- Regional & Property Analysis -
Powell Marsh State Wildlife Area

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Cover Image: Aerial photo of the Vista Flowage
Photo by Ronald Eckstein

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I. Introduction and Overview

Purpose of a Regional and Property Analysis

A Regional and Property Analysis (RPA) is required by Chapter NR 44, Wisconsin Administrative Code, when developing a Master Plan, plan revision, or plan amendment. The RPA forms the foundation of the master plan, providing the baseline information on the property or property group as well as information on how each property fits into or relates to its larger ecological and social context. Functionally, it identifies the most suitable potential future roles or niches for the properties and highlights those elements of the regional context that are most important to consider when planning the properties.

The **Regional Analysis** component of this document describes the broader biological/ecological, cultural, economic, and recreational environments that affect the Powell Marsh Wildlife Area and its uses. It identifies significant ecological and recreational needs within the region. It also defines existing and potential social demands or constraints affecting the property that should be considered during the planning process.

The **Property Analysis** component of this document describes the property's existing resources, uses, management opportunities, limitations, and needs. This section also describes surrounding and adjacent lands, indicating how the character of these lands may affect the property or its use.

The **Findings and Conclusions** component is the most important section of the RPA. Based on all the regional and property data in the body of the document, the Findings and Conclusions section outlines the best probable future role or niche for the property. It helps focus the planning process and becomes the foundation for building the master plan's vision and goals, and action strategies.

Management Authority

The scope of use and management of a state property is governed by its official designation. Wildlife areas are acquired and managed under the authority of Section 23.09(2)(d)3, Wisconsin Statutes, and Chapter NR 1.51, Wisconsin Administrative Code. They are designated to provide places where people can hunt, trap, and fish. Wildlife areas also are open for traditional outdoor uses of walking, skiing, snow shoeing, nature study, berry picking, and other low-impact recreational activities. As directed by NR 1.51 and NR 1.61, other recreational uses may be allowed on wildlife areas by the master plan if those uses do not detract from the primary purpose of the property.

Introduction to the Property

Powell Marsh State Wildlife Area (PMSWA) lies in western Vilas County, 3 miles south of Manitowish Waters and 10 miles north of Lac du Flambeau (Map A). There are 390 acres of private land within the 4,850 acre wildlife area. PMSWA is bounded on three sides by the Northern Highland – American Legion State Forest and by the Lac du Flambeau Indian Reservation on the south. Several cranberry producers own land adjacent to the property. The Turtle Flambeau Flowage Scenic Waters Area (~32,000 ac), lies about six miles to the west. The current property master plan was approved in 1980.

PMSWA is primarily an open peatland with several small flowages and small lakes. It encompasses a portion of a 20,000 acre wetland complex mostly owned and managed by the Lac du Flambeau Reservation. About 12,000 acres of the tribally owned lands have leatherleaf bog habitat similar to the wildlife area. While lakes are abundant in the region, large, open peatlands are rare across northern Wisconsin. Without intervention, these peatlands naturally convert to tamarack forest and black spruce muskeg.

Powell Marsh is a locally important waterfowl production area and that trappers use the area seasonally to pursue muskrat, mink and beaver. The upland fringe is used regularly for deer and grouse hunting. Powell Marsh has been highlighted as a stop on the Great Wisconsin Birding and Nature Trail and is part of an Important Birding Area.

Past Management

Historic photos from the 1930's show that a railroad grade used for logging ran diagonally thru the Marsh significantly impacting the original hydrology. Multiple farmsteads existed in the area and photos show that row crops were planted in drained areas.

The open wetland system currently seen at Powell Marsh was maintained by wildfires for thousands of years. The last of the wildfires were in the 1930's and 1940's. Railroad equipment was believed to have caused large scale fires that burned deep down into the wetland peat layers and large efforts were made to suppress wildfires to protect local homes. Consequently, these fires stimulated new vegetation growth that attracted large flocks of migrating geese. Sportsmen recognized the potential to attract geese to the area and petitioned the Wisconsin Conservation Commission to establish a goose management project. In 1955, the PMSWA was established to produce more geese for hunters.

Early management at PMSWA was one of the pioneering efforts to manipulate an extensive northern sedge leatherleaf bog for geese. Managers used prescribed fire to stimulate new growth for fall waterfowl migrations, similar to conditions that resulted from historic wildfires. A system of ditches and dikes was constructed to provide water level control to enable prescribed burning and allow limited planting of food patches for waterfowl. A decoy flock of 50-150 Canada Geese was established in 1957 to attract migrating geese. This effort was initially successful, but fall populations declined over time. In 1974 the flock was disbanded.

The DNR determined that use of PMSWA by geese was affected by:

- the limited amount of food available,
- the natural succession of woody vegetation within the marsh,
- the dark, shallow water was not optimal for waterfowl, and
- migration patterns shifting west.

Beginning in 1966, a bait site was established to attract and trap ducks for banding. During the late 1960's, 1,500-4,000 ducks used the bait site annually. Duck use declined steadily and trapping was discontinued in the late 1970's. Powell Marsh still provides significant, local wildlife-based recreation, particularly deer and waterfowl hunting and birding.

Current Management

Management emphasizes habitat for game and nongame bird species that require open wetland and grassland habitat. A key management tool is water level control. Water levels are adjusted by installing and removing stop logs in the water control structures to hold back or release water. Deeper, open water provides duck brood habitat, migration habitat, viewing and educational benefits and prevents brush encroachment. Seasonal drawdowns expose mudflats and concentrate invertebrates, favorite foods for shorebirds. Drawdowns and re-flooding also promote desirable vegetation such as moist soil plants that are preferred by ducks and geese. The ditches are linear semi-permanent wetlands that provide excellent habitat for furbearers like mink and muskrat. Due to the low wet terrain, drawdowns are essential to conduct prescribed burns, or to access areas for mowing or shearing trees. The ditches also act as firebreaks during prescribed burns.

Prescribed burns are used to suppress woody vegetation, promote sedges and grasses, and keep the marsh and grasslands open. These open grasslands provide nesting habitat for a variety of waterfowl, including Mallard, Blue-winged Teal, and Black Duck. Many of the rare bird species found at PMSWA require this open habitat. Fire also stimulates fruit production; cranberry and blueberry production improves in the years after an area is burned. In areas where fire cannot be used, trees and brush are mowed and sheared.

In early spring, the shallow impoundments at PMSWA are the first regional waters to be free of ice. Thousands of migratory birds can be found feeding and resting in the open waters of the PMSWA before the surrounding lakes have open water. Migrating birds such as White Pelicans, Northern Pintail, Scaup, Redheads, Red-necked Grebes, Snowy Owls, Blue-winged Teal and Green-Winged Teal have been sited on the property during the spring thaw.

Routine maintenance work on the property includes filling in muskrat holes in dikes, adding gravel to roads or parking lots, treating for invasive plant species, mowing roadsides and dikes, repairing and replacing old or damaged water control structures and signs and maintaining storage buildings.

A 1,800 acre wildlife refuge located within PMSWA protects wildlife from hunting and other disturbances from September 1 – December 31. The refuge protects migrating waterbirds during the waterfowl hunting season.

Tribal Management of Adjacent Powell Marsh Lands

By Larry Wawronowicz, Natural Resources Director, Lac du Flambeau Chippewa Tribe

Management Objectives

The primary objective for Powell Marsh is to increase the number of waterfowl utilizing the marsh and to provide for nesting, resting and feeding areas during the spring and fall migration and spring and summer production season. A secondary objective is to manage the Powell Marsh for other wildlife such as grouse, whitetail deer, etc. and to provide increased hunting and gathering opportunities.

Management Strategies

Following are the management strategies used to achieve the objectives for Powell Marsh:

- Maintain levees and water control structures. Currently, there are 13 miles of levees on Powell Marsh, with plans to impound additional acreage in the Sugarbush Creek area.
- Plant feeding areas with buckwheat and millet. Approximately 30 acres are planted to crops.
- Plant wild rice on Chewelah and Sugarbush Lakes. Fifteen acres of wild rice are planted at Chewelah Lake, and four acres of wild rice are planted at Sugarbush Lake.
- Control woody vegetation by fire and mowing. About 50 acres are mowed each year. This year, there were two prescribed burns on the marsh, 125 acres and 150 acres.
- Establish a breeding population of Canada Geese.

American Woodcock hiding in the reeds along Steppingstone dike (by Michele Woodford)

II. Analysis of the Regional Context

The regional data in this section are largely drawn from the Regional Analysis prepared for the Northern Highland – American Legion State Forest plan revision (Wisconsin Department of Natural Resources. 2002). The region encompasses six counties in North Central Wisconsin; Iron, Vilas, Oneida, Price, Lincoln, and Forest.

Socio-economic Setting

Land use

In North Central Wisconsin, the largest category of property owners is private non-industrial owners, followed by industrial forests, the national forest, county forests, state lands, and tribal land. The region has many smaller tracts of private land with residences, seasonal homes, and resorts or other businesses. State properties in the vicinity of Powell Marsh include the Northern Highland - American Legion State Forest (NHAL), Willow Flowage Scenic Waters Area, Turtle Flambeau Flowage Scenic Waters Area, Hay Creek-Hoffman Lake Wildlife Area, and other smaller tracts.

North Central Wisconsin is one of the most popular recreation and tourism areas in the state. About two million people per year come to the NHAL Forest alone. The sparkling lakes, vast forests, abundant wildlife, campgrounds, and many trails bring visitors to the region year after year. Over the last decade, outdoor recreation has increased for most uses. People continue to move here for work or to retire. They build homes or improve summer homes. Public services and infrastructure are continually added to support the growing population.

Population Trends

North Central Wisconsin is a region in transition. Population and economic growth is affecting land use and ownership patterns, (Table 1, US Census Bureau, 2011). The six-county region has 115,000 residents and has declined about 4 percent in the past decade. Vilas county is the only county to show growth during the past decade. These numbers do not include seasonal populations, which can exceed resident populations. The Wisconsin Department of Revenue reports that 58 percent of homes in Vilas County are intended primarily for recreational use.

Table 1. Census Data, 2010

Wisconsin County	Census population 2010	Population change 2000-2010	Percent population change 2000-2010
Vilas	21,430	+ 397	+1.9%
Oneida	35,998	-778	-2.1%
Forest	9,304	-720	- 7.7%
Iron	5,916	-945	-16.0%
Lincoln	28,743	--898	-3.1%
Price	14,159	-1,663	-1.2%
Regional total	**115,550**	**-4,607**	**-4.0%**

Economic Context

Manufacturing and construction have experienced significant declines in employment since 2000, while the retail trade and other services industries, like health care and social assistance, have seen slow growth.

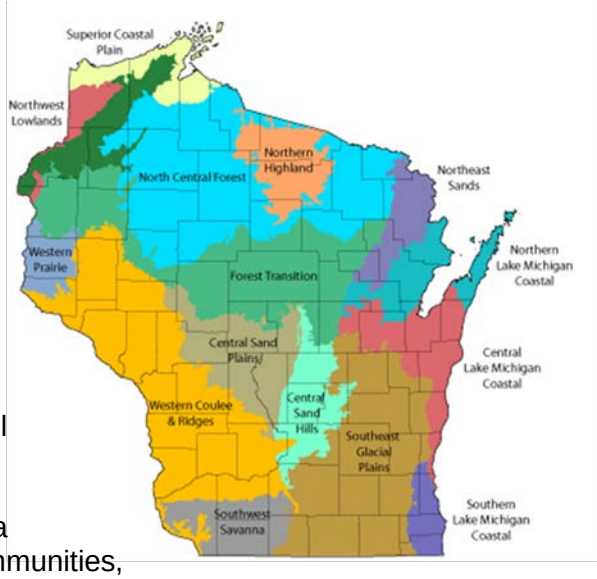
Tourism and recreation are an important part of economic vitality across Wisconsin and also in this region. At the state level, outdoor recreation, specifically, contributes over $9.7 billion annually to the Wisconsin economy in spending from both state residents and guests. Camping is a particularly important activity to the state's economy. In the six counties of the north central region in 2008 industries related to tourism and recreation (including arts, entertainment, recreation, accommodation, and food services) employ more than 6,000 workers (13% of all jobs). However, employment in these sectors decreased in between 2000 and 2008. Tourism and recreation are particularly important to the economy in Vilas County, employing about 22% of workers.

In sum, the economy the region is continuing to transition from a production-based economy toward a service economy, and employment in the region's major industries (especially the ones with higher pay) has been declining. This is an area of the state where it can be difficult to find a good job and the current economic recession may impact this area to a greater extent than some other areas within the state of Wisconsin.

This section is drawn from data in economic profiles developed by the Applied Population Laboratory, Department of Community and Environmental Sociology. University of Wisconsin-Madison (Winkler, R. and Pohlman, J.).

Ecological Setting

The ecological characteristics of the Powell Marsh region can be defined by the Ecological Landscape classification system. This system divides the state into 16 ecologically similar regions based on soils, existing and pre-European settlement vegetation, topography, and types of aquatic features present. The PMSWA lies within the Northern Highlands Ecological Landscape and is made up of three Land type Associations (LTAs): Powell Marsh (212Xb04), Vilas-Oneida Sandy Hills (212Xb02), and Vilas-Oneida Outwash Plains (212Xb03). The majority of the property is located within the Powell Marsh LTA.



The Northern Highlands Ecological Landscape is a complex of lakes, upland forests, and wetland communities, both forested and unforested. In the upland forests, dominant cover types include aspen, paper birch, oak, naturally-occurring pine stands, northern hardwoods and pine plantations. Upland forest communities account for 65% of the Northern Highlands.

Prior to European settlement, the upland forests of the region were dominated by red and white pine, with a mixture of white birch, aspen, jack pine, and red oak. Beginning in the middle of the 19th century, loggers drastically changed the landscape by removing all major

stands of white pine. Selective cutting of hardwood species followed in the early part of the 20th century, and left us with the early to mid-successional upland forests we see in this region today.

Most wetlands in the Northern Highlands are acidic, having accumulated layers of sphagnum peat over several millennia. Open bog, muskeg, poor fen, black spruce swamp, and tamarack swamp are common peatland communities within this Ecological Landscape. Other wetland types are also present, including white cedar swamp, hardwood swamp, emergent and submergent marsh, fen, sedge meadow, alder thicket, shrub-carr, and small patches of floodplain forest along the major rivers. (See Appendix A for more information on wetland types of Northern Wisconsin.)

Unforested Wetlands: About 12% of the total area in the Northern Highland Ecological Landscape is unforested wetlands. Most of the unforested wetlands are areas of open sphagnum moss, while some are lowland brush (i.e. alder thickets or wet meadows). These community types support many rare species and are valued for watershed protection. Unforested wetlands are typically stable, though some are succeeding to tamarack and black spruce. Management such as prescribed burning in unforested wetlands maintains the open habitat, though most unforested wetlands are unmanaged. According to the NHAL's Regional Ecology Assessment, wetland habitats most in need of management attention are lakes, sedge meadows, and bogs.

Forested Wetlands: About 10% of the Northern Highland Ecological Landscape is forested wetlands including, in order of significance, black spruce, tamarack, northern white cedar, and swamp hardwoods. Forested wetlands are widespread on private non-industrial forest, state owned land, industrial forest, and county forest. Forested wetlands have considerable value for a range of wildlife species such as neotropical migrants, rare species such as yellow-bellied flycatchers, and watershed protection. Forested wetlands have slow succession, little harvest, and low potential for the land to support other types of forests. Before European settlement tamarack was by far the leading dominant tree species in forested wetlands with black spruce as a common associate. The peatlands were cut at the turn of the century and have regenerated naturally, with a slow increase in tamarack in open areas. Over time there has been a shift from tamarack to later-successional black spruce.

Within the context of the Northern Highlands, Powell Marsh exists as a unique habitat type, providing an island of nesting, foraging, and stop-over habitat for a number of animal species. Across Wisconsin, wetlands have been drained, filled and otherwise altered, with approximately 50% of the original wetland acreage remaining compared to Pre-European settlement. PMSWA is a wetland that has been altered to improve wildlife habitat. The presence of open water and early successional wetlands at Powell Marsh provides essential habitat for migrating waterfowl, wading birds and grassland birds. PMSWA is located in an area with a high density of lakes and other wetlands. The majority of lakes in the area are highly developed with many year round and seasonal homes as well as resorts and other businesses. With development, the lakeshore around these lakes has been altered by removing aquatic vegetation and coarse woody debris, thus eliminating waterfowl habitat. Water based recreation has increased drastically in recent decades and is one of the most frequent causes of disturbance to waterfowl and other water birds. Disturbances displace these birds from feeding areas, resulting in increased energy expenditure, and may lower productivity of nesting or brooding waterfowl. In contrast, shallow open water supports aquatic plants with adjacent nesting cover at PMSWA. Also, the ability to manipulate water levels benefits a wide variety of bird species.

According to the Ecological Landscapes of Wisconsin Handbook (WDNR 2005), the protection and management of extensive peatlands is an important ecological management opportunity in the Northern Highlands Ecological Landscape. Powell Marsh is also part of the Manitowish/Powell Peatlands Conservation Opportunity Area of Upper Midwest/Regional Significance in Wisconsin's Wildlife Action Plan.

In addition, Wisconsin's Wildlife Action Plan identifies the natural communities of Wisconsin, and the significance of each of these within the context of specific ecological landscapes. There are major or important opportunities to manage several natural communities at PMSWA (Table 2).

A major opportunity (for Natural Community Management) exists when a community type is represented by many significant occurrences within an Ecological Landscape, or the Ecological Landscape is appropriate for major restoration activities.

An important opportunity means that a community type is not extensive or common in an Ecological Landscape but has a minimum of one to several significant intact occurrences that should be considered for preservation and/or management. Or, it means that the natural community type is restricted to just one or a few Ecological Landscapes within the state and should be considered for management there because of limited geographic distribution and a lack of better opportunities elsewhere.

Table 2. Regionally Important Natural Communities of PWMSA

Natural Community Type	Management Opportunity
Emergent Marsh	Major
Inland lakes	Major
Northern Sedge Meadow	Major
Northern Wet Forest	Major
Open Bog	Major
Submergent Marsh	Major
Submergent Marsh - Oligotrophic	Major
Alder Thicket	Important
Impoundments/Reservoirs	Important
Northern Wet-mesic Forest	Important
Shrub Carr	Important

Recreation Resources, Use, and Demand

There is far more public land in the Northern Highland Ecological Landscape than any other Ecological Landscape in the state, both state and federally-owned. The density of campgrounds is the highest in the state. The number of visitors to state lands and the density of multi-purpose trails are both third highest (out of 16 Ecological Landscapes) (WDNR 2006b). Acreage in natural areas is much higher than average, as is the number of legacy sites with high recreation potential. In summary, the Northern Highland Ecological Landscape has both a significant supply and demand for recreational facilities.

State-owned lands and facilities are especially important to recreation in the Northern Highland Ecological Landscape. There are over 233,000 acres of state forest lands including the Northern Highland and the American Legion State Forests. In addition, there are 18,500 acres of state trails and wild rivers, including the Turtle Flambeau Scenic Waters Area, and about 14,300 acres of fisheries and wildlife management lands. The largest of these, Powell Marsh Wildlife Area, and Thunder Lake Wildlife Area each provide over 3,000 acres of recreational land (WDNR 2005b).

Camping: There are 86 public and privately-owned campgrounds which, together provide about 4,465 campsites in the Northern Highland Counties. With 5% of the state's campgrounds, this Ecological Landscape ranks 8th (out of 16 Ecological Landscapes) in the number of campgrounds but first in campground density (per mi^2 of land) (J. Prey, Wisconsin Department of Natural Resources, unpublished data).

Trails: The Northern Highland Counties have about 2,200 miles of recreational trails and ranks third (out of 16 Ecological Landscapes) in trail density (miles of trail per mi^2 of land). There is a higher density of mountain bikes, ATV, snowmobile and cross-country ski trails compared to the rest of the state (J. Prey, Wisconsin Department of Natural Resources, unpublished data).

Land Legacy Sites: The Land Legacy project has identified over 300 places of significant ecological and recreational importance in Wisconsin and 11 are either partially or totally located within the Northern Highland Ecological Landscape. Two of them, the Northern Highland-American Legion State Forest and the Turtle-Flambeau Flowage, are rated as having the highest recreational significance. In addition, the Border Lakes region and the Northern Highland-American Legion State Forest are rated as having the highest conservation significance (WDNR 2006c).

Wildlife Related Recreation Demand and Economic Value

Hunting and wildlife watching are popular activities in the Powell Marsh region.
Data on the demand for wildlife related recreation is not available for the region. At a state level the U.S. Fish and Wildlife Service conducts regular surveys to gauge participation and expenditures for wildlife related recreational activities. The most recent survey data available is for 2011 (U.S. Department of the Interior, 2011).

Participation: According to the U.S. Fish and Wildlife Service almost 900 thousand people hunted in Wisconsin in 2011. They spent a total of 12.2 million days afield. Additionally over 2.4 million people watched wildlife. Nearly 500 thousand of these were "away from home" observers, meaning they traveled at least one mile away from home to see wildlife. The "away from home" observers spent a total of 6.1 million days afield. As a sub-group,

bird watchers totaled 435 thousand. And they spent 4.2 million days engaged in their activity.

Hunting license sales in the region show the high popularity of hunting in northern Wisconsin. On a per capita basis, hunting in the north central counties is twice the state average. Approximately 22 percent of residents in the Powell Marsh WA region purchased hunting licenses in 2013 compared to about 11 percent for the state as a whole.

Table 3. Hunting License Sales in the Region – 2012

County	Number of Hunting Licenses Sold
Forest	2,263
Iron	1,436
Lincoln	6,030
Oneida	7,941
Price	4,128
Vilas	3,429
Total	**25,227**

Expenditures: Expenditures are a valuable gauge on the importance of a recreational use for both the state and local economies. In 2011 the annual expenditure by Wisconsin hunters was 2.6 billion. Overall 58 percent was for equipment and 14 percent for trip related expenses. Miscellaneous expenses made up the remainder. The average expenditure per hunter was $400.

The “away from home” wildlife watchers spent an estimated 1.5 billion in Wisconsin in 2011. Of that total, 1.1 billion (73%) was for equipment, 235 million (16%) was trip related, and the remainder being miscellaneous items. The average per person expenditure was $471.

Statewide Comprehensive Outdoor Recreation Plan (SCORP)

SCORP is the primary source of information on outdoor recreation in Wisconsin. The SCORP periodically evaluates status, trends, demand, and needs for outdoor recreation throughout the state using a variety of public surveys, interviews, and listening sessions. The current plan is for the period 2011-2016 (WDNR 2012). This plan examines broad recreational trends across the state with a focus on developing a strategy to integrate Wisconsin into America’s Great Outdoors, a national initiative launched in 2010 that encourages state and local communities to develop local, grassroots conservation and recreation initiatives.

This approach contrasts with that used in the 2005-2010 SCORP (WDNR 2006b), which divided Wisconsin into 8 planning regions, each representing a particular combination of demographic trends, tourism influences, and environment types, and assessed current and future recreational trends and needs in more detail within each region. The current analysis draws on both of these plans in order to characterize the recreational context of the plan area, as well as on individual county outdoor recreation plans where these are available.

Powell Marsh falls within the Northwoods Region, one of the 8 regions profiled in the 2005-2010 SCORP. The following is an excerpt from the description of this region:

"*The Northwoods Region is located in the north-central part of the state and encompasses Florence, Forest, Iron, Langlade, Lincoln, Oneida, Price, Taylor and Vilas Counties. Many of these counties are considered Non-Metro Recreation Counties because of the abundant natural and recreational resources they offer. With its numerous high quality lakes and rivers, the region supports a large number of water-based recreation opportunities. Tourism is an important-and growing- business in the region as increasing numbers of visitors from Milwaukee, Madison and Chicago make use of the Northwoods environment. With this influx of visitors and an ever-growing population of baby boomers retiring to the region, the Northwoods has experienced a surge in its seasonal housing and recreational property market*." (WDNR 2006b)

The 2005-2010 SCORP compared and contrasted participation rates in recreational activities among both Wisconsin residents and out-of-state visitors; public perspectives on issues creating impediments to recreation and recreation needs; and regional supply shortages among the different regions. Table 4 summarizes these characteristics for the Northwoods Region.

Table 4. Recreational Characteristics of the Northwoods Region

Highest Participation Rate*	Top-ranked Activities among Non-residents	Recreation Issues	Regional Supply Shortages (Nature-based)
• Family gathering • Snow/ice activities (any type) • Golf • Target shooting • Off-road 4-wheel driving (SUV) • Ice-skating outdoors • Cross-country skiing • Rowing • Snowboarding • Ice hockey outdoors • Skateboarding • Scuba diving • Wind surfing	• Boating • Camping • Canoeing • Downhill skiing • Fishing • Hiking • Sight-seeing	• Increased ATV usage & associated impacts • Loss of public access to lands & waters • Noise pollution from motorized activities • The possible loss of silent sport facilities	• Campsites-electrical • Parks

***** These are the activities for which the Northwoods Region had the highest participation rates (among Wisconsin residents) of any region in the state. Source: WDNR 2006b.

The 2011-2016 SCORP includes an examination of changes in participation in a variety of recreational activities in Wisconsin over a 15-year period from 1994 to 2009. Using these data as well as industry forecasts and opinions of recreation professionals, this SCORP presents projected trends identifying activities that will show increasing, stable, and decreasing demand over the next 5 years. These are shown in Table 5.

Table 5. Projected Trends in Wisconsin Recreational Activities

Increasing Demand	Stable Demand	Decreasing Demand
• Adventure racing • Driving for pleasure • Developed/RV camping • Kayaking • Visit a dog park • Soccer outdoors • BMX biking • Climbing • Stand up paddling/paddleboarding • Triathlon (on- and off-road) • Off-highway vehicle driving • Gardening or landscaping for pleasure	• Walking for pleasure • Running or jogging • Waterparks • Motor boating • Day hiking • Golf • Tent camping • Snowboarding • Trail running • View/photograph wildlife • Bicycling (road and non-paved) • Snowshoeing	• Hunting • Inline skating • Skateboarding/skate parks • Horseback riding on trails • Softball • Downhill skiing

III. Description and Analysis of the Property and Adjacent Lands

This section describes the land ownership surrounding the property, the property's physical and biological characteristics, recreational facilities and uses, and historical/archeological resources. Analysis in this section describes significant management issues as well as capabilities, limitations, and opportunities of the property.

Land Ownership and Use

The PMSWA is bounded on the West, North, and East by the NHAL State Forest; and on the South by the Lac du Flambeau Indian Reservation. Private lands in the area include several major cranberry growing operations abutting the eastern boundary of PMSWA on Little Trout Lake, and a number of smaller tracts with cabins and homes on nearby lakes to the north (Maps B and C). Nearby lakes include Dead Pike Lake, Three Stepping Stones Lakes, Little Star Lake, Manitowish Lake and Bolin Lake.

Physical Environment

Topography and soils

PMSWA is mostly bog on nearly level topography with nutrient-poor wet organic soils that provide severe limitations for growing vegetation. Only a small fringe of land along the northern boundary and a small area north of Sherman Lake are high enough to support upland forest. The upland forest areas occur on sandy textured soils with low nutrient content that are excessively drained to well drained sands and loamy sands, but grade to poorly drained sands in the northeast corner of the Marsh. Several small areas of spoils along the dikes are slightly higher and drier.

Water Resources

Lakes within the PMSWA include Homestead Lake, Sherman Lake, and a small unnamed lake, (Table 6). The wildlife area also borders Little Trout Lake, (Maps B and C). The natural lakes within PMSWA are relatively dark, shallow, infertile and prone to winterkill. Fishing pressure on Sherman and Homestead Lakes is light. There is a seasonal boat landing on Sherman Lake.

The flowages are also very shallow and subject to winterkill, so no sport fishery exists. There are some minnows present and the public harvests a limited amount for bait. The amount of open water in each flowage depends on season, precipitation and evapotranspiration. As this is a headwaters area the watershed for these flowages is very small. The seven PMSWA flowages range in size from six to 291 acres, with a total acreage of 764 acres, 196 acres being open water. Data on the flowages is summarized on Table 6. A more detailed description of each flowage is given below.

Table 6. Summary of Lakes and Flowages of the PMSWA

Lake or Flowage	Size	Open water (flowages)	Maximum Depth
Homestead Lake	22 acres	-	17 ft
Sherman Lake	123 acres	-	19 ft
Un-named Lake	6 acres	-	unknown
Little Trout Lake[1]	978 acres	-	98ft
Bolin Lake[2]	67 acres	-	35 ft
Northwest Flowage	40 acres	20 acres	-
Homestead Lake Flowage	16 acres	4 acres	-
Main Flowage	158 acres	6 acres	-
Southeast Flowage	139 acres	4 acres	-
Little Trout Lake Flowage	6 acres	3 acres	-
Vista Flowage	114 acres	74 acres	-
Stepping Stone Flowage	291 acres	85 acres	-

[1] Only a small portion of Little Trout Lake's shoreline is within the wildlife area.
[2] Bolin Lake is surrounded by private lands but lies within the project boundary.

Northwest Flowage: The flowage at the northwest corner of the property has about 20 acres of open water. This is a semi-permanent flowage with no water control structure. The flowage is recharged by precipitation.

Homestead Lake Flowage: A small flowage near Homestead Lake has 4 acres of open water. The water comes from the Main Flowage and flows to the southwest.

Main Flowage: The main flowage with 6 acres of open water is filled through the main ditch from the south and from precipitation and flows to the north.

Southeast Flowage: The flowage towards the southeast part of the property with 4 acres of open water flows to the northwest. This flowage is filled via the Main Ditch and precipitation.

Little Trout Lake Flowage: A very small flowage towards Little Trout Lake holds about 3 acres of open water. This is filled by adding boards to the Little Trout water control structure. The flow would be to the northwest via the Main Ditch.

Vista Flowage: The Vista flowage has 74 acres of open water and flows to the north. This flowage can be refilled with precipitation from the snow melt and, during high water years, spring runoff from the Main Flowage and to some extent through the Stepping Stone Flowage.

Stepping Stone Flowage: The Stepping Stone Flowage has 85 acres of open water. Water flows to the north. The flowage is recharged via precipitation.

Minimum Flow and Water Quality

In 2007, Main Ditch (the primary ditch draining the Powell Marsh flowages) was defined as a navigable stream. On navigable streams, a minimum flow through water control structures is required. That flow has been estimated at 1.2 cfs by use of the Base Flow Index and at 0.6 CFS by use of the Area Weighted method (Lenz, 2007). Since 2007 a minimum flow of 1.2 cfs has been maintained by water discharge from the pools. Previous to this, water management primarily entailed capturing spring runoff to fill the ponds and fall drawdowns for vegetation management. Minimum flows in the ditch were not historically maintained.

Both iron precipitate and iron bacteria naturally occur in nearby lakes and ditches in Iron and Vilas Counties. However, the management of the Powell Marsh ditch system contributes to the production of iron floc (precipitate) when there is no water flow. In the past, this management regime seasonally produced a plume that discharged downstream into Dead Pike Lake. Since the initiation of minimum flow through the main dike in 2007, water program staff have observed greatly reduced iron floc formation and improved aesthetic quality in the ditch system.

The revised master plan for Powell Marsh State Wildlife Area must address management actions necessary to maintain minimum flow and to manage the formation of iron precipitate and /iron bacteria in the ditch system. Currently there is no formal operating order (under Chapter 31) for the Powell Marsh Wildlife Area. Most water management options will require review and approval by water regulators within the Department of Natural Resources as required by Manual Code 3565.1. The Master Planning process could be used to develop an operating order.

<u>Iron floc production</u>: Ground water in the vicinity of Powell Marsh is low in dissolved oxygen and contains high concentrations of dissolved iron. When this ground water flows into a surface ditch or into a water body containing high levels of dissolved oxygen, the dissolved iron will solidify or “precipitate.” The process of “precipitation” produces energy and iron bacteria depend on this process for survival. These iron bacteria produce rusty, oily looking plumes around their colonies, which remain in suspension in water. This inflow from PMSWA affects the aesthetic quality of Dead Pike Lake and may cause variation in water level of the lake.

This precipitation process occurs in the ditches of PMWSA. In periods of low flow (or when water is held back in the impounded ponds), the primary source of water entering the ditch system is groundwater. The groundwater table is shallow (2-3 feet below the ground surface) and is naturally high in dissolved iron. Dissolved iron in the groundwater is precipitated (contact with oxygen) as it enters the ditch system. This causes an orange coloration in the water. The problem may be magnified by the formation of plumes of iron bacteria. When the water is released from the flowages or when rainfall occurs, water in the ditch system flows into Dead Pike Lake. If the ditches have been stagnant for some time, the initial flows out of the flowages produce a plume at the inlet to Dead Pike Lake.

Naturally occurring dissolved iron is the source of iron floc in the Powell Marsh ditches. It is not uncommon to see iron floc formation in natural systems in Northern Wisconsin. It should also be noted that iron floc is also formed on the near shore environment of Dead

Pike Lake as a result of direct ground water recharge around the lake. Aggregate of iron hydroxide (precipitate, or floc) can be found throughout the shallows of Dead Pike Lake.

The wildlife impoundments may increase or force more groundwater into adjacent ditches (i.e. Vista Pool and Main Ditch) (hydraulic head). When the wildlife impoundments are full, much of the ditch system that lies within the impounded areas are eliminated (flooded); therefore, iron hydroxide formation is reduced (less groundwater entering the ditches because of the hydraulic head). A review of water quality data from Dead Pike Lake indicates normal levels of phosphorus, pH, alkalinity and conductivity when compared to other drainage lakes in the north central part of Wisconsin. Water color is quite high (stained), but is also typical for a lake that drains a large wetland area.

Past Water Resource Analysis:

DNR-USGS Powell Marsh – Dead Pike Lake Study: The United States Geological Survey and the DNR studied the immediate hydrology associated with PMSWA and its connection to Dead Pike Lake (Krohelski, James T., Rose, William J., and Hunt, Randall J. 2002.) A ground-water-flow model indicates ground water generally flowing from Powell Marsh northwest toward Dead Pike Lake and west toward Little Lost Creek. Simulation results indicate that Dead Pike Lake receives about 77% of its water from ground water and 23% of its water as surface water. The surface water is mostly from the PMSWA. If the Powell Marsh water control structures were removed, Dead Pike Lake would receive about 88% of its water as ground water and 12% as surface water. These results show that Powell Marsh water control structures change the distribution of the water budget components but only slightly affect the overall water budget for Dead Pike Lake.

The report also concluded that on the PMSWA water moves from Vista Pond and the marsh and discharges into the ditches where the iron floc is formed. If ditches were removed, this floc would not be present in the surface water that flows into Dead Pike Lake from the PMSWA.

Dead Pike Lake Management Plan, BARR Engineering and Dead Pike Lake Association**:** In June 2007, the Dead Pike Lake Association committed to engage in a scientific study to investigate the cause and effect of elevated iron and manganese discharges from the Powell Marsh into Dead Pike Lake and to determine the extent to which current management practices on the Marsh contribute to excessive water level fluctuations within the lake. The management plan was supported by three Wisconsin Department of Natural Resource grants (LPL-1188-09, LPL-1189-08, LPL-1348-10). In addition the WDNR arranged for and funded an aquatic plant survey of Dead Pike Lake which then became an integral part of the Management Plan. The study included the following evaluations: (1) Dead Pike Lake water quality and effects of Powell Marsh discharge on water quality, (2) hydrologic evaluation of Powell Marsh and effect of Powell Marsh management on Dead Pike Lake water levels, (3) Powell Marsh iron and manganese export; quantification and mechanisms. (4) fisheries in Dead Pike Lake, (5) aquatic plants in Dead Pike Lake, (6) potential toxicity of iron discharges from the Powell Marsh and its effect upon Dead Pike Lake aquatic life, (7) survey of Dead Pike Lake users and residents. This study's results show 67 percent of Dead Pike Lake's water budget comes from surface flow and 33 percent from groundwater. Lake sediment core analysis indicates changes correlating to human disturbances on the marsh.

Water quality data, particularly for phosphorous and iron loading, are contained in the USGS and the Barr studies described above. Each study used different data sets and models to estimate the surface water and groundwater flows and phosphorous and iron loading to DPL. Consequently they reached different conclusions. Paul Garrison, WDNR Fisheries and Aquatic Sciences Research Section, compared the data of both reports. His analysis is presented in Appendix B.

Dam Failure Analysis: A Dam Failure Analysis was conducted during summer 2007 on pool # 2 also referred to as 'Main Pool' (Map B). This analysis contained two separate evaluations. The first was an evaluation of the area that would be inundated by a failure of the Main Pool Dam. This was required in accordance with s. NR 333.05(2), Wis. Adm. Code for the proposed reconstruction of the dam. As a result of that analysis, the consultant recommended that the main water control structure be rated as a Low Hazard dam. A second hydrologic analysis was included in the study. This analysis was conducted to determine the minimum low flow of the watershed of the main pool. This minimum flow would need to flow through the Main Ditch in compliance with s. 31.34, Wis. Stats (Lenz, 2007).

Minimum Flow Analysis: The minimum flow (Q7, 10) was estimated by use of two models: The Base Flow Index estimated minimum flow at 1.2 cubic feet per second (cfs), while the Area Weighted method estimated minimum flow at 0.6cfs. Consultants estimated the storage capacity of 3 compartments within the main pool (Attachment B). When filled to capacity (1605' elev.), the compartments would hold 272, 892 and 684 ac-ft of water, totaling 1,848 ac-ft of water. This capacity would accommodate minimum flows for 114, 374 and 287 days, respectively, at 1.2cfs (total = 775 days). These estimates were used to develop a minimum flow requirement of 1.2 cfs in the Main Ditch, which has been in place since 2007 but not contained in any formalized operating order (Lenz, 2007).

Vegetation and Natural Habitats

Historically, the Powell Marsh State Wildlife Area was a mosaic of sedge meadow, emergent marsh, open bog and forested wetlands. These cover types were interspersed with forested uplands of predominantly white and red pines. It is not a true marsh, but is a large peatland complex containing several wetland types and plant communities. The property is currently comprised of forested and unforested wetlands, open water, and a small amount of forested upland (Map D). Additionally, an area of sand blows and old fields, remnants of past management, included planting food plots for wildlife, lie adjacent to one of the dikes.

Approximately 2,500 acres at Powell Marsh have been managed with prescribed fire and/or mechanical removal of woody species at some point in the past. Tamarack, black spruce, speckled alder and willow species pioneer into these managed areas and exist in scattered thickets or as individual trees. The result is a complex of open wetlands in various stages of succession across the majority of the property.

The forested wetlands include northern wet forest, dominated by black spruce and tamarack, and scattered areas of northern wet-mesic forest, with white cedar as the dominant tree species. Unforested wetland types include poor fen, sedge meadow and open bog. Some areas of open bog include muskeg, which is essentially identical to open bog, but contains scattered tamarack and/or black spruce with a stunted growth form.

The remainder of the natural communities on the property consists of scattered upland wooded areas that primarily contain quaking aspen, red oak, red maple and white birch.

These areas account for a small percentage of the overall property, and exist as small islands or around the perimeter of the wetland communities. There are minimal amounts of spotted knapweed along service roads that are treated annually.

The primary plant communities of PMSWA include:

- Open water flowages with submerged and floating aquatic plants
- Unforested wetlands comprised of sedge meadows; alder and willow fens; and bogs with low shrubs, sphagnum moss and stunted spruce and tamarack.
- Forested wetlands of black spruce and tamarack
- Grassy upland islands
- Upland forest of aspen, white birch, red maple, red oak and white pine

Table 7. Summary of Vegetation Cover on PMSWA

Cover Type	Acres	Percent
Open Water	210	5
Unforested Wetlands	2,415	53
Forested Wetlands	1,284	28
Grassy Upland Islands	62	1
Upland Forest Fringe	580	13
Total:	**4,551**	**100**

***** Private land within the project boundary is 392 acres, which is not reflected in the table. The total of GIS derived acreage within the boundary is 4,943 acres.

Trumpeter Swans on the Vista Flowage (by Michele Woodford)

Wildlife

The plant communities of PMSWA support a wide variety of wildlife. Forest and wetland game and furbearers are abundant. The wetlands host a variety of waterfowl and semi-aquatic furbearers, including Mallard, Blue-winged Teal, Canada Goose, muskrat, mink and beaver. The forests host deer, Ruffed Grouse and American Woodcock. Other common mammals include thirteen lined ground squirrel, red squirrel, snowshoe hare, star-nosed mole, the southern bog lemming, and various shrews, mice and voles.

There are also a variety of reptiles and amphibians at PMSWA, such as wood frog, American toad, spring peeper, several species of snakes, red-backed salamander, western painted turtle and snapping turtle. Uncommon amphibians are four-toed salamander, northern leopard frog, eastern gray tree frog, green frog, western chorus frog and mink frog.

Powell has been highlighted as a stop on the Great Wisconsin Birding and Nature trail. It is also part of the Manitowish Peatlands, an area designated as a state Important Bird Area (IBA). Important Bird Areas are an international effort to protect birds and their habitat. The IBA program in the United States is administered by the National Audubon Society. In Wisconsin, the IBA program is being implemented as a part of the overall strategy of the Wisconsin Bird Conservation Initiative. To qualify as an IBA, a site must:

- Support species listed as endangered or threatened in Wisconsin,
- Be important to species identified as high conservation priorities in Wisconsin,
- Have an assemblage or species associated with a habitat type that is representative, rare or threatened in Wisconsin
- Provide a place where significant numbers of birds concentrate for breeding, migration/staging, or wintering, and
- Be important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation and/or education.

A wide variety of birds are known to occur at PMSWA. Table 8 provides a list of birds that have been observed by biologists and experienced bird watchers. This is not a complete list, but represents a variety of bird guilds that use the property.

Table 8. Representative Birds Known to use PMSWA

Common name	Status*	Type of use	Cover type
American Bittern	SC	Nesting	Unforested Wetland
American Black Duck	SC	Migratory	Unforested Wetland
American Golden-Plover	SC	Migratory	Unforested Wetland
American Woodcock	SC	Nesting	Upland Forest Fringe
Black Tern	END	Nesting	Unforested Wetland
Black-billed Cuckoo	SC	Nesting	Upland Forest Fringe
Blue-winged Teal	SC	Nesting	Unforested Wetland
Bobolink	SC	Nesting	Unforested Wetland /Grassy Upland
Boreal Chickadee	SC	Nesting/resident	Forested Wetland
Brown Thrasher	SC	Nesting	Upland Forest Fringe
Buff-breasted Sandpiper	SC	Migratory	Unforested Wetland
Canada Warbler	SC	Nesting	Upland Forest Fringe
Common Loon	PRO	Nesting	Open Water
Dunlin	SC	Migratory	Unforested Wetland
Eastern Meadowlark	SC	Observed	Grassy Upland
Golden-winged Warbler	SC	Nesting	Upland Forest Fringe
Gray Jay	SC	Nesting	Forested Wetland
Henslow's Sparrow	THR	Observed	Unforested Wetland
Least Bittern	SC	Observed	Unforested Wetland
Least Flycatcher	SC	Observed	Upland Forest Fringe
Lesser Scaup	SC	Migratory	Open Water
Merlin	SC	Observed	Unforested Wetland
Northern Harrier	SC	Observed	Sedge Meadow /Grassy Uplands
Northern Pintail	SC	Migratory	Unforested Wetland
Rusty Blackbird	SC	Migratory	Unforested Wetland
Sandhill Crane	PRO	Nesting	Unforested Wetland
Sharp-tailed Grouse	SC	Nesting/resident	Unforested Wetland
Short-billed Dowitcher	SC	Migratory	Unforested Wetland

Short-eared Owl	SC	Nesting	Unforested Wetland
Solitary Sandpiper	SC	Migratory	Unforested Wetland
Trumpeter Swan #	SC	Observed	Open Water
Veery	SC	Nesting	Upland Forest Fringe
Whimbrel	SC	Migratory	Unforested Wetland
Whip-poor-will	SC	Observed	Upland Forest Fringe
Wilson's Phalarope	SC	Migratory	Unforested Wetland

* Status: PRO=Protected, SC=Special Concern, THR=Threatened, END=Endangered
# this species is also recorded in the DNR's Natural Heritage Inventory (NHI) database

Threatened, Endangered, and Special Concern Species

The Wisconsin Wildlife Action Plan recognized the Powell Marsh as part of the Manitowish/Powell Peatlands Conservation Opportunity Area (COA). This COA is of regional significance within the Upper Midwest for large sedge meadows, fens and prairies (WDNR, 2008). These open landscape communities are home to several bird Species of Greatest Conservation Need.

Biotic inventories conducted at Powell Marsh from 1997 – 2007 by Department of Natural Resources staff have revealed the presence of several rare plant and animal species. In addition, the DNR's Natural Heritage Inventory lists a number of rare species present at Powell Marsh. A list of Special Concern, Threatened, and Endangered species found on the property as a result of recent inventories, or are listed in the NHI database follows (Table 9).

Table 9. Documented Rare Species at Powell Marsh

Common Name	Scientific Name	State/Federal Status
Mammals		
Gray Wolf	Canis lupus	SC / None / SGCN
Hoary Bat	Lasiurus cinereus	SC / None / SGCN
Little Brown Bat	Myotis lucifugus	THR / None
Silver-haired Bat	Lasionycteris noctivagans	SC / None / SGCN
Herpetiles		
American Bullfrog	Rana catesbeiana	SC / None
Mink Frog	Rana septentrionalis	SC / None / SGCN
Invertebrates		
Wingless Mtn. Grasshopper	Booneacris glacialis	SC / None
Bog Copper (Butterfly)	Lycaena epixanthe	SC / None
Frigga Fritillary (Butterfly)	Boloria frigga	SC / None
Plants		
Swamp-pink orchid	Arethusa bulbosa	SC / None
Sparse-flowered sedge	Carex tenuiflora	SC / None

SC – Special Concern; Thr – Threatened; End – Endangered; P – Protected species

Rare Birds of Powell Marsh

Northern Sedge Meadow Birds

Sedge meadows, like those of Powell Marsh, offer conditions favorable to many bird species. Migration can bring numbers of waterfowl, shorebirds and passerines into sedge meadows for short periods of time. About 50 species of birds regularly nest in northern sedge meadows. Species commonly found in northern sedge meadows, and at Powell Marsh, include the Red-winged Blackbird, Sedge Wren, Bobolink, Common Snipe, Song Sparrow and Swamp Sparrow.

Several uncommon to rare species, limited to larger tracts of sedge meadow, also can be found at Powell Marsh. These species include Nelson's sharp-tailed sparrow, LeConte's Sparrow, Yellow Rail, Short-eared Owl, Northern Harrier, American Bittern and Merlin. In addition, two special concern species and one threatened species are found in consistent numbers at Powell Marsh. Powell Marsh is one of only three places in the state where all three of these species nest, and precautions should be considered to assure their continuance.

Yellow Rail (Thr): This secretive species is the smallest rail found in Wisconsin. Its preferred habitat is wet sedge meadows. If woody vegetation, such as willow or bog birch, become too abundant, the Yellow Rail will vacate the site. They also tend to avoid cattails. The Yellow Rail feeds mostly on snails, insects and occasional seeds. The population in Wisconsin is limited to a few large sedge meadows, being known from about 10 sites.

LeConte's Sparrow (SC): This small, secretive sparrow is found in wet prairies, sedge meadows and old, wet fields. The secretive nature of this bird keeps it well hidden in vegetation at most times. LeConte's Sparrow feeds mostly on seeds, but takes many insects, especially during nesting. Concerns about populations focus mostly on habitat loss or degradation through brush growth.

Nelson's Sharp-tailed Sparrow (SC): This bird, found at only three places in the state on a regular basis, is another secretive member of the sedge meadow-wet prairie bird community. Sharp-tails occupy areas with denser grass and sedge vegetation, but do not tolerate many woody plants in their territories. Food consists of insects, spiders, amphipods and seeds. Habitat destruction and conversion to woody species are the primary management concerns.

<u>Management Needs for These Species</u>: Large, open sedge meadows are preferred habitat for Yellow Rail, LeConte's Sparrow and Nelson's Sharp-tailed Sparrow. These open meadows are the only place that Nelson's Sharp-tailed Sparrow and the Yellow Rail will nest. Woody species control is the primary requirement of habitat manipulation; changes in water levels, prescription burning, and mowing help control woody growth.

Existing Recreational Facilities and Uses

Many people visit PMSWA each year. They include hunters, trappers, berry pickers, bird watchers, and photographers. The most common hunting activities are for waterfowl and deer. The marsh also is an important resource for local trappers pursuing muskrat, mink and beaver. The upland fringe is used regularly for grouse and deer hunting. Powell Marsh

has been highlighted as a stop on the Great Wisconsin Birding and Nature Trail and is part of an Important Birding Area.

A scenic overlook is located at the north end of the marsh. There are four designated parking areas. There are no designated trails on the wildlife area but roads and dikes provide walking access throughout much of the wildlife area. A designated hike and ski trail is adjacent to the western boundary of the marsh on the NHAL State Forest.

Naturalists from the NHAL State Forest and private naturalists offer 7 to 12 guided interpretive programs annually at Powell Marsh. The most common programs include birding/wildflower hikes, full moon night hikes and cranberry marsh tours. The overlook and parking lot near the wildlife area sign on Powell Road is a popular spot for visitors to enter the marsh. There are no interpretive trails within the property. The roads and dikes provide excellent non-motorized access to the different habitat types throughout the wildlife area.

Historical / Archeological Resources

The Vilas County Archaeological and Historical Sites map (WDNR, 2012) indicates one Historical site on this property. This site includes the service buildings.

Non-Public Use Facilities or Structures

There are 4 buildings: a workshop, two equipment storage buildings and a granary. The buildings are old but have been maintained in good to fair condition. The granary needs no repair, the beams in the larger equipment shed should be replaced, the small storage building should be painted, and the workshop roof should be repaired. Project requests for these repairs have been submitted for the DNR six-year development plan.

There are 4 parking lots, 7 gates, 14 water control structures, 9 miles of ditches, 8.5 miles of dikes and 6 miles of access roads. Four of the 6 miles of access roads are in good condition and are regularly used. About 1 mile of the sandy upland access roads is in fair condition, and the southern 1 mile of the Stepping Stone grade is in poor condition. Currently the parking lots and gates are in good condition.

The dikes and ditches on the wildlife area were constructed in the mid-1950s and many are in disrepair. Dikes constructed of peat are especially vulnerable to muskrat burrowing. The main water control structure is original to the property and due for replacement. The control structure at Little Trout Lake is currently inoperable and would require repair if it needed to be used in the future. The ditches have silted in and require dredging. About 6 miles of the dikes are in fair to poor condition and are used mainly by tractors or heavy equipment. The remaining dikes are in good condition and can be traveled with pickup trucks.

IV. Findings and Conclusions

Purpose of the Property

The scope of use and management of a property is governed by its official designation. The PMSWA is designated as a State Wildlife Area. Wildlife Areas are managed under the authority of Sec. 23.09 (2) (d) 3 Wis. Stats. and ch. NR 1.51, the administrative code on management of state wildlife areas. Wildlife areas are to provide an area where people can hunt, trap, and fish. Wildlife areas are also open for traditional outdoor uses of walking, nature study, berry picking. As directed by ch. NR 1.51 and ch. NR 1.61, other recreational uses may be allowed by the property's Master Plan if those uses do not detract from the primary purpose of the property.

Funding from the Federal Aid in Wildlife Restoration Act (also known as the Pittman-Robertson Act) was used on the marsh. Lands acquired and managed with these funds are to be used for wildlife restoration, acquisition and improvement of wildlife habitat.

Existing Conditions

Habitat

Approximately 85 percent of this property is wetland and about 57 percent is open wetland. Currently, the open habitats are maintained by seasonal manipulation of water levels in the flowages and ditches, the periodic use of prescribed fire and cutting and shearing brush and trees.

Infrastructure

The dikes and ditches on the wildlife area were constructed in the mid-1950s and many are in disrepair. The ditches have silted in and need dredging. The main water control structure is original to the property and due for replacement. The control structure at Little Trout Lake is currently inoperable. Four of the six miles of access roads are in good condition.

Main Ditch, located adjacent to the Vista flowage, has recently been defined as a navigable channel by the DNR, which requires that a minimum flow be discharged from the pools to the ditch. Minimum flow has not been historically discharged from the pools and management must be changed to allow this discharge. That flow has been estimated at 1.2 cfs or more.

Iron Precipitate

Groundwater and surface water generally flows from PMSWA northwest toward Dead Pike Lake. Nearly all of the surface water input to Dead Pike Lake, which is about 23 percent of the lake's water originates in PMSWA, and it flows out through Main Ditch.

The groundwater in the PMSWA area has high natural levels of dissolved iron that precipitates, forming a rusty or oily appearing floc in area waters. Prior to 2007 low-flow to no-flow conditions occurred seasonally in the Powell Marsh ditches that were especially favorable for the production and accumulation of iron floc. Rain events following low-flow conditions flush the accumulated floc out of the ditches and into Dead Pike Lake, further

impacting the aesthetic quality of water in that lake. Since 2007 a minimum water flow of 1.2 cfs has been maintained from Main Ditch to Dead Pike Lake. Since the initiation of minimum flow, iron floc formation in the ditch system has been greatly reduced and there has been improved aesthetic quality of water in the ditch system.

Significant Ecological Opportunities, Capabilities, and Limitations

The Northern Highlands Ecological Landscape is a complex of lakes, upland forests, and wetland communities. The large open wetland habitat with shallow open water habitat of Powell Marsh is unique in the region. While Powell Marsh does not lie on a major waterfowl flyway, its open water and early successional wetlands provide essential habitat for migrating waterfowl, shore birds and grassland birds. Powell is a locally important production area for waterfowl and semi-aquatic furbearers. It also provides regionally significant nesting habitat for a number of uncommon to rare bird species.

Natural succession

Without active management intervention or wildfire, this open peatland habitat will succeed to tamarack forest and black spruce muskeg. A combination of manipulation of water levels in the flowages and ditches, prescribed fire, hand cutting, mowing and shearing prevents the growth of shrubs and trees.

Upland forest management

The property has a small amount of upland forest, located primarily on the fringe of the marsh. This may be managed as young brushy forest, left to mature or converted to grassy upland to further expand the open-habitat acreage. However, this small fringe should be considered in a landscape scale context as part of the extensive, adjacent state forest.

Wildlife food plots

Overall, Powell Marsh has nutrient-poor soils. Crops such as corn, buckwheat or legumes do not grow well because of the infertile soils and frequent frosts. Further, these soils tend to be subject to wind erosion if tilled. The upland fields are better suited for permanent grasslands.

Fisheries management

The lakes and flowages on the PMSWA have poor potential as a productive fishery, as they are infertile and relatively shallow, making them prone to winter kill.

Management Opportunities for Conservation of Biological Diversity

PMSWA offers rich opportunities to continue to provide habitat for Threatened, Endangered, Special Concern species and for wildlife Species of Greatest Conservation Need (SGCN), which are identified by the Wisconsin's Wildlife Action Plan (WDNR, 2006). Some are ranked as having the highest management concern. Management to maintain the open aspect of the wildlife area and management of the flowages benefits all of these species.

Sharp-tailed Grouse are regionally scarce and occur in small, scattered locations in northern Wisconsin. Powell Marsh contains a small, remnant population of these birds. Maintenance

of this small population would require managing much of the wildlife area as well as adjacent lands outside of the wildlife area for open, brushy habitat.

Significant Recreation Opportunities, Capabilities, and Limitations

Larger areas of habitat that raise, attract and hold waterfowl are highly limited within this region. While not as productive as wildlife areas in other parts of the state, this site is locally important for waterfowl hunters. It is also highly valued for hunting by the members of the Lac du Flambeau Band, who live nearby. Trapping for muskrat, mink and beaver is locally important. While the acres of upland are small, those sites are popular for grouse, turkey and deer hunting.

Overall, PMSWA's potential for recreational use is greatly limited by its wet and unstable soils. The property is most suited to hunting, trapping, and wildlife watching from selected viewing sites. Limited trails could be developed on the higher ground along the northern boundary and along the roads and dikes. Human use of the interior areas of the property should be restricted to the trail system in the spring and early summer to protect nesting birds and in fall during migration.

PMSWA is a rich resource for nature interpretation and education, but its remote location limits the opportunities for naturalist-led programs. Therefore, the property is better suited for self-guided interpretive and educational opportunities.

Much of this property is not suited for motorized uses due to unsafe travel conditions on the dikes, disturbance of wildlife and recreational users.

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Appendix A

Types of Northern Wisconsin Wetlands; by Ron Eckstein, DNR Wildlife Biologist

A wetland is an area saturated by surface or ground water long enough to support vegetation adapted to life in saturated soil conditions. No two wetlands are exactly alike. We can, however, classify wetlands into some broad categories. In the field, it is often difficult to classify wetlands without a detailed look at the hydrology, vegetation, and types of soils.

Marshes
A marsh is a wetland developed on mineral soil and characterized by emergent aquatic plants such as cattails, reeds and rushes that grow in shallow water. Marsh soils have a high mineral content and plant biomass productivity is high. Marshes are among the most productive of all wetlands for waterfowl and muskrats. There are few true marshes in northern Wisconsin.

Northern Sedge Meadows
Northern sedge meadows are wet, “grassy” meadows. They have a moderate amount of mineral nutrients and are dominated by a low growth of various sedges and grasses.

Shrub Swamps
Shrub swamps are rich in minerals and have understories of various grasses, sedges and ferns. There are two types of shrub swamps in Wisconsin. Alder thickets are dominated by speckled alder and occur primarily along streams. Shrub-carrs are dominated by species of willow and red-osier dogwood. They occur in areas with a supply of mineral ground or runoff water. Shrub-carrs are uncommon in northern Wisconsin.

Conifer and Hardwood Swamps
Forested swamps are rich in minerals and highly productive. Examples of swamps include northern white cedar swamps and black ash swamps.

Peatlands
Peatlands develop in cool, humid regions where water drainage is blocked. In northern Wisconsin, glaciers formed the landscape into shallow lakes and depressions conducive to the formation of peat. Peat is a soil made up of partially decomposed plant remains. It develops under water-soaked conditions, and has a low content of nutrient minerals. There are two distinct types of peatlands.

If the water flowing across the peatland surface originates on an adjacent upland, the vegetation can be quite distinctive. Such a peatland is called a fen. Fens are dominated by sedges and grasses, often with scattered shrubs such as bog birch and tamarack. Fens are fairly rich in minerals and moderately high in productivity. Rich fens have high mineral nutrient content while poor fens have only moderate mineral nutrient availability. Most of the fens of northern Wisconsin are poor fens.

If the peatland surface is raised slightly above the level plain, the mineral-rich water will be diverted, and the peatland becomes a bog. Bogs accumulate water-soaked organic matter and are characterized by plants that can grow under water conditions of relatively high acidity and low nutrients.

Muskeg
Over time, bogs can develop into muskeg. Muskeg is an acid peatland supporting black spruce and/or tamarack, an understory of shrubs, and a ground cover of sphagnum mosses. Without disturbance, muskeg can dominate peatlands for thousands of years.

Appendix B

Thoughts on phosphorus and iron loading to Dead Pike Lake, Vilas County

Paul Garrison, Fisheries and Aquatic Sciences Research Section, WDNR

23 April 2012

This work is a comparative analysis of the data in the USGS study (Krohelski, James T., Rose, William J., and Hunt, Randall J. 2002) and the Barr Engineering study (Barr Engineering Company and Dead Pike Lake Association. 2011).

I worked through the [water quality study] files in the CD that were provided by Barr Engineering through the Dead Pike Lake Association. I concentrated on the data for phosphorus and iron loading for the lake. The information mostly includes flow and concentrations for the stream entering the lake from Powell Marsh. I also used the data from the 2002 USGS study report.

I estimated P and Fe loading to the lake using the hydrologic budgets determined by Barr and the USGS. These two methods result in very different conclusions concerning how much water enters the lake through groundwater and how much enters through surface water. The Barr estimate is that the largest source of water is the stream draining Powell Marsh while the USGS estimates that most of the water entering the lake is from groundwater. To estimate Fe and P loading I used data from both studies and calculated annual loads based on the Barr model and the USGS model.

Method

- Barr measured flows in the stream in 2008 from May 1 through Oct 31. I assumed their flows were correct and made estimates from these flows for the rest of the year to obtain annual loads. Generally I assumed the average flow Aug 1 through Oct 31 was base flow and used these flows for November and December. For the winter months January and February I reduced this flow by ½ assuming flows would be reduced because of ice cover. I used flows measured in May to simulate spring runoff and applied these flows for the period March and April.
- Barr estimated groundwater input as the difference between what their model predicts for lake level and measured stream flow. This results in average surface inflow of 2.9 cfs and groundwater of 0.5 cfs for total annual average flow of **3.1 cfs**.
- The USGS did not measure continuous stream flows but only a few times. They applied an existing groundwater flow model and used lake level as the controlling end point against which to calibrate their model. Their results were that the annual average input from the stream was 1.0 cfs and groundwater contributed 3.3 cfs for a total average flow of **4.3 cfs**. Given that these models were constructed using measurements from different years, I think the average flows are similar. They are very different in concluding which component contributes most of the water.
- Because the USGS has extensive experience with hydrologic modeling I assumed their estimate of average flow for the system was more correct than the Barr estimate. Because I assumed that Barr's estimate of surface flow was correct (since it is actual measurements), I increased the groundwater input in the Barr hydrologic budget to 1.4 cfs.

Table 1. Percentage of hydrologic budget with the two models

	BARR	USGS
Surface water	67	23
Ground water	33	77

- *Phosphorus:* Barr measured P concentrations 5 times in 2008 during the period May 27 through October 7 in the stream. I used these values and weighted them for the measured flows to compute loads from the stream. I used the average weighted P concentration for the rest of the year and the flows discussed above to compute the load from the surface water. Dale Robertson gave me an estimate of the P concentration in ground water of 17 µg L^{-1} which I used to compute the load from the groundwater.
- *Iron:* Barr measured Fe concentrations 12 times during the period May 27 through September 20 in the stream. I used these values and weighted them for the measured flows to compute loads from the stream. For the rest of the year I estimated Fe concentrations from measured values in the stream and the flows discussed above to compute the load from the surface water. I used lower Fe concentrations (4 mg L^{-1}) during base flow and a higher concentration (10 mg L^{-1}) during spring runoff. During the USGS study they measured dissolved Fe at various depths in the ground water. I chose the value I thought that was most reasonable (25 mg L^{-1}) and applied it towards the ground water flow to compute the Fe load from ground water.
- With both models the highest source of P is from the stream draining the marsh (Table 2). I estimate between 80 and 93% of the P load is from this source. Phosphorus deposition in the sediment core reflects increased P loading after the marsh was ditched so the importance of the stream for P loading seems reasonable.
- The stream seems less important for the Fe loading. The Barr model estimates 43% from the stream while the USGS model estimates 17%. I don't have as much confidence in the Fe loading estimate because I was not sure what concentration to use for the ground water. As with P, the sediment core indicates increased Fe loading after the marsh was ditched and managed.

Table 2. Percentage of loading of P and Fe from water sources using the two models.

		BARR	**USGS**
Phosphorus	Surface Water	93	80
	Ground Water	7	20
Iron	Surface Water	43	17
	Ground Water	57	83

- *What happens if the marsh is returned to its natural state*? I think it is likely that less P will enter the lake. I also think it is reasonable that some (much) of the P that enters the lake now is not biologically available because it is sequestered with the iron. I think this is likely because, the in-lake P concentration is less than I would expect given the estimated P load. This means I think P loading will decline but I am not sure how the in-lake P concentration will be reduced. I am less confident on the outcome of Fe loading. It is likely that less Fe will enter the lake given the history of Fe deposition in the core. I think it is reasonable that since the Fe in the groundwater will not enter the surface water in marsh (in the absence of the ditches and ponds) but much of this will go somewhere and it likely will be, in part, Dead Pike Lake. Other lakes in the region experience iron floc in the near shore waters and I think we can expect this in Dead Pike Lake.
- I think we should concentrate on the P loading scenario more than iron. There is no evidence that the iron concentrations in the lake are adversely affecting the lake ecosystem but we know that elevated P levels lead to algal blooms and other problems.

One of the issues with the Barr report was lack of recommendations for how changes to the lake inflow hydrology will affect water levels. Both the Barr and USGS reports conclude that removing the ditches and ponds will not change the overall water input to the lake. The Barr data indicates the timing of the inflow would change but the annual inflow of water will remain similar.

Appendix C

Differences in Water Chemistry of the Powell Marsh Ditch System as it Relates to Holding or Passing Water from the Wildlife Impoundments.

Jim Kreitlow, WDNR Water Program. 2007

Abstract

This study evaluated differences in water chemistry variables in the Powell Marsh ditch system as it relates to holding or passing surface water from the wildlife impoundments. Can we reduce the formation of iron hydroxide (iron floc) and improve the aesthetic quality of water in the ditch system by passing water?

Formation of iron floc is a problem that occurs in the Powell Marsh ditches. This orange colored water discharges to Dead Pike Lake producing objectionable plumes. The problem occurs during periods of low flow (or when water is held back or stored in wildlife impoundments). The primary source of water entering the ditches at this time is groundwater naturally high in dissolved iron. When groundwater comes in contact with oxygen the dissolved iron precipitates and forms iron hydroxide (orange or rust color).

It is important to try to improve the aesthetic quality of the water before it enters Dead Pike Lake. The goal is to reduce the iron precipitate in the ditch system. The theory is that by drawing water from one or more of the wildlife impoundments (or another source) we can change the water chemistry and improve the aesthetic quality of water in the ditches. The water in the ditch would be surface water dominated (lower in total and dissolved iron), and would reduce the retention time (time water remains in the ditches and is exposed to oxygen from atmosphere). It may also reduce the amount of groundwater entering the ditches (hydraulic head).

Pre and post monitoring was conducted (before and after passing water) to see if there are positive water quality changes in the ditch system. Sampling locations included both the impounded areas and the ditch system. Seven sampling events took place over a one year period (August 2005- August 2006). Five of the sampling events could be considered pre monitoring and two post monitoring. Water chemistry data was collected using two methods. First, multi-probe monitoring meters (sondes) were deployed. These meters collected data continuously over a selected monitoring period. Second, grab water samples were collected just beneath the surface at the selected locations during each monitoring event. Flow gauging was conducted to determine flow velocities being passed through the ditch system (both pre and post monitoring). The amount of water being released from a control structure (post monitoring) was determined using an equation for a sharp crested weir.

The results show there is a difference in water quality between the impounded pools and the ditches. Passing water improves the water quality in the ditch system. Total iron, dissolved iron, manganese and suspended solids concentrations are reduced. Water clarity (turbidity) and aesthetic quality is improved (photo documentation). Retention time also plays a role in floc formation. The less residence time the better. The amount of water stored in the wildlife

impoundments (elevation) reduces iron floc formation in the ditches (i.e. Main Ditch) that are located within impounded areas (hydraulic head). Stored water in wildlife impoundments can also force more groundwater into ditches below a control structure (i.e. South Ditch), or ditches that lie adjacent (i.e. Ditch #3) increasing the probability of floc formation during low flow conditions.

Based on this study, passing water does have a positive impact and could reduce the frequency of slug discharges of aesthetically unpleasing water entering Dead Pike Lake.

For a discussion on methods and the data collected see the full document, *Differences in Water Chemistry of the Powell Marsh Ditch System as it Relates to Holding or Passing Water from the Wildlife Impoundments.* Jim Kreitlow, WDNR Water Program. 2007