island
- Big Bay
- Outer Island
- Raspberry Bay
- Sand Bay
- Lost Creek
- Bark Bay
- Port Wing
- Bad River
- Allouez Bay – Wisconsin Point
- Red River Breaks – St. Louis River Marshes
- Pokegama - Carnegie Wetlands

INFORMATION GAPS AND FUTURE INVENTORY NEEDS

The Lake Superior coastal wetland sites described in this report were identified through an inventory and assessment conducted by NHI staff. A detailed description of this evaluation was provided in a report (Epstein et al. 1997). Due to the comprehensive nature of this inventory effort, Lake Superior's coastal zone is fairly well understood in terms of the presence of rare or otherwise significant elements. However, several interior bogs on the Apostle Islands were not surveyed as part of this study and should be inventoried in the future. The red clay wetlands, especially those in northwestern Douglas County near the city of Superior, warrant additional attention for taxa other than plants.

Future inventory efforts would benefit our understanding of Lake Michigan coastal wetlands. A good deal of effort was spent throughout this project incorporating existing data sources for the primary sites, and several sites were visited as part of this project. In addition, portions of some of the sites have been surveyed through various other efforts (e.g. several of the state parks on the Door Peninsula, recently completed surveys for rare plants and natural communities of the Niagara Escarpment and Grand Traverse Islands, and detailed surveys conducted to support conservation projects initiated on the Door Peninsula shoreline by private conservation organizations). Nonetheless, the collective level of detailed information known about the sites is unbalanced. For example, the extensive marshes and lowland forests along the west shore of Green Bay are a high priority for additional survey work in the future, especially for birds and wetland communities. These wetlands are extensive and at least some of them have potential for rare species; unfortunately, they also face threats due to the high amount of development pressure, hydrologic disruption, and the spread of invasive plants and animals. Also, several features and sites along Wisconsin's central Lake Michigan shoreline need additional survey work, such as the extensive ridge and swale system at Point Beach (Manitowoc County) and the little studied white cedar forests of the "coastal canyons."

Specific inventories for the Federally Endangered Hine's emerald dragonfly in Eastern Wisconsin have been funded by the U.S. Fish and Wildlife Service over the past few years and a new three-year project was recently funded. This project will result in a fairly complete inventory for this very rare species in Wisconsin.

GLOSSARY OF TERMS USED IN THE REPORT

*Please note the definitions for wetlands given here are generalized based on definitions found in wetland publications used for this report. The natural community definitions used to describe and classify some Lake Michigan primary sites and all of the Lake Superior primary sites can be found in **Appendix C**.*

BCD. The Natural Heritage Inventory Biological Conservation Database, a relational database management application containing 36 database files and more than 2,000 information fields regarding tracked plants, animals, and natural communities.

Bog. A wetland receiving water and nutrients only from atmospheric inputs, dominated by sphagnum mosses and ericaceous shrubs, and characterized by low nutrient and oxygen availability, high acidity, and peat accumulation.

Bottomland. Lowlands along streams and rivers, usually on alluvial floodplains that are periodically flooded.

Calciphilic/Calciphilous A term applied to an organism that prefers to grow in, or can only grow in habitats rich in calcium.

Element Occurrence (or EO). A record or series of records of rare, endangered, threatened, and special concern plant and animal species, and natural communities, tracked by the Natural Heritage Inventory program.

Ericaceous shrubs or ericads. Shrubby, often evergreen plants in the "heath" (Ericaceae) family that typically grow on open to semi-open canopied, acidic soil or peat. Labrador tea, leatherleaf, cranberries, blueberries and huckleberry are examples.

Fen. A peat-accumulating wetland that receives mineral enriched, aerated water from the surrounding landscape. "Rich" fens are differentiated from "poor" fens by the levels of groundwater-borne calcium available to plants, floristic indicators, and, in some cases, special landforms associated with peatland complexes. Dominant plants include sedges, grasses, and mosses, but shrubs and trees may also be important components of fen communities.

Freshwater (Coastal) Estuary In Wisconsin, estuaries occur only on the Great Lakes shorelines where various geological and hydrological processes have created drowned river mouths

GIS (Geographic Information System). A system of computer hardware, software, procedures, standards, geographical data, and personnel for the capture, storage, maintenance, manipulation, analysis and display of all forms of geographically referenced (spatial) information. A GIS can be thought of as having three essential components: a graphical (or pictorial) interface, a database, and a capacity to perform spatial analysis (i.e. how many lakes are in a particular county and what proportion of land do they cover) from that database in a graphical way.

Interdunal Wetland. A type of coastal wetland that occurs between dunes adjacent to the Great Lake coasts (and follow no specific pattern). They generally occur where the water table is close to or exposed at the surface, and are dynamic features formed by wind, wave, and storm action.

Lake Dune System or Barrier Lagoon Wetlands. Wetlands or lagoons which were once part of the Great Lakes but are now separated from the lake by an unbroken natural barrier sand dune or ridge. They generally have very little flow.

Macrophyte A large plant, especially a large aquatic flowering plant. Examples include water-lilies, cattails and pondweeds.

Marsh. A frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Muskeg. Acidic peatlands characterized by sphagnum mosses, sedges, ericaceous shrubs, and a scattered growth of stunted black spruce or tamarack. Floristically and functionally, “muskeg” is very similar to “bog”, but differs structurally owing to the sparse growth of coniferous trees.

Natural Heritage Inventory (or NHI). A program was established by the Wisconsin Legislature in 1985 and is maintained by the Wisconsin DNR's Bureau of Endangered Resources. The NHI program is responsible for maintaining data on the locations and status of rare species, natural communities, and natural features in Wisconsin.

Peatland. Any wetland characterized by the accumulation of partially decomposed plant matter.

Pothole. A shallow, small pond that may hold water throughout the year.

Red Clay Complex Wetlands. Wetlands found in northwestern Wisconsin that occur on old lake plains adjoining Lake Superior and develop on heavy red clay soils. The red clay wetlands may occupy topographic high points in the local landscape, creating “perched” wetlands.

Reedswamp. Marsh dominated by *Phragmites* (common reed)

Ridge and Swale Wetland. A complex and distinctive coastal landform composed of sandy ridges running parallel to the shore, and low areas (swales) between the ridges. Ridge and swale systems were created as post-glacial Great Lakes levels receded. The swales are generally saturated or inundated and create a unique and complex mosaic of wetland vegetation.

Seiche. This is a natural process generated when wind blows in a constant direction and piles water up on a downwind shore. When the wind drops, the water is released and flows back to the opposite shore. For example, when a seiche moves towards the western shore of Lake Michigan or Green Bay, it acts as a dam, slowing the discharge of rivers and creeks into the lake or even forcing water to reverse course and move upstream (adopted from Manitowoc report, 1998). Seiches can be especially dramatic in funnel-shaped bays where great volumes of water are pushed into increasingly smaller areas. This phenomenon is particularly important at sites

such as Green Bay, Chequamegon Bay, and in the estuaries associated with the St. Louis and Mink rivers.

Slough. A swamp or shallow lake system with standing water.

Swamp. A wetland dominated by trees or shrubs.

Vernal pond. A small, shallow, intermittently flooded wetland, generally dry for most of the summer and fall. Vernal ponds provide critical habitat for breeding amphibians, and are also important for certain invertebrates and plants.

Wave-splashed Cliff/Rock Ledge. Exposed bedrock along the Great Lakes shorelines that receive high levels of moisture from wave spray. Such sites can support rare plants.

Wet Meadow. A grass or sedge dominated wetland with saturated soil, but without standing water for most of the year.

Wet Prairie. Rare wetlands dominated by native prairie plants that occur only in the southeastern portion of the project area. Moisture levels are intermediate between those of a marsh and a wet (or sedge) meadow.

SPECIES LIST

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

Common name	Scientific name	Vegetation type
alder	<i>Alnus spp.</i>	Shrub
alder-leaved buckthorn	<i>Rhamnus alnifolia</i>	Shrub
alpine cotton grass	<i>Scirpus hudsonianus</i>	Herbaceous
American beech	<i>Fagus grandifolia</i>	Tree
American elm	<i>Ulmus americana</i>	Tree
arrowheads	<i>Sagittaria spp.</i>	Aquatic macrophyte
aspen	<i>Populus spp.</i>	Tree
autumn olive	<i>Elaeagnus angustifolia</i>	Exotic tree/shrub
balsam fir	<i>Abies balsamea</i>	Tree
balsam poplar	<i>Populus balsamifera</i>	Tree
basswood	<i>Tilia americana</i>	Tree
beach-pea	<i>Lathyrus japonicus</i>	Herbaceous
bedstraw bellflower	<i>Campanula aparinoides</i>	Herbaceous
beech	<i>Fagus grandifolia</i>	Tree
beggar-ticks	<i>Bidens spp.</i>	Herbaceous
big bluestem	<i>Andropogon gerardi</i>	Herbaceous
bird's eye primrose	<i>Primula mistassinica</i>	Herbaceous
black ash	<i>Fraxinus nigra</i>	Tree
black oak	<i>Quercus velutina</i>	Tree
black willow	<i>Salix nigra</i>	Tree
bladderworts	<i>Urtricularia spp.</i>	Herbaceous
blue vervain	<i>Verbena hastata</i>	Herbaceous
blueberries	<i>Vaccinium angustifolium, V.</i>	Shrub
bluejoint grass	<i>Calamagrostis canadensis</i>	Herbaceous
bog birch	<i>Betula pumila</i>	Shrub
bog goldenrod	<i>Solidago uliginosa</i>	Herbaceous
bog laurel	<i>Kalmia polifolia</i>	Shrub
bog rosemary	<i>Andromeda glaucophylla</i>	Shrub
bogbean	<i>Menyanthes trifoliata</i>	Herbaceous
boneset	<i>Eupatorium perfoliatum</i>	Herbaceous
box elder	<i>Acer negundo</i>	Tree
bracken fern	<i>Pteridium aquilinum</i>	Herbaceous
broad-leaved cattail	<i>Typha latifolia</i>	Herbaceous
buckbean	<i>Menyanthes trifoliata</i>	Herbaceous

Common name	Scientific name	Vegetation type
bullhead lily	<i>Nuphar variegata</i>	Aquatic macrophyte
bulrush	<i>Scirpus spp.</i>	Herbaceous
bunchberry	<i>Cornus canadensis</i>	Shrub
bur oak	<i>Quercus macrocarpa</i>	Tree
burdock	<i>Arctium spp.</i>	Herbaceous
bur-reed	<i>Sparganium eurycarpum</i>	Herbaceous
Canada wild-rye	<i>Elymus canadensis</i>	Herbaceous
cattails	<i>Typha spp.</i>	Herbaceous
clearweed	<i>Pilea pumila</i>	Herbaceous
club mosses	<i>Lycopodium spp.</i>	Bryophyte
common bladderwort	<i>Utricularia macrorhiza</i>	Aquatic macrophyte
common buckthorn	<i>Rhamnus cathartica</i>	Shrub
common juniper	<i>Juniperus communis</i>	Shrub
common reed	<i>Phragmites australis</i>	Herbaceous
cottonwood	<i>Populus deltoides</i>	Tree
cow-wheat	<i>Melampyrum lineare</i>	Herbaceous
dame's rocket	<i>Hesperis matronalis</i>	Herbaceous
dogwoods	<i>Cornus spp.</i>	Shrub
duck-potato	<i>Sagittaria latifolia</i>	Herbaceous
dwarf lake iris	<i>Iris lacustris</i>	Herbaceous
early blueberry	<i>Vaccinium angustifolium</i>	Shrub
few-seeded sedge	<i>Carex oligosperma</i>	Herbaceous
field wormwood	<i>Artemisia campestris</i>	Herbaceous
flat-topped white aster	<i>Aster umbellatus</i>	Herbaceous
fly honeysuckle	<i>Lonicera involucrata</i>	Shrub
glossy buckthorn	<i>Rhamnus frangula</i>	Shrub
gray dogwood	<i>Cornus racemosa</i>	Shrub
green ash	<i>Fraxinus pennsylvanica</i>	Tree
hemlock	<i>Tsuga canadensis</i>	Tree
Hill's oak	<i>Quercus ellipsoidalis</i>	Tree
Hines emerald dragonfly	<i>Somatochlora hineana</i>	Dragonfly
hoary willow	<i>Salix candida</i>	Shrub
Indiangrass	<i>Sorghastrum nutans</i>	Herbaceous
ironwood	<i>Ostrya virginiana</i>	Herbaceous
jack pine	<i>Pinus banksiana</i>	Tree
Japanese barberry	<i>Berberis thunbergii</i>	Shrub
joe-pye weed	<i>Eupatorium maculatum</i>	Herbaceous
kentucky bluegrass	<i>Poa pratensis</i>	Herbaceous

Common name	Scientific name	Vegetation type
lake cress	<i>Armoracia lacustris</i>	Aquatic macrophyte
lake sedge	<i>Carex lacustris</i>	Herbaceous
late goldenrod	<i>Solidago gigantea</i>	Herbaceous
leatherleaf	<i>Chamaedaphne calyculata</i>	Shrub
little bluestem	<i>Schizachyrium scoparium</i>	Herbaceous
livid sedge	<i>Carex livida</i>	Herbaceous
marram grass	<i>Ammophila breviligulata</i>	Herbaceous
marsh cinquefoil	<i>Potentilla palustris</i>	Herbaceous
marsh fern	<i>Thelypteris palustris</i>	Herbaceous
mayflower	<i>Maianthemum canadense</i>	Herbaceous
meadowsweet	<i>Spiraea alba</i>	Shrub
moccasin flower	<i>Cypripedium acaule</i>	Herbaceous
mountain maple	<i>Acer spicatum</i>	Tree
narrow-leaved cattail	<i>Typha angustifolia</i>	Herbaceous
nettles	<i>Laportea or Urtica spp.</i>	Herbaceous
New Jersey tea	<i>Ceanothus americanus</i>	Shrub
ninebark	<i>Physocarpus opulifolius</i>	Shrub
nodding beggar's ticks	<i>Bidens cernuus</i>	Herbaceous
paper birch	<i>Betula papyrifera</i>	Tree
perfumed cherry	<i>Prunus mahaleb</i>	Shrub
pine	<i>Pinus spp.</i>	Tree
pitcher plant	<i>Sarracenia purpurea</i>	Herbaceous
poor sedge	<i>Carex paupercula</i>	Herbaceous
purple loosestrife	<i>Lythrum salicaria</i>	Herbaceous (invasive exotic)
red maple	<i>Acer rubrum</i>	Tree
red oak	<i>Quercus rubra</i>	Tree
red pine	<i>Pinus resinosa</i>	Tree
red-osier dogwood	<i>Cornus stolonifera</i>	Shrub
reed canary grass	<i>Phalaris arundinacea</i>	Herbaceous
round-leaved sundew	<i>Drosera rotundifolia</i>	Herbaceous
sand cherry	<i>Prunus pumila</i>	Shrub
sand-reed grass	<i>Calamovilfa longifolia var magna</i>	Herbaceous
shrubby cinquefoil	<i>Potentilla fruticosa</i>	Shrub
silver maple	<i>Acer saccharinum</i>	Tree
slender willow	<i>Salix gracilis</i>	Shrub
small cranberry	<i>Vaccinium oxycoccos</i>	Shrub
small fringed gentian	<i>Gentianopsis procera</i>	Herbaceous

Common name	Scientific name	Vegetation type
small yellow lady's slipper	<i>Cypripedium parvifolium</i>	Herbaceous
smooth brome	<i>Bromus inermis</i>	Herbaceous
snowberry	<i>Gaultheria hispidula</i>	Shrub
soft-stemmed bulrush	<i>Scirpus validus</i>	Herbaceous
speckled alder	<i>Alnus incana</i>	Shrub
spike-rushes	<i>Eleocharis spp.</i>	Herbaceous
stinging nettles	<i>Urtica dioica</i>	Herbaceous
sugar maple	<i>Acer saccharum</i>	Tree
swamp white oak	<i>Quercus bicolor</i>	Tree
sweet gale	<i>Myrica gale</i>	Shrub
tamarack	<i>Larix laricina</i>	Tree
tartarian honeysuckle	<i>Lonicera tartarica</i>	Shrub
tawny cotton-grass	<i>Eriophorum virginicum</i>	Herbaceous
thimbleberry	<i>Rubus parviflorus</i>	Shrub
three square bulrush	<i>scirpus americana</i>	Herbaceous
three-leaved false Solomon's-	<i>Smilacina trifolia</i>	Herbaceous
three-sedged sedge	<i>Carex trisperma</i>	Herbaceous
trembling aspen	<i>Populus tremuloides</i>	Tree
tufted hair grass	<i>Deschampsia cespitosa</i>	Herbaceous
tussock cotton-grass	<i>Eriophorum vaginatum</i>	Herbaceous
tussock sedge	<i>Carex stricta</i>	Herbaceous
twig-rush	<i>Cladium mariscoides</i>	Herbaceous
water arum	<i>Calla Palustris</i>	Herbaceous
water horsetail	<i>Equisetum fluviatile</i>	Herbaceous
water parsnip	<i>Sium suave</i>	Herbaceous
water-marigold	<i>Megalodonta beckii</i>	Aquatic macrophyte
water-milfoils	<i>Myriophyllum spp.</i>	Aquatic macrophyte
white birch	<i>Betula papyrifera</i>	Tree
white cedar	<i>Thuja occidentalis</i>	Tree
white pine	<i>Pinus strobus</i>	Tree
white spruce	<i>Picea glauca</i>	Tree
wild rice	<i>Zizania aquatica</i>	Aquatic macrophyte/Herb
willows	<i>Salix spp.</i>	Shrub
Wintergreen	<i>Gaultheria procumbens</i>	Shrub
wire leaved sedges	<i>Carex oligosperma, C. lasiocarpa,</i>	Herbaceous
wood ferns	<i>Dryopteris spp.</i>	Herbaceous
wood nettle	<i>Laportea canadensis</i>	Herbaceous
wool grass	<i>Scirpus cyperinus</i>	Herbaceous

Common name	Scientific name	Vegetation type
woolly sedge	<i>Carex lasiocarpa</i>	Herbaceous
yellow water lily	<i>Nuphar variegatum</i>	Aquatic macrophyte
yew	<i>Taxus canadensis</i>	Shrub

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APPENDIX A: NATURAL HERITAGE INVENTORY METHODS OVERVIEW

The Wisconsin Natural Heritage Inventory program 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 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: ECOLOGICAL COMMUNITY SETTINGS FOR COASTAL COMMUNITIES

Coastal Peatlands. Wetland complexes characterized by the accumulation of sedge and moss peat that have developed in association with sandspits at the inundated mouths of several streams entering Lake Superior on the margins of the Bayfield peninsula, several of the Apostle Islands, and at the mouths of the Bad and Kakagon rivers. For this evaluation, priority peatland communities consisted of coastal fen, coastal bog, and tamarack swamp. Other important associated communities were interdunal wetland, alder thicket, beach, lake dune, dry boreal pine forest, and Great Lakes pine barrens. The priority sites surveyed were Port Wing, Bark Bay, Lost Creek, Sand Bay, Big Bay, Stockton Island Tombolo, Outer Island Sandspit and Lagoon, Long Island-Chequamegon Point, Bayview Beach-Sioux River Slough, Red Cliff Reservation, and Bad River Reservation.

Threats to these communities include invasive species, diminished water quality, increased development, and suppression of natural disturbance regimes.

With a few exceptions, these communities and associated landforms are unique to the coastal zone. Many rare species are restricted to the coastal peatlands and their associated features. Outer Island Sandspit and Lagoon and Long Island-Chequamegon Point are especially important migratory bird concentration areas. Bad River Reservation contains aquatic biota of high regional significance.

Estuarine Marsh. Wetlands composed of stands of emergent, submergent, and floating-leaved aquatic macrophytes, occurring at the mouths of drowned rivers along the Lake Superior shore. Peat accumulation is minimal or absent. For this evaluation, priority communities consisted of emergent aquatic, submergent aquatic, northern sedge meadow, and boreal forest.

Threats to these communities include invasive species, diminished water quality, and increased development pressure.

Coastal Cliffs and Ledges. Exposures of sandstone bedrock are frequent shoreline features of the northern Bayfield peninsula and also occur on some of the Apostle Islands. Cold currents, fogs, and wave spray create conditions suitable for the maintenance of populations of many specialized vascular plants, which are not present in similar rocky habitats away from the coast. For this evaluation, priority communities consisted of moist cliff, dry cliff, Great Lakes rocky shore, hemlock-hardwood forest, and pine forest. The priority sites surveyed were Red Cliff Reservation, Stockton Island Tombolo, and Sand Bay.

Threats to these communities include quarrying, shoreline development, and rock climbing.

These natural communities are critical habitat for many rare plants, most of them habitat specialists and restricted to coastal environments. Many additional sites occur on the Apostle Islands and on the northern Bayfield Peninsula.

Red Clay Flats. Though red clay soils blanket much of Wisconsin's portion of the basin, in the vicinity of the City of Superior there is a concentration of shrub- and sedge-dominated wetlands on the nearly level, poorly drained clays. For this evaluation, priority communities consisted of alder thicket, shrub-carr, northern sedge meadow, and emergent aquatic. The priority sites surveyed were Pokegama-Carnegie Wetlands, Red River Breaks, and Superior Airport/Hill Avenue Wetlands/South Superior Triangle.

Threats to these communities include disruption of hydrology, increased development, invasive species, pollution, and suppression of natural disturbance regimes.

While within the rather arbitrarily defined coastal zone, the poorly drained red clay flats are not directly affected by coastal processes and so are placed here. All of the sites are in the vicinity of the City of Superior and vulnerable to a variety of disturbances. These sites are most notable for their concentrations of rare plants, some of which occur nowhere else in the drainage basin or state.

Stream Corridors. For this evaluation, priority communities consisted of white cedar swamp, hardwood swamp, floodplain forest, mesic hardwood bottoms, alder thicket, emergent aquatic, boreal forest, and northern dry-mesic forest. The priority sites surveyed include Bad River Reservation, Brule Spillway, and Nemadji River Bottoms.

Threats to these communities include disruption of hydrology, logging, increased development, and invasive species.

Several of the large streams deeply entrenched in the region's red clays possess unique attributes, especially the Bad and Nemadji rivers. The entire length of the Brule River contains unique features.

Bedrock-influenced Shoreline: Bedrock has created special conditions for wetland species assemblages at several locations on the Great Lakes coast. Lake Michigan's Door Peninsula is underlain by Silurian Age dolomite, which is exposed as a steep cliff-forming escarpment (the Niagara Escarpment) on the west side of the Peninsula along Green Bay, and as flat alkaline rock "beach" on the east side of the Peninsula north of Bailey's Harbor. Both the Escarpment and the dolomite beaches provide habitat for highly specialized organisms, including many that are rare or otherwise sensitive. Cliffs, talus slopes, seepages, alvar, rock beaches, and splash pools are among the special habitats owing their origin to the bedrock.

On Lake Superior sandstone is exposed along the northern Bayfield Peninsula and on the shores of several of the Apostle Islands. Cliffs and level rocky ledges support populations of many rare plants, including several, such as the carnivorous butterwort (*Pinguicula vulgaris*), that occur in Wisconsin only on wet cliffs in the Apostle Islands.

Coastal Canyons: These features occur primarily along the central stretches of the Lake Michigan coast where small streams have cut through glacio-lacustrine deposits creating short,

steep-walled valleys perpendicular to the shoreline. The vegetation is typically forest, with white cedar dominant, and a mixture of other “northern” conifers and various hardwoods the major associates. The slopes often harbor seepages that can provide habitat for rare plants. Similar features also occur in the red clay regions of southwestern Lake Superior in Douglas county.

Lacustrine Plain: Nearly level lakeplain occurs in a wide band along the west shore of Green Bay. The uplands have generally been developed for agricultural and residential purposes, and some of the wetlands have been drained or pastured, but significant amounts of emergent marsh, sedge meadow, and lowland hardwood forest have persisted in certain areas. Large open wetland complexes occur at the mouths of the Oconto and Peshtigo Rivers, and some extensive remnants of marsh occur in Lower Green Bay.

The west shore wetlands provide critical habitat for many animals, especially nesting and migrating birds, and fish. Development threats remain significant and there are significant problems with invasive species at virtually all of the wetland sites.

Ridge and Swale Systems: As the water levels of Lake Michigan dropped following the last glacial retreat, long narrow ridges separated by wet swales were created by shoreline processes leaving unique landforms at several locations. These ridge and swale systems are best developed on the east side of the Door Peninsula and in the Point Beach area on the central Lake Michigan coast. The vegetation mosaic is even more complex than the landform, and often includes a high diversity of plant associations, including marsh, fen, bog, meadow, shrub swamp, hardwood swamp, and conifer swamp. The sandy ridges are typically forested with mixtures of conifers and hardwoods, and moisture conditions vary from mesic (moist) to very dry depending on local soil conditions and depth to water table.

Several of these ridge and swale features are quite large, reaching sizes of several thousand acres. These provide critical habitat for many native plants and animals, including some that are area sensitive, or habitat specialists.

Appendix C: NHI NATURAL COMMUNITY DESCRIPTIONS FOR COMMUNITIES FOUND WITHIN THE COASTAL ZONE

(January 14, 2002 Revision) Prepared by Eric Epstein, Emmet Judziewicz and Elizabeth Spencer

Specific palustrine community types found in either the coastal zone or the Lake Superior Basin interior are described below.

Alder Thicket. This tall shrub wetland community is dominated by speckled alder (*Alnus incana*). Common sites include stream and lake margins, the interface between open and forested wetland communities, the interface between open wetlands and upland communities, and depressions where there is movement of groundwater through the soil. Common associates include marsh marigold (*Caltha palustris*), black currant (*Ribes americanum*), crested shield fern (*Dryopteris cristata*), spotted touch-me-not (*Impatiens biflora*), rough bedstraw (*Galium asprellum*), sensitive fern (*Onoclea sensibilis*), horsetails (*Equisetum* spp.), and arrow-leaved tearthumb (*Polygonum sagittatum*). Rare species occurring in alder thickets include auricled twayblade (*Listera auriculata*), sweet coltsfoot (*Petasites sagittatus*), small shinleaf (*Pyrola minor*), and the wood turtle (*Clemmys insculpta*).

Alvar. This rare community consists of areas of thin discontinuous soil overlying horizontal beds of limestone or dolomite in the vicinity of Great Lakes shorelines. They are characterized by relatively low tree cover and a distinctive biota, which includes elements of rock pavement, prairie, savanna and boreal forest communities. Among these are regional endemics, some very rare. This community type is much more common and better-developed in Michigan and Ontario than in Wisconsin. Small coniferous and deciduous trees (cedar, fir, pine, oak, aspen, birch) are scattered among an assemblage of species that can include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian-grass (*Sorghastrum nutans*), and wood lily (*Lilium philadelphicum*), as well as shoreline plants such as silverweed (*Potentilla anserina*) and dwarf lake iris (*Iris lacustris*).

Bedrock Shore. Wave-splashed bedrock shoreline ledges are best developed on sandstone in the Apostle Islands of Lake Superior. Stunted trees of white cedar (*Thuja occidentalis*), white birch (*Betula papyrifera*), showy mountain-ash (*Sorbus decora*) and green alder (*Alnus crispa*) are often present in crevices. Common herbs are ticklegrass (*Agrostis hyemalis*), fireweed (*Epilobium angustifolium*), and Canada goldenrod (*Solidago canadensis*), but the flora often includes unusual plants such as bird's-eye primrose (*Primula mistassinica*), brook lobelia (*Lobelia kalmii*), and three-toothed cinquefoil (*Potentilla tridentata*).

Black Spruce Swamp. This forest wetland community occurs primarily in acid peatlands of insular basins. Black Spruce (*Picea mariana*) is the dominant tree. Canopy associates include tamarack (*Larix laricina*) and occasionally balsam fir (*Abies balsamea*). A level mat of *Sphagnum* mosses covers the surface and provides a substrate upon which a characteristic set of understory plants grows. Among these are Labrador tea (*Ledum groenlandicum*), three-leaved false Solomon's seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), three-

seeded sedge (*Carex trisperma*), and moccasin flower (*Cypripedium acaule*). Windthrow gaps are often common in mature stands, and these contain thickets of spruce or tamarack saplings. As the sphagnum peat accumulates, the canopy may break up and a very acid muskeg will result.

Black spruce swamp and tamarack swamp have previously been treated as “northern wet forest”, as described by Curtis (1959). We have recognized two types based on compositional differences and the diverging successional pathways demonstrated by these communities. Rare species include many boreal birds and lepidoptera.

Boreal Rich Fen. Neutral to alkaline cold open peatlands of northern Wisconsin through which carbonate-rich groundwater percolates. Sphagnum mosses are absent or of relatively minor importance, as calciphilic species (especially the “brown” mosses) predominate. Dominant/characteristic plants include woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), beaked bladderwort (*Utricularia cornuta*), rushes (*Juncus* spp.), and Hudson Bay cotton-grass (*Scirpus hudsonianus*). Shrubby phases also occur, with bog birch (*Betula pumila*), sage willow (*Salix candida*), and speckled alder (*Alnus incana*) present in significant amounts.

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.

Clay Seepage Bluff (formerly called Alkaline Clay Bluff). Steep, clay bluffs occur along some stretches of the Great Lakes shorelines and less commonly inland on streams draining into Lake Superior and Lake Michigan. Vegetative cover ranges from forested with pines (*Pinus resinosa* and *P. strobus*), white cedar (*Thuja occidentalis*) and white birch (*Betula papyrifera*), to bare clay with only a few herbs present. Buffaloberry (*Shepherdia canadensis*) is a characteristic shrub, but more typically, alders (*Alnus incana* and *A. crispa*), as well as herbs such as Canada goldenrod (*Solidago canadensis*) and pearly everlasting (*Anaphalis margaritacea*) are dominant. Both native and exotic pioneers such as fireweed (*Epilobium angustifolium*) and Canada thistle (*Cirsium arvense*) are common, especially on unstable sites. But it is the semi-stabilized “weeping” bluffs that are of the greatest biological interest. Golden sedge (*Carex aurea*), orchids and calciphilic fen species may colonize such sites, which can be local repositories of rare or otherwise noteworthy species.

Coastal Bog (Poor Fen). The coastal bog is also considered an herbaceous wetland community. The surface layer of this weakly minerotrophic open peatland community, which occurs as a part of the coastal sandspit-lagoon complexes, is comprised of *Sphagnum* mosses. The mats are typically quite firm and may be “grounded” along the margins of the uplands adjoining the wetland complexes. At larger sites, the coastal bogs grade into a sedge fen community toward

the open lagoon waters and to tamarack swamp toward the uplands. Characteristic plants associated with the sphagnum mats are a number of ericaceous shrubs and sedges, particularly leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), large cranberry (*Vaccinium macrocarpon*), woolly sedge (*Carex lasiocarpa*), few-seeded sedge (*C. oligosperma*), mud sedge (*C. limosa*), a sedge (*C. chordorrhiza*), white beak-rush (*Rhynchospora alba*), and tawny cotton-grass (*Eriophorum virginicum*). Shrub components of this type often include bog birch (*Betula pumila*), speckled alder (*Alnus incana*), and bog willow (*Salix pedicellaris*).

Other typical species include pitcher plant (*Sarracenia purpurea*), buck bean (*Menyanthes trifoliata*), scheuchzeria (*Scheuchzeria palustris*), sweet gale (*Myrica gale*), rose pogonia (*Pogonia ophioglossoides*), grass pink (*Calopogon tuberosus*), and club-spur orchid (*Platanthera clavellata*). Floristically, the coastal bogs closely resemble the "poor fens" and "sphagnum lawns" of the upper Great Lakes region, and they should perhaps be treated as a subtype of that community.

Among the rare plants found in the coastal bogs are dragon's mouth orchid (*Arethusa bulbosa*), Michaux's sedge (*Carex michauxiana*), sooty beak-rush (*Rhynchospora fusca*), *Carex tenuiflora*, and yellow star grass (*Xyris montana*). Rare animals include birds, such as northern harrier and American bittern, and a number of boreal lepidoptera.

Coastal Fen (Sedge Fen). This herbaceous (sedge-dominated) wetland community occurs in coastal areas on the margins of shallow lagoons, which are protected from wind, wave, and ice action on Lake Superior by sandspits. Woolly sedge (*Carex lasiocarpa*) is usually the primary mat component. Typical associates are twig rush (*Cladium mariscoides*), buck bean (*Menyanthes trifoliata*), sweet gale (*Myrica gale*), pitcher plant (*Sarracenia purpurea*), bladderworts (*Utricularia cornuta*, *U. intermedia*, *U. minor*), cotton-grass (*Scirpus hudsonianus*), intermediate sundew (*Drosera intermedia*), water horsetail (*Equisetum fluviatile*), marsh muhly (*Muhlenbergia glomerata*), and white beak-rush (*Rhynchospora alba*).

Floristically, these communities appear intermediate to rich and poor fens as described in both Michigan (Crum 1988) and Minnesota (Wright et al. 1992). The rich fen indicators of the Minnesota peatlands and eastern Wisconsin such as grass-of-Parnassus (*Parnassia glauca*), false asphodel (*Tofieldia glutinosa*), linear-leaved sundew (*Drosera linearis*), beaked spike rush (*Eleocharis rostellata*), and the sedge *Carex sterilis*, are absent from these coastal fens.

Rare and uncommon plants of coastal fens include coast sedge (*Carex exilis*), livid sedge (*C. livida*), Michaux's sedge (*C. michauxiana*), bog arrow grass (*Triglochin maritimum*), English sundew (*Drosera anglica*), tall white bog orchid (*Platanthera dilatata*), and sooty beak-rush (*Rhynchospora fusca*). Several rare birds also occur in the sedge mats, including yellow rail and LeConte's sparrow.

Emergent Aquatic. The aquatic plant community is best developed in shallow, protected, usually permanent waters. Most of the dominant plants are tall and erect with narrow leaves. Frequently a single species will form a zone within an emergent marsh, often correlated with

water depth. Cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), bur-reeds (*Sparganium* spp.), arrowheads (*Sagittaria* spp.), spike rushes (*Eleocharis* spp.) and water plantain (*Alisma plantago-aquatica*) are important members of this community. Unrooted floating-leaved species such as the duckweeds (*Lemna minor*, *L. trisulca*, *Spirodela polyrhiza*), and several submergent aquatic macrophytes may occur among the stems of the emergents. Emergent marshes are important to many nesting and migratory waterbirds, mammals, invertebrates, and fish.

Floodplain Forest. Confined to the floodplains of large streams, this forest wetland community is rare in the Lake Superior Basin. Canopy trees include silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), box elder (*A. negundo*), and occasionally bur oak (*Quercus macrocarpa*). The primary disturbance dynamic affecting this community is flooding, which occurs in the spring after the ice goes out and the snow melts, and after heavy rains. The understories are often quite open, supporting ostrich fern (*Matteucia struthiopteris*), wood nettle (*Laportea canadensis*), green-headed coneflower (*Rudbeckia laciniata*), swollen sedge (*Carex intumescens*), Gray's sedge (*C. grayii*), and Tuckerman's sedge (*C. tuckermanii*).

Great Lakes Alkaline Rockshore. These are creviced, wave-splashed, nearly horizontal dolomite ledges along Lake Michigan on the Door Peninsula. Depending on lake levels, large expanses of this habitat may be either inundated or exposed during a given year. Common members of this community are the shrubs ninebark (*Physocarpus opulifolius*), shrubby cinquefoil (*Potentilla fruticosa*), and the herbs silverweed (*Potentilla anserina*), goldenrods (especially *Solidago hispida*), brook lobelia (*Lobelia kalmii*), gentians (*Gentiana* spp.), grasses-of-Parnassus (*Parnassia* spp.), Indian paint-brush (*Castilleja coccinea*), low calamint (*Calamintha arkansana*) and many other calciphiles. Plants endemic to the Great Lakes shores are significant components of some stands.

Hardwood Swamp. The hardwood swamp can also be considered a forest wetland community. These deciduous lowland forests situated on wet to wet-mesic mineral or muck substrates outside of active floodplains are often dominated by black ash (*Fraxinus nigra*). Canopy associates may include red maple (*Acer rubrum*), green ash (*F. pennsylvanica*), American elm (*Ulmus americana*), white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and yellow birch (*Betula alleghaniensis*). However, black ash not infrequently occurs in almost pure stands, and is often well represented as a sapling or small tree. A dense tall shrub layer of speckled alder (*Alnus incana*) and winterberry (*Ilex verticillata*) is commonly present. Seasonal pools are features of many stands.

Among the characteristic groundlayer plants are marsh marigold (*Caltha palustris*), swamp saxifrage (*Saxifraga pensylvanica*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), skunk cabbage (*Symplocarpus foetidus*), mint (*Mentha arvensis*), fowl manna grass (*Glyceria striata*), and many sedges.

Interdunal Wetland. This herbaceous wetland community is extremely rare, occurring only within dune systems of the Great Lakes. As there are fewer than five occurrences known in the western Lake Superior Basin, and they are quite a distance from one another, it is difficult to characterize them floristically. Graminoids are prominent at all sites, including shore rush (*Juncus balticus*) and the sedge *Carex viridula*. Other species found at some, but not all sites, are woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), and nodding ladies' tresses (*Spiranthes cernua*).

At some sites, this community may be ephemeral. At least one site has been known for many decades, and is being encroached on by woody species and invaded by exotics. A great number of rare species were documented in the interdunal wetlands, including marsh grass-of-Parnassus (*Parnassia palustris*), small purple bladderwort (*Utricularia resupinata*), Robbins spike rush (*Eleocharis robbinsii*), sooty beak-rush (*Rhynchospora fusca*), shore sedge (*Carex lenticularis*), and variegated horsetail (*Equisetum variegatum*). An old borrow pit on one of the coastal barrier spits has been colonized by several of these rare plants and also held the first Wisconsin record for juniper clubmoss (*Lycopodium sabinaefolium*).

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*).

Northern Sedge Meadow. Two distinct types of sedge meadow, another herbaceous wetland community, are currently recognized within the Lake Superior Basin. The first is found along the margins of low gradient streams and drainage lakes. Dominants are often tussock sedge (*Carex stricta*) and bluejoint grass (*Calamagrostis canadensis*). Associates include swamp milkweed (*Asclepias incarnata*), spotted joe-pye-weed (*Eupatorium maculatum*), blue flag (*Iris versicolor*), yellow loosestrife (*Lysimachia terrestris*), marsh St. Johnswort (*Triadenum fraseri*), marsh bellwort (*Campanula aparinoides*), water horehound (*Lycopus uniflorus*), panicled aster (*Aster simplex*), purple meadow rue (*Thalictrum dasycarpum*) and the sedges *Carex comosa*, *C. diandra*, and *C. canescens*. This type is found throughout most of the project area, though the stands are often small.

The other type tends to occur more in insular depressions, especially in the vicinity of northwestern Douglas County. The usual dominants are broad-leaved sedges, usually lake sedge (*Carex lacustris*), sometimes with beaked sedge (*Carex rostrata*). Associates include bluejoint grass (*Calamagrostis canadensis*), fringed brome (*Bromus ciliatus*), flat-topped aster (*Aster umbellatus*), rough bedstraw (*Galium asprellum*), spotted touch-me-not (*Impatiens biflora*), spotted joe-pye-weed (*Eupatorium maculatum*), water horehound (*Lycopus uniflorus*), blue flag (*Iris versicolor*), late goldenrod (*Solidago gigantea*), and other sedges. Several rare plants were

found in this community, including sweet coltsfoot (*Petasites sagittatus*), Vasey's rush (*Juncus vaseyi*), and New England violet (*Viola novae-angliae*). Encroachment by woody shrubs appears to be occurring at many locations, especially for the broad-leaved type.

Open Bog. This peatland type herbaceous wetland community is dominated by deep layers of *Sphagnum* mosses which isolate the other members of the community from the influence of nutrient-rich groundwater or runoff. There is often a pronounced hummock-hollow microtopography. Ericaceous shrubs, sedges, and stunted, scattered black spruce (*Picea mariana*) are the most characteristic vascular plants. Among the ericads the most important species are typically leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Sedges with a tolerance for these ombrotrophic peatlands include the carices *Carex oligosperma*, *C. pauciflora*, and *C. pauperula*, and the cotton-grasses *Eriophorum angustifolium*, *E. spissum*, and *E. virginicum*. Round-leaved sundew (*Drosera rotundifolia*) is among the few other vascular plants frequently found in the open bogs. In the "muskeg" phase, the community structurally resembles a savanna owing to the scattered, often stunted, black spruce and tamarack.

Bogs occur mostly in poorly drained depressions in glacial till and in isolated kettles within end moraines or outwash. Scale and landscape context of this community often differs markedly within different landforms. Within the project area, the largest bogs occur in the Mille Lacs Uplands and Winegar Moraines subsections. Rare species found in the bogs include a number of birds and butterflies of boreal affinity.

Shrub-carr. Willows (*Salix* spp.) are the dominant plants in this tall shrub wetland community. Important species include slender willow (*Salix gracilis*), pussy willow (*S. discolor*), balsam willow (*S. pyrifolia*), and autumn willow (*S. serissima*). Other common shrubs, which may be co-dominant in some stands, are meadowsweet (*Spiraea alba*), red-osier dogwood (*Cornus stolonifera*), nannyberry (*Viburnum lentago*), and speckled alder (*Alnus incana*). Representative herbs are bluejoint grass (*Calamagrostis canadensis*), spotted touch-me-not (*Impatiens biflora*), sensitive fern (*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), and purple meadow rue (*Thalictrum dasycarpum*).

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*). Common associates are water-horehound (*Lycopus uniflorus*), paniced 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.

Submergent Aquatic. This aquatic plant community occurs in bodies of permanent water, usually where there is some protection from excessive wave action and strong currents. Characteristic species include waterweed (*Elodea canadensis*), coontail (*Ceratophyllum*

demersum), water milfoils (*Myriophyllum exalbescens*, and *M. verticillatum*), wild celery (*Vallisneria americana*), water marigold (*Megalodonta beckii*), naiad (*Najas flexilis*), mare's-tail (*Hippuris vulgaris*), common bladderwort (*Utricularia macrorrhiza*), and many pondweeds, especially *Potamogeton amplifolius*, *P. epihydrus*, *P. natans*, *P. richardsonii*, and *P. zosteriformis*. Rooted, floating-leaved, aquatic macrophytes often occur with this group in shallower waters. Most common among these are water shield (*Brasenia schreberi*), yellow water lily (*Nuphar variegatum*), and white water lily (*Nymphaea tuberosa*). Some members of the bur-reed genus *Sparganium* also form beds of floating leaves. Some biologists separate the floating from the submerged beds, but there is often considerable spatial overlap between them so they have been treated together here.

Rare and uncommon species of submergent aquatic communities are lake cress (*Armoracia lacustris*), a water milfoil (*Myriophyllum alterniflorum*), and small yellow water lily (*Nuphar microphyllum*).

Tamarack Swamp. This forest wetland community, a weakly minerotrophic conifer swamp, is dominated by tamarack (*Larix laricina*). The shrub/sapling layer is often well-developed, composed of black ash (*Fraxinus nigra*), speckled alder (*Alnus incana*), and other tall shrubs. The groundlayer is often mossy, though genera other than *Sphagnum* may be most important. Characteristic low shrubs and herbs include smooth white violet (*Viola pallens*), Labrador tea (*Ledum groenlandicum*), goldthread (*Coptis trifolia*), three-leaved false Solomon's seal (*Smilacina trifolia*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), sensitive fern (*Onoclea sensibilis*), twinflower (*Linnaea borealis*), small bishop's cap (*Mitella nuda*), and many sedges such as *Carex crinita*, *C. disperma*, *C. leptalea*, and *C. stipata*.

This is a one-generation forest type, as the tamarack (*Larix laricina*) cannot reproduce under its own shade. It is also the most common forested wetland in the coastal zone. Rare species found in tamarack swamps include the sedges *Carex tenuiflora* and *C. vaginata*, fly honeysuckle (*Lonicera involucrata*), showy lady's slipper (*Cypripedium reginae*), and yellow-bellied flycatcher.

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 (*Liatrix 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*).

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*).

Wet Sand Flats. Found only on the Chequamegon Bay side of the former gap between Long Island and Chequamegon Point, this herbaceous wetland community has developed within the past two decades. The wetter, more open areas are dominated by short sedges (*Carex* spp., *Scirpus* spp.) and rushes (*Juncus* spp.). Slightly drier sands support thickets of willows (*Salix exigua*, *Salix* spp.) and speckled alder (*Alnus incana*), and many sapling green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), balsam poplar (*P. balsamifera*), and box elder (*Acer negundo*).

Because of its short tenure and rapidly changing structure and composition, it's difficult to make any recommendations except to continue efforts to control the serious infestation of purple loosestrife (*Lythrum salicaria*) now established. The stand should also be visited periodically by skilled biologists as unusual numbers of interesting waifs have appeared here.

White Cedar Swamp (Northern Wet-mesic Forest). This forest wetland community (wet-mesic conifer forest) is dominated by white cedar (*Thuja occidentalis*), often in association with balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), and black ash (*Fraxinus nigra*). White cedar mixed with hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) is not treated as "white cedar swamp". Canopy gaps are frequently occupied by fir or ash saplings. Young cedar seldom reach the sapling stage. The tall shrub layer is typically well-developed, composed primarily of mountain maple (*Acer spicatum*), speckled alder (*Alnus incana*), and elder buckthorn (*Rhamnus alnifolia*). Common herbs/low shrubs include bluebead lily (*Clintonia borealis*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), dwarf raspberry (*Rubus pubescens*), small bishop's cap (*Mitella nuda*), many sedges, and a lush cover of bryophytes. Orchids may be especially well-represented in this forest community.

Springs and spring runs are present in many cedar forests, often containing spotted touch-me-not (*Impatiens biflora*), golden saxifrage (*Chrysosplenium americanum*), and swamp saxifrage (*Saxifraga pennsylvanica*), as well as aquatic mosses. The presence of mineral-rich groundwater is a given in this community.

Concern for the cedar swamps is warranted as reproduction of cedar is severely suppressed in the presence of high deer densities. Silvicultural experiments have not succeeded in addressing this issue. Among the many rare inhabitants of this type are fairy slipper (*Calypso bulbosa*), Lapland

buttercup (*Ranunculus lapponicus*), northern black currant (*Ribes hudsonianum*), and sheathed sedge (*Carex vaginata*).

Appendix D: Explanation of the NHI Working List Species Status

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked, and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. The Natural Heritage Program welcomes your input on any aspect of this list. Wisconsin's extirpated species list is at the end. The most recent list of species and natural communities can be obtained by writing the Bureau of Endangered Resources.

US Status refers to the Federal protection status in Wisconsin designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

WI Status is a protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.