Wisconsin Coastal Wetlands Assessment
Phase 2

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THE WISCONSIN COASTAL MANAGEMENT PROGRAM, part of the Wisconsin Department of Administration, and overseen by the **WISCONSIN COASTAL MANAGEMENT COUNCIL**, was established in 1978 to preserve, protect and manage the resources of the Lake Michigan and Lake Superior coastline for this and future generations.

Introduction

The following report summarizes the work completed during the second phase of the Coastal Wetlands Assessment project being conducted by the Bureau of Endangered Resources (BER). Over the past decade, BER has completed a number of important inventory and data assessment projects aimed at increasing our understanding of Coastal ecosystems and, in particular, coastal wetland sites. More recently, BER initiated an assessment of coastal wetland data to determine ecologically significant coastal wetland sites within the Lake Michigan and Lake Superior basins. Phase 1 of this project, completed in 2000, resulted in the identification of 64 Primary Sites within the coastal zones of Lakes Michigan and Superior, including 28 sites for Lake Superior and 36 sites for Lake Michigan. The significance of the sites was based on the current level of information available. However, it was acknowledged that large data gaps existed, especially for Lake Michigan coastal wetlands. The significant inventory and information gaps that existed were documented as part of the final report for this phase of the project.

Phase 2 was initiated in October of 2000 with the goal of filling some of the most critical data gaps and developing some preliminary products that will ultimately serve as the basis for public documents to be developed in subsequent phases. The following work items were completed: A "windshield survey" of 26 of 36 Lake Michigan Primary Sites (as defined in Phase 1) was conducted. Prioritization criteria for evaluating the "known ecological significance" of coastal wetland sites was developed and applied to all 64 sites to develop a "top 10" list of priority sites for both Lake Michigan and Lake Superior. Next, survey "data gaps" (future inventory needs) for all 64 coastal wetland sites were identified and a prioritized list of sites with large "data gaps" for both Lake Michigan and Lake Superior was developed. Based on many of the images taken during the windshield survey, a prototype CD-ROM with descriptions and images of over 50 Wisconsin Great Lakes priority sites was developed.

In addition, our knowledge of the sites was expanded from extensive data gathering for missing bird and fish data. Two primary databases were procured, the Wisconsin Breeding Bird Atlas and the Wisconsin Fish Species database, as were a number of other important but smaller databases. Finally, we initiated efforts to make all of the above information available through a "coastal wetland" web page and a prototype CD-ROM that will contain project reports, coastal wetland site descriptions, and photographs of important ecological sites and features. The webpage includes the basic structure for a comprehensive overview of all the information collected by BER through the efforts of the Coastal Wetland Assessment project. It is available through the Wisconsin Bureau of Endangered Resource website "http://www.dnr.state.wi.us/org/land/er/."

Results

The six work items of Phase 2 are summarized in detail below:

1. SITE PRIORITIZATION CRITERIA

Two sets of prioritization criteria were developed to evaluate coastal wetland sites.

The first set of criteria (presented in Table 1) ranks sites based on the their known ecological significance. This set of criteria attempts to integrate such factors as unique site attributes; size; number and quality of rare animal, plant, and community Element Occurrences (EOs); perceived development and/or use pressure on the site; defensibility and potential for restoration; and connectivity to other sites.

A. **Attributes/qualities unique to Great Lakes coastal wetlands**. Sites with the presence of endemic, near-endemic, or regionally rare elements – such as the alvar community at the Red Banks Glades site – received the highest rankings in this category. "Landscape complexes" such as forested-ridge-and-swale systems (Northeast Door County, Point Beach), freshwater estuaries (such as the St. Louis River on Lake Superior), and coastal embayment systems (such as Big Bay on Lake Superior) were also considered to be highly-rated attributes.

B. **Size.** Size categories were delimited based on powers of ten. The largest sites received the highest rankings. The size of the site is taken from the Phase 1 report (Merryfield et al. 2000).

C. **Number of Element Occurrences (EOs).** Elements with the largest numbers of EOs received the highest rankings. The number of EOs in each site is taken from the Phase 1 report, plus updated NHI data through 2001. Note that, although B) size and C) number of EOs are positively correlated, there are exceptions that make it useful to be maintain B0 and C) as separate measures of ecological significance. For example, County Line Swamp is much larger than Chiwaukee Prairie, but the latter site has many more EOs than the former.

D. **Quality of EOs.** Elements with higher EO, global or state ranks received higher weight. This takes into account rarity and rank of the EOs that occur there.

E. **Development / use pressure**. This is a somewhat subjective measure of the vulnerability of the site to either direct (e.g., on-site commercial or residential construction) or indirect (e.g. off-site pollution of Green Bay) degradation of its ecological quality.

F. **Defensibility / potential for restoration**. This index attempts to measure each site's potential for being "defensible" from potential threats, and its potential for restoration. Sites that are nearly or totaling destroyed (such as Ansul Patterned Dunes) received a "1", while sites such as Lower Green Bay, which is covered with extensive growths of giant reed but still is important for water birds, received a "2".

G. **Value of the site as migration/spawning/staging area for birds and fish**. A measure of the importance of a site as seasonal habitat for species. Weight increases with higher number of groups and increased presence of foraging habitat.

H. **Connectivity**. A measure of how well each site is "connected" to neighboring sites. This is difficult to quantify, but an attempt was made, based mainly on the presence or absence of shoreline development between adjacent sites.

TABLE 1. Prioritization Criteria for Site Ecological Significance

	LOW (1 point)	LOW/MEDIUM (2)	MEDIUM/HIGH (3)	HIGH (4 points)
Attribute / qualities (unique to Great Lakes Coastal Wetlands)	Woodlot on small feeder creek (e.g., Fischer Creek, Manitowoc County)	Marsh on west side of Green Bay (e.g. Pensaukee Marsh)	Marsh on lakeside of Door Peninsula (e.g. The Ridges, Mink River)	Endemic or near-endemic species, communities; e.g. Alvar (Red Banks Glades), Lakeplain Prairie (Chiwaukee Prairie)
Size	<100 acres	100-1000 acres	1000-10,000 acres	10,000+ acres
Number of EOs	1-4 EOs	4-8 EOs	9-15 EOs	16+ EOs
Quality of EOs (weight given to high EO-ranked populations and/or high g/s ranked species/communities)	S4/S5 special concern species present. G5S3 community EO may be present. High-ranking G3/S3 EOs.	Any rank G3/S3 species, or B rank community EOs present.	Any rank G1G2/S1S2 species, or any rank state endangered/ threatened species, or A rank community EO present.	Great Lakes endemics and communities with high EO rank; AB rank G1G2/S1S2 species present, or A rank G1G2/S1S2 community EO present.
Development/use pressure	LOW - e.g. Emergent aquatic marshes on west side of Green Bay.	LOW-MEDIUM - e.g. Great Lakes alkaline rockshore.	MEDIUM-HIGH - e.g. Forested ridge and swale community complexes.	HIGH - e.g. Alvar, Great Lakes barrens.
Defensibility / potential for restoration	LOW - e.g.Ansul Patterned Dunes	LOW-MEDIUM - e.g. Ahnapee River Wetlands	MEDIUM-HIGH - e.g. Ridges area	HIGH - e.g. Marshes on west shore of Green Bay.
Value of site as migration / spawning / staging area for birds and fish	Few groups, concentrated - responding to barriers.			Concentrations of several groups, includes foraging habitat.
Connectivity (to other sites; may not be relevant for islands) optional	Sites effectively isolated by extensive surrounding areas of human development; e.g. Chiwaukee Prairie	Sites with some connectivity to other landscape sites; e.g. Point Beach State Forest	Sites with considerable connectivity with adjoining sites; e.g. The Ridges (Northeast Door County Area)	Sites part of extensive natural corridor such as the marshes along the west side of Green Bay; e.g., Oconto Marsh

Table 2 shows the results when this set of criteria was applied to the 36 Lake Michigan sites (presented in rank order).

The "top 10" Lake Michigan coastal sites – in terms of known ecological significance - included four large Door County sites (all on the Lake Michigan side of the Peninsula). Also included were Point Beach State Park, Chiwaukee Prairie, the Red Banks Glades (Brown County), Kohler Andrae State Park, and four sites on the western shore of Green Bay from the city of Green Bay north to Peshtigo Harbor (the Lower Peshtigo River).

The second set of Criteria focuses mainly on "data gaps" (future survey needs including potential for the discovery of rare species). Judziewicz (plants, communities) consulted with Heritage Ecologist Eric Epstein (communities, some animals), and Heritage Zoologist William A. Smith (animals), to assign values from 1-4 for groups of organisms such as mammals, birds, herps, mussels, butterflies and moths, dragonflies and damselflies, other invertebrates (including terrestrial snails), vascular plants, and natural communities. Also integrated into this set of criteria is an estimate (1-4) on the amount of effort that would be needed for landowner contact efforts. All of these indices are aggregated to obtain a single "priority for further survey efforts" score to be used when planning Phase 3 field surveys.

Table 3 shows the results when this set of criteria is applied to the 36 Lake Michigan sites (presented in rank order). These are the Lake Michigan sites with the largest "data gaps" – sites which, based on their landscape context, have high potential to harbor rare species and communities, AND have not yet been the subject of comprehensive survey work. These priority sites include the Red Banks Glades alvar complex (Brown County), two inland swamps and a river corridor in Kewaunee County (Black Ash, Duvall, and the Ahnapee River), Point Beach State Park, two Door County Lake Michigan coastal areas, the Root River corridor in Milwaukee and Racine counties, and two sites along the western shore of Green Bay (County Line Swamp and the Lower Peshtigo River).

TABLE 2. Lake Michigan Sites - Known Ecological Significance

	Unique Attributes / Qualities	Size of Site	Number of EOs	Quality of EOs	Development / Use Pressure	Defensibility / Restoration Potential	Connectivity to Other Sites	Aggregate Score
LM18 - Northeast Door County Area	4	4	4	4	3	3	3	**25**
LM21 - Point Beach	4	4	4	4	2	3	2	**23**
LM30 - Upper Door County Area	3	3	4	4	3	3	3	**23**
LM32 - Chiwaukee Prairie	4	2	4	4	4	3	1	**22**
LM28 - Shivering Sands Area	3	3	4	4	3	3	2	**22**
LM24 - Red Banks Glades	4	3	4	4	3	2	1	**21**
LM11 - Kohler Andrae	4	3	4	4	1	3	1	**20**
LM03 - Washington Island Wetlands	3	2	4	4	2	3	1	**19**
LM15 - Lower Green Bay	2	3	3	3	4	2	2	**19**
LM20 - Pensaukee River Wetlands	2	3	4	3	2	3	2	**19**
LM16 - Lower Peshtigo River	2	3	4	2	1	3	3	**18**
LM19 - Oconto Marsh	2	3	2	3	2	3	3	**18**
LM07 - County Line Swamp	1	4	2	2	1	4	3	**17**
LM14 - Long Tail Point	3	2	1	3	3	2	2	**16**
LM34 - Root River Riverine Forest	2	2	2	4	2	2	1	**15**
LM35 - Warnimont Park Fens	3	1	3	3	2	2	1	**15**
LM13 - Little Tail Point	3	1	1	3	2	3	2	**15**
LM26 - Seagull Bar	3	1	2	2	2	3	1	**14**
LM01 - Ahnapee River Wetlands	3	2	1	1	2	3	1	**13**
LM02 - Ansul Patterned Dunes	4	1	1	1	4	1	1	**13**
LM10 - Kewaunee River Wetlands	2	2	2	2	2	2	1	**13**
LM36 - Harrington Beach Lacustrine Forest	1	1	2	3	2	3	1	**13**
LM17 - Mud Creek Wetland	1	2	2	2	2	2	2	**13**
LM04 - Black Ash Swamp	1	3	1	1	1	4	1	**12**
LM08 - Duvall Swamp	2	3	1	1	1	3	1	**12**
LM22 - Point Creek	1	1	2	3	2	2	1	**12**
LM33 - Kenosha Sand Dunes and Low Prairie	2	1	2	2	3	1	1	**12**
LM23 - Point du Sable	2	1	2	1	2	2	1	**11**
LM25 - Renard Swamp	2	2	1	1	2	2	1	**11**
LM31 - Whitney Slough	1	1	1	1	3	3	1	**11**
LM06 - Cleveland Swamp	1	2	1	1	1	3	2	**11**
LM27 - Sensiba Wildlife Area	1	2	1	1	2	2	2	**11**
LM09 - Fischer - Centerville Creeks	1	2	1	1	2	2	1	**10**
LM12 - Little Manitowoc River	2	1	1	1	3	1	1	**10**
LM29 - Silver - Calvin Creeks Area	1	1	2	1	2	2	1	**10**
LM05 - Charles Pond	2	1	1	1	1	2	2	**10**

TABLE 3. Lake Michigan Sites - Data Gaps

	Landowner Contact Priority?	Comprehensive Biotic Survey Needed?	Natural Communities	Mammals	Birds	Herps	Mussels	Butterflies & Moths	Dragonflies, Damselflies	Terrestrial Snails, other invertebrates	Vascular Plants	Aggregate Score	Priority for Future Field Surveys?
LM24 - Red Banks Glades	4	3	3	2	3	2		2	2	3	4	**28**	**High**
LM04 - Black Ash Swamp	4	4	4	2	3	2		2	3		3	**27**	**High**
LM08 - Duvall Swamp	4	4	4	2	3	2		2	2		4	**27**	**High**
LM21 - Point Beach	1	4	3	2	3	3		2	4		3	**25**	**High**
LM18 - Northeast Door County Area	2	2	2		3	2		2	2	3	4	**22**	**High**
LM30 - Upper Door County Area	2	2	2		3	2		2	2	3	4	**22**	**High**
LM34 - Root River Riverine Forest	2	3	2	2	2	2		2	4		3	**22**	**High**
LM01 - Ahnapee River Wetlands	4	4	3		1	2		2		2	4	**22**	**High**
LM11 - Kohler Andrae	1	3	1	2	2	2		2	4	4	1	**22**	**High**
LM07 - County Line Swamp	2	3	3	2	3	2		2	2		2	**21**	**High**
LM16 - Lower Peshtigo River	2	2	2	2	2	2		2	4	1	2	**21**	**High**
LM28 - Shivering Sands Area	3	2	2		3	3					4	**17**	**Medium**
LM03 - Washington Island Wetlands	2	1	1		2	2			4	2	1	**15**	**Medium**
LM13 - Little Tail Point	3	3	1		3	2					1	**13**	**Medium**
LM25 - Renard Swamp	3	3	2		2	1					2	**13**	**Medium**
LM06 - Cleveland Swamp	3	3	3		2						2	**13**	**Medium**
LM19 - Oconto Marsh	3	2	1		2	2		2			1	**13**	**Medium**
LM14 - Long Tail Point	3	3	1		3	2					1	**13**	**Medium**
LM35 - Warnimont Park Fens	1	2	1		1	1			4		3	**13**	**Medium**
LM10 - Kewaunee River Wetlands	1	2	1		4	3					1	**12**	**Medium**
LM09 - Fischer - Centerville Creeks	2	2	2							4	2	**12**	**Medium**
LM23 - Point du Sable	1	3	1		3	2					1	**11**	**Medium**
LM20 - Pensaukee River Wetlands	1	2	1		2	2		2			1	**11**	**Medium**
LM05 - Charles Pond	1	1	1	1	2	1					1	**11**	**Medium**
LM29 - Silver - Calvin Creeks Area	1	4	1								2	**8**	**Low**
LM31 - Whitney Slough	1	2	2		2						1	**8**	**Low**
LM02 - Ansul Patterned Dunes	1	1	1						4		1	**8**	**Low**
LM22 - Point Creek	1	4	1								1	**7**	**Low**
LM15 - Lower Green Bay	1	1	1		3						1	**7**	**Low**
LM36 - Harrington Beach Lacustrine Forest	1	2	1								2	**6**	**Low**
LM33 - Kenosha Sand Dunes and Low Prairie	1	1	3								1	**6**	**Low**
LM12 - Little Manitowoc River	1	2	1								1	**5**	**Low**
LM17 - Mud Creek Wetland (Oconto Co)	1	1	1								1	**4**	**Low**
LM26 - Seagull Bar	1	1	1								1	**4**	**Low**
LM27 - Sensiba Wildlife Area	1	1	1								1	**4**	**Low**
LM32 - Chiwaukee Prairie	1	1	1								1	**4**	**Low**

2. PRIORITIZATION OF LAKE SUPERIOR SITES

Lake Superior sites were prioritized according to the same criterion as the Lake Michigan sites.

Table 4 shows the results when the criteria presented Table 1 ("known ecological significance") were applied to the 28 Lake Superior sites (presented in rank order). The "top 10" Lake Superior coastal sites in terms of known ecological significance included the Kakagon – Bad River Sloughs (which had the highest "aggregate score" of any coastal wetland site), the Brule River Spillway, two Apostle Islands "barrier spit"-enclosed wetlands, four Lake Superior estuarine wetland complexes (Port Wing, Allouez Bay – Wisconsin Point, Bark Bay, and Red River Breaks – St. Louis River marshes, and two inland wetlands, one on the Lake Superior clay plain (the Pokegama-Carnegie Wetlands) and one further inland at the headwaters of the White River (Bibon Swamp).

Table 5 shows the results when the set of criteria for "data gaps" (future survey needs including potential for the discovery of rare species) were applied to the 28 Lake Superior sites (presented in rank order). The Lake Superior sites with the largest "data gaps" – sites with pressing NHI survey needs, and, based on their landscape context, having high potential to harbor rare species and communities – included two tribal lands (the Kakagon – Bad River Sloughs and the Red Cliff Reservation), several inland wetlands in Douglas County (Black Lake, Pokegama-Carnegie Wetlands, Belden Swamp, and the Mid Lake – Ericson Creek area), several insular or coastal estuarine complexes (Big Bay, Outer Island sand spit, Stockton Island tombolo, and Wisconsin Point – Allouez Bay), and the Caroline Lake wetlands at the headwaters of the Bad River.

3. WINDSHIELD SURVEYS OF LAKE MICHIGAN SITES

A subset (26 of 36) Lake Michigan sites were selected for "windshield surveys" in attempt to evaluate their ecological significance, and the necessity for future field surveys. In addition, photographs were taken for the future CD-ROM and web-based products.

The following Lake Michigan sites were visited in 2000:

LM01 - **Ahnapee River Wetlands**, November 8. This extensive, linear site appears to have good potential habitat for rare plants and invertebrates (including federally listed species) – particularly in associated calcareous sedge meadows and tamarack rich swamps. Some landowner contact will need to be initiated. The site has a **high priority** for future field surveys.

LM02 – **Ansul Patterned Dunes**, November 8. This site has been nearly destroyed by urban commercial developments. A few small remnant second growth white pine – red oak forests, alder thickets and wetland swales (with emergent aquatic vegetation) are all that remain. There is still some potential for federally-listed invertebrates, but otherwise the site has a **low priority** for future field surveys.

LM04 – **Black Ash Swamp**, November 8. This large, elliptical site appears to have good potential habitat for communities, rare plants and invertebrates (including federally listed species). Communities present include northern wet-mesic forest (white cedar swamp) and northern hardwood swamp (black ash swamp). Other communities such as tamarack rich swamp may be present; it was not possible to tell from the road. Extensive landowner contacts will need to be initiated. The site has a **high priority** for future field surveys.

LM05 – **Charles Pond**, August 27. This small site is centered on a State Natural Area that was seriously impacted by a stochastic event (a storm that removed the barrier bar that enclosed the "pond"). It still has

some medium quality forested (northern wet-mesic forest dominated by hardwoods) and open wetland communities (emergent aquatics along the shore of Green Bay). The site has a **medium priority** for future field surveys

LM06 – **Cleveland Swamp**, October 19. This medium-sized site is still extant. A northern hardwood swamp was visible from the road, and there is also reportedly a northern wet-mesic forest (white cedar swamp) that was not seen. There is a potential for rare invertebrates (including federally listed species). Landowner contacts will need to be initiated. The site has a **medium priority** for future field surveys.

LM07 – **County Line Swamp**, August 19, September 6, November 8. This very large site has been impacted by ditching and repeated and ongoing logging. The dominant vegetation type is northern hardwood swamp (black ash swamp). There is also alder thicket, and along the shoreline of Green Bay, emergent aquatic vegetation. Much of the site is county forest land, and is free from development. There is perhaps the highest survey potential for rare birds, but all groups of organisms should be surveyed. The site has a **high priority** for future field surveys.

LM08 – **Duvall Swamp**, November 8. This large site appears to have good potential habitat for communities, rare plants and invertebrates (including federally listed species), especially around the calcareous Little Mud Lake area in the northern part – which could harbor a boreal rich fen and/or tamarack rich swamp. Other communities likely to be present include northern wet-mesic forest (white cedar swamp) and northern hardwood swamp (black ash swamp). Extensive landowner contacts will need to be initiated. The site has a **high priority** for future field surveys.

LM09 – **Fischer-Centerville Creeks Area**, October 20. This is an extensive, diverse site, but one that has been highly fragmented by agricultural and residential developments. There are northern mesic forests dominated by sugar maple and beech, and ravine complexes with forested seeps. Perhaps the most interesting natural communities are the coastal clay seeps on Lake Michigan, which could harbor rare plants and rare invertebrates. The site has a **medium priority** for future field surveys.

LM10 – **Kewaunee River Marshes**, November 8. This small- to medium-sized, estuarine site has the potential for rare birds and herps. Communities present in 2000 included emergent aquatics, sedge meadow, and some northern wet-mesic forest (white cedar swamp). The site has a **medium priority** for future field surveys.

LM11 – **Kohler Andrae**, October 20. This medium-sized site is well-protected within a State Park, but visitor overuse is always a threat. Although many rare plants are known from this site, the data is decades old, and the site has never been systematically surveyed for plants. Most other groups of organisms also need survey work. There are many natural communities present, the most important being Great Lakes dune and Great Lakes beach. The site has a **high priority** for future field surveys.

LM12 – **Little Manitowoc River**, October 20. This very small, estuarine site (dominated by emergent aquatic vegetation) has a **low priority** for future field surveys.

LM13 – **Little Tail Point**, August 31. Only the very base of this privately-owner point was surveyed in 2000. It has emergent marshes and sedge meadows, and good potential for rare birds and herps. This small- to medium-sized, estuarine site has the potential for rare birds and herps. The site has a **medium priority** for future field surveys.

LM15 – **Lower Green Bay**, August 31. This large site has been seriously impacted by dredging, industrial development, pollution, and the dominance of exotic plants such as purple loosestrife (*Lythrum*

salicaria) and giant reed (*Phragmites australis*) in the emergent marshes along Green Bay. The avifauna still requires further survey work. Overall, though, the site has a **low priority** for future field surveys.

LM16 – **Lower Peshtigo River**, August 18, 31, September 6. A large site with a dynamic landscape context (the meandering lower course and delta of the Peshtigo River), this site has received some survey work in past decades, but needs updated/more comprehensive surveys of all groups of organisms – especially birds. Communities present include emergent aquatics, sedge meadow, floodplain forest, alder thicket, shrub-carr, and southern hardwood swamp. The site has a **high priority** for future field surveys.

LM17 – **Mud Creek Wetland**, September 6. This small site has some low quality forested and medium-quality open wetland communities – with emergent aquatics dominant. It has a **low priority** for future field surveys.

LM19 – **Oconto Marsh**, August 17, September 6, November 8. A medium-sized site dominated by emergent aquatic, sedge meadow, alder thicket, and shrub-carr communities, this site has received some survey work in past decades, but needs updated/more comprehensive surveys of all groups of organisms, especially birds. Some landowner contact will need to be initiated. The site has a **medium priority** for future field surveys.

LM20 – **Pensaukee River Wetlands**, August 31. A medium-sized, mostly linear coastal site dominated by emergent aquatic, sedge meadow, alder thicket, and shrub-carr communities, but also with inland hardwood swamp and even dry forest (oak dominant) communities. This site has received some survey work in past decades, but needs updated/more comprehensive surveys of all groups of organisms, especially birds. The site has a **medium priority** for future field surveys.

LM21 – **Point Beach**, October 19-20. This medium- to large-sized site is well-protected within a State Park, but visitor overuse is always a threat, especially along the beach and dunes. Although many rare plants are known from this site, the data is mostly decades old, and the site has never been systematically surveyed for plants. Most other groups of organisms also need survey work, especially invertebrates (there is potential for federally listed species). There are many natural communities present, the most important being Great Lakes dune, Great Lakes beach, and forested ridge and swale. The site has a **high priority** for future field surveys.

LM26 – **Seagull Bar**, August 19. This small site is a critical migratory bird concentration site. It is dominated by emergent aquatic marsh, but there is also a small Great Lakes beach present. It is generally well-surveyed for other organisms. It has a **low priority** for future field surveys.

LM27 – **Sensiba Wildlife Area**, August 31. This small site has some low quality forested (reportedly southern hardwood swamp) and medium-quality open wetland (emergent aquatic) communities. Its hydrology has been compromised by ditching and diking. It has a **low priority** for future field surveys.

LM29 – **Silver-Calvin Creeks Area**, October 19. This is a small site that has been highly fragmented by agricultural and residential developments. It has some remnant northern mesic forest of sugar maple and beech, grading into white cedar forest on steep slopes along the ravine bottoms. The site has a **low priority** for future field surveys.

LM31 – **Whitney Slough**, November 8. This is a small site set in an urbanized landscape. The presence of a small area of remnant, intact, forested hardwood/floodplain ridge-and-swale landscape lends it some significance, but it has a **low priority** for future field surveys.

LM32 – **Chiwaukee Prairie**, October 21. This small, isolated site has many significant attributes including the only remaining example of lake plain prairie in Wisconsin. Although it is generally well-surveyed for plants, it still lacks invertebrate surveys and a comprehensive vegetation map. It has a **low priority** for future field surveys.

LM34 – **Root River Riverine Forest**, October 21. A small, linear corridor, this site is wooded with a number of forested communities, including a southern mesic forest, floodplain forest, and a forested seep. It has the potential for rare species in a number of taxonomic groups, especially dragonflies and plants. The site has a **high priority** for future field surveys.

LM35 – **Warnimont Park Fens**, October 21. This small, linear lakeside site is wooded with a number of forested communities (including deep mesic ravines with southern mesic forest), as well as supporting a unique seeping tamarack fen (also with white cedar and white birch) on a Great Lakes coastal bluff. It has some potential for rare species in a number of taxonomic groups, especially plants – there are a number of historical records that require new surveys. The site has a **medium priority** for future field surveys.

LM36 - **Harrington Beach Lacustrine Forest**, October 20. A small, somewhat degraded site that has supports a hardwood swamp (ash swamp) community. It has a **low priority** for future field surveys.

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Lake Superior sites were prioritized in a similar manner as Lake Michigan sites.

Table 4 shows the results when the criteria presented in Table 1 ("known ecological significance") were applied to the 28 Lake Superior sites (presented in rank order). The "top 10" Lake Superior coastal sites in terms of known ecological significance included the Kakagon – Bad River Sloughs (which had the highest "aggregate score" of any coastal wetland site), the Brule River Spillway, two Apostle Islands "barrier spit"-enclosed wetlands, four Lake Superior estuarine wetland complexes (Port Wing, Allouez Bay – Wisconsin Point, Bark Bay, and Red River Breaks – St. Louis River marshes, and two inland wetlands, one on the Lake Superior clay plain (the Pokegama-Carnegie Wetlands) and one further inland at the headwaters of the White River (Bibon Swamp).

Table 5 shows the results when the set of criteria for "data gaps" (future survey needs including potential for the discovery of rare species) were applied to the 28 Lake Superior sites (presented in rank order). The Lake Superior sites with the largest "data gaps" – sites with pressing NHI survey needs, and, based on their landscape context, having high potential to harbor rare species and communities – included two tribal lands (the Kakagon – Bad River Sloughs and the Red Cliff Reservation), several inland wetlands in Douglas County (Black Lake, Pokegama-Carnegie Wetlands, Belden Swamp, and the Mid Lake – Ericson Creek area), several insular or coastal estuarine complexes (Big Bay, Outer Island sand spit, Stockton Island tombolo, and Wisconsin Point – Allouez Bay), and the Caroline Lake wetlands at the headwaters of the Bad River.

Table 4. Lake Superior Sites - Known Ecological Significance

	Unique attributes / qualities	Size of site	Number of EOs	Quality of EOs	Development / use pressure	Defensibility / restoration potential	Connectivity to other sites	Aggregate score
LS26 - Kakagon - Bad River Sloughs	4	4	4	4	2	4	4	**26**
LS13 - Brule River Spillway	4	3	4	4	2	4	2	**23**
LS15 - Port Wing - Bibon Lake	4	3	4	4	3	3	1	**22**
LS24 - Stockton Island Tombolo	4	3	4	4	2	4	4	**25**
LS11 - Wisconsin Point - Allouez Bay Marshes	4	2	4	4	3	3	2	**22**
LS23 - Big Bay Wetlands	4	3	4	3	2	4	2	**22**
LS28 - Bark Bay	4	3	4	3	3	3	1	**21**
LS05 - Pokegama - Carnegie Wetlands	3	3	3	4	2	3	3	**21**
LS06 - Red River Breaks - St. Louis River Marshes	4	3	3	3	1	4	3	**21**
LS14 - Bibon Swamp	3	4	3	3	1	4	2	**20**
LS16 - Lost Creek	3	2	4	4	2	3	1	**19**
LS22 - Long Island - Chequamegon Point	4	2	3	4	1	4	3	**21**
LS17 - Sand Bay	3	2	4	3	1	4	3	**20**
LS18 - Red Cliff Reservation	3	2	3	3	2	4	3	**20**
LS20 - Bayview Beach - Sioux River Slough	2	2	3	4	3	3	1	**18**
LS08 - Superior Municipal Forest	3	3	2	2	3	3	3	**19**
LS09 - Superior Airport - Hill Avenue Wetlands	3	3	2	3	4	1	2	**18**
LS12 - Divide Swamp	2	2	3	3	2	4	2	**18**
LS25 - Outer Island Sand Spit and Lagoon	3	2	3	3	1	4	4	**20**
LS01 - Black Lake Bog	2	3	2	2	1	4	4	**18**
LS02 - Belden Swamp	1	3	3	2	1	4	4	**18**
LS27 - Caroline Lake Wetlands	1	3	2	2	2	4	3	**17**
LS03 - Mud Lake - Erickson Creek Area	1	2	3	2	1	4	3	**16**
LS21 - Fish Creek Slough	2	3	2	1	2	3	1	**14**
LS07 - Oliver Marsh	3	2	1	1	2	3	3	**15**
LS19 - Sultz Swamp	1	2	2	2	1	4	2	**14**
LS04 - Lower Nemadji River Bottoms	1	2	1	1	2	4	3	**14**
LS10 - Nemadji River Marshes	2	2	1	1	1	3	2	**12**

Table 5. Lake Superior Sites – Data Gaps

	Landowner Contact Priority?	Comprehensive Biotic Survey Needed?	Natural Communities	Mammals	Birds	Herps	Mussels	Butterflies & Moths	Dragonflies, Damselflies	Terrestrial Snails, other invertebrates	Vascular Plants	Aggregate Score	Priority for Future Field Surveys? (Based on site potential, thoroughness of past survey efforts)
LS26 - Kakagon - Bad River Sloughs	1	2	3	3	3	3	2	4	3	2	3	**29**	**High**
LS18 - Red Cliff Reservation	2	2	4	2	3	3	2	2	3	2	3	**28**	**High**
LS01 - Black Lake Bog	1	3	2	2	3	2		4	2	3	2	**24**	**High**
LS05 - Pokegama - Carnegie Wetlands	3	4	3	2	2	2		2	2		4	**24**	**High**
LS25 - Outer Island Sand Spit and Lagoon	1	1	1		3	1	2	4	4	4	1	**22**	**High**
LS23 - Big Bay Wetlands	1	1	1		3	2	2	2	4	4	1	**21**	**High**
LS24 - Stockton Island Tombolo	1	1	1		2	1	2	4	4	4	1	**21**	**Medium**
LS02 - Belden Swamp	1	3	2	2	3	2		2	3		2	**20**	**Medium**
LS03 - Mud Lake - Erickson Creek Area	1	3	2	2	3	2		2	3		2	**20**	**Medium**
LS11 - Wisconsin Point - Allouez Bay Marshes	1	2	1	2	2	2	2	2		3	2	**19**	**Medium**
LS27 - Caroline Lake Wetlands	1	2	2	2	2	2		2	3		2	**18**	**Medium**
LS14 - Bibon Swamp	2	1	2		2	2		3	4		2	**18**	**Medium**
LS06 - Red River Breaks - St. Louis River Marshes	1	2	2	2	2	2	2	2	1		2	**18**	**Medium**
LS09 - Superior Airport - Hill Avenue Wetlands	3	2	2		2	2		2			4	**17**	**Medium**
LS19 - Sultz Swamp	1	2	2	2	2	2		2	2		2	**17**	**Medium**
LS28 - Bark Bay	1	1	1				2	2	4	4	1	**16**	**Medium**
LS15 - Port Wing - Bibon Lake	2	1	1				2	2	3	3	1	**15**	**Medium**
LS22 - Long Island - Chequamegon Point	1	1	1		1	1	2	2	3	2	1	**15**	**Medium**
LS04 - Lower Nemadji River Bottoms	1	3	2		3	2	2				2	**15**	**Medium**
LS10 - Nemadji River Marshes	1	3	2		2	2	2	1			2	**15**	**Medium**
LS20 - Bayview Beach - Sioux River Slough	1	1	1		2		2	2	3	2	1	**15**	**Medium**
LS16 - Lost Creek	1	1	1				2	2	4	1	1	**13**	**Medium**
LS17 - Sand Bay	1	1	1				2	2	4		1	**12**	**Medium**
LS21 - Fish Creek Slough	1	1	1		2			2			1	**10**	**Low**
LS08 - Superior Municipal Forest	1	2	1					2			2	**8**	**Low**
LS07 - Oliver Marsh	1	1	1								1	**4**	**Low**
LS12 - Divide Swamp	1	1	1					1			1	**4**	**Low**
LS13 - Brule River Spillway	1	1	1					1			1	**4**	**Low**

4 . BCD DATABASE DEVELOPMENT

Phase 1 of the Coastal Wetland Assessment project identified fish and bird data gaps for the coastal zone area and noted the importance of these data to enhancing our understanding of the Primary Sites. During Phase 2, staff spent a great deal of time pulling together bird data from a variety of sources and developing a methodology for incorporating the data into the BCD. For the fish data, a statewide fish database was procured and development of this database will be a major focus of Phase 3. Detailed descriptions of all bird and fish data sources follow.

Bird Data

During Phase 2, staff contacted known ornithology experts to ascertain the feasibility of obtaining missing bird data. As a result, five major bird databases were procured. One of these databases, the Wisconsin Breeding Bird Atlas, is lacking significant information. Obtaining this absent information will be the focus of the next phase. The remaining four databases have all the appropriate information and will be added to the BCD in the upcoming months. By the conclusion of Phase 3, all five databases will be incorporated into the BCD and available for final reporting.

Table 1 summarizes the five databases and provides an estimate of the maximum number of element occurrences that may result from each dataset. Following the table, additional information is provided for each database, including recommendations necessary for completing the development of the data.

Table 6. Bird Data Obtained

Data Source	Format	Estimated Maximum # of EO's in Coastal Zone	Data Missing	Estimated Non-Coastal EO's
BBA	PARADOX	1,109	Precise locations	8,532
SNA	ACCESS, Hard copy	66 41	Quad, DTRSQQ	700 (ACCESS) 475 (Hard Copy)
Colonial Waterbirds	Excel	96	Quad, DTRSQQ (need the GIS coverage)	19
Apostle Islands	ACCESS	112	Quad, DTRSQQ	--
Federal BBS	On-line, Hard copy	99 100	Precise locations for stops	1200 (On-line) 500 (Hard Copy)
All		1,623		11,426

Wisconsin Breeding Bird Atlas (BBA)

This database was obtained from the Wisconsin Breeding Bird Atlas Project and contains a maximum of 9,641 records from throughout the state. Approximately 1, 190 unique records occur within the Coastal Zone area. The database includes all necessary data fields except specific locational information. Thus, BBA observers still need to be contacted to extract latitude and longitude information and Township, Range, Section, Quarter/Quarter Section information for each record.

In Phase 2, BER staff transferred the BBA database to Microsoft ACCESS and developed a mapping and contact procedure to obtain needed locational information from BBA observers for individual coastal zone records. Letters were sent to 240 observers requesting they provide the additional locational information to BER. To date, approximately 75 records have been obtained.

Additional Data Needs
- Specific locations of remaining records

Recommendations for Additional Work
- Continue to contact observers for precise locations, with a goal of contacting the observers of 620 records
- Provide results to NHI mappers for database development
- Send a follow-up letter to all observers with Coastal Zone records encouraging them to contribute rare bird data in the future. A list of bird species on the Natural Heritage Working List and Rare Animal Field Report forms will be included with the letter.

State Natural Areas Breeding Bird Survey
Twenty-two State Natural Areas fall within the Coastal Zone Boundary Area. DNR conducts annual breeding bird surveys of many of the state natural areas, and BER procured this survey information from DNR Bureau of Integrated Science Services in two forms. First, statewide surveys from 1990-2000 was received in an ACCESS database. The database contains 66 surveys from 12 out of 22 State Natural Areas within the Coastal Zone area, resulting in an estimated maximum of 66 element occurrences. Second, photocopies of field sheets from surveys between 1980 and 1989 were obtained. The field notes contain 40 surveys from 15 of the 22 State Natural Areas within the Coastal Zone area, resulting in an estimated maximum of 41 element occurrences.

Additional Data Needs
- Quadrangle, DTRSQQ information

Recommendations for Additional Work
- Obtain quadrangle and DTRSQQ for each State Natural Area from website and files
- Provide results to NHI mappers for database development
- Send photocopies of quad maps to observers for recording locations of rare birds

Colonial Waterbird Survey
This survey data was provided by Dr. Francesca Cuthbert and Anup Joshi at the University of Minnesota-Twin Cities. The data, provided in the form of Excel files, are from surveys conducted between 1997-1999. The files contain 96 element occurrences from 83 different observers. Also provided are the latitude and longitude of rookeries in decimal degrees. In order to map this data the quadrangle, township/range/section/quarter-quarter section information are needed. Further work remaining include obtaining GIS point coverage from Anup Joshi and providing results to NHI mappers for database development

Apostle Islands Breeding Bird Survey
The Apostle Islands Breeding Bird Survey was procured from Julie Van Stappen and Geoff Smith at the Apostle Islands National Lakeshore. Also provided was a copy of the Apostle Islands Breeding Bird Survey Report that outlines survey methodology and provides analysis of trends over the last 10 years. The database contains 116 breeding bird surveys between 1990-2000 containing approximately 112 element occurrences. Seventy-one of these element occurrences are from 1995-2000 and have GPS coordinates. The other 41 element occurrences dated between 1990 and 1994 do not have permanent survey points. Mapping these 41 without exact locations can be done either by mapping at the scale of the transect or by estimating the average distance and assigning a lower accuracy to the points. Quadrangle, township/range/section/quarter-quarter section information is needed for mapping all element occurrences. Results will be provided to NHI mappers for database development.

Federal Breeding Bird Survey Route Data
The data for this survey spans from 1980-2000. The data for surveys conducted between 1997 and 2000 was maintained of the website. For surveys conducted between 1980 and 1996, photocopies of field sheets were procured. The survey routes are 24.5 mile transects with 50 points at ½ mile intervals. Eight survey routes occur partly or entirely in the Coastal Zone area –there are an estimated 99 element occurrences from the 1997-2000 data and approximately 100 more element occurrences from the 1980-1996 data. Precise locations for each stop need to be obtained from observers. Results will be provided to NHI mappers for database development.

Other Potential Bird Data Sources
The following is a list of additional bird data sources that were identified as a result of the work of this Phase. These data sources require considerable effort beyond the scope of this project before they can be entered into the NHI's Biological Conservation Database (BCD). Most sources were either suggested by Sumner Matteson, Avian Ecologist with the DNR Bureau of Endangered Resources, or by other ornithology experts that were contacted. They are listed here to guide future efforts to consolidate bird data within the coastal boundary and other parts of Wisconsin.

- Mike Mossman-WIDNR Bureau of Integrated Science Services
  - Black tern surveys, grassland bird surveys, Coastal Wetlands/Lake Superior Kakagon Sloughs, Door County loggerhead shrike surveys
  - Much of this data would have to be transcribed from field notebooks
- Tom Erdman-Richter Museum Curator
- Bill Brooks-Ripon College
- Dr. Ed Burkett, UW-Superior
- Dick Verch-Northland College
- Pam Dryer-U.S Fish and Wildlife Service Whittlesey Creek National Refuge
- Greg Fisher-Red Cliff Tribe
- Tom Custer-U.S.Geological Survey
- Ken Stromberg-U.S. Fish and Wildlife Service
- Joel Trick-U.S. Fish and Wildlife Service
- The Nature Conservancy-Becky Abel
- U.S Shorebird Conservation Plan
- North American Bird Conservation
- Wisconsin Bird Initiative

Fish Data
BER staff contacted Don Fago, DNR Warm Water Fisheries Ecologist and gained access to a large database of Wisconsin Fish Species. Staff need to convert river miles to actual locations and then the results will be provided to the NHI mappers for database development.

Other Potential Fish Data Sources
The following is a list of additional fish data sources that were identified as a result of the work of this Phase. These data sources require considerable effort beyond the scope of this project before they can be entered into the NHI's Biological Conservation Database (BCD). Most sources were either suggested by Bureau of Endangered Resources staff, or by contacting the U.S. Fish and Wildlife Service. They are listed here to guide future efforts to consolidate fish data within the coastal boundary and other parts of Wisconsin.

- Dr. Owen Gorman-U.S. Geological Survey Lake Superior Biological Station
- Mark Holey and Robert Elliot-U.S. Fish and Wildlife Service-Green Bay

- Terry Litchwick
- Greg Cornelly
- Ron Brook
- Mike Tonies-DNR-Sturgeon Bay
- Mark Dryer-U.S. Fish and Wildlilfe Service-Ashland
- Janet Smith-U.S. Fish and Wildlife Service-Green Bay
- Tim Ehlinger-UW-Milwaukee
- John Lyons-DNR Bureau of Intergrated Science Services

5. PRELIMINARY PHOTO LIBRARY (CD-ROM)

The CD-ROM accompanying this report contains the following files:

1. **Site Descriptions and Pictures**: The primary library of Coastal Wetland Sites. Includes separate Word document files containing descriptions and photos for all 64 Primary Sites. The site descriptions are excerpted from the primary sites that were developed as part of Phase 1 of the Coastal Wetlands Assessment project (Merryfield et al. 2000). Each photograph within the text is accompanied by a short description of what natural feature or part of the site is being illustrated. The Word document files are named according to the lake abbreviations and site numbers and names used in the Merryfield et al. report; that is, it is arranged by Great Lake (Lake Michigan first, and then Lake Superior) and by site number. Also in this folder are index maps to the Lake Michigan and Lake Superior sites.
2. **Individual Scans:** Contains jpeg files for the same pictures from the previous folder plus a few additional ones, but arranged and labeled just by acronym (LM01-01 etc to LS28-02). A separate "Figure Captions" Word document gives fuller info on these pictures.
3. **Final Report of Phase 2**: Microsoft Word document of this report.

The images on the CD were obtained from various sources:

- Lake Michigan: 2000 field work on 26 of 36 sites by Judziewicz (funded by this grant).
- Lake Michigan: 2000 field work by Judziewicz on the Niagara Escarpment, funded by the Bureau of Endangered Resources, Wisconsin DNR (Judziewicz 2001).
- Lake Michigan: 1997-1999 WDNR field work on the Door County islands by Judziewicz, funded by the Wisconsin Coastal Management program, Department of Administration (Judziewicz, in review; Judziewicz & Kopitzke 1998, Penskar et al. 1999).
- Lake Superior: 1995-1996 WDNR field work by Eric J. Epstein and Judziewicz on the wetlands of the Lake Superior drainage basin (Epstein et al. 1997a, 1997b, 1999).
- Lake Superior: 1990-1999 field work by Judziewicz on the Apostle Islands, funded by contract with the National Park Service (Judziewicz & Koch 1993, Judziewicz 1999).
- Lake Superior: 1995-1996 field work by Eric J. Epstein on the St. Louis River estuary, funded by National Oceanic and Atmospheric Administration and the Wisconsin Coastal Management program, Department of Administration (Epstein 1997).
- Lake Superior and Lake Michigan field work by Epstein over the years during his duties as Heritage Ecologist.

6. WEBPAGE DEVELOPMENT

Phase 2 included the development of a webpage linked to the existing BER website that will serve as the information source for the Coastal Wetland Project. At the conclusion of Phase 2, the webpage will contain its basic structure, the final report from Phase 1, and placeholders for other information that will be added during Phase 3. The work on webpage development during Phase 2 included: general website development, data management, Lake Superior report and maps, Lake Michigan report and maps and Photo Library integrations. Details of tasks for each of these aspects follows.

Website Development

Work was completed on the initial layout of the webpage including the development of the project description for the main page, code writing, and linkage testing for subpages. In addition, the final report from the first phase of the Coastal Wetland Assessment project and associated maps were converted and posted on the webpage, and a table of partners and research links was developed.

Recommendations for Next Steps

- Review and modify existing page layout
- Write code and test links for partners

Lake Michigan Report and Maps

A summary table of the Priority Sites for Lake Michigan from Phase 2 and individual pages for the 10 highest priority sites were posted to the webpage. The individual site pages include the updated site descriptions with photos as described above under CD-ROM development.

Recommendations

- Create links between reports and maps
- Develop individual pages for remaining 26 sites
- Create links in site table to pages

Lake Superior Report and Maps

A summary table of the Priority Sites for Lake Superior from Phase 2 and individual pages for the 10 highest priority sites were posted to the webpage. The individual site pages include the updated site descriptions with photos as described above under CD-ROM development.

Recommendations

- Convert report and maps from the “Wisconsin’s Lake Superior Coastal Wetlands Evaluation” and “Priority Wetland Sites of Wisconsin’s Lake Superior Basin.”
- Create links between reports and maps
- Develop individual pages for remaining 18 sites
- Create links in site table to description pages

Photo Library

Phase 2 work involved creating an index page for the photo library. Future work will focus on creating links from individual site descriptions to index page. This will involve writing code and testing the links.

References Cited

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