WHITTLESEY CREEK NATIONAL WILDLIFE REFUGE HABITAT MANAGEMENT PLAN AND ENVIRONMENTAL ASSESSMENT

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WHITTLESEY CREEK NATIONAL WILDLIFE REFUGE
HABITAT MANAGEMENT PLAN

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I. Introduction

A. Scope and Rationale

The U.S. Fish and Wildlife Service (Service) established the Whittlesey Creek National Wildlife Refuge (Whittlesey Creek NWR of refuge) in 1999. The Service's main focus for new refuges is to acquire lands within the acquisition boundary, and once lands are acquired, conduct habitat restoration and management. The Service's work at the Whittlesey Creek NWR is guided by Congressional Authorities (National Wildlife Refuge Improvement Act), the purpose for which the refuge was established (protection of fish and wildlife resources) and the goals stated in the Whittlesey Creek NWR 1998 Interim Comprehensive Conservation Plan. This habitat management plan provides clear and comprehensive guidance about habitat restoration and management as lands are acquired.

The plan encompasses all land proposed as Whittlesey Creek NWR, even though not all land within the refuge acquisition boundary is currently owned by the Service. The plan also includes recommendations for habitat improvement practices within the Whittlesey Creek watershed. Private lands within the proposed refuge and watershed remain under control of the private landowner, but the Service and its partners will provide technical and financial assistance to interested landowners to restore and manage fish and wildlife habitat.

B. Legal Mandates

The Service established the Whittlesey Creek NWR as a means of working with individuals, groups, and government entities to protect and restore coastal wetlands and spring-fed tributaries to Lake Superior. The Whittlesey Creek NWR was established under the authority of the Fish and Wildlife Act of 1956 (16 USC 742(a)-754) for the purpose of: "... the development, advancement, management, conservation, and protection of fish and wildlife resources."

The National Wildlife Refuge System Improvement Act (16 USC 668dd) became law in 1997 to provide a mission for the Refuge System, and clear standards for its management, use, planning and growth. The mission of the Refuge System, as stated in the Act, is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The Service's work in the Whittlesey Creek NWR and within the Whittlesey watershed includes fishery population rehabilitation. The State of Wisconsin has primary jurisdiction over resident fish and wildlife and human activities affecting these species. The Service plays a role to coordinate activities and ensure the protection of species that are managed under numerous Federal and international authorities, such as migratory birds, and species that are managed by multiple jurisdictions (referred to a interjurisdictional species), such as lake trout in Lake Superior.

C. Relationship to other plans

An interim comprehensive conservation plan was written for the Whittlesey Creek NWR prior to its establishment. This plan established broad goals for the refuge and allowed us to begin to acquire and restore lands. These broad goals provide excellent guidance for the habitat management plan.

Interim Comprehensive Conservation Plan Goals:
The Service will work with individuals, groups, and government entities to:

- Protect and restore habitat in Whittlesey Creek, Little Whittlesey Creek and Terwilliger Creek for migration, spawning, and rearing of potadromous[1] trout and salmon from Lake Superior.
- Plan and implement a project to reintroduce coaster brook trout[2] under the guidance of the Lake Superior Brook Trout Restoration Plan.
- Restore and manage habitat for waterfowl, neotropical migrants[3] and other migratory birds.
- Restore to the extent possible historical hydrologic conditions in the coastal wetlands and streams, including restoring Whittlesey Creek to its historic channel.
- Restore topography where altered by development and enhance existing constructed ponds for wildlife values.
- Manage for public use, including environmental education, hunting, fishing, wildlife-viewing, and demonstrating restoration and management techniques.
- Conduct all management activities using an ecosystem approach in cooperation with agencies that manage adjacent and nearby lands and facilities.

A public use plan was completed in 2001 (U.S. Fish and Wildlife Service 2001), which allows us to open acquired refuge land for wildlife-dependent recreation. Objectives in the public use plan will overlap with the habitat management plan. The general philosophy of public use at the Whittlesey Creek NWR is: Everything the Service does in relation to the refuge (management, restoration, public use, monitoring, and research) will provide an opportunity for public participation and to teach/encourage environmental stewardship. Programs and activities will be developed to create in our visitors:

- Awareness and ecological understanding of the refuge and adjacent landscape
- Knowledge of how humans affect the natural system
- Understanding of the value of habitat for fish and wildlife
- Recognition of fish and wildlife values in general.

Another plan that guides much of the Service's work within Whittlesey Creek, the refuge and the watershed, is the plan for coaster brook trout rehabilitation, titled "An Experiment to Establish a

[1] Potadromous fish have life requirements that span a lake and tributary streams or rivers. They are also referred to as migratory. A commonly used, similar term is anadromous, which technically describes a fish whose life span includes the ocean and a fresh water stream or river. Most anadromous or potadromous fish will spend most of their lives in the ocean or lake and spawn in a river or stream.
[2] Coaster brook trout are native brook trout (*Salvelinus fontinalis*) that exhibit a migratory (potadromous) life-history which includes spending at least part of their life cycle in Lake Superior.
[3] Neotropical migratory birds breed in one continent and winter in another.

Self-sustaining Brook Trout Population in Whittlesey Creek that Exhibits a Migrating Life History (Coaster) by Stocking, Enacting Protective Regulations and Implementing Habitat Improvements." This plan was written jointly by the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources (Wisconsin DNR). Implementation of the plan began in 2003 and will continue for several years.

The most recent brook trout management plan was finalized in 2005 by the Wisconsin DNR and the U.S. Fish and Wildlife Service (Wisconsin DNR 2005). The Wisconsin Lake Superior Brook Trout Plan identified a goal to "protect and improve self-sustaining brook trout populations and their habitat in Wisconsin's Lake Superior Basin and attempt to establish several populations that exhibit life history diversity (both stream resident and migratory "coaster" life history types)." Objectives cover stream habitat and watershed health, harvest, rehabilitation stocking, genetics management, life history and management, species interactions and outreach. Whittlesey Creek is included as an experimental rehabilitation stream.

The Nonpoint Source Pollution Control Plan for the Whittlesey Creek Priority Watershed Project (Gardner and Malischke 1996) is a local plan that provides significant insights and acts as a cornerstone for partnership efforts. This plan identifies habitat needs and lists strategies for improving the watershed health of Whittlesey Creek. The primary water resources goal is to protect and improve fish habitat for both potadromous and resident trout and salmon in each of the watershed streams. This plan is being implemented by the Bayfield County Land Conservation Department in cooperation with the Wisconsin Department of Agriculture, Wisconsin Department of Natural Resources and other partners.

D. Relationship with private lands in the watershed

The Whittlesey Creek NWR is located at the bottom of the Whittlesey watershed (Figures 1 and 2). Stewardship of lands in the watershed, therefore, directly and indirectly affects the refuge, especially the stream and its coastal wetland. The Service and its partners cannot reach our goals without the assistance of private landowners and other partners. Therefore, the Service will continue to work with partners and private landowners to benefit fish, wildlife and downstream resources.

The Habitat Management Plan addresses watershed needs and specifically identifies goals, objectives and strategies for meeting these needs. Private lands remain the responsibility of the landowner, so private lands work will be conducted only with voluntary participation by landowners. Private landowners have no requirements to implement strategies, but if they are interested and if we can come to agreement on strategies that fit their goals, the Service and our partners will provide financial and technical assistance to them.

Appendix A lists the partners and the programs that are available to private landowners for habitat improvement, sediment reduction and flood flow attenuation. Significant work has already been done by many landowners, working cooperatively with the Bayfield County Land Conservation Department, Wisconsin Department of Agriculture Trade and Consumer Protection, Natural Resources Conservation Service, Trout Unlimited and the Service. All of this work will continue. This plan provides guidelines for measuring the effects and hopefully success of land management and restoration on Whittlesey Creek and its inhabitants.

II. Background

A. Inventory and description of habitat

1) Location

Whittlesey Creek NWR is located in Bayfield County along the south shore of Lake Superior near Ashland, Wisconsin (Figure 1). The refuge is located within Chequamegon Bay, which is defined by Long Island to the east, Madeline Island to the north, and the shore of Lake Superior to the west and south. The Bay is relatively shallow when compared with Lake Superior. The mouth of Whittlesey Creek is affiliated with a large coastal wetland that extends along the Bay's south shore.

2) Physical or geographic setting

Watershed

The Whittlesey Creek NWR is located in the Lake Superior basin on the Bayfield Peninsula. Lake Superior is the largest freshwater lake, by surface acres, in the world. It holds over 15 quadrillion gallons of water which remains cold year round, with an average temperature of 40 degrees Fahrenheit (°F). The surface acres of the upland watershed are smaller than the lake itself, resulting in very short drainage systems into the Lake, especially along the south shore in Wisconsin.

The level of Lake Superior in Chequamegon Bay fluctuates throughout the day with surface water oscillations (called seiches), annually depending on rainfall and snowmelt, and sometimes seasonally from annual hydrologic cycles. The overall lake level, however, is controlled by the International Joint Commission through the lock and dam system on the Great Lakes since 1921. They have maintained a relatively stable lake level since 1973. Lake Superior continues to rebound from glacial weight, and is doing so unevenly, with isostatic rebound greater to the east. This creates higher average water elevation relative to land elevation in Chequamegon Bay (up to 26 cm since 1870's) (Fitzpatrick et al. 1999). This rebound has created "drowned river mouths" at Whittlesey Creek and Fish Creek Sloughs. Lake water level fluctuations also affect coastal wetland composition and function, and affect stream flows and sediment loading.

The Whittlesey Creek watershed covers approximately 12,000 acres when both groundwater recharge and surface water contributing areas are included. The groundwater recharge portion of the watershed is found to the northwest of the surface-water contributing area, which have deep sand deposits (Copper Falls Formation described below). Most of this portion of the watershed is contained in the Chequamegon-Nicollet National Forest. The surface water contributing area is approximately 4,700 acres, which includes Whittlesey Creek, the North Fork and numerous small tributaries that enter both (Figures 2 & 3). The elevation of the surface water contributing area changes from 1,100 feet mean sea level (msl) at the upper end, to about 600 feet msl at Lake Superior.

The geology and groundwater flow of the Bayfield peninsula, which includes the Whittlesey Creek watershed, is described very well in U.S. Geological Survey's (USGS) Whittlesey Creek

hydrology study (Lenz et al. 2003)[4]. Their findings are summarized in the following four paragraphs.

The surface and groundwater flow of the Whittlesey Creek watershed is defined by three main geologic features – Bayfield Group, Copper Falls Formation and the Miller Creek Formation (Figure 4). The Bayfield group is the Precambrian bedrock of the peninsula, which consists mostly of sandstone, siltstone and locally abundant shale and conglomerate. The bedrock outcrops in places along the shoreline in Bayfield County. This is overlain by the Copper Falls Formation of sandy till that is up to several hundred feet thick. This sandy till is thickest along the central spine of the peninsula and thins toward Lake Superior. The Miller Creek Formation overlies the Copper Falls Formation and Bayfield Group up to about 1,100 ft. above sea level (500 ft. above Lake Superior). Miller Creek Formation overlays are dominated by glacial lake clay deposits and some places have layers of sandy relict shoreline.

These geologic features have resulted in two groundwater flow systems. A deep flow system moves through the sandy Copper Falls Formation and into the Bayfield Group. This system surfaces at various discharge points along Whittlesey Creek. The main discharge areas are found along a mile of the creek upstream and downstream of the confluence of Whittlesey Creek with the North Fork of Whittlesey Creek (North Fork) (Figure 3), where it discharges at approximately 18 cubic feet per second (cfs). This discharge provides year-round flow in Whittlesey Creek at a constant temperature.

The second type of groundwater system is a shallow flow system, likely created where the less-permeable Miller Creek Formation is found. Layers of sand and clay alternate in this formation, which can result in isolated, perched water separated from the deep system by 100 feet or more. These can provide regular flow into upper stretches of Whittlesey or the North Fork, but are not large enough to sustain flow year-round in the creeks.

Whittlesey Creek and Little Whittlesey Creek flow into Lake Superior, forming a deltaic coastal wetland. The delta has created a backwater area that remains relatively protected from the harsh waves and ice movement of the Lake. This deltaic system is also influenced by the intermixing of waters from the stream, which are often colder in the summer than the adjacent waters of the shallow bay.

Uneven isostatic rebound of Lake Superior has affected the mouth of Whittlesey Creek for about 9000 years. Lake Superior continues to rebound from glacial weight, with isostatic rebound greater to the east at a rate of about one foot per century, thus raising the water relative to land by about one foot per century. This alone creates aggradation at the mouth of tributaries in Chequamegon Bay, including Whittlesey Creek. It also drowns river mouths and contributes to the formation of coastal wetlands.

Soils within the watershed are mostly formed in clays originating from the post-glacial lakebed of Lake Superior. These fine red clay soils have very low infiltration rates and contribute to very quick runoff from the uplands to the streams, especially in the steeper, upper portions of the

[4] Permission was received from the Water Resources Division of U.S. Geological Survey to use figures from their Whittlesey Creek study report.

watershed. Alluvial fine sands are also common, being deposited in floodplains from past and present overbank floods. Till plain and lake plain (upland) soils cover roughly 1/3 of the refuge. These soils are characteristically clay loams, silt loams or sandy loams and are predominant throughout the watershed. Poor internal drainage produces intermittently saturated conditions on the clay loams. Sandy and loamy alluvial floodplain soils cover about 2/3 of the refuge, but are less common across the watershed. Groundwater has been measured at less than 10 feet below the surface on these sites within the refuge. Localized areas of peats and mucks are found in saturated depressions or where springs are present.

Ecoregion

The refuge is located in the Laurentian Mixed Forest Province of Bailey's Ecoregions (Bailey 1976; Bailey 1980). This province is found along the Great Lakes and New England lowlands. Vegetation is dominated by coniferous or deciduous forests. In the Whittlesey Creek watershed, it is not unusual to see mixed deciduous and coniferous forests. White pine (*Pinus strobes*), white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) are typically intermixed with white (*Betula papyrifera*) or yellow birch (*Betula lutea*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*) and aspen (*Populus sp.*).

Topography

The topography of the watershed was formed by glacial lake plain and glacial outwash. It is relatively flat in the lake plain near Lake Superior, but increases in elevation, from about 600 feet msl to around 1,200 feet msl in less than 10 miles. The hills are rolling, except the stream and tributary banks, which are very steep in the upper and middle section of the watershed (Figure 5). The slope of the watershed and stream banks flattens out considerably about one-half mile west of the refuge's western boundary. Floodplains that connect Little Whittlesey and Whittlesey Creeks, and Whittlesey and Terwilliger Creeks are relatively level with a gentle slope toward Lake Superior, about a 20 foot drop in elevation over one mile.

Climate

The climate of northern Wisconsin along Lake Superior is moderated by the lake, creating longer springs and falls, cooler summers and increased precipitation when compared to inland areas. Over the last 30 years, the average annual temperature was 40.5°F. The average temperature for January was 9.8°F and for July it was 67.2°F. The area averaged 40.4 days where the temperature was below 0°F and only 6.3 days above 90°F.

The average annual precipitation over the past 30 years was 30.02 inches. The greatest precipitation falls from June to September. Average annual snowfall is 58.0 inches, which typically falls from November through March. The average growing season over the last 30 years, using median at 28°F, is from May 18 to October 1 (135 days).

Historic Conditions

Historic conditions for the purpose of this document refer to the 1850's to present day. The first written record of physical conditions of the land was provided by land surveyors who took notes of vegetation and water bodies as they encountered them (Figure 6). This information is available from the University of Wisconsin's Library web site (http://digicoll.library.wisc.edu/SurveyNotes/SurveyInfo.html).

Land Cover Maps of Bayfield County were completed by the Wisconsin State Planning Board in the 1930's in cooperation with the Work Progress Administration. These maps, along with aerial photographs from 1938, provide a good description of conditions during the peak agricultural period. Aerial photos are available from 1938 to present, taken in maximum of 10 year intervals. These also provide good documentation of changes in streams, land use and shoreline accretion/erosion.

Another source of historic information is from personal interviews with long-time residents. The Service cooperated with Northland College in Ashland to train students in conducting oral history interviews. Five interviews were conducted from spring to fall of 2003 (Appendix B). These residents provided invaluable information about farming, hunting, fishing and flooding. Articles written by local historians about the area were also used to understand landscape changes that took place over the past 150 years.

Historic Vegetation

The vegetation information from the original land surveys was compiled and interpreted by several geographers (Irving 1880; Finley 1976) to describe historic vegetation. This information has been mapped and most recently placed into geographic information systems (GIS) as a data layer. It can be accessed on several web sites, including the Wisconsin DNR's site (http://maps.dnr.state.wi.us/imf/dnrimf.jsp?site=webview) and the Lake Superior Decision Support system (http://oden.nrri.umn.edu/lsgis/index.htm).

The historic vegetation of the refuge and vicinity, according to Finley (1976), shows a large conifer swamp at the mouth of Fish Creek, extending into the property owned by the Northern Great Lakes Visitor Center and up to Whittlesey Creek (Figure 7). The vegetation would likely have been northern white cedar (*Thuja occidentalis*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), balsam fir (*Abies balsamea*) and black ash (*Fraxinus nigra*). Remnants of this vegetation type exist on the southern edge of the refuge and northern edge of the Visitor Center's land. The northern edge of the refuge, which is at a higher elevation, is described as white-red pine forest. The area south of the conifer swamp is shown as boreal forest, which would have included aspen (*Populus sp.*), paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), balsam fir, red pine (*Pinus resinosa*) and white pine. The refuge and vicinity likely included all three of these vegetative communities. The public land survey notes from 1852 to 1855 listed black ash (*Fraxinus nigra*), spruce, tamarack, white pine, red pine, balsam, cedar, and elm (*Ulmus Americana*) as timber or post trees (Figure 6). Understory species listed include alder (*Alnus sp.*), cedar, willow (*Salix sp.*), hazel (*Corylus sp.*), and dwarf maple (*Acer spicatum*).

Most of the timber noted by surveyors was harvested by the early 1900's. The land nearest to Lake Superior would have been the first lands cleared by European settlers. Roads, railroads and bridges were built by the early 1900's, which affected stream and overland water flow. Most land within the refuge boundary was farmed or used as pasture after it was cleared of trees. The lowland areas were historically burned in the spring and grasses were an important source of animal feed for logging era animals. The 1938 aerial photo and land cover map show the extent of farmland/pastureland (Figures 8 and 9). Most likely, land within the refuge was often too wet, either from floods, or from high groundwater, to produce consistent crops. By the time the

Whittlesey Creek NWR was established in 1999, only about 90 acres were hayed or pastured. No annually tilled cropland remained.

Historic Hydrology and Stream Conditions

Early surveyors made notes of streams, lakes and marshes or swamps. Whittlesey Creek's stream bottom in the refuge was described as sandy. Its width was about 20 feet wide (30 chain links). Little Whittlesey and Terwilliger Creeks are also recorded in their notes and were about one-third as wide as Whittlesey Creek. Their streambeds are not described. Swamp and marsh are noted several times in their notes.

Roads, railroads and bridges affected the flow of streams within the refuge and altered overland flood flows, either channeling them or slowing them by creating artificial dikes. Landowners who were interviewed for the Whittlesey Creek oral history project talked of significant floods in 1942 and 1946, and of changes in stream flow and depth from sedimentation[5]. A section of Nick Rouskey's interview is included in Appendix B, where he describes his memories of the floods. Nick grew up on land currently owned by the U.S. Forest Service for the Northern Great Lakes Visitor Center.

The floods of the 1940's likely caused residents and federal agencies to think about reducing floods to homes and farms along Whittlesey Creek. In 1949, the U.S. Army Corps of Engineers dredged Whittlesey Creek's lower mile of stream, took out its meanders, and redirected its flow straight east into Lake Superior from Highway 13. The Wisconsin Conservation Department and Bayfield County Land Conservation Department redirected the channel to its present location in 1958.

Timber harvest and land-use changes over the years have affected overland flow and stream conditions significantly. Landscape changes from timber to cropland and pastureland have increased peak flows on the creek. Clay soils in the watershed exacerbate overland flows. Lenz et al. (2003) ran a surface water model that simulates these landscape changes and demonstrates how peak flood flows increased during the peak agriculture period (Figure 11). This increased flood power destabilized stream banks as well as tributaries entering the stream. The net result is increased sediment loads that are carried downstream and dropped in slower moving stretches of the stream. While erosion, sediment transport and deposition are normal stream processes, excess flood power will contribute to stream destabilization and aggradation downstream.

Concerns about stream changes, flooding and loss of fishery habitats were noted in the 1950's (Red Clay Interagency Committee 1960). Because of these concerns, the Red Clay Interagency Committee initiated watershed improvement projects from 1955 to 1959. They designed and built projects to reduce flows and sediment transport from streambanks, road ditches and farm fields. Projects included fencing cattle out of streams and away from stream banks, vegetating eroding banks and road ditches, farm planning, farm ponds and tree planting. The oral history interview with Helen Jack noted that she and her mother planted black (crack) willow trees during that time to help stabilize Whittlesey Creek's bank. This interagency group also redirected

[5] Oral history interviews are not science studies and the information provided by landowners doesn't imply technical accuracy of ecosystem functions and measureable changes in those functions. Rather, oral history interviews can help us understand the human aspects of landscape changes and local residents' connection to their land.

the stream channel as mentioned above. Their report (Red Clay Interagency Committee 1960) notes that the new channel lowered the water level in the floodplain 30 inches.

A portion of the refuge was proposed for development into an 18-hole golf course in the late 1980's. Construction was initiated in 1990, when fill was spread and fairway shaping began. In addition, four deep ponds (about 12 feet deep) were dug as water hazards. This development was discontinued around 1997, prior to refuge establishment.

Current Conditions and Changes from Historic Conditions

Current habitat cover types and their acreages of the refuge are shown in Figure 10. The habitat types listed follow the National Vegetation Classification System (Federal Geographic Data Committee 1997), which is still in draft form for Wisconsin.

The saturated and seasonally flooded lands within the Whittlesey Creek NWR receive water from both overland flow and groundwater seeps. Where the groundwater is close to the surface, these lands will remain saturated near or at the surface most of the year. Shrubby wetlands and forested wetlands are a result of these conditions. These saturated conditions are prevalent near Lake Superior, at floodplains between the creeks and along Terwilliger Creek (see vegetation types 1 and 2 in Figure 10).

Land use within the refuge boundary was mostly farmland in the 1930's. Since then, most of the farmland has been abandoned and has regrown with water-tolerant trees and shrubs such as willows, white cedar, black ash and speckled alder (*Alnus rugosa*). Currently, about 60 acres remain as hayland or pastureland. Reed canarygrass (*Phalaris arundinacea*) dominates many old hayfields, especially where golf course construction was initiated.

Four main factors continue to affect hydrological conditions of Whittlesey Creek, the watershed and the refuge: 1) uneven hydrostatic rebound of Lake Superior after the last glacial melt (see section describing watershed, page 6), 2) flood flows and sediment movements, and 3) human infrastructure (roads, bridges, channelization) and 4) changes in landscape cover.

Flood Flows and Changes in Landscape Cover - Lenz et al. (2003) analyzed vegetation changes within the watershed using WISCLAND data for current conditions, WPA land cover map for cover types in the 1930's and Finley (1976) for historic conditions. Figures 11 and 12 show the changes from historic conditions to present for land cover and peak flood flows. Landscape cover affects overland flow and runoff into watershed streams and tributaries, resulting in increased peak flows and flood power (Lenz et al. 2003 and Fitzpatrick et al. in review). Past landscape changes have resulted in:

- More surface runoff, more flooding
- Less upland storage/infiltration of runoff
- Erosion in the upper main stem of Whittlesey Creek from bank and gully erosion, especially from 970 to 670 ft msl.
- More potential for channel migration throughout the main stem of Whittlesey Creek.
- More sedimentation dropped near the mouth, creating aggradation of the lower channel.
- Less woody debris, less channel roughness.

Decreased forest and wetland cover results in faster surface water runoff, higher peak flood flows and increased erosion of bed, banks and gullies into Whittlesey Creek. Sediments (mostly sands) are carried downstream and cover habitat that is used for brook trout and other coldwater species. Basically, the watershed hydrological system is no longer in balance and is trying to reach some type of equilibrium. If left alone, it will, over time, reach this equilibrium. However, continual human-induced changes will continue to affect this balance. Also, if left alone, the equilibrium reached might not be favorable for trout. Changes in the landscape and within the stream that will improve the balance for brook trout are proposed in this plan.

Dredging, channelizing, rechannelizing and tree planting have also had a very significant effect on Whittlesey Creek within the refuge, as noted in the previous section. The channel from about Wickstrom Road to the mouth has vertically aggraded (filled in), leaving little fish habitat. The crack willows that were planted in the 1950's have helped stabilize the banks, so little bank erosion is taking place. There is little woody debris in the channel, further limiting fish habitat. Flood water along this stretch has overflowed its banks during flood stages, sometimes covering portions of Cherryville Road and even Highway 13.

The U.S. Geological Survey took a 30 foot sediment core next to Whittlesey Creek within the refuge (Figure 13). They described the alluvial stratigraphy in the core and estimated elevation of presettlement soils. Based on their work, they estimate sediment build-up in the floodplain and channel from four to nine feet in the last 150 years (Fitzpatrick et al., in review). This floodplain rise, stream aggradation and bank stabilization from crack willow plantings has created a stream that appears to be incising within the refuge, even though it is not.

Human Infrastructure – The refuge includes five bridges, one state highway and two town roads. Two additional town roads border the west and north boundaries. In addition, several homes and one business were originally located within the refuge and several homes remain. Two structures have been built since the refuge was established. Bridges affect water movement in the stream, especially during flood flows. Aggradation has occurred at the lower end of Whittlesey Creek, which is a natural occurrence (see isostatic rebound), but excess sediment has dropped and accumulated upstream of bridges, partly because bridges slow flows.

Refuge staff hypothesizes that based on soils, topography and land forms, sheet flood flows were a common occurrence across most of the refuge historically. Currently, with roads, bridges, drainages and channel changes, sheet flood flows are seen in only a few places. Most overland flooding is channelized into field ditches, road ditches and culverts.

Figure 1 – Location of Whittlesey Creek National Wildlife Refuge, Bayfield County, Wisconsin.

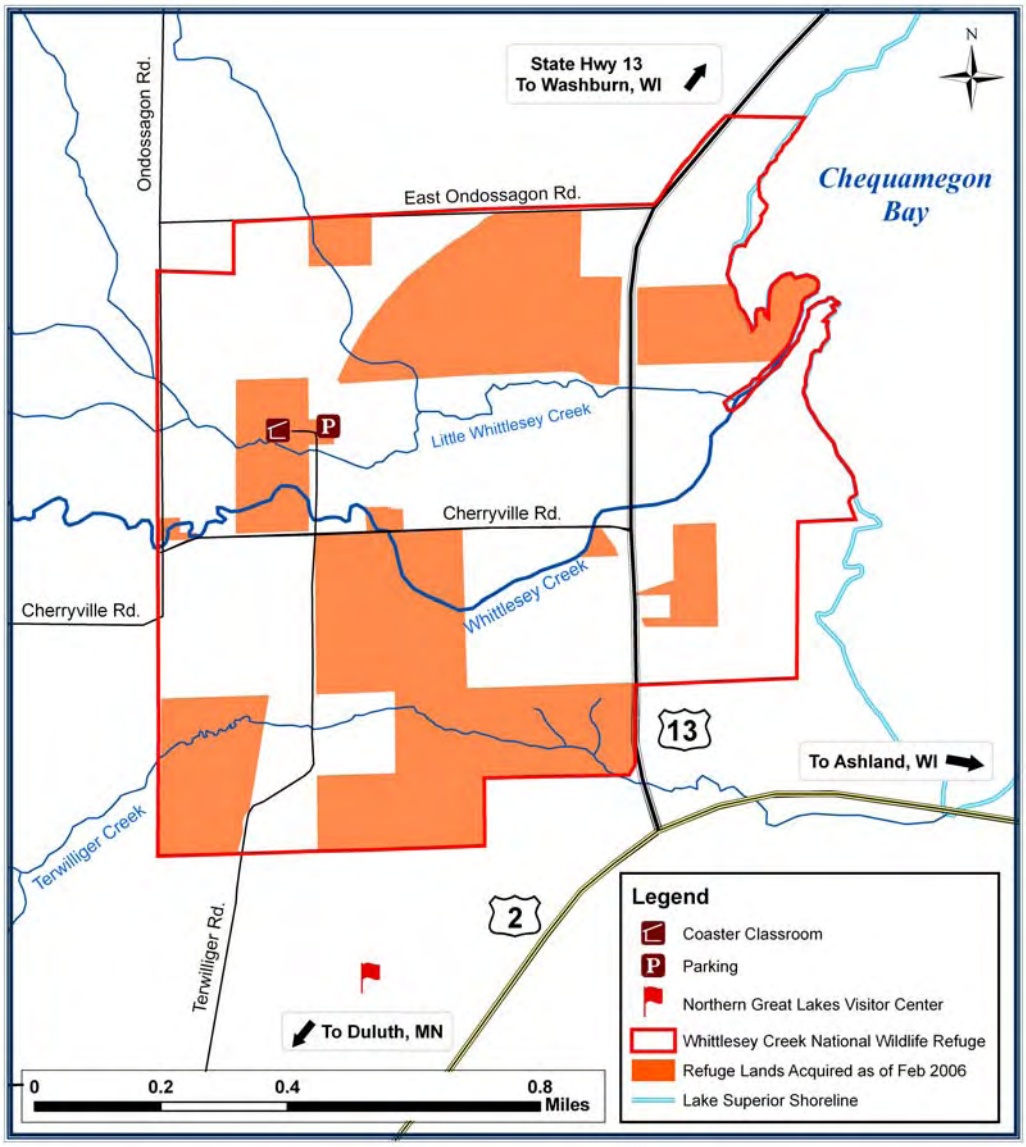


Figure 2 - Surface Water Contributing Area of the Whittlesey Creek Watershed, Bayfield County, WI

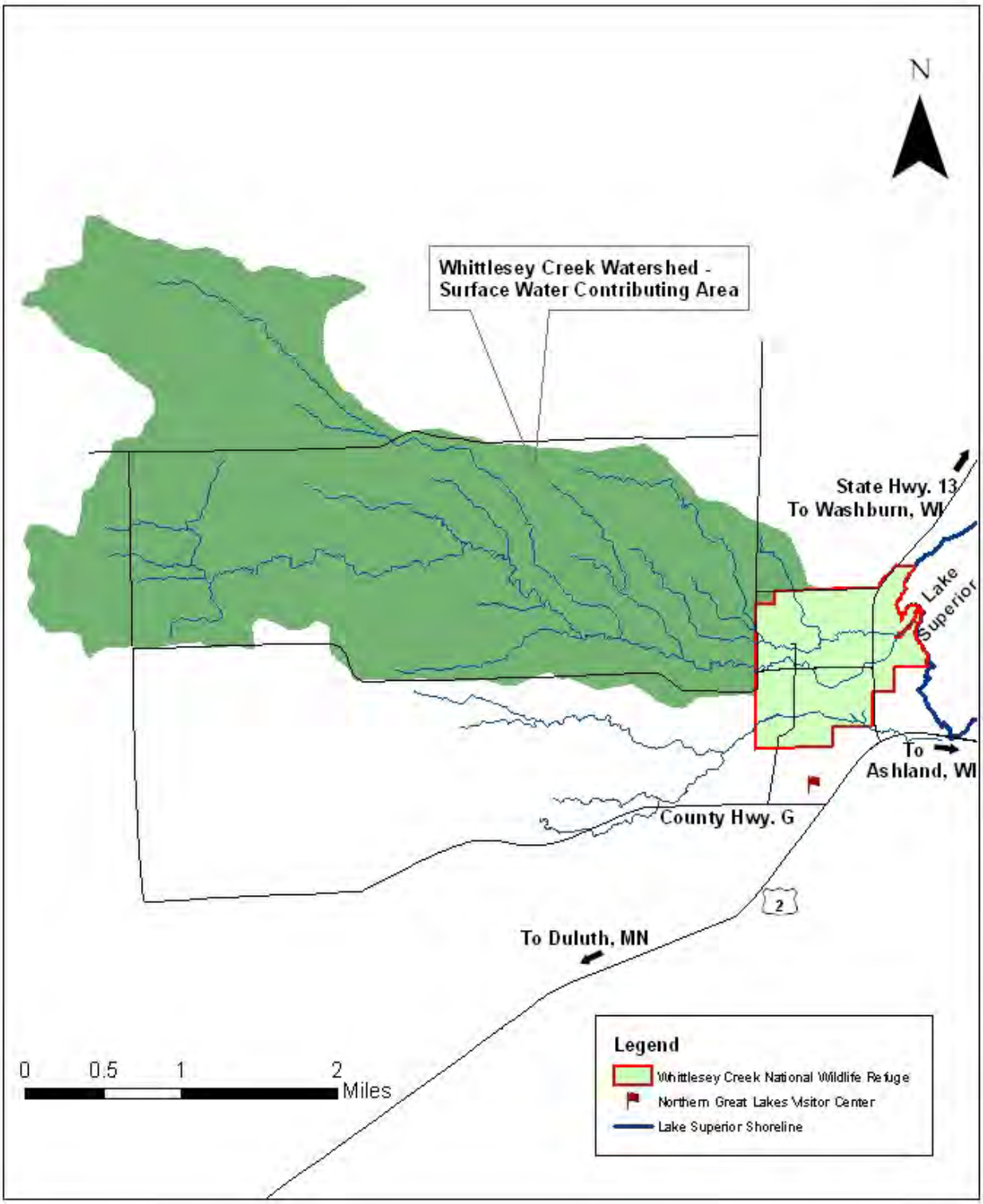


Figure 3 - Stream Reaches on Whittlesey Creek and North Fork Whittlesey Creek

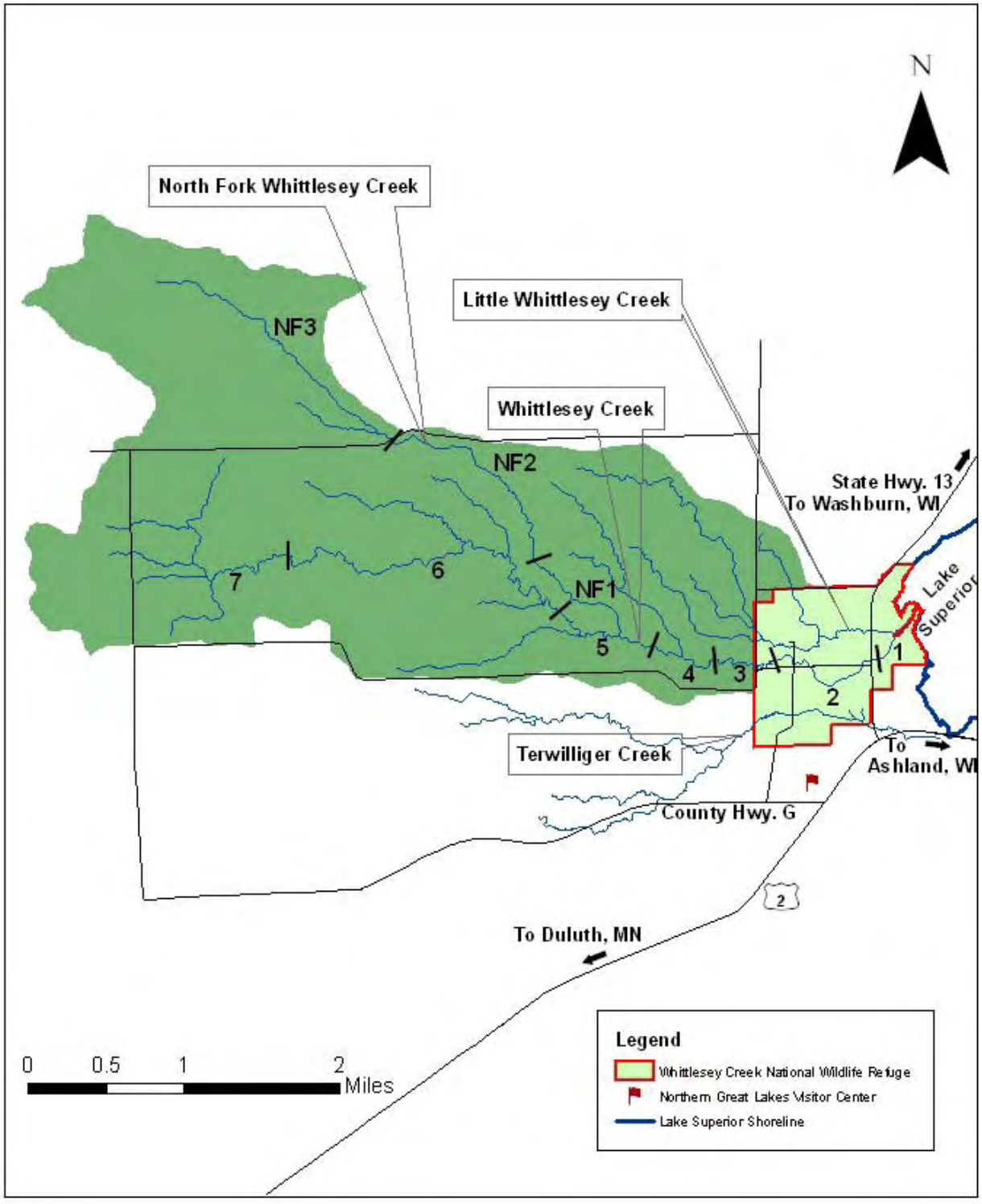


Figure 4 – Cross-Section of Whittlesey Creek Watershed Geologic Features (from Lenz et al. 2003; reprinted with permission from U.S. Geological Survey).

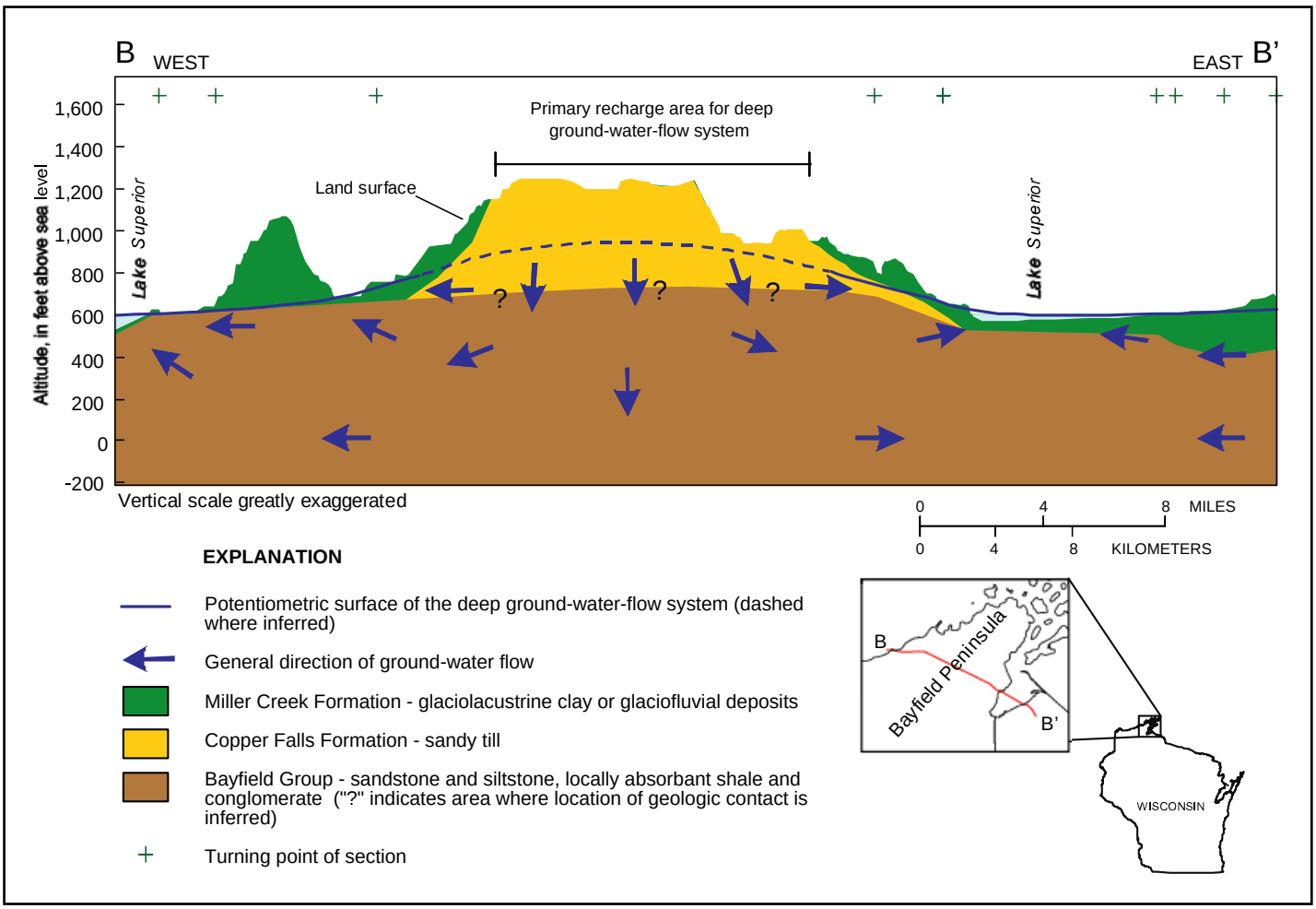


Figure 5 – Digital Elevation Model of Whittlesey Creek Watershed.

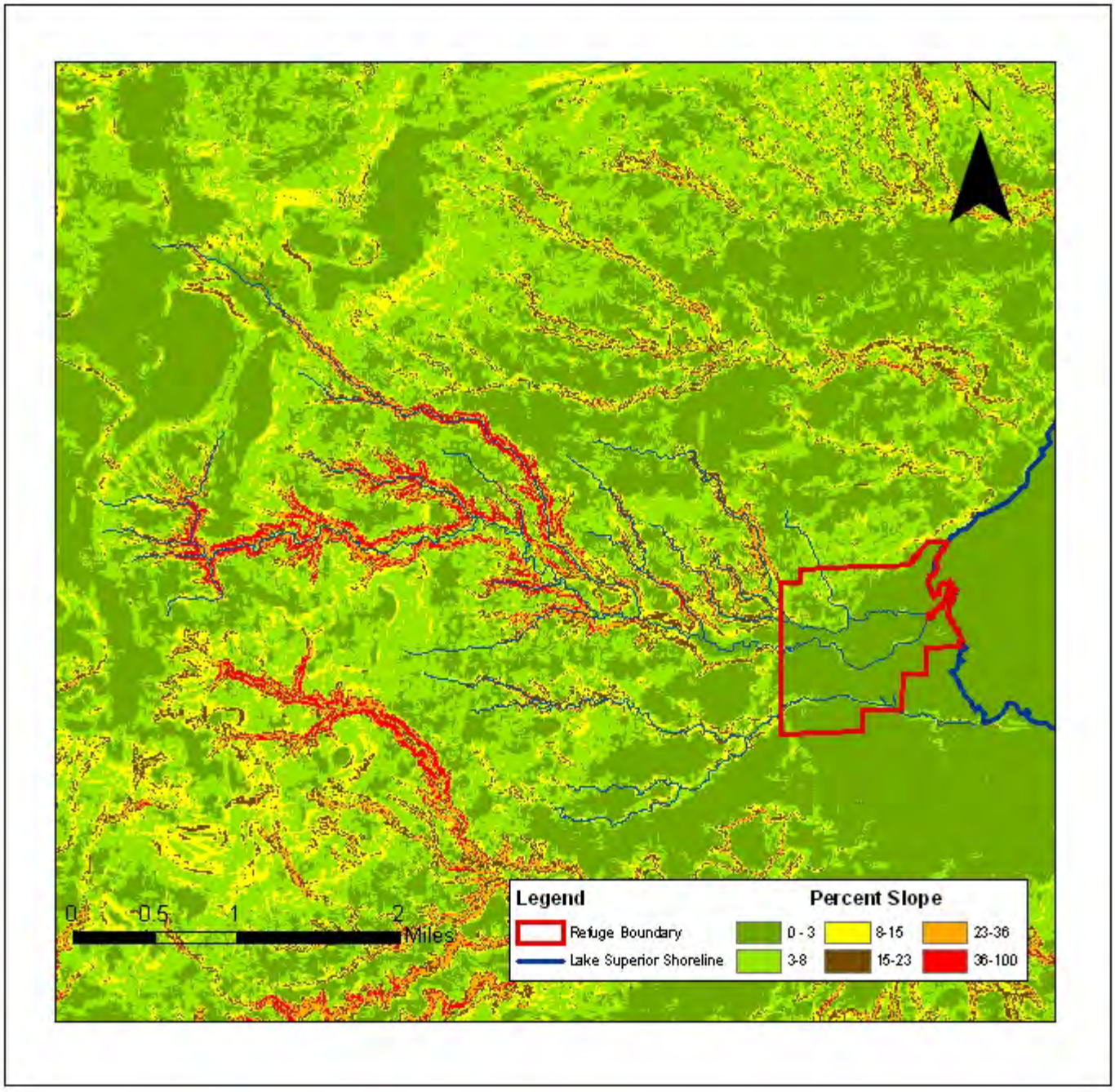


Figure 6 - Notes From Original Public Land Surveys in the 1850s.

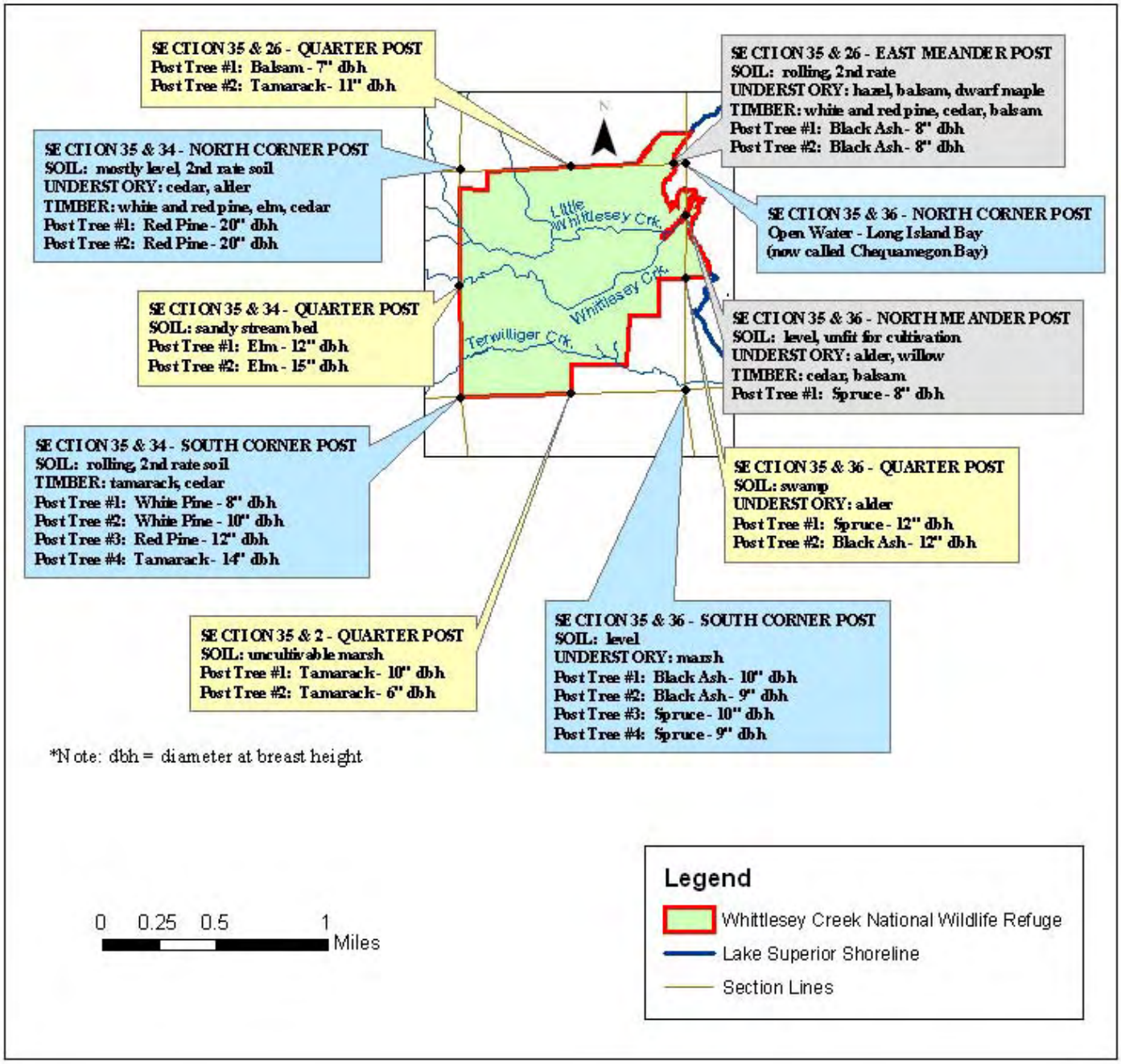


Figure 7 - Historic Vegetation at the Head of Chequamegon Bay, Lake Superior, Bayfield County, WI (Finley 1976).

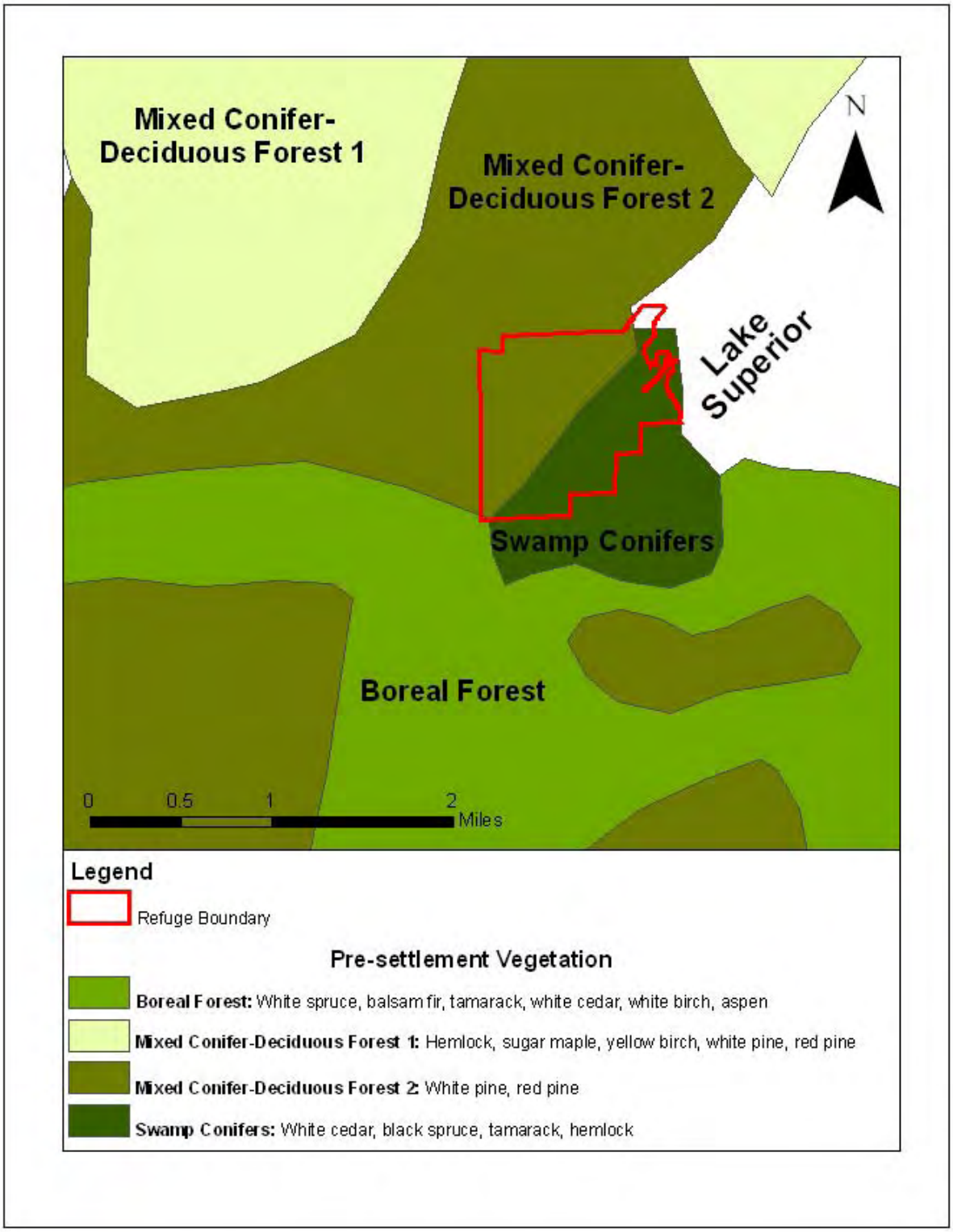


Figure 8 - Land Use Within the Refuge in the 1930's

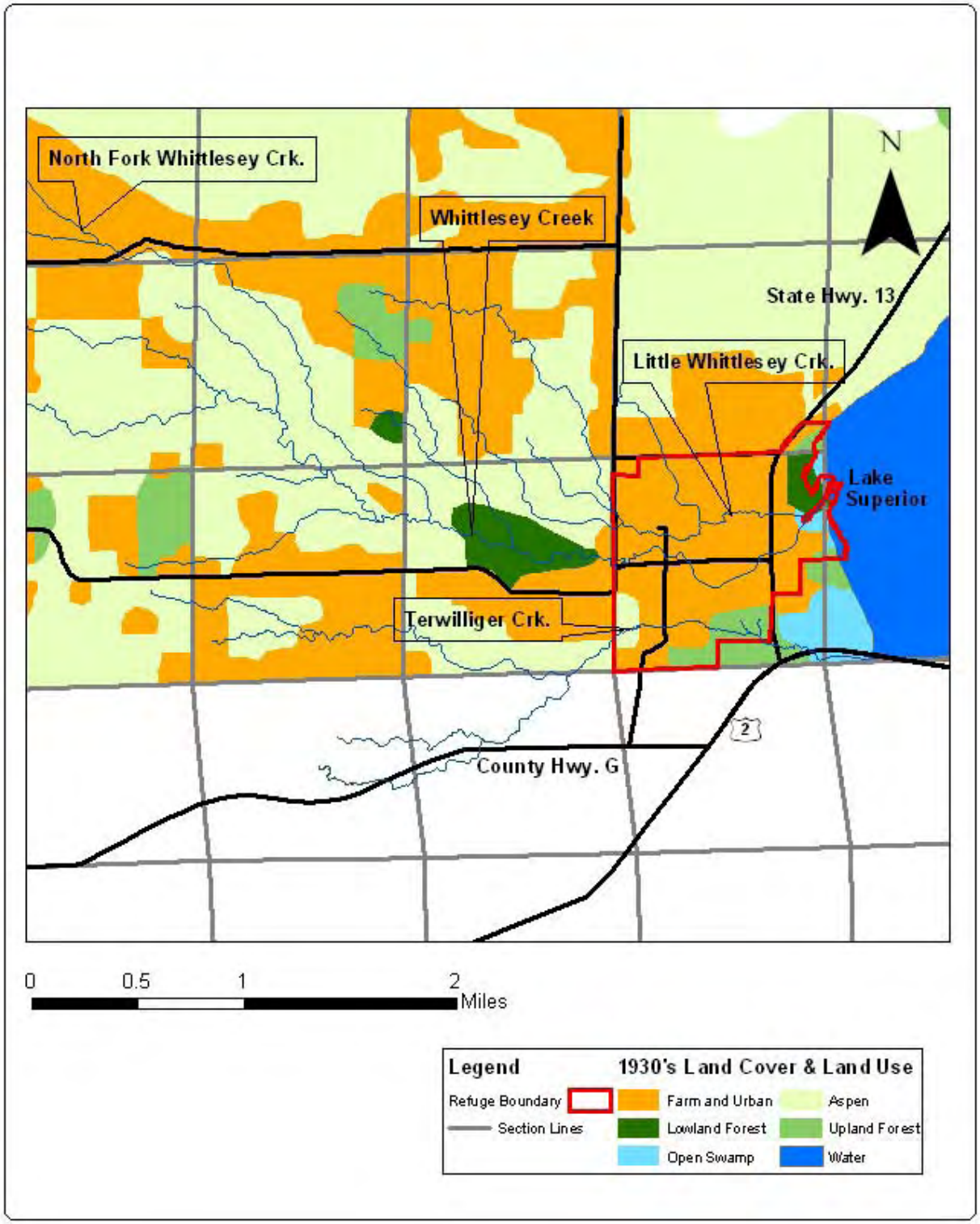


Figure 9 - 1938 and 1995 Aerial Photography Whittlesey Creek National Wildlife Refuge.

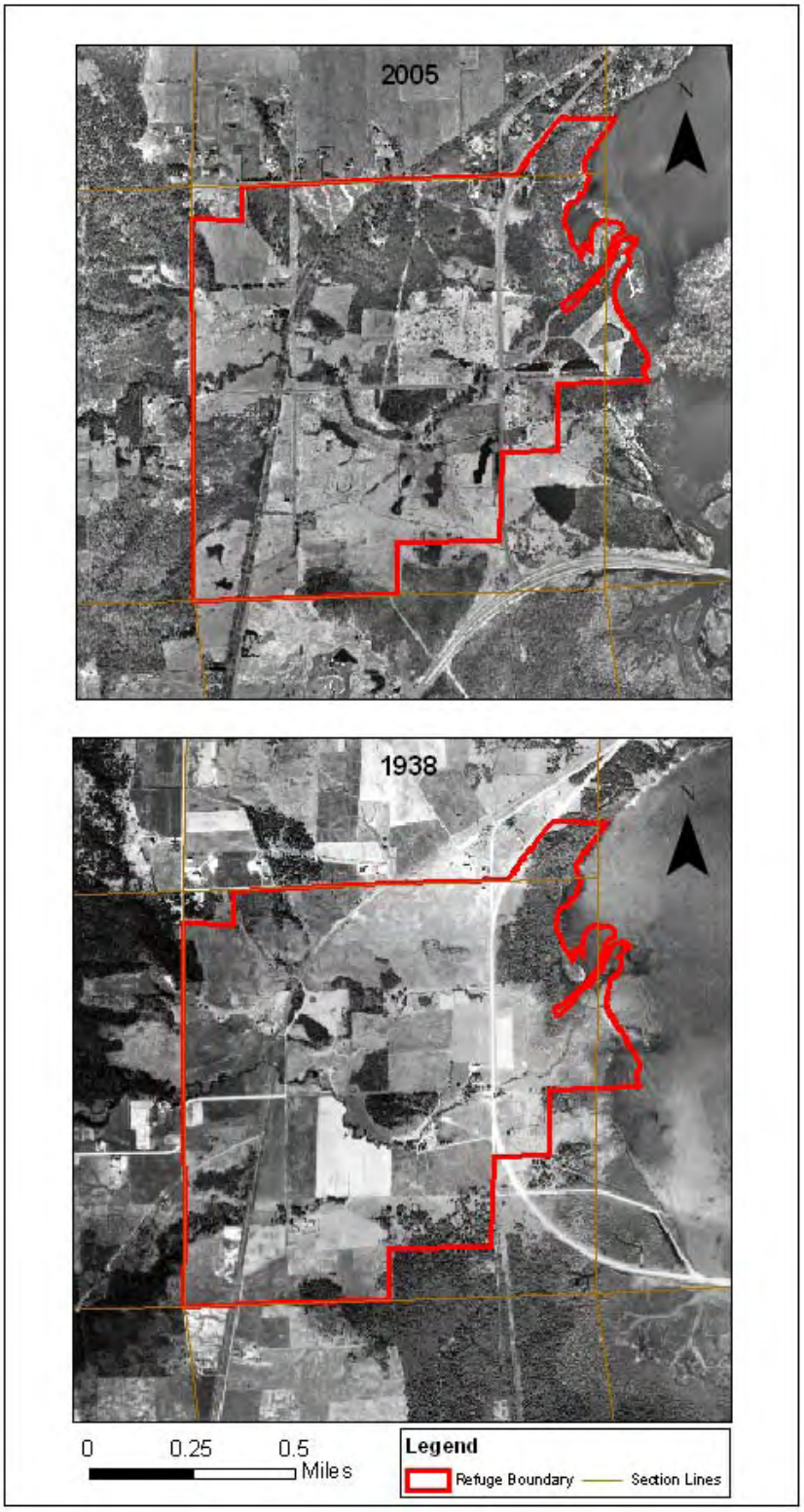
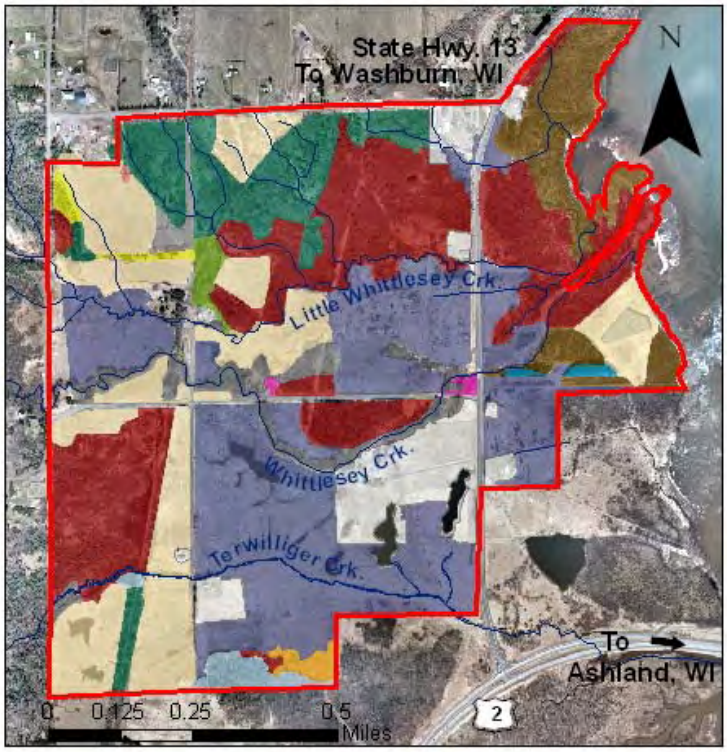


Figure 10 - Vegetation Cover Types of the Whittlesey Creek NWR in 2002



NVCS ID

1 2 3 4 5 6 7 8 9 10 11 12 13 14

National Vegetation Classification System (NVCS)			
ID	NVCS CODE	NVCS Code Description	Acres
1	I. B. 2. N. g.1	Saturated cold-deciduous forest: Black Ash-Red Maple saturated forest alliance	125.9
2	I. B. 2. N. d.11	Temporarily flooded cold-deciduous forest: Green Ash-American Elm temporarily flooded forest alliance	24.6
3	I. B. 2. N. d. 25	Temporarily flooded cold-deciduous forest: Trembling Aspen temporarily flooded forest alliance	3.5
4	II. B. 2. C. b.	Orchard	0.3
5	I. B. 2. N. b. 5	Montane or boreal cold-deciduous forest: Trembling Aspen-Paper Birch forest alliance	45.3
6	I. A. 8. N. b. 14	Rounded-crowned temperate or subpolar needle-leaved evergreen forest: White Pine forest alliance	3.1
7	I. A. 8. N. g. 6	Saturated temperate or sub-polar needle-leaved evergreen forest: White Cedar saturated forest alliance	6.6
8	V. A. 5. N. k. 39	Seasonally flooded temperate or sub-polar grassland: Canadian Blue-Joint seasonally flooded herbaceous alliance	155.9
9	III. B. 2. N. e. 1	Seasonally flooded cold-deciduous shrubland: *Alnus inoana* seasonally flooded shrubland alliance	37.2
10	V. A. 5. C. a	Hay/cultivated crop	92.7
11	I. A. 8. C. a.	Plantation	1.5
12	V. A. 5. N. m. 7	Sedge saturated herbaceous alliance	3.3
13		Old Homesites	1.1
14		Private Residence or Business	38.4

Vegetation cover types were delineated based on aerial photographs and field surveys. They have been classified according to the National Vegetation Classification System, with more detailed descriptions recorded in the field notes.

Figure 11 - Flood Hydrographs of Daily Mean Flow from The Whittlesey Creek Soil and Water Assessment Tool (SWAT) Model of Various Land Covers (Lenz et al. 2003; reprinted with permission from U.S. Geological Survey).

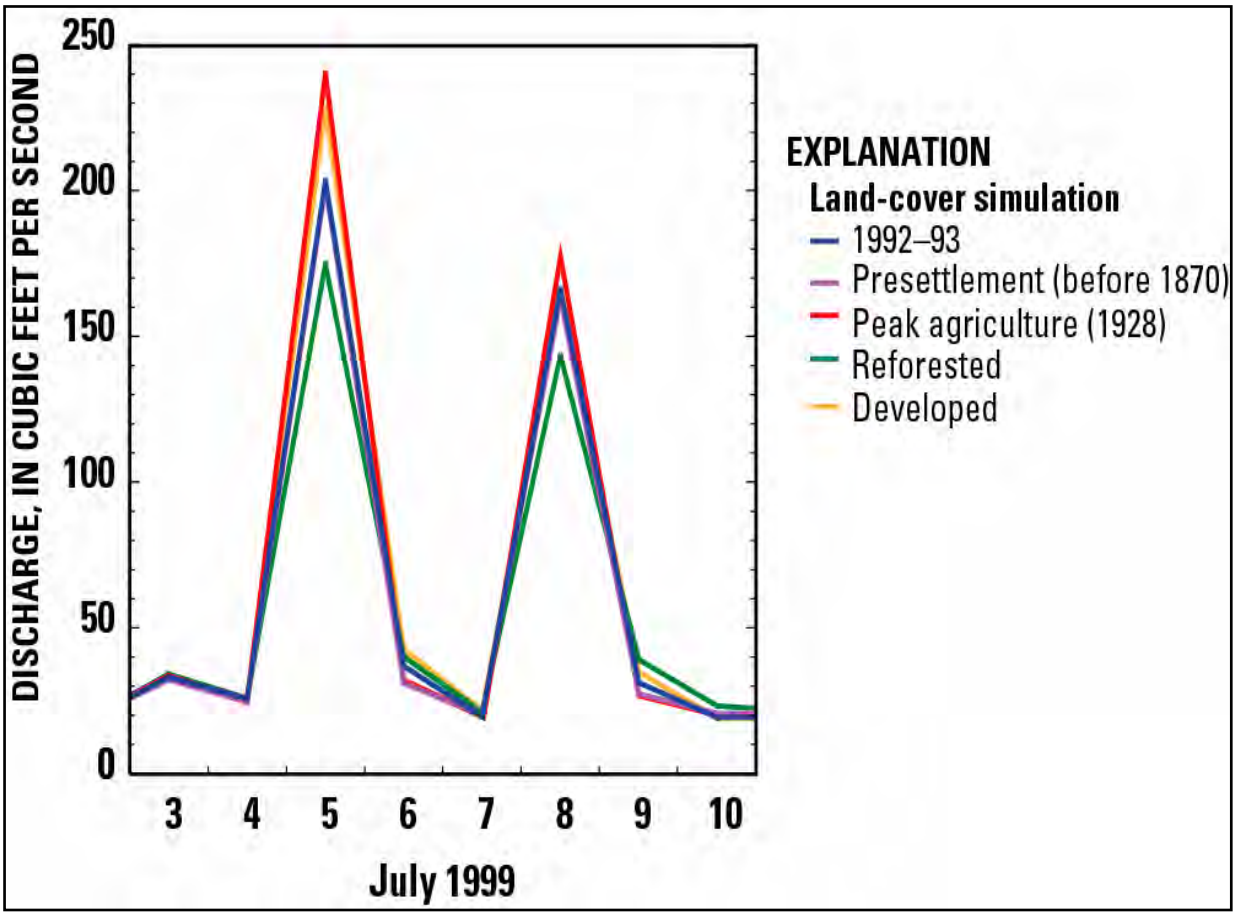


Figure 12 - Whittlesey Creek Watershed Land Use History Comparison (data from Lenz et al. 2003; reprinted with permission from U.S. Geological Survey).

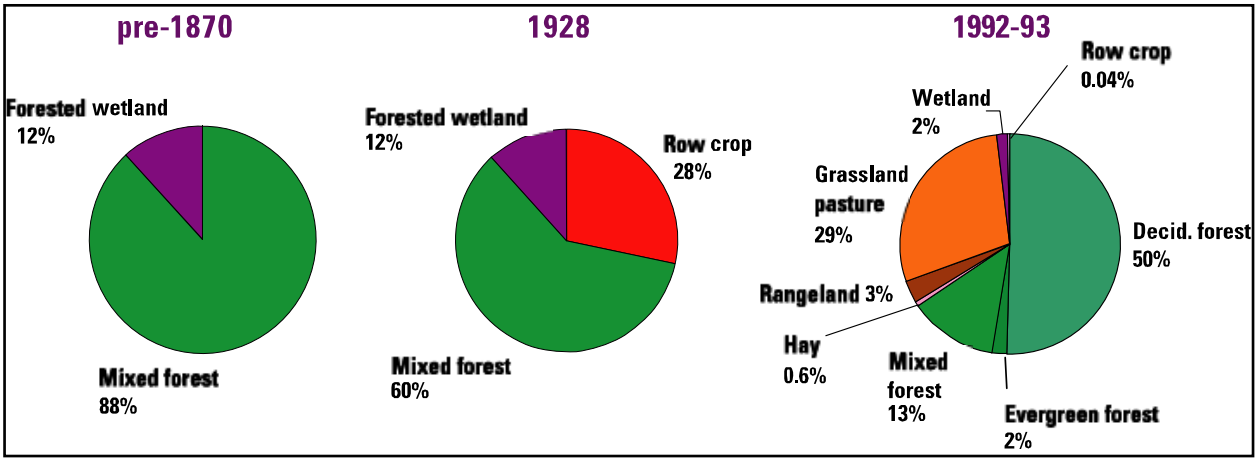
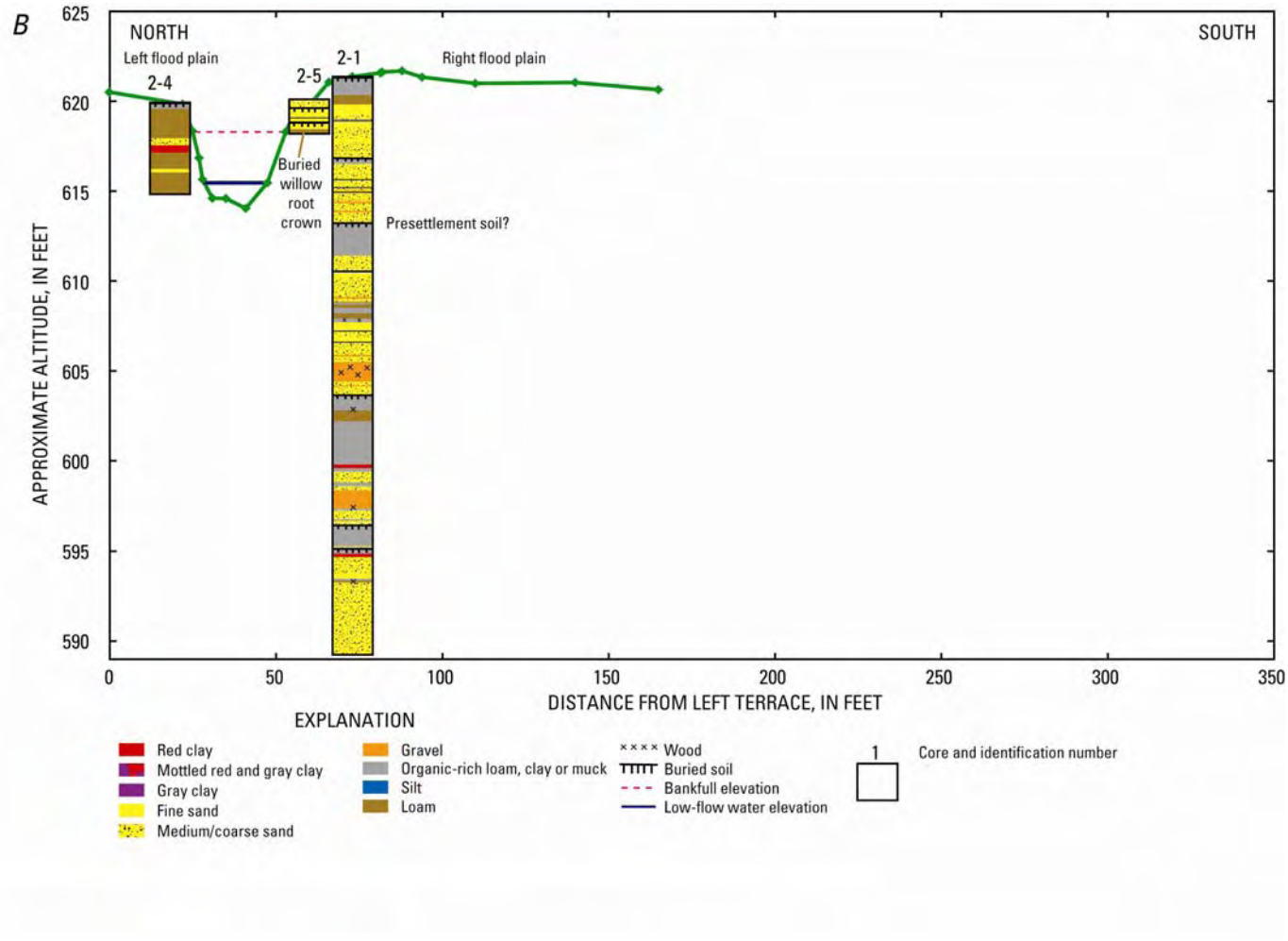


Figure 13 - Diagram of Sediment Core Taken Along Whittlesey Creek within the Refuge (reprinted with permission from U.S. Geological Survey).



III. Resources of Concern

Whittlesey Creek NWR was established under the Service's general authority for fish and wildlife conservation. The goals developed when the refuge was established, however, focused on the coastal wetland, cold-water streams and native species that use these habitats. Coaster brook trout and migratory birds were specifically included in the goals (Introduction, page 6).

The Service provides guidance for developing habitat management plans and specifies that resources of concern should be identified. A resource of concern can be a natural community, a species or a group of species. Resources of concern become the primary focus of the plan; objectives and management/restoration strategies will fill the needs of the species or communities identified. The process involves identifying resources of concern, identifying habitat requirements of resources of concern, determining the refuge's contribution to these resources and reconciling conflicting habitat needs. From this review, goals and objectives are developed.

In addition to Service procedures, Refuge staff also used guidance from Lambeck (1997) for identifying resources of concern. He recommends that a suite of focal species be identified that define different spatial and compositional requirements that must be present in a landscape, along with their appropriate management regimes. This approach allowed staff to consider a full range of species' needs within the restraints of the landscape in and around the refuge.

Several key sources were consulted and reviewed to identify Resources of Concern for Whittlesey Creek NWR.

- Region 3, Whittlesey Creek NWR's geographical region of the Service, has developed a list of resource conservation priority species (U.S. Fish and Wildlife Service 2002), which are used to help guide the Service's conservation actions. This list includes federally threatened and endangered species, important management species, and species of concern that might require specific actions to restore their populations.
- Three listed federally threatened and endangered species are known to occur in or near the refuge and one is known historically from the region.
- The Wisconsin Department of Natural Resources (Wisconsin DNR) has developed a Comprehensive Wildlife Conservation Plan, which includes a list of the state's species of greatest conservation need[6].
- Gary Casper of the Milwaukee Museum reported on status and trends of reptiles and amphibians for the Lake Superior Binational Program (Casper 2002), which lists all herptile species found in the Lake Superior basin.

[6] Congress created the State Wildlife Grants Program to prevent wildlife from becoming endangered. The grant program provides funding for on-the-ground conservation projects to state wildlife agencies. Each state is required to prepare a Comprehensive Wildlife Conservation Plan (CWCP) to remain eligible for funding. Each CWCP must focus on "Species of Greatest Conservation Need". The Wisconsin DNR has developed its "Strategy for Wildlife Species of Greatest Conservation Need" (Wisconsin DNR 2005).

- The State Natural Heritage Inventory was consulted for state threatened and endangered species and other species of concern.
- The Partners in Flight program's North American Landbird Conservation Plan (Rich et al. 2004) was consulted for priority species and groups of species.
- The refuge has reports and files from species and habitat inventories. In addition, refuge species lists were developed for the Service by Northland College students and Biology and Natural Resources Professor, Dr. Gus Smith.

A list of potential resources of concern was developed from these sources (Table 1). For each species of concern identified, information was collected via literature review and discussions with experts to answer the following questions:

- What is the refuge's contribution to habitat or other resource needs of this species or community?
- Is the species rare, declining or unique to the refuge or landscape?
- Is there some other reason to consider this species or community?
- Do the needs or requirements of this species or community encompass other resources of concern, so they could be considered umbrella[7] or indicator species?

Table 1. Species of Concern within the Whittlesey Creek NWR and watershed.

SPECIES NAME	ABUNDANCE IN WHITTLESEY WATERSHED	FEDERAL OR STATE STATUS [i]	USFWS REGION 3 PRIORITY SPECIES	WI SPECIES OF GREATEST CONSERVATION NEED
Canada Lynx	Not known	FT	Y	
Gray Wolf	Rare	FT	Y	Y
Northern Water Shrew	Patchy			Y
Pine Marten	Extremely Rare	SE		Y
American Bittern	Uncommon	SC	Y	Y
American Black Duck	Common	SC	Y	Y
Bald Eagle	Uncommon	FT, SC	Y	Y
Black-billed Cuckoo	Uncommon	SC	Y	Y
Blue-winged Teal	Common		Y	Y
Bobolink	Common		Y	Y
Canada Warbler	Uncommon		Y	Y
Common Loon	Uncommon	SC	Y	
Common Tern	Uncommon	SE	Y	Y
Eastern Meadowlark	Uncommon		Y	Y
Least Flycatcher	Common			Y
Le Conte's Sparrow	Uncommon	SC	Y	Y
Mallard	Common		Y	
Northern Flicker	Common		Y	

[7] An umbrella species has been defined as a species whose conservation confers protection to a large number of naturally co-occurring species (Roberge and Angelstam 2004).

SPECIES NAME	ABUNDANCE IN WHITTLESEY WATERSHED	FEDERAL OR STATE STATUS [i]	USFWS REGION 3 PRIORITY SPECIES	WI SPECIES OF GREATEST CONSERVATION NEED
Northern Waterthrush	Uncommon			
Northern Harrier	Common	SC	Y	Y
Piping Plover	Rare	FT	Y	Y
Sedge Wren	Common		Y	
Sora Rail	Uncommon			
Swamp Sparrow	Common			
Upland Sandpiper	Uncommon	SC	Y	Y
Veery	Common			Y
Willow Flycatcher	Common			Y
Wood Duck	Common		Y	
Wood Thrush	Uncommon		Y	Y
Yellow Rail	Rare		Y	Y
Wood Turtle	Rare	ST		Y
Common Mudpuppy	Common			Y
Four-toed Salamander	Patchy/ Uncommon	SC		Y
Mink Frog	Uncommon			Y
Northern Leopard Frog	Common			
Coaster Brook Trout	Rare		Y	NA
Coho Salmon	Common		Y	NA
Marsh Horsetail *Equisetum palustre*	Rare	SC		NA
Northern Black Currant *Ribes hudsonianum*	Rare	SC		NA

[i] FT = federally threatened, SE = state endangered, ST = state threatened, SC = State species of concern.

Based on analysis of species of concern, four resources of concern were selected to focus restoration and management efforts: coldwater streams (as brook trout habitat), riparian forest, lowland forest, and emergent wetland (targeting the coastal wetland). Refuge staff used Lambeck's (1997) process of identifying a suite of focal species, and defining attributes and management schemes that must be present in a particular landscape to meet those species needs. The species with the most limiting factors or most sensitive to a particular threat is used as the minimum acceptable level of habitat attribute or management requirement. A matrix showing the resources of concern and their limiting attributes was developed and is available from refuge staff.

Resources of concern were selected to encompass the refuge's main habitat types and associated species of concern that have limiting attributes connected with that habitat type.

Whittlesey, Little Whittlesey and Terwilliger Creeks are all coldwater stream habitats. Whittlesey is perhaps the most important of the three for coldwater species such as trout. Whittlesey's water is groundwater fed so it flows year-round at a relatively constant temperature. Coaster brook trout is the primary species of concern associated with coldwater stream habitat because it is very sensitive to in-stream habitat degradation, especially habitat degradation associated with increased flood power and resulting sedimentation. It is also associated with other stream-sensitive species, such as northern water shrew (*Sorex palustris*) and wood turtle (*Clemmys insculpta*). Northern water shrews require high water quality. Wood turtle habitat would be degraded with rip-rap along streambanks.

Riparian forests serve a habitat function for brook trout, veery and wood turtle. They serve a function for bank stabilization and provide in-stream large woody debris.

Lowland forest and shrub are the main habitat types in coastal wetlands and floodplains. Their critical function is to give flood waters a means of dispersal. This habitat was also selected as a resource of concern because adjacent public lands are dominated by this habitat type. Habitat for veery (*Catharus fuscescens*), Canada warbler (*Wilsonia canadensis*) and northern waterthrush (*Seiurus noveboracensis*) could be enhanced by cooperative management of these public lands on a landscape scale.

Emergent wetland habitat is found within the coastal wetland and includes restored wetlands. These habitats provide a mix of open water and emergent wetland vegetation where primary production takes place. These wetlands assimilate nutrients, store floodwaters and provide nursery areas for fish, frogs and waterbirds. They are threatened by excess sedimentation and invasive species such as purple loosestrife.

The refuge also provides habitat for priority grassland species such as eastern meadowlark, Le Conte's sparrow and bobolink. These species are found primarily in the refuge and watershed on open lands that are either haylands or emergent wetlands. Neither the habitats they use nor the species themselves are included as resources of concern for the refuge. The refuge is small and cannot accommodate all the priority species. As the refuge begins to move toward goals and objectives established in this plan, most of the habitat for these grassland species will disappear. Habitat in the watershed is likely to remain, however, if agriculture continues.

Three threatened and endangered species are known to occur on or near the refuge: piping plover, gray wolf and bald eagle. Piping plovers have been seen at the mouth of Whittlesey Creek during spring and fall. They have nested on sandy shores of the Apostle Islands National Lakeshore. Sandy shore habitat at Whittlesey Creek is very limited. Gray wolf tracks and scat have been seen within the refuge. There are also incidental reports by local residents of wolves near the refuge and Fish Creek sloughs. Packs are known to occur in the Bayfield Peninsula, especially in and near large tracts of federal and county forest lands. Sightings around the refuge are likely an individual wolf. Bald eagles forage in the refuge and vicinity all year. They have nested within two miles of the refuge on the shore of Lake Superior. No nests are found on the refuge.

All three of these threatened and endangered species utilize the refuge incidentally to their use of the Lake Superior landscape and its mosaic of habitats. Therefore, refuge staff did not consider these as species of concern for this habitat management plan; refuge habitat restoration and management would not contribute to their recovery. However, care will be taken to provide for these species' needs. No activities are planned that would adversely impact their potential habitat or food sources.

A. Resource of Concern – Coldwater Streams

Whittlesey Creek is a cold-water, groundwater-fed stream, classified as a Class I trout stream by the Wisconsin DNR. Even with habitat loss, it provides excellent water quality, good temperature ranges for brook trout and flows year-round. Groundwater discharge keeps the creek at a relatively stable temperature all year, which is critical for overwintering eggs and young. Habitat quality is variable, as noted below. Sediment loading continues to degrade habitat, especially at the lower stream reaches. High peak flood flows also create problems for larval and juvenile fish, especially where there is lack of in-stream cover.

Whittlesey Creek and the North Fork of Whittlesey were divided into stream reaches for this plan (Figure 3), based on habitat and hydrologic changes seen from one reach to the next, such as presence or absence of constant base flow, streambed substrate and topography. Reaches were developed and descriptions provided during a meeting of stream and fishery experts in February 2005 (Appendix C lists experts who attended the meeting). Habitat assessment work conducted by inter-fluve, inc. and Graber (2003) was also used to define reaches of Whittlesey Creek. Reach locations and summary descriptions follow.

> **Reach 1:** Lake Superior to Hwy. 13. Fish habitat quality is limited and fluxing from excess sand from upstream deposited into this reach. Isostatic rebound continues to influence sand deposition also. Purple loosestrife is found near the mouth.
>
> **Reach 2:** Highway 13 to Town Hall Road - Fish habitat is similar to Reach 1 with excess sedimentation from upstream. This reach also includes five bridges, which affect hydrology and aggradation. Some overhanging vegetation is present but most is all one age – crack willow planted about 50 to 60 years previous. Pool depths are lacking because large woody debris is largely lacking. Overbank sedimentation has resulted in levy formation and subsequent loss of floodplain connection with the stream. Isostatic rebound also continues to affect this reach. Reaches 1 and 2 are within the Whittlesey Creek NWR.
>
> **Reach 3:** Town Hall Road to unnamed tributary (UTM coordinates, NAD 83: 654612 E, 5162243 E) - Spawning habitat is poor, with only a few unstable, embedded gravel deposits. Juvenile and adult cover is good at the outside of sharp meander bends and under large woody debris jams. Overhanging vegetation coverage is good. Fish habitat structures (cross-logs) installed in the mid to late 1990's are almost completely buried with sand. The floodplain is no longer connected to the stream.

Reach 4: Unnamed tributary to confluence with North Fork of Whittlesey Creek – Reaches 4 and 5 are important spawning areas in Whittlesey Creek. Spawning-sized gravel deposits are common, but depths may be low in fall and velocities too high in spring. The threat of sand inundation is high given that large quantities of fine sediments can move through the reach during flood events. Juvenile habitat in the form of large woody debris jams is good, although most pools are shallow (<1 ft., residual pool depth 2 ft.) Overhanging vegetation is sparse due to the thick overhead canopy. Adult cover and winter cover is limiting here, as pool depths are limited. Large woody debris density is good (10-12 pieces per 100 ft.).

Reach 5: Confluence to top of groundwater discharge area (approximate UTM coordinates: 653062 E, 5162782 N) – This is an important spawning area in Whittlesey Creek. The habitat is very similar to Reach 4.

Reaches 6 and 7: From headwaters to top of Reach 5 – Water through these reaches are mainly from surface drainage. Reaches 6 and 7 are separated by a stream bed feature (approximate UTM coordinate: 650082 E, 5163104 N) that allows some of this surface drainage to flow under the stream bed and reemerge downstream. Most sediment inputs into Whittlesey come from these two reaches, especially from stream banks. Past land use (especially land clearing) destabilized the stream and its banks; effects of this destabilization remain today. Warmer water in Reach 7 makes it less viable as brook trout habitat, even though some local groundwater flow is provided.

North Fork Reach 1: Confluence to ½ mile upstream (UTM Coordinates: 653545 E, 5162851 N) – This is the most important spawning area in the system. Sand inputs are significant and may influence spawning habitat quality, but gravel deposits are good. Juvenile cover is excellent, both in terms of large woody debris, backwater habitat and connected wetland pools. Good scour pools exist below large woody debris jams. Red maple, ash, alder and birch provide good overhead canopy coverage. Adult pool quality is marginal and pools are consistently < 2 ft. deep. Large wood debris density is very good (12 pieces per 100 ft.).

North Fork Reach 2: One-half mile from confluence to Cozy Corner Road – This stretch is above the main groundwater discharge area, so water levels are variable and temperatures can be too high for brook trout. Otherwise, habitat is similar to North Fork Reach 1. There is a fish passage concern at Cozy Corner Road.

North Fork Reach 3: Segment above Cozy Corner Road – Local groundwater system feeds this stretch of the stream. A large headwater wetland, either created or enhance by a beaver dam, provides good water storage.

The Whittlesey Creek NWR also includes portions of Little Whittlesey Creek and Terwilliger Creek. Little Whittlesey Creek flows into the coastal wetland near Whittlesey Creek. Terwilliger Creek flows into Fish Creek. Original land survey maps show Terwilliger Creek as a tributary to Whittlesey Creek. Little Whittlesey Creek emptied into Whittlesey Creek within

Reach 2, farther upstream than its current location. The accuracy of these stream locations seen on the original survey map is unknown. Terwilliger and Little Whittlesey Creeks are also spring-fed and flow year-round. No fishery or habitat assessments have been conducted on either stream.

Species of Concern[8] Associated with Coldwater Streams

Coaster Brook Trout - Coaster Brook Trout are considered a good indicator of habitat quality. Coaster brook trout's ecological requirements relate to the entire stretch of Whittlesey Creek, the watershed and the near-shore habitat of Lake Superior. Coaster brook trout are native brook trout that exhibit a migratory life-history which includes spending at least part of their life cycle in Lake Superior.

The migratory life-history of brook trout is nearly gone from Wisconsin waters of Lake Superior and its tributaries. Overharvest in the late 1800s and early 1900's reduced the population. Loss of habitat from changes in land use (see physical and geographic setting under Background for habitat change descriptions) continued to cause their decline. The Wisconsin DNR stocked brook trout in Lake Superior from 1960 through 1999, intermittently, but populations were not self-sustaining.

Coaster brook trout typically spawn in cold-water tributaries to Lake Superior or along rocky shores of the lake (they have also locally been called Rock Trout). Specific conditions required for redd (spawning bed) locations include loose, silt-free gravel or coarse sand over strong groundwater seepage. Thermal stability seems to be a key factor in the use of spring seeps as redds. Upon hatching, alevins[9] remain in redds until the yolk sac is nearly fully absorbed. Emergence from redds usually occurs in March, but may be earlier or later depending on latitude.

Service fishery biologists expect most brook trout to spawn in October in Whittlesey Creek. The average water temperature in Whittlesey Creek and the North Fork during the winter 2003-2004 was 40°F and 41°F, respectively. If spawning occurs on Oct. 15, egg hatch should take place at the end of January or early February. Eggs were stocked in Whittlesey Creek in late 2003. These stocked eggs were fertilized in the hatchery in October in different batches at different times, but each batch showed similar patterns following the temperature needs for incubation and hatching. Depending on time of fertilization, creek location, and creek temperature, egg hatch ranged from the week of January 16 to mid April (Henry Quinlan, U.S. Fish and Wildlife Service, Ashland, WI, personal communication, 2005).

The most limiting factor for brook trout in Whittlesey Creek is increased flood power caused by increased watershed runoff. Floods destabilize spawning sites or destroy incubation environment, erode upper channel banks and sand buries or embeds redd environment; flood flows kill emergent fry. Brook trout will also be limited by lack of resting sites for adults as

[8] Summary of habitat requirements was obtained from species accounts in NatureServe (2005) unless otherwise noted.

[9] Trout eggs hatch as alevins. They have yolk sacs that provide food for one to two months, which allows them to stay in the redd during that time.

they aggregate near spawning sites, nursery habitat (low velocity water and cover) for fry, and organic matter and structures to fuel primary production. The stream must also provide adequate passage for adults as they run to spawning sites.

The Service and the Wisconsin DNR have initiated an experimental stocking program in Whittlesey Creek to determine stocking's effectiveness for coaster brook trout rehabilitation (U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources 2003). Stocking was initiated in the summer of 2003 and will continue until 2010. Monitoring was initiated in 2003 and will continue until 2030.

Wood turtle – This state endangered reptile prefers lowland hardwood forests and open wet meadows associated with moderate to fast current streams and rivers with sand or gravel substrates. Pratt (1981) shows the mouth of Whittlesey Creek to Highway 13 and Little Whittlesey Creek from its mouth to Wickstrom Road as wood turtle habitat. Wood turtles may forage in upland deciduous mesic forest and open meadows in summer. They use south facing sandy river banks or flat sandy soil openings adjacent to rivers for nesting sites, including gravel banks, roadsides, fields and meadows. Hatchling and juveniles prefer alder thickets associated with shorelines and are considered critical habitat for this segment of the population. They are vulnerable to bank riprap and nest predation.

Water shrew – This mammal requires cold-water streams with high water quality and abundant cover such as rocks, logs, or overhanging streambank. Suitable management consists primarily of maintaining these conditions. It is most abundant along small cold streams with thick overhanging riparian growth, but is also found around lakes, ponds, marshes, bogs and other lentic habitats. It is rarely far from water. Nest sites are near water in underground burrows, rafted logs, beaver lodges, and other areas providing shelter. Its food is primarily aquatic insects, but it also eats various other invertebrates and may take small vertebrates (fishes, amphibians) when available. It hunts under and on top of water and may even be seen running across the water surface.

B. Resource of Concern - Lowland Forest and Shrub

This habitat type is found mainly in the floodplain and coastal wetland area of the refuge. Dominant plant species include willow, speckled alder, white cedar, trembling aspen (*Populus tremuloides*), black ash and red maple (*Acer rubrum*). Refuge staff combined several National Vegetation Classification System (NVCS) alliances into this habitat type: saturated cold-deciduous forest, black ash/red maple alliance; temporarily flooded cold-deciduous forest, trembling aspen temporarily flooded forest alliance; saturated temperate or sub-polar needle leaved evergreen forest, white cedar saturated forest alliance; and seasonally flooded cold-deciduous shrubland, speckled alder seasonally flooded shrubland alliance. Wisconsin's Natural Communities of the Natural Heritage Inventory correspond with northern hardwood swamp, northern wet forest, tamarack (poor) swamp and alder thicket. Planning and management by the Service in this habitat should consider overlap with lowland forests and shrubland on other public lands at the head of Chequamegon Bay: Northern Great Lakes Visitor Center, owned by the U.S. Forest Service; Fish Creek Sloughs, owned by the Wisconsin DNR; and Prentice Park, owned by the City of Ashland. Important functions of lowland forests and shrubs are floodwater storage, primary production and wildlife habitat.

Species of Concern Associated with Lowland Forest and Shrub

Northern waterthrush – This migratory warbler prefers thickets along edges of wooded swamps for breeding habitat; fallen trees with exposed root masses are preferred nest sites. It will be absent in highly fragmented landscapes. On its breeding grounds, wooded streambanks should be protected. It favors nest sites in cavities of root systems of wind-blown trees in wooded swamps, or on sides of fern clumps or under cover on the banks of lakes or rivers.

Northern black currant - *Ribes hudsonianum* is found mostly in cold, neutral to calcareous conifer swamps, generally in shaded to partly shaded areas, and often more abundant and fertile on the edge of a blowdown or other opening. Records are also from black ash swamps. Natural Heritage Inventory community types are northern wet forest and northern wet-mesic forest (Craig Anderson, WIDNR, WI Natural Heritage Program, personal communication, 2005). It is found on the refuge at the edge of a conifer and black ash swamp.

Marsh Horsetail – *Equisetum palustre* is found along Terwilliger Creek in the Canada blue-joint (*Calamagrostis canadensis*) seasonally flooded herbaceous alliance. Its habitat requirements are variable and include calcareous fens, alder tickets, wet sedge meadow, bog and swamp margins. It has also been recorded from black ash swamps, white cedar swamps, marshes, sand dunes, and sandy-gravelly streambanks. It is found in canopy cover that varies from open sun to partly shaded (30-50%) to fully shaded swales, but most often is found in unshaded to partly shaded habitats. It is usually found in moist settings (Craig Anderson, WIDNR, WI Natural Heritage Program, personal communication, 2005).

Veery – see riparian forest below.

C. Resource of Concern - Riparian Forest

Riparian forest was separated from lowland forest because of stream interface and the functions riparian vegetation provide for hydrology and habitat. Mature trees will fall into the stream and create large woody debris for aquatic species habitat. Root masses help keep banks stable. Overhanging vegetation provides shade to keep the water cool and cover for fauna. The riparian zone of Whittlesey Creek within the refuge is dominated by crack willow[10] that was planted in the 1940's and 1950's. Large American elm trees dominated the riparian areas until the 1970's, when they were wiped out by Dutch Elm disease.

The NVCS type is temporarily flooded cold-deciduous forest, green ash-American elm temporarily flooded forest alliance. Wisconsin's corresponding natural community is boreal forest.

Species of Concern within Riparian Forest

Veery – This migratory and breeding thrush prefers forest patches larger than 100 ha (250 acres). It uses poplar, aspen, or other swampy forest, especially in more open areas with

[10] Most local people refer to these trees as black willow. They were identified as crack willow (*Salix fragilis*) by Refuge staff. It is a non-native species.

shrubby understory. It also likes second growth willow or alder shrubbery near water. Veerys require a vertical and horizontal heterogeneous vegetation structure. Their nests are usually on or near the ground, at the base of shrubs, in a clump of weeds, or in a shrub or low tree.

Wood Turtle – See coldwater stream section.

E. Resource of Concern – Coastal Wetland

This habitat's most important characteristic is its location – where Lake Superior's water influences the vegetation along the shore. Most of Whittlesey Creek's coastal wetland would be considered a complex of emergent marsh edged with lowland shrub. Whittlesey and Little Whittlesey Creeks enter Lake Superior here, creating a mixture of water temperatures, especially in the summer. The wetland is influenced by lake seiches, wave action and ice movements. The wetland is also influenced by sediments that are carried by Whittlesey and Little Whittlesey Creeks and then reworked by wave and wind action. Lake levels and isostatic rebound have influenced this stream mouth for thousands of years, creating the coastal estuary as a drowned river mouth. It can be characterized as a pulse stable community where change is the norm, with water levels and plant communities.

Coastal wetlands remain critical biological reserves for many aquatic species, especially as a sanctuary from the cold, clear lake. NVCS include permanently flooded temperate or subpolar hydromorphic rooted vegetation; and seasonally flooded cold-deciduous shrubland, speckled alder seasonally flooded shrubland alliance. The Wisconsin Natural Heritage Inventory recently added a community complex to their list of natural communities, called Great Lakes estuary, which is likely the corresponding natural community.

Species of Concern in Coastal Wetland

Black Duck - *Anas rubripes* breeding habitat and nest sites are very diverse; favors wooded swamps and marshes, brackish or freshwater. Usually nests on ground in concealing vegetation, rarely in abandoned tree nest of other bird species.

Common Mudpuppy – *Necturus maculosus* typically congregate in river harbors and river mouths of Lake Superior where warmer water and higher biotic productivity occurs. They are supposedly sensitive to pesticides and herbicides, so a concern has been raised about lampricides. Lampricide is not used in Whittlesey Creek since the water is too cold for sea lamprey larvae. Therefore, protection of a population in the Whittlesey Creek estuary could be important, but their presence or absence in the refuge is unknown.

Sora Rail – *Porzana carolina* is a secretive marsh bird is found primarily in shallow, freshwater emergent wetlands (e.g., marshes of cattail (*Typha sp.*), sedge (*Carex sp.*), blue-joint (*Calamagrostis sp.*), or bulrush (*Scirpus sp.*)), less frequently in bogs, fens, wet meadows, and flooded fields, sometimes foraging on open mudflats adjacent to marshy habitat. Breeding habitat can include very small marshes (e.g., 4 nests have been found in a half-acre marsh). Soras have been sighted during the breeding season in restored wetlands in

the refuge, on Northern Great Lakes Visitor Center lands and in the coastal wetlands of Fish Creek Sloughs (Refuge files). All were noted in cattail cover.

IV. Habitat Goals, Objectives and Strategies

Habitat and population goals were adopted for the Whittlesey Creek NWR when the Interim Comprehensive Conservation Plan was written (list of original goals on page 6). Revisions to the original goals were made for this plan, only to clarify, add watershed approaches or merge similar habitats into one goal. The intent and direction of the original goals were not altered.

The goals and objectives discussed in this document were developed with an understanding that upstream events, both past and present, directly impact the streams and floodplain within the refuge. Our goals, objectives and strategies must be based on flows and sediments entering the refuge from upstream. As engaged landowners continue to restore habitats that reduce flows and sediments, our objectives can be better defined.

The Service will gain a much better understanding of the dynamics of sediment entering the stream once a sediment transport study has been done. This study will identify sediment sources, quantify the amount, and model the movement of sediment entering and moving through the system. Until this study is done, stream restoration objectives within the Whittlesey Creek NWR will not be set, because anything we might try to do could be negated with excess sediment buildup or simply lost to high flood flows.

Goals, objectives and strategies are divided into two categories based on land ownership: Whittlesey Creek NWR and private lands. Private lands here refer to lands that are upstream of the refuge boundary and located within the surface water drainage area of Whittlesey Creek (Figure 2). The Service has no jurisdiction or authority over private land actions, but it can provide financial and technical assistance to landowners who are interested in restoring fish and wildlife habitat.

Several resources were used to redraft goals and draft objectives:

- Refuge staff convened a group of scientists that have expertise in hydrology, geomorphology, fisheries biology or wildlife biology to identify stream reaches and describe potential habitat and geomorphic characteristics for each reach. They were extremely helpful in formulating stream goals and objectives. A list of participants is provided in Appendix C.
- We convened another group of scientists that have expertise in plant ecology and soils to help us identify historic and potential native plants for the floodplain. A list of participants from this group is provided in Appendix C.
- We relied on data collected for the Whittlesey Creek hydrology study, as well as results of the analysis from this work (Lenz et al. 2003). Faith Fitzpatrick of USGS and coauthor of the Whittlesey Creek hydrology study (Lenz et al. 2003) and Marty Melchoir of inter-fluve, inc. provided valuable insight and helped us quantify objectives for the stream.
- Other reports and studies were used as references, such as the “Bayfield Peninsula Stream Assessment” (inter-fluve, inc. and Graber 2003) and “Guidelines for Evaluating Fish Habitat in Wisconsin Streams” (Simonson et al. 1993).

Steam objectives are set to provide habitat for coaster brook trout. If these objectives are not reachable by slowing overland flow and reducing sediment inputs, then the Service assumes the stream will still provide habitat for other fish and wildlife species, such as wood turtle, black duck and coho salmon.

A. Habitat Goals

Habitat Goal 1 – Stream: Restore watershed[11] and stream hydrologic functions that improve fish and wildlife habitat within the stream and the refuge, with an emphasis on native species.

Brook Trout Population Goal: Establish a self-sustaining brook trout population in the Whittlesey Creek watershed that exhibits a migrating life history.

Objectives and Strategies are laid out in the document titled, "An experiment to establish a self-sustaining brook trout population in Whittlesey Creek that exhibits a migrating life history (coaster) by stocking, enacting protective regulations and implementing habitat improvements." Specific objectives are:

1) By 2030, establish a self-sustaining migratory brook trout population. A population is considered self-sustaining when it supports itself for at least two life spans after stocked fish no longer contribute to recruitment.

2) Stocking Objective: Establish 25 spawning pairs of brook trout exhibiting the migratory life history.

Assessment needs, stocking schedules and monitoring requirements are specified in the Whittlesey Creek Brook Trout plan mentioned above.

Habitat improvements will improve the chances of success for Coaster Brook Trout and other species of concern, such as wood turtle and northern water shrew. The following habitat objectives are laid out to improve brook trout survival.

Objectives for Entire Whittlesey Creek:

Objectives for Whittlesey Creek are to slow the flow of water over the upland and within the stream. These objectives are measured with geomorphic terms. In the next 30 years, Whittlesey Creek will have:

1) A 20 percent reduction in flood peaks in Whittlesey Creek, as measured by 2 to 10 year flood events.

[11] Watershed in goals, objectives and strategies refers to the surface-water contributing portion of the watershed only.

2) In-channel roughness of 0.06 (using Manning's roughness coefficient). [12]

3) Roughness coefficient of overland flow increased to 0.5 (using overland flow coefficient calculated in SWAT model (Lenz et al. 2003)).[13]

Objectives for Whittlesey Creek Within Refuge:

Within the next 30 years, Whittlesey Creek will have:

4) Whittlesey Creek Reach 1: A moving, dynamic channel and delta with the channel freely meandering in the floodplain. Conditions allow spawning adult fish to pass to spawning sites. Adjacent wetlands and floodplains are dominated by native tree, shrub and emergent vegetation.

5) Whittlesey Creek Reach 2: A naturalized stream channel, with variable depth and cover. Habitat rated as good to excellent when using Simonson et al. (1993) quantitative habitat assessment for Wisconsin streams.[14] Native riparian vegetation with a diversity of tree age classes and good shrub cover. The floodplain reconnected to the stream.

Objectives for Whittlesey Creek Within Private Lands:

The Service will work with partners and private landowners to restore the Creek toward:

6) Whittlesey Creek Reaches 3 – 5: Complex in-stream habitat with good cover (large woody debris, undercut banks, boulders, and macrophytes), pools, gravel and overhead riparian cover (rating of good to excellent when using Simonson et al. (1993) quantitative habitat assessment for Wisconsin streams). Riparian forest maturing naturally, to include conifers co-dominant with hardwoods. The floodplain reconnected to the stream.

7) Whittlesey Creek Reaches 6 and 7: Sediments entering the stream from this reach significantly reduced.[15] Complex in-stream habitat with good cover (large woody debris, undercut banks, boulders), especially good pool structure and overhead riparian cover (rating of good when using Simonson et al. (1993) quantitative habitat assessment for Wisconsin streams). Riparian forest maturing naturally, with conifers co-dominant with hardwoods. Stream water temperatures below 70 °F.

[12] Manning's roughness coefficient represents the resistence to flood flows in a stream channel. A streambed with a lot of debris, boulders, rubble or vegetation will have a higher roughness coefficient. A rough stream will slow flood flows and the erosive power of a stream. The Manning's coefficient of 0.6 corresponds to a stream with a large amount of large woody debris. North Fork Reach 2 is the most important stretch for increasing channel roughness in the Whittlesey watershed.

[13] Overland flow is also referred to as sheetflow. It is surface runoff from rain that is not absorbed (infiltrated into the ground) but insead fills small depressions and runs downslope into streams. In the SWAT model, the overland flow is related to vegetation type and soil type.

[14] Refuge staff will consider each habitat variable on a case-by-case basis and use those that fit well with Whittlesey Creek specifically and Bayfield peninsula streams generally.

[15] We will need to complete a sediment transport study to give us amounts of sediments that are entering and flowing through the system. Then we can set quantifiable objectives for this reach.

8) North Fork Reach 1: Same as Whittlesey Creek reaches 3 - 5.

9) North Fork Reach 2: Adequate fish passage between North Fork Reaches 2 and 3, without creating incision problems below Cozy Corner Rd. Complex in-stream habitat with good cover (large woody debris, undercut banks, boulders, and macrophytes), pools, gravel and overhead riparian cover (rating of good to excellent when using Simonson et al. (1993) quantitative habitat assessment for Wisconsin streams). Riparian forest maturing naturally, with conifers co-dominant with hardwoods.

10) North Fork Reach 3: Large upstream wetland protected and maintained.

Objectives for Terwilliger and Little Whittlesey Creeks Within the Refuge:

Within the next five years, the Service will have determined the potential to restore Little Whittlesey and Terwilliger Creeks as tributaries to Whittlesey Creek within reach 2, as they may have done historically.

Strategies for Whittlesey Creek Within Refuge:

Clear, quantifiable strategies cannot be identified for the stream within the refuge until a sediment transport study is completed (objective 1, page 45). This study will not only identify quantity, flow and deposition of sediments, but will also provide recommendations for how to meet our objectives for reaches 1 and 2. In the meantime, broad strategies are placeholders for future, specific strategies. Many private lands strategies will also apply to appropriate habitats within the refuge.

Stream Strategy 1: Reach 1 – Investigate the possibility of removing spoil banks that were deposited when the stream was channelized, along with other man-induced barriers, to allow the stream to meander within the floodplain.

Stream Strategy 2: Reaches 1 and 2 - Restore natural stream channel as recommendations are provided in the sediment transport study (objective 1, page 45).

Stream Strategy 3: Reach 2 – Improve stream habitat in conjunction with or in addition to natural stream channel restoration work. Determine specific work to be conducted as part of stream restoration design.

Strategies for Whittlesey Creek on Private Lands[16]:

Private Lands Strategy 1: Slow overland flow

This strategy will help fulfill objective 3 (page 40) regarding slowing overland flow by increasing surface "roughness." Upland roughness can be increased by adding obstructions that will slow water as it flows over the watershed's clay soils. Wetlands, wooded land,

[16] All strategies on private lands will be conducted with willing landowners who voluntarily agree to work with the Service and other partners to participate in habitat projects. Also, these projects will be limited to the surface-drainage portion of the watershed.

surface micro-topography, and shrubs are examples of such obstructions that reduce flow (Lenz et al. 2003; Fitzpatrick et al. 1999) and can also be good wildlife habitat. The Service will work with willing landowners and other partners to add these features in appropriate places. The Service, in cooperation with partners, will rerun the SWAT model (from Lenz el al. 2003) and the watershed health/open lands model[17] (Kroska 2005) adding restored habitat features to determine if we can sufficiently increase overland roughness to slow the flow. We will also analyze our actions on a subwatershed basis to help set priorities. Until these models are rerun, we will give priority to uplands around North Fork 2 and Whittlesey Creek 6 and 7 reaches. This is also the highest priority strategy to implement.

Private Lands Strategy 1a: Restore wetlands and create detention ponds.

Private Lands Strategy 1b: Plant trees and shrubs on abandoned fields and open lands (new clearcuts), encouraging conifers such as red pine, white pine and white spruce, as much as possible.

Private Lands Strategy 1c: Restore hydrology of old fields (by filling old ditch networks) that were leveled and drained, but are no longer used for agriculture.

Private Lands Strategy 1d: Experiment with other new techniques as they are developed (infiltration ponds, detention wetlands, etc.)

Private Lands Strategy 2: Reduce gully erosion

This strategy will help us meet the sediment reduction goal (page 45). Measurable objectives were not developed for this goal, but practices to reduce sediment inputs can still be implemented. The Bayfield Peninsula Stream Assessment report noted that gully erosion of tributaries, especially those near open land, is a source of sediments into Bayfield streams (inter-fluve and Graber 2003). Inter-fluve inc. also provided recommendations for actions that can reduce erosion and restore hydrology to these tributaries. One of their recommendations is incorporated into this plan: that the Wisconsin DNR's best management practice of 35 foot no-harvest buffers around intermittent streams (Wisconsin DNR 1995) be increased to 50 feet for Whittlesey Creek because of steeper slopes and heavy clay soils. They also recommended a selective harvest buffer (no clearcuts) within 300 feet of intermittent streams in the Whittlesey watershed.

Several landowners in the Whittlesey watershed have replaced stream and tributary crossings that were eroding and/or causing increased erosion downstream of the crossing. Additional opportunities to stem erosion from gullies, either at crossings or elsewhere likely exist. The Service will work with interested landowners and partners to provide technical and financial assistance to fix such sites. Priority will be given to problems that affect Whittlesey Creek reaches 6 and 7, and North Fork reaches 2 and 3.

[17] This model was developed in 2004 and 2005 as part of the project titled: Comparative Analysis of Subwatersheds in the WI Portion of the Lake Superior Watershed. The project is a joint effort of the Wisconsin Coastal Management Program (Wisconsin Department of Administration), the Great Lakes Protection Fund (Wisconsin DNR) and the Ashland/Bayfield/Douglas/Iron Counties Land Conservation Department.

Private Lands Strategy 2a: Identify roads that cross stream tributaries or are near the stream bank. Note crossings and roads that are exacerbating gully erosion, and restore hydrology and habitat to reduce erosion where possible.

Private Lands Strategy 2b: Identify other gully erosion problem areas, such as those created by field drainages, and use appropriate technology to fix them.

Private Lands Strategy 2c: Encourage no-cut zones of at least 50 feet around steep gullies and tributaries and recommend selective harvest within 300 feet of them.

Private Lands Strategy 2d: Where there are no trees near steep gullies, tributaries, and high terraces, plant buffer zones of trees and shrubs that are at least 100 feet wide (interfluve inc. and Graber 2003).

Private Lands Strategy 3: Reduce bank and slump erosion

This strategy will also help meet the sediment reduction goal (page 45). There are a few locations that have large slumps creating substantial bank erosion. The Service is not suggesting that we armor banks that are eroding – that is often counterproductive to stream dynamics and if not done correctly, will reduce in-stream habitat. There are some locations, however, where proper technology can reduce erosion from slumps. U.S. Geological Survey has successfully installed flow-deflecting vanes[18] in the North Fork of Fish Creek to stop erosion from 100 foot tall banks (Fitzpatrick et.al, 2004). The Service and Partners have incorporated large woody debris to stabilize a slump that was eroding in reach 5 of Whittlesey Creek. The partners do not know yet whether that action will be successful. All actions to reduce slump erosion must be carefully designed and placed appropriately.

Private Lands Strategy 3a: Identify locations of bank slumps that add large sediment loads and use appropriate technology to fix them.

Private Lands Strategy 4: Install large woody debris and riffle grade structures in appropriate areas to reduce flood power.

This strategy will help meet objective 2 regarding channel roughness (page 40) under habitat goal 1. Flood power is a function of water's specific weight, flow and channel slope. When the roughness of the channel increases, flood power is reduced. Inter-fluve inc. and Graber (2003) note that prior to settlement, channel roughness was likely very high due to complex log jams in the channel and floodplain. The addition of properly sized and placed log jams is an appropriate means to add channel roughness to Bayfield peninsula streams. Whittlesey Creek has substantial access difficulties, with steep slopes and few roads to the creek. This confounds large woody debris projects in Whittlesey Creek. One project has been done where Whittlesey Creek flows through Galligan Farms in Reach 5. There are likely other locations that are possible large woody debris project sites if landowners are interested. The

[18] Vanes are vertical plates that protrude from a stream-bed about one-third of the bankfull depth, are oriented at an angle to the local stream velocity, and are distributed in a group along the stream near the eroding bank. They deflect the flow and cause sedimentation at the toe of a cut bank, preventing further undercutting and helpint to stabilize the bank.

best location for these projects is above the regional groundwater discharge area (upper end of reach 5, reaches 6 and 7), where excess sand can accumulate and not affect spawning sites.

Private Lands Strategy 5: Protect groundwater discharge areas by purchasing conservation easements from willing sellers.
The largest groundwater discharge area (about 18 cfs) is located around the confluence of Whittlesey Creek and the North Branch (Lenz et al. 2003). These groundwater upwellings are also important spawning and nursery areas for trout and salmon in Whittlesey. In-stream habitat is better here than anywhere else within the drainage, but there remain limiting factors, such as shallow pools and sparse overhanging vegetation (inter-fluve, inc. and Graber 2003). Much of the riparian vegetation is nearing maturity (70 to 80 years old), and could be a good source of large woody debris.

The most effective means to protect this groundwater discharge area is to leave it alone. An appropriate easement would restrict any activity such as trails, roads, buildings, and logging within and near the discharge area. Easements are purchased only from willing landowners.

Private Lands Strategy 6: Purchase development rights from willing landowners on lands with development potential that are located in sensitive portions of the watershed.
The SWAT analysis showed that daily mean flow on peak flood days would increase up to 12 percent if the basin were developed to 25 percent urban (Lenz et al. 2003). Whereas this substantial change from rural residential and agriculture to urban is not likely to happen within the next 20 years, concerns remain about roads that increased housing development could bring. Roads channelize flows and often increase erosion and sedimentation. Housing development often fragments habitats, which can reduce wildlife populations that require large blocks of habitat. Human habitation will bring in domestic cats and dogs that prey on wildlife. The Service will therefore purchase development rights from willing landowners, especially in the upper portion of the watershed.

Private Lands Strategy 7: Find or develop a program that provides incentives and technical assistance for sustainably managing forests along riparian corridors and upland buffers.
Retention of existing forest cover in the basin will help keep peak flows at current levels.[19] Most landowners obtain income from their forests, and if they are following a management plan, are also required to harvest timber to improve stands and diversity. The Service will encourage the use of existing state programs to maintain sustainable forestry, but not all forest lands are or can be included in state program. The Service proposes to work with partners to provide additional incentives to either forgo timber harvest in some areas, such as steep slopes, or to provide an additional means to manage forests. It will be important to include tributaries of Whittlesey Creek in this program. It will also be important to emphasize growth of conifers, such as white pine, red pine, white spruce and white cedars, as much as possible. Mature trees will eventually fall into the stream bank to provide large woody debris.

[19] Increasing forest cover is provided in strategy 1b.

Habitat Goal 2 - Sediments: Reduce sediment loads into Whittlesey Creek to historic (pre-European settlement) range of variability.

Sediment Objective:

Within the next five years, conduct a sediment transport study to determine the amount and supply of sediment load in the stream, and to determine the proper sizing and geomorphology of Whittlesey Creek through the refuge.

Habitat Goal 3 – Floodplain and Wetland Hydrology: Restore to the extent possible floodplain function in the coastal wetlands and floodplains of the refuge.

Hydrology Objective:

Restore habitat by reconnecting the floodplain to the stream and allowing overbank flooding onto all stream floodplains within the refuge at least once a year.

Hydrology Strategy 1: Within the next five years, review road and bridge infrastructure within the refuge to identify how transportation needs and habitat restoration needs can overlap.

Hydrology Strategy 2: Within the old golf course, remove fill, especially in areas that have high groundwater to restore flooded conditions. Consider re-contouring the bottoms of some of the deep ponds to provide one-half to three feet of water.

Habitat Goal 4 – Floodplain Habitat: Restore native species composition of trees and shrubs in the floodplain that will provide heterogeneous vertical and horizontal structure for migratory bird habitat.

Floodplain within the refuge includes lowland forest, lowland shrub, riparian forest and coastal wetland. These habitats can provide for several species of concern: northern waterthrush, veery, northern black current, marsh horsetail, and black duck. The habitat objectives for lowland forest and shrub are based on habitat needs of veery.

Objectives for Lowland Forest and Shrub:

Over the next 50 years, aim for a mosaic of native trees and shrubs, both deciduous and coniferous, that provide a relatively open tree canopy (25 to 60 percent canopy cover) and a dense shrub canopy cover (25 to 50 percent). Habitat patches should be at least 250 acres contiguous with adjacent Wisconsin DNR and Northern Great Lakes Visitor Center lands.

Objective for Riparian Forest:

Remove exotic trees and shrubs and restore native tree and shrub canopy cover at a rate that provides a 75 percent canopy cover on the stream through the refuge; allow these trees to mature and drop into the stream to produce large woody debris.

Objective for Coastal Wetland:

Eliminate invasive plant species and allow the native plants to follow a natural successional pathway.

Coastal Wetland Strategy: Eliminate invasive species according to invasive free zone objectives and strategies, and provide native species restoration when necessary and possible.

Strategies for Floodplain within the Refuge:

Floodplain Strategy 1. Replace reed canarygrass with native species.
Floodplain objectives are to restore hydrology (page 45) and native species (see objectives under floodplain habitat goal, page 45). Over 50 percent of the floodplain is infested with varying densities of reed canarygrass, which seriously inhibits native species growth. This invasive species is most prevalent where land had been logged, drained, farmed and then abandoned. Reed canarygrass was likely planted for cattle forage in some of these fields. Reed canarygrass has dominated these fields for many years, so the seed bank will be very dense.

The Service's goal is to eliminate all invasive plant species on refuge and Northern Great Lakes Visitor Center lands. A more detailed description of the invasive project is provided later (page 47). The invasive species inventory, and control and monitoring plan will be appended to this document once it is completed (late 2006). That plan will provide details on location and timing of strategies recommended in this section.

Recent studies of reed canarygrass have provided excellent guidelines for its control and for restoring native species in its place (Reinhardt and Galatowitsch 2004; Tu 2004). It is expected that reed canarygrass control will take several years. The Service's preliminary strategy is to:

- Annually treat reed canarygrass as seed heads emerge, typically in August, with Rodeo or a similar glyphosate herbicide using selective (weed wiper) application techniques. At this growth stage the species is most susceptible to systemic herbicides.
- Continue annual herbicide application to control both established plants and new plants arising from the seed bank. Monitoring, described below, will guide the decision to discontinue herbicide treatment and proceed with habitat restoration.
- Remove the duff layer, either by mowing or burning during the year prior to habitat restoration.
- Till to prepare for planting.
- Replant to adapted woody and herbaceous native species. Lists of such species will be developed for use in various floodplain locations.

Floodplain Strategy 2. Plant native conifers along stream corridor.
Plant red pine, white spruce and other adopated conifers interspersed with hardwood shrubs and trees. Plant cedar and hemlock in patches that can be protected from deer browsing with techniques such as exclosures or repellent sprays.
Note: This strategy should not be implemented until decisions have been made on stream and floodplain hydrological restoration.

Floodplain Strategy 3. Allow natural succession to take place.
Some areas within the floodplain are dominated by native species. Native trees and shrubs are reestablishing themselves in former agricultural fields that haven't been in production for many years. Where native species make up greater than 50% of the tree and shrub canopy, plants will be left alone to follow natural successional pathways. Where trees and shrubs make up less than 50% of the canopy, but where it appears their cover is increasing, consider allowing natural succession to take place. Where appropriate, speed succession by inter-planting swamp conifers such as cedars and protect them from deer browsing with exclosures or repellent sprays.

Strategies for All Refuge Lands and Habitats - Invasive Free Zone Development:
The U.S. Fish and Wildlife Service, U.S. Forest Service and partners of the Northern Great Lakes Visitor Center (Center) are establishing the Whittlesey Creek NWR and the lands of Center as a model Invasive Free Zone, covering 720 acres. The model will include inventory and control of terrestrial and emergent aquatic plants that are non-native invasives, along with an education program about invasive species. The project will integrate inventory and control programs of two federal agencies on their adjacent lands and cooperate with private landowners to participate in inventory and control efforts. The Center will be used as a platform to demonstrate invasive species control and prevention, as well as native habitat restoration.

The Invasive Free Zone includes: inventory of invasive species known or suspected to be present, initial control of targeted species that are present, development of a plan to prevent further spread on Invasive Free Zone lands, development of education and interpretive programs to be given at the Center, and presentation of the project's successes and failures to Lake Superior basin agencies and interested parties. Future work will include: continued control and prevention of newly-found invasive species on federal and private lands, additional delivery of education and interpretive programs at the Center and refinement of our model based on successes and failures. Our experience and results will be used to produce a "case study" which will be circulated widely to serve as a template for other interested parties.

Invasive Free Zone Strategy 1: Comprehensive inventory of terrestrial and emergent aquatic plant invasive species.
Standardized methods will be used to ensure systematic GPS mapping and documentation of invasive species. All collected data will be managed via the refuge's geographic information system.

Invasive Free Zone Strategy 2: Control of known invasive species
Target exotic buckthorn, exotic bush honeysuckle, purple loosestrife and reed canarygrass for initial control. Generally, the following techniques will be used:

- Buckthorn and Honeysuckle – Cut stems and apply herbicide to the stumps. Marking paint will also be applied to monitor treatment efficacy.
- Purple loosestrife – Large infestations are found at the mouth of Whittlesey. Smaller infestations are found along road rights-of-way. Control larger infestations with *Galerucella sp.* beetles. Small infestation will be treated with Rodeo or similar herbicide using selective (weed wiper) application techniques.
- Reed canarygrass – Strategies are provided in the Floodplain strategy section (page 46).

Invasive Free Zone Strategy 3: Design a monitoring program for all species.
Monitoring will be targeted by species. Spatially referenced locations will be established for long-term monitoring of invasive control and habitat restoration results. Monitoring techniques will include transects, quadrats, photo-points and possibly aerial photo interpretation. Monitoring will guide follow up control, restoration and maintenance efforts.

Invasive Free Zone Strategy 4: Develop a plan for prevention of spread and future control.
A thorough literature search, consultations and experience will guide the U.S. Fish and Wildlife Service and the U.S. Forest Service in formulating prescriptions to eradicate terrestrial and emergent aquatic invasive plant species within the Invasive Free Zone. The plan will include recommended techniques, a control schedule, expected costs and a monitoring program as described above. Restoration of appropriate native flora will be included. The plan will also identify and incorporate additional partners for the project.

Invasive Free Zone Strategy 5: Demonstrate lessons learned and provide education about invasive species.
The partnership between federal agencies and private landowners within the refuge, as well as educational opportunities provided at the Center, make this an ideal setting to demonstrate this model of cooperation and to educate visitors about the need to stop invasive species. An education program will be developed cooperatively with the U.S. Forest Service and partners of the Center.

Invasive Free Zone Strategy 6: Promotion
A plan to market the project beyond our boundaries will be developed that will include outreach to other agencies and organizations who can lead future prevention and control efforts.

V. Monitoring

A separate monitoring plan will be completed and attached to this document at a later date. However, a general description of expected monitoring is included to provide guidance in the meantime.

Monitoring is based on resources of concern identified in the HMP and objectives developed to meet the needs of resources of concern. Where possible, objectives are stated in measurable terms, such as numbers of fish or quality of habitat. Where objectives are not measurable, the Service will continue with applicable studies, such as sediment budgets for streams; or with wildlife surveys, such as wood turtle inventories.

Our monitoring will initially focus on stream hydrology and habitat, fish populations, bird populations, wildlife habitat and terrestrial invasive species.

A. Stream Hydrology

Measurement

Objectives for reducing peak flows are tied to the measurements derived from the Soil and Water Assessment Tool (SWAT) modeling done for Whittlesey Creek by U.S. Geological Survey (Lenz et al. 2003). This model provides two specific measurements that will be tracked over time: 1) Overland roughness coefficient for upland habitat restoration. The target number is 0.5 2) Manning's roughness coefficient for in-stream channel roughness. The target number is 0.06. In addition, average flood peaks will be tracked from gauging station data. Our objective is to reduce peak floods by 20 percent over 30 years.

Monitoring Strategy

The SWAT model is GIS based. New data will be inputted into the SWAT model and rerun every five years, beginning in 2007. Acreage of habitat restored, best management practices installed, and updated soils information will be added to the model data. It will be run using a one hour or 15 minute time step. Aerial photography (currently available from 1995, 2000 and 2005) will be interpreted to update other land cover data such as new buildings, roads, and other habitat changes that are not habitat projects. Overland roughness coefficient will be recalculated based on updated land cover. Manning's roughness coefficient will be updated based on in-channel roughness projects completed. This new data will be used to re-run the SWAT model and re-calculate peak flows. Peak flows will also be tracked from streamflow-gage station data, but our ability to measure trends using gaging station data is limited because there is no historical streamflow information; the station was installed and began collecting data in 1998.

B. Stream Habitat

Measurements

Fish stream habitat objectives are based on the Fish Habitat Rating System (Simonson et al. 1993) for stream fishery habitat. This system uses habitat features such as cover, pool area, fine sediments and riparian buffer width that are measured and placed into models that rank habitat condition from poor to excellent. The system was developed specifically for Wisconsin streams and was recommended by the experts who attended the stream restoration meeting that took

place on February 23, 2005 (Appendix C). Refuge staff will attempt to use all measurements recommended, but might modify them slightly based on logistics and in consultation with statisticians.

Monitoring Strategy

Refuge staff will use permanently established monitoring stations to track habitat changes over time. Two stations are established within the refuge to track bed and bank erosion/accretion, and habitat measurements will be added to those two stations. In addition, six or more stations will be added on Whittlesey Creek and North Fork of Whittlesey, at least two on Terwilliger Creek, and three on Little Whittlesey Creek. Habitat measurements will be collected according to Simonson et al. (1993), but each index will be ranked separately. Adjustments that might improve the accuracy of the index for refuge streams will be made as staff tests and learns the system.

C. Fish populations

The brook trout experiment (U.S. Fish and Wildlife Service and WI Department of Natural Resources 2003) specifies how coaster brook trout and other fish populations will be monitored. The brook trout monitoring plan will be implemented by the Ashland Fishery Resources Office of the Service.

D. Breeding Birds

Measurement

Number of territorial males of songbirds and presence of secretive marsh birds will be used to track breeding bird populations on the refuge and in the watershed. Monitoring will focus on bird species of concern: veery, northern waterthrush and sora rail. Black duck is also identified as a waterfowl species of concern. Once a regional waterfowl monitoring protocol is developed for refuges, refuge staff will begin to monitor breeding populations of black duck. Until then, incidental sightings seen during other surveys will be recorded.

Monitoring Strategy

Breeding bird point count surveys will follow Region 3 protocols, but will be modified to fit within the protocols suggested for the Great Lakes (Howe et al. 1998), for tracking songbird populations over time. Points will be randomly selected within all habitats of veery and northern waterthrush in the watershed. Point sample size is not large enough to use standard statistical trend analysis, but the PRESENCE program, which tracks species detection probabilities and proportion of area occupied, can be used to estimate population trends. It uses analysis similar to mark and recapture techniques. It was developed by Daryl MacKenzie, based on his work to estimate detection probabilities of species and extinction rates (MacKenzie et al. 2002 and 2003).

Secretive Marsh bird survey protocols will follow National Wildlife Refuge standards once they are developed. In the meantime, the Great Lakes Marsh Monitoring Program protocols will be used. PRESENCE can also be used for this analysis.

E. Floodplain and Coastal Habitat

Measurement

Objectives are tied to several measurable units - hydrology, species composition and habitat structure. The objectives remain general or have a wide range of variability. A hydrological analysis, as part of the sediment transport study, will help identify restoration potential in the floodplain. General tree and canopy cover estimates will be used for breeding bird habitats until habitat needs for species of concern are refined.

Species composition will be tied to invasive species elimination. Native plants must replace the invasive species (Terrestrial Invasive Species section below).

Monitoring Strategy

Still in development.

F. Terrestrial Invasive Species

Measurement

The invasive free zone goal is to eliminate terrestrial plant and emergent aquatic invasive species. Restoration objectives are to replace the invasive species with native plant communities appropriate for the site. Presence of invasive species and the extent of coverage will be measured as part of the invasive free zone project.

Monitoring Strategy

General strategies have been developed for invasive species monitoring. All lands on the refuge fee-title area and the Northern Great Lakes Visitor Center will be inventoried. A ranking system will be assigned to sites that show extent of infestation. The data be collected with a global positioning system (GPS) and will be managed through a Geographic Information System (ARC-GIS), which will allow us to monitor changes of infestations over time. Specific monitoring strategies will be developed in 2006 and will be appended to this document.

VI. Required Resources

Item	Unit	Cost/Unit	One-time Expenses	20 year total
Gauging Stations (60% FWS, 40% USGS)	Station	$7,000		$140,000
Stream hydrology studies, inventories	Watershed	$200,000	$200,000	$200,000
Bridge replacement	Sq. foot + engineering	$65 + 50%	$415,350	$415,350
Road & culvert repairs for fish passage and floodplain hydrology	Pipe diameter - ft.	2000	$80,000	$80,000
Wetland restorations	acre	$1,000		$400,000
In-channel roughness	foot	$100		$2,400,000
Erosion control – bank and gully	foot	$60		$1,440,000
Buffers	Acre	$40		$320,000
Forestry BMPs & Stewardship planning	Acre	$15		$96,000
Engineering & Planning	Per Project Cost	15%		$650,300
Coordination – GS 0401-9/11	Salary & Expenses	$75,000		$1,500,000
Monitoring, including data base development and management	Annual	$50,000		$1,000,000
Easements	acre	$1,000		$1,000,000
Education	watershed	$10,000		$500,000
Invasive Species Elimination	Acre	$20		$40,000
Native Species Restoration	Acre	$400	$100,000	$100,000
TOTAL			**$745,350**	**$10,731,650**
COST PER YEAR				**$562,582**

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VIII. Appendices

Appendix A. Private Lands Programs Available in the Whittlesey Watershed

Agency[20]	Program Name and Acronym	Brief Description of Program
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife (Partners)	Working with others to restore and enhance fish and wildlife habitat on private lands. Restoring habitat for migratory birds, threatened and endangered species, interjurisdictional fish and other wildlife. Restoring habitat within the watersheds of our national wildlife refuges. Voluntary participation.
	Great Lakes Coastal Program	Restore degraded coastal wetland, upland, and stream habitats by working with partners to implement on-the-ground projects. It works through cooperative partnerships that identify, restore and protect habitat in priority coastal areas, working with a variety of partners, including conservation organizations and private landowners.
	Challenge Cost Share	Project that directly or indirectly benefit refuge lands: habitat restoration (wetlands, grasslands, in-stream, and riparian); invasive species control; environmental education and outreach. A cooperator and a minimum 50:50 cost share ratio are required from non-Federal sources. A cooperators match may consist of funds, materials, or in-kind services.
Natural Resources Conservation Service (NRCS)	Environmental Quality Incentive Program (EQIP)	This voluntary conservation program is for farmers and ranchers that promote agricultural production and environmental quality. NRCS in WI provides between 50 and 75 percent of the costs of eligible conservation practices. Incentive payments may be made to encourage a farmer to adopt land management practices, such as nutrient management, manure management, integrated pest management, and wildlife habitat management.

[20] Various non-profit organizations are also involved in financial and technical assistance for conservation projects, such as Trout Unlimited and Ducks Unlimited. They are not included in this summary.

Agency[20]	Program Name and Acronym	Brief Description of Program
	Wildlife Habitat Incentive Program (WHIP)	WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, NRCS provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat.
	Wetlands Reserve Program (WRP)	WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection through 30 year or permanent easements.
	Conservation Reserve Enhancement Program (CREP)	CREP is a voluntary program for agricultural landowners. Through the CREP, farmers can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible land. A stream buffers program is available for the Lake Superior watershed in Wisconsin.
Wisconsin DNR	Managed Forest Law (MFL)	MFL is intended to foster sustainable timber production on private lands. Landowners receive a property tax break for enrolling. A portion of the tax is recouped by the state when timber is harvested. Specific qualifications apply.
	Forest Legacy Program	FLP identifies and protects environmentally important private forestlands threatened with conversion to nonforest uses - such as subdivision for residential or commercial development. To help maintain the integrity and traditional uses of private forest-lands, the Forest Legacy Program promotes the use of conservation easements. Landowners must complete a detailed application process and compete with other applications.
	One-time grants	Several grants are available for partnership efforts, such as Great Lakes Protection Fund, Private Lands Grants, and State Wildlife Grants. These might be available for specific conservation projects on private lands.
	Nonpoint Source Water Pollution Abatement Program	Whittlesey Creek was designated as a priority watershed in 1991. A plan was written and nonpoint source conservation practices were implemented cooperatively. The funding for the Whittlesey watershed will expire in 2006.

Agency[20]	Program Name and Acronym	Brief Description of Program
Bayfield County Land Conservation Department	Whittlesey Creek Priority Watershed Project	Same as above, but County provides some of their funds and the state Dept. of Agriculture, Trade and Consumer Protection (DATCP) also provides funding. The County has taken the lead role in coordinating conservation efforts in the watershed.

Appendix B. Whittlesey Creek Oral History Interviews: An Overview

Compiled by Kat Hentsch, U.S. Fish and Wildlife Service

1. History of the interviews
    - The Whittlesey Creek oral history interviews were begun as a method of recording a history of the refuge and adjacent areas as experienced by long-term residents of the area.
    - Seven students from Northland College (including a FWS student employee) and Pam Dryer, Manager of Whittlesey Creek National Wildlife Refuge attended an oral interview training session led by Mary Rehwald of Northland College in February of 2003.
    - Long-term residents of the Whittlesey Creek area were interviewed between February and October of 2003 in five interviews. They included: Nick Rouskey, Helen and Jerry Jack; Hazel, David, and Carol Wickstrom; Denis Schramke, and Bill Chingo. John Buvala was also interviewed, but due to a malfunction in the tape, the interview was not recorded. The locations where these individuals lived in the area are available on a map through the Fish and Wildlife Service.
    - Currently, all these interviews are transcribed into text (but unedited) and are available, either via hard copy or electronically, upon request at refuge headquarters.

2. Topics and findings of the interviews
    a. Flooding
        - Two major floods occurred in the 1940's: the floods of 1942 and of 1946
        - The flood in 1946 washed away Long Bridge on Highway 2 over Fish Creek. The bridge was rebuilt in 1947, but a temporary pontoon bridge was in place until the new bridge was finished. In Ashland, at 15th Ave. West and 3rd St., a culvert in Bay City Creek washed out. Homes lining Bad River in Odanah were destroyed, as were many roads in Mellen. This flood also removed the railroad bridge over Terwilliger Creek and a tavern at the convergence of Fish and Pine Creeks near Moquah by the name of Fish Creek Annie's.
        - The flood in 1942 also washed out Long Bridge and did considerable damage to the cemetery in Bayfield, causing caskets to surface and flush downstream.
        - Between Whittlesey Creek and Little Whittlesey on the Wickstrom's property, the entire property/hayfield between the creeks flooded regularly in the spring. Often the water would flow over Wickstrom Rd.
        - Flooding may have increased after the Army Corps of Engineers' modification of the Whittlesey Creek channel.
        - Excerpt from Nick Rouske's interview:
          "In 1942 and in 1946 we had 2 tremendous floods. Those you could probably pick up and read about probably through the archives of the Daily Press. There was some terrible flooding. The one in '46 is the one that pretty much spelled the demise of Whittlesey Creek; that, plus the fact that the Corp. of Engineers came in here and really did it in, because they decided to cut new channels for it, and new stream bed. That was really, basically, the end of the stream, as far as I can say;

as far as a stream that would produce like it had in the past. From the second bridge on Cherryville Rd. they just made a horseshoe out of it, and when it got to the highway they cut it straight to the lake. That stream filled in so fast, and the lake, well, that's the way it is right now, down at the mouth: it is so filled in. In fact, where I live, I can walk down on the end of my place and stand on dry land where, when I was a kid, we used to fish Northern Pike in 8 feet of water. The bay out here has filled in just tremendously. It's the same way – the bridge that runs over Fish Creek over here at the bay – that was taken out; the flood was so bad, it was taken out in '42, and then it was taken out again in'46. When I was a kid, my buddy and I used to sneak over there fishing. In '47 they built a new bridge, but in 1946 we had a pontoon bridge across there. In '47 they built a new bridge, and it was an iron structure, and my friend and I used to sneak over there and fish off of it while the iron workers were putting this thing together, and they used to get just wild with us, because the seiche or the current in there was so strong that if you ever fell in…and they were screaming at us, because there was 27 feet of water under that bridge at that time. Those sloughs that run up to the south and southwest of there used to average from 10-14 feet; now I think you can walk anywhere in there. It just gives you an idea. The same way out in front of the Marine Bar there – you can walk for half a mile, and it wasn't that long ago, it was maybe in the 70's, I used to fish trout out there in 12 feet of water. It gives you an idea of how things change."

b. Creek modification
   - In 1949 the Army Corps of Engineers made an attempt to control flooding in Whittlesey Creek by changing its course. The area between the Wickstrom Rd. bridge and the Highway 13 bridge was made into a large horseshoe, and from the Highway 13 bridge to the lake, Whittlesey was dredged in a straight line east.
   - The construction of the Highway 2 bridge over Fish Creek (Long Bridge) caused a "levee"-type situation, which decreased the flow out of Fish Creek. Before the bridge was built, the Fish Creek outlet was around 27 feet deep – this allowed the sediment carried in the creek to wash farther out into the bay because of strong currents. The bridge slowed water flow and therefore sediment built up – creating the Fish Creek Sloughs and the sand bars at its mouth.
   - In the mid-1940's, Ashland Construction built the Marine Club on the sand bar created to reroute Highway 2 along the lake front.
   - In 1990's, a contractor attempted to create a gravel pit/mine in the headwaters of Whittlesey Creek on the North Fork. This action was discovered and curbed by concerned members of the Town of Barksdale and the DNR.
   - Modification via dumping:
     - The course of Whittlesey Creek at the Ondossagon Rd. bridge was altered by a former landowner by dumping junk cars into the creek and filling it in using a bulldozer.
     - A trolley car from the former Ashland trolley was transported to the former Jack residence on Whittlesey Creek for use as an apartment for Helen Jack. After years of being unused, erosion of the stream bank upon

which the car sat caused it to fall into the creek. Sediment gradually covered the car, and only a portion of it is still exposed today.

c. Water quality
    - Whittlesey Creek was the main source of water for those living on it. Others in the area had spring-fed wells. Some local taverns, like the Scottie Club, used the creek water as well.
    - There was an increase in sediment deposition and erosion after the modification of the stream bed.
    - Cattle that were allowed uncontrolled access to the streams increased erosion of the stream banks and increased the runoff pollution in the creek. A program in the 1950's addressed this problem by encouraging farmers to fence off the stream from the cattle except in designated crossing areas designed to keep erosion to a minimum.
    - The Mountain Valley cheese factory on Ondossagon Rd. released by-products, whey, into Little Whittlesey Creek. The whey caused an unpleasant odor in the water, a tacky buildup on vegetation along the creek, and fish death.

d. Fishing
    - There were many species of salmonids in Whittlesey Creek. The trout included native brook trout and introduced German brown and rainbow trout. The introduced salmon also spawned in Whittlesey, including Coho and Chinooks. This made Whittlesey a popular fishing spot.
    - Smelt navigated into Lake Superior via the St. Lawrence seaway. Shortly after their introduction their population exploded, and many came from as far as Rhinelander to partake in smelting. It became a tradition in the area every spring to catch smelt in the bay, including the mouth of Whittlesey, and have raging bonfires prepared on the beach. Now their populations have reached a more sustainable level and the smelting is considered by some to be less productive than in prior years.
    - Northern Pike used Terwilliger and Fish Creeks for spawning.
    - After the modification of the creek's course, the increase of sediment deposition in the stream bed downstream of the Highway 13 bridge caused the water level to become too low for most spawning trout and salmon to enter the stream. Interviewees noted that a period of years passed when young salmonids in the stream were reduced because of this.
    - The interviewees also noted that the two large floods in the 40's contributed to a decline in fish in the streams.
    - A weir was installed in Fish Creek by the Bureau of Commercial Fisheries Biological Laboratory in 1957-1960 to prevent the migration of Sea Lamprey into the creek to spawn. However, spawning salmonids would often attempt to cross the barrier to reach spawning grounds and be killed by the strong electrical current.
    - A large amount of sand has been deposited in Chequamegon Bay over the last few decades. Before that, fishermen were able to take larger boats directly into Fish Creek because the channel, and the majority of the bay, was much deeper.

- Beavers at one point created a barrier in Whittlesey Creek and the salmonids were no longer able to migrate upstream. Flooding has since destroyed that dam, but beaver activity remains on Whittlesey.

e. Animals in the Whittlesey area
   - Sharp-tailed grouse populations were high during the days of small dairy farms.
   - Small numbers of bobcats were located around Whittlesey Creek.
   - Badgers, skunks, and other predators often claimed poultry of local farmers.
   - Fishers were introduced and became common in the area, after feeding on the porcupine population. Landowners commented on the reduction of porcupines.
   - Red fox populations seem to have decreased, whereas bear populations seem to have increased.
   - Deer populations seem to have increased over the years. Some commented that the decrease in snowfall over the years has allowed the population to increase, and the migration into "deer yards" has decreased.

f. Vegetation change
   - The Whittlesey headwaters and the surrounding "barrens" were clear-cut at the turn of the century. This made blueberry production very high and therefore it was a tradition in the area. The main tree species logged out of the area was white pine, and after logging they would burn the area. Local residents would collect charred pine stumps for firewood.
   - Most of the land was farmed. Crops planted for livestock included oats, corn, alfalfa, barley, wheat, and an invasive accidentally planted with hay: mustard.
   - "Popple" trees, most likely an aspen species, were common, and were harvested for firewood.
   - A common food crop raised was rutabagas. Others included peas, potatoes, beets, and carrots. Many people also had apple orchards, the remnants of which can still be seen today.
   - There were a few common tree species in the bottomland areas. By far, the most abundant and large tree was the American elm, which was wiped out by the introduction of Dutch elm disease. Along Whittlesey were chokecherries, red maples, "popple", and birch. After the death of large canopy elms, more species like alder, raspberry, and willow took over.
   - Some common spring wildflowers along the creeks included violets, marsh marigold, and buttercups.
   - Many of the large trees currently lining Whittlesey Creek were planted by prior landowners.
   - Jack Pine was planted to replace logged trees in the barrens in the 1930's.
   - Overall, almost all landowners interviewed agreed that the land was much more open during their days living on Whittlesey. The main change to them has been an increase in "brush" and shrub-scrub undergrowth.

g. Climate change
   - Nearly all landowners agreed that the winters are both warmer and have less snow than in the past.

h. Roads and railroads

- In 1909, the only way to Duluth was through the barrens, on what is now Cherryville Rd., and was then Highway 10 and later Highway 2; this was paved in 1968. At this same time, Highway 13 (where it now intersects with Highway 2) ran almost flush to the lakefront at the head of the bay. Later, Highway 2 followed the current Highway 137 and connected near the shooting range south of the Northern Great Lakes Visitor Center.
- Terwilliger Rd. was known as Ashland Junction Rd., and Ondossagon was known as Town Rd. Ondossagon School was Barksdale High School; Terwilliger Creek was Spring Brook.
- There were many railroads in the area until the 1980's. The main line (Omaha line: western division) across Whittlesey ran parallel to Terwilliger/Wickstrom Roads and went up to Washburn and Bayfield. An older railroad, the Peirless Line, ran southwest from the corner of Terwilliger and Cherryville Roads. This railroad was not in operation some years prior to 1946. The east-west line from Ashland to Superior/Duluth was the Northern-Pacific. The line running south from the remaining Ashland ore dock is the Soo line. The Soo and Superior passenger lines met in Spencer. Today these railroad grades, with the exception of the Peirless line, are snowmobile trails. Others in the barrens are currently logging roads.

3. Conclusions

- Extensive changes have occurred within the past 100 years. Logging necessitated railroad construction, and with the construction of roads, this greatly dissected the landscape. The uninhibited use of land by cattle created erosion problems and increased runoff pollution in local creeks. Some of the invasive plants we find today are food crops gone wild after the farms dwindled or moved. Prior to modification, Whittlesey, Little Whittlesey, and Terwilliger Creeks were prime habitat and spawning grounds for the sport fish both native and introduced in this region. The modification of the creeks created new problems with sediment deposition and fish passage to spawning grounds, reducing the quantity of resident and migratory salmonids in the creeks. Two significant flood events also seemed to negatively affect fish populations in the creeks.
- Winter conditions have become milder in the past 100 years. Reduced snowfall and higher temperatures contributed to the lack of natural population reduction of deer. Other animal populations in the watershed have changed for many reasons, including fur trapping, reintroduction, and predation.
- The information collected from these interviews helps us determine historical hydrology, flora, and fauna, which we use to help guide our management decisions. Improvements in the Whittlesey Creek watershed could not be properly considered without the well-documented history of those that relied on it for generations.

Appendix C. Scientists who Met with the Service to Provide Expertise

The Service gratefully acknowledges the following people who gave us their time and expertise in their particular fields. We (refuge staff) did our best to take your advice, and in doing so, we hope that this work will be scientifically justified and practical to implement.

Vegetation and Community Ecology Meeting:

Jim Meeker	Ecology Professor, Northland College (1411 Ellis Ave., Ashland, WI 54806; phone: 715-682-1550)
Ulf Gafvert	Former Soil Scientist with Natural Resources Conservation Service, now with National Park Service (Great Lakes Inventory and Monitoring Office, 2800 E. Lakeshore Dr., Ashland, WI 54806; phone: 715-682-0632)
Faith Fitzpatrick	Fluvial Geomorphologist, U.S. Geological Survey (Research Hydrologist, Fluvial Geomorphology, USGS Wisconsin Water Science Center, 8505 Research Way, Middleton, WI 53562; phone: 608-821-3818)
Gary Walton	Botanist, Finite Earth Environmental L.L.C. (394 S. Lake Ave., Ste 306, Duluth, MN 55802; phone: 218-722-5566)
Mike Gardner	Former Whittlesey Creek Watershed Coordinator, now with Sigurd Olson Environmental Institute (Northland College, 1411 Ellis Ave., Ashland, WI 54806; phone: 715-682-1481)

U.S. Fish and Wildlife Service Representatives: Mike Mlynarek and Pam Dryer (Whittlesey Creek NWR, 29270 County Hwy. G, Ashland, WI 54806; phone: 715-685-2678)

Stream Habitat and Hydrology Meeting:

Jeff Gunderson	Fisheries and Aquaculture Extension Educator, Minnesota Sea Grant (Minnesota Sea Grant College Program, 2305 East 5th St., Duluth, MN 55812-1445; phone: 218-726-8715)
Dennis Pratt	Fishery Biologist, Wisconsin DNR (DNR Service Center 1401 Tower Ave, Superior WI 54880; phone: 715-392-7990)
Faith Fitzpatrick	Fluvial Geomorphologist, U.S. Geological Survey (see above listing)
Laura Hewitt	Watershed Programs Director, Trout Unlimited (222 S. Hamilton St., Ste. 3, Madison, WI 53703; phone: 608-250-3534)
Dr. Casey Huckins	Associate Professor in Biological Sciences, Michigan Tech (MTU, 1400 Townsend Drive, Dow 740, Houghton, MI 49931; phone: 906-487-2475)
Marty Melchoir	Fishery Biologist and Geomorphologist, inter-fluve, inc. (124 East Lake Street, Lake Mills, WI 54551; phone: 920-648-5500)

U.S. Fish and Wildlife Service contingent: Pam Dryer, Mike Mlynarek and Katie Goodwin (Whittlesey Creek NWR); Mark Dryer, Ted Koehler and Lee Newman (Ashland Fishery Resources Office, 2800 Lakeshore Dr. E., Ashland, WI 54806; phone: 715-682-6185)

Appendix D. Refuge Species Lists

COMMON NATIVE TREES, SHRUBS, GRASSES AND FORBS FOUND ON AND NEAR THE REFUGE

Common name	**Scientific name**
Conifers	
Northern white cedar	*Thuja occidentalis*
Balsam fir	*Abies balsamea*
Eastern hemlock	*Tsuga canadensis*
Jack pine	*Pinus banksiana*
Red pine	*Pinus resinosa*
White pine	*Pinus strobes*
White spruce	*Picea glauca*
Deciduous Trees and Shrubs	
Speckled alder	*Alnus rugosa*
Black ash	*Fraxinus nigra*
Green ash	*Fraxinus pennsylvania*
Mountain ash	*Sorbus americana*
Large-toothed aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Red-osier dogwood	*Cornus stolonifera*
Balsam poplar	*Populus balsamifera*
Paper birch	*Betula papyrifera*
River birch	*Betula nigra*
Yellow birch	*Betula lutea*
Box elder	*Acer negundo*
Choke cherry	*Prunus virginiana*
Pin cherry	*Prunus pennsylvanica*
American elm	*Ulmus americana*
Ironwood	*Ostrya virginiana*
Juneberry	*Amelanchier canadensis*
Red maple	*Acer rubrum*
Sugar maple	*Acer saccharum*
Meadowsweet	*Spirea alba*
Vibernum	*Vibernum sp*
Willow	*Salix sp*.
Grasses and Forbs	
Canada bluejoint	*Calamagrostis canadensis*
Slender sedge	*Carex lasiocarpa*
Common cattail	T*ypha latifolia*
Marsh horsetail	*Equisetum palustre*
Northern black currant	*Ribes hudsonianum*

INVASIVE PLANT SPECIES LIKELY FOUND ON THE REFUGE (bolded species confirmed to occur)

Common name	**Scientific name**
Reed canarygrass	***Phalaris arundinacea***
Bull thistle	***Cirsium vulgare***
Canada thistle	***Cirsium arvense***
Common buckthorn	***Rhamnus cathartica***
Crack willow	***Salix fragilis***
Glossy buckthorn	*Rhamnus frangula*
Exotic honeysuckles	***Lonicera spp.***
Purple loosestrife	***Lythrum salicaria***
Bird's foot trefoil	***Lotus corniculatus***
Red clover	***Trifolium pratense***
White clover	***Trifolium repens***
White sweet clover	***Melilotus alba***
Yellow sweet clover	***Melilotus officinalis***
Smooth bromegrass	***Bromus inermis***
Quackgrass	***Elytrigia repens***
Tall fescue	***Festuca elatior***
Common reed	***Phragmites australis***
Kentucky bluegrass	***Poa pratensis***
Leafy spurge	*Euphorbia esula*
Brown knapweed	***Centaurea jacea***
Spotted knapweed	*Centaurea maculosa*
Common tansy	***Tanacetum vulgare***
Ox-eye daisy	***Chrysanthemum leucanthemum***
Orange hawkweed	***Hieracium aurantiacum***
Yellow hawkweed	***Hieracium caespitosum***
Wintercreeper	*Euonymous fortunei*
Wild parsnip	*Pastinaca sativa*
Common burdock	***Arctium minus***
Orange day lily	***Hemerocallis fulva***
Butter-and-eggs	*Linaria vulgaris*
Periwinkle	*Vinca minor*
Chicory	*Cichorium intybus*
Lily-of-the-valley	*Convallaria majalis*
Crown vetch	***Coronilla varia***
Queen Anne's lace	*Daucus carota*
Creeping Charlie	*Glechoma hederacea*
Common St. John's-wort	*Hypericum perforatum*
Curly cock	*Rumex crispus*
Watercress	*Nasturtium officinale*
Canada bluegrass	***Poa compressa***

Field bindweed	*Convolvulus arvensis*
Forget-me-not, garden	*Myosotis sylvatica*
Forget-me-not, aquatic	*Myosotis scorpioides*
Common mullein	***Verbascum thaspus***
Bishop's goutweed	***Aegopodium podagraria***

MAMMALS

Common name	**Scientific name**	**Listing**	**USFWS Region 3 Priority**
Virginia Opossum	*Didelphis virgiana*		no
Northern Short-tailed Shrew	*Blarina brevicauda*		no
Arctic Shrew	*Sorex arcticus*		no
Masked Shrew	*Sorex cinereus*		no
Pygmy Shrew	*Sorex hoyi*		no
Water Shrew	*Sorex palustris*		no
Star-nosed Mole	*Condylura cristata*		no
Big Brown Bat	*Eptesicus fuscus*		no
Silver-haired Bat	*Lasionycteris noctivagans*		no
Little Brown Bat	*Myotis lucifugus*		no
Northern Myotis	*Myotis septentrionalis*		no
Red Bat	*Lasiurus borealis*		no
Hoary Bat	*Lasiurus cinereus*		no
Eastern Pipistrelle	*Pipistrellus subflavus*		no
Snowshoe Hare	*Lepus americanus*		no
Eastern Cottontail	*Sylvilagus floridanus*		no
Southern Flying Squirrel	*Glaucomys volans*		no
Northern Flying Squirrel	*Glaucomys sabrinus*		no
Woodchuck	*Marmota monax*		no
Eastern Gray Squirrel	*Sciurus carolinensis*		no
Red Squirrel	*Tamiasciurus hudsonicus*		no
Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*		no
Least Chipmunk	*Tamias minimus*		no
Eastern Chipmunk	*Tamias striatus*		no
Plains Pocket Gopher	*Geomys bursarius*		no
American Beaver	*Castor canadensis*		no
Muskrat	*Ondatra zibethicus*		no
Southern Red-backed Vole	*Clethrionomys gapperi*		no

Common name	Scientific name	Listing	USFWS Region 3 Priority
Meadow Vole	*Microtus pennsylvanicus*		no
House Mouse	*Mus musculus*	introduced	no
North American deermouse	*Peromyscus maniculatus*		no
White-footed deermouse	*Peromyscus leucpus*		no
Norway Rat	*Rattus norvegicus*	introduced	no
Southern Bog Lemming	*Synaptomys cooperi*		no
Woodland Jumping Mouse	*Napaeozapus insignis*		no
Meadow Jumping Mouse	*Zapus hudsonius*		no
Common Porcupine	*Erethizon dorsatum*		no
Coyote	*Canis latrans*		no
Gray Wolf	*Canis lupus*	federal endangered	no
Red Fox	*Vulpes vulpes*		no
Gray Fox	*Urocyon cinereoargenteus*		no
Black Bear	*Ursus americanus*		no
Common Raccoon	*Procyon lotor*		no
American Marten	*Martes americana*	state endangered	no
Fisher	*Martes pennanti*		no
short-tailed Weasel	*Mustela erminea*		no
Long-tailed Weasel	*Mustela frenata*		no
Least Weasel	*Mustela nivalis*		no
Mink	*Mustela vison*		no
American Badger	*Taxidea taxus*		no
Striped Skunk	*Mephitis mephitis*		no
Northern River Otter	*Lutra canadensis*		no
Canada Lynx	*Lynx canadensis*	federally threatened	no
Bobcat	*Lynx rufus*		no
White-tailed Deer	*Odocoileus virginianus*		no
Moose	*Alces alces*		no

BIRDS

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Common Loon	*Gavia immer*		Sp, Su, Fa	no
Pied-billed Grebe	*Podilymbus podiceps*		Sp, Fa	yes
Horned Grebe	*Podiceps auritus*		Sp, Fa	no
Red-necked Grebe	*Podiceps grisegena*	state endangered	Sp, Fa	no
Eared Grebe	*Podiceps nigricollis*		Sp	yes
American White Pelican	*Pelecanus erythrorhynchos*		Sp, Su, Fa	yes
Double-crested Cormorant	*Phalacrocorax aurtis*		Sp, Su, Fa	yes
American Bittern	*Botaurus lentiginosus*		Sp, Su, Fa	yes
Least Bittern	*Ixobrychus exilis*		Sp, Su	yes
Great Egret	*Ardea alba*	state threatened	Sp	yes
Great Blue Heron	*Ardea herodias*		Sp, Su, Fa	yes
Cattle Egret	*Bubulcus ibis*		Sp, Fa	yes
Green Heron	*Butorides virescens*		Sp, Su, Fa	yes
Snowy Egret	*Egretta thula*	state endangered	Sp	yes
Tricolored Heron	*Egretta tricolor*		Sp	yes
Yellow-crowned Night Heron	*Nyctanassa violacea*	state threatened	Sp, Su	yes
Black-crowned Night Heron	*Nycticorax nycticorax*		Sp, Su	yes
Turkey Vulture	*Cathartes aura*		Sp, Su, Fa	yes
Greater White-fronted Goose	*Anser albifrons*		Sp, Fa	yes
Snow Goose	*Chen caerulescens*		Sp, Fa	yes
Ross's Goose	*Chen rossii*		Sp	no
Canada Goose	*Branta canadensis*		Sp, Su, Fa, Wi	no
Mute Swan	*Cygnus olor*	introduced	Sp, Su, Fa, Wi	no
Tundra Swan	*Cygnus buccinator*		Sp, Fa	no
Trumpeter Swan	*Cygnus columbianus*	state endangered	Sp, Su, Fa	no
Wood Duck	*Aix sponsa*		Sp, Su, Fa	yes
Gadwall	*Anas strepera*		Sp, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
American Widgeon	*Anas americana*		Sp, Fa	yes
American Black Duck	*Anas rubripes*		Sp, Su, Fa, Wi	no
Mallard	*Anas platyrhynchos*		Sp, Su, Fa, Wi	yes
Blue-winged Teal	*Anas discors*		Sp, Su, Fa	yes
Green-winged Teal	*Anas crecca*		Sp, Su, Fa, Wi	yes
Northern Pintail	*Anas acuta*		Sp, Fa, Wi	yes
Northern Shoveler	*Anas clypeata*		Sp, Fa	yes
Canvasback	*Aythya valisineria*		Sp, Fa	yes
Redhead	*Aythya americana*		Sp, Fa	yes
Ring-necked Duck	*Aythya collaris*		Sp, Su, Fa	yes
Lesser Scaup	*Aythya affinis*		Sp, Su, Fa, Wi	yes
Greater Scaup	*Aythya marila*		Sp, Su, Fa	no
King Eider	*Somateria spectabilis*		Fa	no
Oldsquaw	*Clangula hyemalis*		Sp, Fa, Wi	no
Surf Scoter	*Melanitta perspicillata*		Sp, Fa	no
Black Scoter	*Melanitta nigra*		Sp, Fa	no
White-winged Scoter	*Melanitta fusca*		Sp, Fa	no
Bufflehead	*Bucephala albeola*		Sp, Fa, Wi	no
Common Goldeneye	*Bucephala clangula*		Sp, Fa, Wi	no
Ruddy Duck	*Oxyura jamaicensis*		Sp, Fa	yes
Hooded Merganser	*Lophodytes cucullatus*		Sp, Fa	yes
Common Merganser	*Mergus merganser*		Sp, Fa, Wi	no
Red-breasted Merganser	*Mergus serrator*		Sp, Su, Fa	yes
Osprey	*Pandion haliaetus*	state threatened	Sp, Su, Fa	yes
Bald Eagle	*Haliaeetus leucocephalus*		Sp, Su, Fa, Wi	no
Northern Harrier	*Circus cyaneus*		Sp, Su, Fa, Wi	yes
Sharp-shinned Hawk	*Accipiter striatus*		Sp, Su, Fa, Wi	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Cooper's Hawk	*Accipiter cooperii*		Sp, Su, Fa	yes
Northern Goshawk	*Accipiter gentilis*		Sp, Su, Fa, Wi	no
Red-shouldered Hawk	*Buteo lineatus*	state threatened	Sp, Su, Fa	no
Broad-winged Hawk	*Buteo platypterus*		Sp, Su, Fa	yes
Swainson's Hawk	*Buteo swainsoni*		Sp	yes
Red-tailed Hawk	*Buteo jamiacensis*		Sp, Su, Fa	yes
Rough-legged Hawk	*Buteo lagopus*		Sp, Fa, Wi	no
Golden Eagle	*Aquila chrysaetos*		Sp	no
American Kestrel	*Falco sparverius*		Sp, Su, Fa, Wi	yes
Merlin	*Falco columbarius*		Sp, Su, Fa	yes
Peregrine Falcon	*Falco peregrinus*	state endangered	Sp, Fa	yes
Ring-necked Pheasant	*Phasianus colchicus*	introduced	Sp, Su, Fa, Wi	no
Ruffed Grouse	*Bonasa umbellus*		Sp, Su, Fa, Wi	no
Sharp-tail Grouse	*Tympanuchus phasianellus*		Sp, Su, Fa	no
Yellow Rail	*Coturnicops noveboracensis*	state threatened	Sp, Su, Fa	no
Virginia Rail	*Rallus limicola*		Sp, Su, Fa	yes
Sora Rail	*Porzana carolina*		Sp, Su, Fa	yes
American Coot	*Fulica americana*		Sp, Fa	yes
Sandhill Crane	*Grus canadensis*		Sp, Su, Fa	yes
Black-bellied Plover	*Pluvialis squatarola*		Sp, Su, Fa	yes
American Golden Plover	*Pluvialis dominica*		Sp, Su, Fa	yes
Semipalmated Plover	*Charadrius semipalmatus*		Sp, Su, Fa	yes
Piping Plover	*Charadrius melodus*	federally endangered	Sp, Fa	yes
Killdeer	*Charadrius vociferus*		Sp, Su, Fa, Wi	yes
American Avocet	*Recurvirostra americana*		Sp, Su	yes
Greater Yellowlegs	*Tringa melanoleuca*		Sp, Su, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Lesser Yellowlegs	*Tringa flavipes*		Sp, Su, Fa	yes
Solitairy Sandpiper	*Tringa solitaria*		Sp, Su, Fa	yes
Willet	*Catoptrophorus semipalmatus*		Sp, Su	yes
Spotted Sandpiper	*Actitus macularia*		Sp, Su, Fa	yes
Upland Sandpiper	*Bartramia longicauda*		Sp, Su	yes
Whimbrel	*Numenius phaeopus*		Sp, Su, Fa	yes
Hudsonian Godwit	*Limosa haemastica*		Sp	yes
Marbled Godwit	*Limosa fedoa*		Sp	yes
Ruddy Turnstone	*Arenaria interpres*		Sp, Su, Fa	yes
Red Knot	*Calidris canutus*		Sp, Su, Fa	yes
Sanderling	*Calidris alba*		Sp, Su, Fa	yes
Semipalmated Sandpiper	*Calidris pusilla*		Sp, Su, Fa	yes
Least Sandpiper	*Calidris minutilla*		Sp, Su, Fa	yes
White-rumped Sandpiper	*Calidris fuscicollis*		Sp, Su, Fa	yes
Baird's Sandpiper	*Calidris bairdii*		Sp, Su, Fa	yes
Pectoral Sandpiper	*Calidris melanotos*		Sp, Su, Fa	yes
Dunlin	*Calidris alpina*		Sp, Su, Fa	no
Stilt Sandpiper	*Calidris himantopus*		Sp, Su	yes
Buff-breasted Sandpiper	*Tryngites subruficollis*		Su, Fa	yes
Short-billed Dowitcher	*Limnodromus griseus*		Sp, Su, Fa	yes
Long-billed Dowitcher	*Limnodromus scolopaceus*		Sp, Fa	yes
Common Snipe	*Gallinago gallinago*		Sp, Su, Fa, Wi	yes
American Woodcock	*Scolopax minor*		Sp, Su, Fa	no
Wilson's Phalarope	*Phalaropus tricolor*		Sp, Fa	yes
Franklin's Gull	*Larus pipixcan*		Sp, Su, Fa	yes
Little Gull	*Larus minutus*		Sp, Su	no
Bonaparte's Gull	*Larus philadelphia*		Sp, Su, Fa, Wi	yes
Ring-billed Gull	*Larus delwarensis*		Sp, Su, Fa, Wi	yes
Herring Gull	*Larus argentatus*		Sp, Su, Fa, Wi	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Thayer's Gull	*Larus thayeri*		Fa	no
Lesser Black-backed Gull	*Larus fuscus*		Sp, Su	no
Greater Black-backed Gull	*Larus marinus*		Sp	no
Glaucous Gull	*Larus hyperboreus*		Sp, Wi	no
Caspian Tern	*Sterna caspia*	state endangered	Sp, Su, Fa	yes
Common Tern	*Sterna hirundo*	state endangered	Sp, Su, Fa	yes
Arctic Tern	*Sterna paradisaea*		Sp, Su	no
Forster's Tern	*Sterna forsteri*	state endangered	Sp, Su, Fa	yes
Black Tern	*Chlidonias niger*		Sp, Su	yes
Rock Dove	*Columba livia*	introduced	Sp, Su, Fa, Wi	no
Mourning Dove	*Zenaida macroura*		Sp, Su, Fa, Wi	yes
Black-billed Cuckoo	*Coccyzus erythropalmus*		Sp, Su	yes
Great Horned Owl	*Bubo virginianus*		Sp, Su, Fa, Wi	no
Snowy Owl	*Nyctea scandiaca*		Wi	no
Northern Hawk Owl	*Surnia ulula*		Wi	no
Barred Owl	*Strix varia*		Sp, Su, Fa, Wi	no
Great Gray Owl	*Strix nebulosa*		Sp, Su, Fa, Wi	no
Long-eared Owl	*Asio otus*		Sp	no
Short-eared Owl	*Asio flammeus*		Sp, Su, Fa	yes
Boreal Owl	*Aegolius funereus*		Wi	no
Northern Saw-whet Owl	*Aegolius acadicus*		Sp, Su, Fa, Wi	no
Common Nighthawk	*Chordeiles minor*		Sp, Su, Fa	yes
Whip-poor-will	*Capirmulgus vociferus*		Sp, Su, Fa	yes
Chimney Swift	*Chaetura pelagica*		Sp, Su, Fa	yes
Ruby-throated Hummingbird	*Archilochus colubris*		Sp, Su, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Belted Kingfisher	*Ceryle alcyon*		Sp, Su, Fa, Wi	yes
Red-headed Woodpecker	*Melanerpes erythrocephalus*		Sp, Su, Fa, Wi	no
Red-bellied Woodpecker	*Melanerpes carolinus*		Sp, Su, Fa, Wi	no
Yellow-bellied Sapsucker	*Sphyrapicus varius*		Sp, Su, Fa	yes
Downy Woodpecker	*Picoides pubescens*		Sp, Su, Fa, Wi	no
Hairy Woodpecker	*Picoides villosus*		Sp, Su, Fa, Wi	no
Three-toed Woodpecker	*Picoides tridactylus*		Sp, Fa	no
Black-backed Woodpecker	*Picoides arcticus*		Sp, Su, Fa, Wi	no
Northern Flicker	*Colaptes auratus*		Sp, Su, Fa	no
Pileated Woodpecker	*Dryocopus pileatus*		Sp, Su, Fa, Wi	no
Olive-sided Flycatcher	*Contopus cooperi*		Sp, Su	yes
Eastern Wood Pewee	*Contopus virens*		Sp, Su	yes
Yellow-bellied Flycatcher	*Empidonax flaviventrus*		Sp, Su	yes
Alder Flycatcher	*Empidonax alnorum*		Sp, Su	yes
Least Flycatcher	*Empidonax minimus*		Sp, Su	yes
Eastern Phoebe	*Sayornis phoebe*		Sp, Su, Fa	yes
Great-crested Flycatcher	*Myiarchus crinitus*		Sp, Su, Fa	yes
Eastern Kingbird	*Tyrannus tyrannus*		Sp, Su	yes
Western Kingbird	*Tyrannus verticalis*		Sp	yes
Northern Shrike	*Lanius excubitor*		Sp, Fa, Wi	no
Loggerhead Shrike	*Lanius ludovicianus*	state endangered	Sp	yes
Yellow-throated Vireo	*Vireo flavifrons*		Sp, Su	yes
Blue-headed Vireo	*Vireo solitarius*		Sp, Su, Fa	yes
Warbling Vireo	*Vireo gilvus*		Sp, Su, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Philadephia Vireo	*Vireo philadelphicus*		Sp, Fa	yes
Red-eyed Vireo	*Vireo olivaceus*		Sp, Su, Fa	yes
Blue Jay	*Cyanocitta cristata*		Sp, Su, Fa, Wi	no
American Crow	*Corvus branchyrhynchos*		Sp, Su, Fa, Wi	no
Common Raven	*Corvus corax*		Sp, Su, Fa, Wi	no
Horned Lark	*Eremophila alpestris*		Sp, Fa	no
Purple Martin	*Progne subis*		Sp, Su	yes
Tree Swallow	*Tachycineta bicolor*		Sp, Su, Fa	yes
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		Sp, Su	yes
Cliff Swallow	*Petrochelidon pyrrhonota*		Sp, Su	yes
Bank Swallow	*Riparia riparia*		Sp, Su	yes
Barn Swallow	*Hirundo rustica*		Sp, Su, Fa	yes
Black-capped Chickadee	*Poecile atricapilla*		Sp, Su, Fa, Wi	no
Boreal Chickadee	*Poecile hudonicus*		Sp, Su, Fa, Wi	no
Red-breasted Nuthatch	*Sitta canadensis*		Sp, Su, Fa, Wi	no
White-breasted Nuthatch	*Sitta carolinensis*		Sp, Su, Fa, Wi	no
Brown Creeper	*Certhia americana*		Sp, Su, Fa, Wi	no
House Wren	*Trogodytes aedon*		Sp, Su, Fa	yes
Winter Wren	*Trogodytes troglodytes*		Sp, Su, Fa	no
Sedge Wren	*Cistothorus platensis*		Sp, Su	yes
Marsh Wren	*Cistothorus palustris*		Sp, Su, Fa	yes
Golden-crowned Kinglet	*Regulus satrapa*		Sp, Su, Fa, Wi	no
Ruby-crowned Kinglet	*Regulus calendula*		Sp, Su, Fa	yes
Eastern Bluebird	*Sialia sialis*		Sp, Su, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Veery	*Catharus fuscescens*		Sp, Su, Fa	yes
Gray-cheeked Thrush	*Catharus minimus*		Sp, Fa	yes
Swainson's Thrush	*Catharus ustulatus*		Sp, Su, Fa	yes
Hermit Thrush	*Catharus guttatus*		Sp, Su, Fa	yes
Wood Thrush	*Hylocichla mustelina*		Sp, Su, Fa	yes
Varied Thrush	*Ixoreus naevius*		Sp, Su, Fa	no
American Robin	*Turdus migratorius*		Sp, Su, Fa, Wi	yes
Gray Catbird	*Dumetella carolinensis*		Sp, Su, Fa, Wi	yes
Northern Mockingbird	*Mimus polyglottos*		Sp, Su	no
Brown Thrasher	*Toxostoma rufum*		Sp, Su, Fa	no
European Starling	*Sturnus vulgaris*	introduced	Sp, Su, Fa, Wi	no
American Pipit	*Anthus rubescens*		Sp, Fa	yes
Bohemian Waxwing	*Bombycilla garrulus*		Sp, Fa, Wi	no
Cedar Waxwing	*Bombycilla cedrorum*		Sp, Su, Fa, Wi	yes
Golden-winged Warbler	*Vermivora chrysoptera*		Sp, Su, Fa	yes
Tennessee Warbler	*Vermivora peregrina*		Sp, Su, Fa	yes
Orange-crowned Warbler	*Vermivora celata*		Sp, Fa	yes
Nashville Warbler	*Vermivora ruficapilla*		Sp, Su, Fa	yes
Yellow Warbler	*Dendroica petechia*		Sp, Su, Fa	yes
Northern Parula	*Parula americana*		Sp, Su, Fa	yes
Chestnut-sided Warbler	*Dendroica pensylvanica*		Sp, Su, Fa	yes
Magnolia Warbler	*Dendroica magnolia*		Sp, Su, Fa	yes
Cape May Warbler	*Dendroica tigrina*		Sp, Su, Fa	yes
Black-throated Blue Warbler	*Dendroica caerulescens*		Sp, Su, Fa	yes
Yellow-rumped Warbler	*Dendroica coronata*		Sp, Su, Fa	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Black-throated Green Warbler	*Dendroica virens*		Sp, Su, Fa	yes
Blackburnian Warbler	*Dendroica fusca*		Sp, Su, Fa	yes
Pine Warbler	*Dendroica pinus*		Sp, Su, Fa	yes
Palm Warbler	*Dendroica palmarum*		Sp, Su, Fa	yes
Bay-breasted Warbler	*Dendroica castanea*		Sp, Su, Fa	yes
Blackpoll Warbler	*Dendroica striata*		Sp, Fa	yes
Black-and-white Warbler	*Mniotilta varia*		Sp, Su, Fa	yes
American Redstart	*Setophaga ruticilla*		Sp, Su, Fa	yes
Ovenbird	*Seiurus aurocapillus*		Sp, Su, Fa	yes
Northern Waterthrush	*Seiurus noveboracensis*		Sp, Su, Fa	yes
Connecticut Warbler	*Oporornis agilis*		Sp, Su	yes
Mourning Warbler	*Oporornis philadelphia*		Sp, Su, Fa	yes
Common Yellow-throat	*Geothylpis trichas*		Sp, Su, Fa, Wi	yes
Wilson's Warbler	*Wilsonia pusilla*		Sp, Su	yes
Canada Warbler	*Wilsonia canadensis*		Sp, Su, Fa	yes
Scarlet Tanager	*Piranga olivacea*		Sp, Su, Fa	yes
Western Tanager	*Piranga ludoviciana*		Sp	yes
Eastern Towhee	*Pipilo erythrophthalmus*		Sp, Su	no
American Tree Sparrow	*Spizella arborea*		Sp, Fa, Wi	no
Chipping Sparrow	*Spizella passerina*		Sp, Su, Fa	yes
Clay-colored Sparrow	*Spizella pallida*		Sp, Su, Fa	yes
Field Sparrow	*Spizella pusilla*		Sp, Su, Fa	no
Vesper Sparrow	*Pooecetes gramineus*		Sp, Su, Fa	yes
Lark Sparrow	*Chondestes grammacus*		Sp	yes

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Lark Bunting	*Calamospiza melanocorys*		Sp	yes
Savannah Sparrow	*Passerculus sandwichensis*		Sp, Su, Fa	yes
Grasshopper Sparrow	*Ammodramus savannarum*		Sp, Su	yes
Le Conte's Sparrow	*Ammodramus leconteii*		Sp, Su	no
Fox Sparrow	*Passerella iliaca*		Sp, Fa	no
Song Sparrow	*Melospiza melodia*		Sp, Su, Fa	no
Lincoln's Sparrow	*Melospiza lincolnii*		Sp, Su, Fa	yes
Swamp Sparrow	*Melospiza georgiana*		Sp, Su, Fa	yes
White-throated Sparrow	*Zonotrichia albicollis*		Sp, Su, Fa, Wi	no
Harris's Sparrow	*Zonotrichia querula*		Sp, Fa	no
White-crowned Sparrow	*Zonotrichia leucophrys*		Sp, Fa	yes
Dark-eyed Junco	*Junco hyemalis*		Sp, Su, Fa, Wi	no
Lapland Longspur	*Calcarius lapponicus*		Sp, Fa	no
Snow Bunting	*Plectrophenax nivalis*		Sp, Fa, Wi	no
Northern Cardinal	*Cardinalis cardinalis*		Sp, Su, Fa, Wi	no
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		Sp, Su, Fa	yes
Indigo Bunting	*Passerina cyanea*		Sp, Su, Fa	yes
Dickcissel	*Spiza americana*		Sp, Su	yes
Bobolink	*Dolichonyx oryzivorus*		Sp, Su, Fa	yes
Red-winged Blackbird	*Agelaius phoeniceus*		Sp, Su, Fa, Wi	yes
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		Sp, Su, Fa	yes
Eastern Meadowlark	*Sturnella magna*		Sp, Su, Fa, Wi	yes
Western Meadowlark	*Sturnella neglecta*		Sp, Su, Fa	yes
Rusty Blackbird	*Euphagus carolinus*		Sp, Fa	no

Common name	Scientific name	Listing	Seasonality	USFWS Region 3 Priority
Brewer's Blackbird	*Euphagus cyanocephalus*		Sp, Su, Fa	yes
Common Grackle	*Quiscalus quiscula*		Sp, Su, Fa, Wi	no
Brown-headed Cowbird	*Molothrus ater*		Sp, Su, Fa	yes
Orchard Oriole	*Icterus spurius*		Sp	yes
Baltimore Oriole	*Icterus galbula*		Sp, Su	yes
Pine Grosbeak	*Pinicola enucleator*		Sp, Fa, Wi	no
Purple Finch	*Carpodacus purpureus*		Sp, Su, Fa, Wi	no
House Finch	*Carpodacus americana*	introduced	Sp, Su, Fa, Wi	no
Red Crossbill	*Loxia curvirostra*		Sp, Su, Fa, Wi	no
White-winged Crossbill	*Loxia leucoptera*		Sp, Su, Fa, Wi	no
Common Redpoll	*Carduelis flammea*		Sp, Fa, Wi	no
Hoary Redpoll	*Carduelis hornemanni*		Wi	no
Pine Siskin	*Carduelis pinus*		Sp, Su, Fa, Wi	no
American Goldfinch	*Carduelis tristis*		Sp, Su, Fa, Wi	yes
Evening Grosbeak	*Coccothraustes vespertinus*		Sp, Su, Fa, Wi	no
House Sparrow	*Passer domesticus*	introduced	Sp, Su, Fa, Wi	No

AMPHIBIANS

Common name	Scientific name	Listing	USFWS Region 3 Priority
Central Newt	*Notophthalmus viridescens*		no
Common Mudpuppy	*Necturus maculosus*		no
Blue-spotted Salamander	*Ambystoma laterale*		no
Spotted Salamander	*Ambystoma maculatum*		no

Common name	Scientific name	Listing	USFWS Region 3 Priority
Four-toed Salamander	*Hemidactylium scutatum*	special concern: DNR	no
Eastern Red-backed Salamander	*Plethodon cinereus*		no
Eastern American Toad	*Bufo americanus*		no
Northern Spring Peeper	*Pseudacris crucifer*		no
Western chorus frog	*Pseudacris triseriata*		no
Gray Treefrog	*Hyla versicolor*		no
American Bullfrog	*Rana catesbeiana*		no
Green Frog	*Rana clamitans*		no
Northern Leopard Frog	*Rana pipiens*		no
Mink Frog	*Rana septentrionalis*		no
Wood Frog	*Rana sylvatica*		no

REPTILES

Common name	Scientific name	Listing	USFWS Region 3 Priority
Common Snapping Turtle	*Chelydra serpentina*		no
Painted Turtle	*Chrysemys picta*		no
Wood Turtle	*Clemmys insculpta*	state threatened	no
Northern Prairie Skink	*Eumeces septentrionalis*		no
Ring-necked Snake	*Diadophis punctatus*		no
Western Fox Snake	*Elaphe vulpina*		no
Eastern Hog-nosed Snake	*Heteron platirhinos*		no
Northern Water Snake	*Nerodia sepidon*		no
Smooth Green Snake	*Opheodrys vernalis*		no
Northern Red-bellied Snake	*Storeria occipitomaculata*		no

Common name	Scientific name	Listing	USFWS Region 3 Priority
Common Garter Snake	*Thamnophis sirtalis*		no

FISH

Common name	Scientific name	Listing	USFWS Region 3 Priority
Brown Trout	*Salmo trutta*	Introduced	no
Brook Trout	*Salvelinus fontinalis*		yes
Rainbow Trout	*Oncorhynchus mykiss*	Introduced	no
Coho Salmon	*Oncorhynchus kisutch*	Introduced	yes
Chinook Salmon	*Oncorhynchus tshawytscha*	Introduced	yes
Splake	Lake trout x brook trout	Hybrid	no
Slimy Sculpin	*Cottus cognatus*		no
Ninespine Stickleback	*Pungitius pungitius*		no
Brook Stickleback	*Culaea inconstans*		no
Common Shiner	*Luxilus cornutus*		no
Spottail Shiner	*Notropis hudsonius*		no
Blackchin Shiner	*Notropis heterodon*		no
Johnny Darter	*Etheostoma nigrum*		no
Fathead Minnow	*Pimephales promelas*		no
Blacknose Dace	*Rhinichthys atratulus*		no
White Sucker	*Catostomus commersoni*		no
Rainbow Smelt	*Osmerus mordax*	Introduced	no
Creek Chub	*Semotilus atromaculatus*		no
Central Mudminnow	*Umbra limi*		no

Appendix E. Environmental Assessment

Section 1. Purpose of and Need for Action

Purpose and Need for Action

The purpose of the proposed action is to specify a direction for restoration and management of fish and wildlife habitat on the Whittlesey Creek National Wildlife Refuge. The direction is described in detail in the goals, objectives and strategies of the Habitat Management Plan.

The action is needed because detailed management direction does not exist for Whittlesey Creek National Wildlife Refuge. The U.S. Fish and Wildlife Service (Service) established the Whittlesey Creek National Wildlife Refuge in 1999. The Service's main focus for new refuges is to acquire lands within the acquisition boundary, and once lands are acquired, conduct habitat restoration and management. The work done for the Whittlesey Creek NWR is guided by our Congressional Authorities (National Wildlife Refuge Improvement Act), the purpose for which the refuge was established (protection of fish and wildlife resources) and the goals laid out when the refuge was established (stated in the Whittlesey Creek National Wildlife Refuge Interim Comprehensive Conservation Plan, 1998). Even with this broad guidance, our on-the-ground decisions, especially related to habitat restoration, have been rather piecemeal. The development of a Habitat Management Plan will give the Service clear guidance about habitat restoration and management decisions as lands are acquired.

This Environmental Assessment (EA) was prepared using guidelines of the National Environmental Policy Act of 1969. The Act requires federal agencies to examine effects of their proposed actions on the natural and human environment. The following sections describe three alternatives for future refuge management, the environmental consequences of each alternative and our preferred management direction. Each alternative was designed as a reasonable mix of fish and wildlife habitat restoration on refuge lands owned by the Service and on private lands with landowners who are interested in habitat management within the Whittlesey Creek watershed.

Background

The Whittlesey Creek National Wildlife Refuge (Whittlesey Creek NWR or refuge) was established with the first purchase of land by the U.S. Fish and Wildlife Service (Service) in October 1999. The refuge is located in Bayfield County of northern Wisconsin in the Town of Barksdale (Figure 1). The purpose of the Whittlesey Creek NWR is for the development, advancement, management, conservation and protection of fish and wildlife resources. The Service is working with individuals, groups and governmental entities to protect and restore coastal wetland and stream habitats that are utilized by migratory trout and salmon from Lake Superior and by migratory birds. Up to 540 acres of coastal wetland, stream habitat and upland

habitat will be acquired in fee title and up to 1260 acres will be protected through conservation easements in the Whittlesey watershed.

Decision Framework

The Regional Director for the Great Lakes-Big Rivers Region of the U.S. Fish and Wildlife Service will use the Environmental Assessment to select one of three alternatives and determine whether the alternative selected will have significant environmental impacts requiring preparation of an environmental impact statement. Specifically, analysis and findings described in this EA will help the Regional Director decide whether to continue with current management at the refuge (no action alternative) or to adopt another approach to management.

For details beyond those included in this EA, the reader should refer to the Whittlesey Creek National Wildlife Refuge Habitat Management Plan, especially the goals, objectives and strategies.

Authority, Legal Compliance and Compatibility

The National Wildlife Refuge System includes federal lands managed primarily to provide habitat for a diversity of wildlife species. National wildlife refuges have been established under many different authorities and funding sources for a variety of purposes. The purpose(s) for which a particular refuge is established are specified in the authorizing document for that refuge. These purposes guide the establishment, design and management of the refuge. The Whittlesey Creek National Wildlife Refuge was established under the authority of the Fish and Wildlife Act of 1956 (16 USC 742(a)-754) for the purpose of: "... the development, advancement, management, conservation, and protection of fish and wildlife resources."

The Whittlesey Creek National Wildlife Refuge Interim Comprehensive Conservation Plan (U.S. Fish and Wildlife Service 1998) provides general guidance for habitat management on the refuge until a habitat management plan is developed and adopted.

Further details of federal and state authorities are provided in the "Legal Mandates" section of the Habitat Management Plan.

Scoping of the Issues

Scoping is the process of identifying opportunities and issues that can be used to develop and evaluate alternative approaches to management.

The Service has sought public involvement in the project through outreach to interest groups, local governments and the general public. Our intent to develop the plan was publicly announced in February 2004. Several avenues were used to send and receive information about the draft habitat management plan:

Meetings with partners

Service personnel met with several agency personnel, college professors, and other experts from various organizations to gather advice and opinions on objectives and strategies. A list of people who attended two strategic meetings is provided in Appendix C of the Habitat Management Plan.

Contacts with landowners, interested parties and other agencies

Via mail and the Whittlesey Creek NWR web site, the Service notified landowners within the watershed, citizens who have expressed interest in the refuge, agencies and public officials announcing our intent to prepare a habitat management plan. A cover letter, fact sheet, and return post card for comments and to request plan copies was included in the March 2004 mailing. A fact sheet and comment sheet were also posted on the refuge's home page.

Open house

The Service conducted a public open house for the purpose of communicating our plans and to listen to suggestions from citizens and experts who attended. The open house took place at the Northern Great Lakes Visitor Center on March 30, 2005 from 3:00 to 8:00 p.m. Those who attended had the opportunity to provide comments in writing or orally and request copies of the draft plan when available. The meeting included technical presentations by refuge staff and experts in the Center's theater. The meeting room had posters, publications and maps for perusal by the public. This part of the open house was informal, but Service staff was available to answer questions.

Issues and Concerns

Several key issues were noted by the Service during our meetings with partners and in reviewing results of the comments received (Appendix F). Below is a description of these key issues as perceived by the Service. These issues are addressed in each alternative of this environmental assessment.

Fish Habitat Improvement

Several comments were received about the need to improve fish habitat. Suggestions included adding more cover for fish, building lunker structures and improving habitat in the watershed to improve in-stream fish habitat.

Native Fish Restoration and Possible Conflicts with Naturalized Salmonids

The Service's responsibility is to protect, manage and restore native migratory, endangered or interjurisdictional species such as black duck. The coaster brook trout is a native salmonid species with a migratory life history. Some salmonid species introduced into Lake Superior, such as brown trout and coho salmon, have become naturalized, exhibit similar life histories and utilize similar habitats as coaster brook trout. A few comments received addressed this issue. Some comments stated concerns that coaster brook trout restoration might conflict with coho salmon populations.

Native Plant Species Restoration

Native species restoration, specifically cedar and tamarack were suggested by two people. Invasive species control becomes part of this issue, because reed canary grass is a dominant grass cover within the refuge. Several people suggested that habitat restoration and protection in general is the most important function of a refuge, desiring to keep it as natural as possible.

Public Use

Several comments were received about public use on the refuge. Concerns were raised about allowing appropriate hunting in specific locations. One commenter noted the need to minimize signage. One asked that motorized recreational vehicles be prohibited. One suggested a cross-country ski trail. The Service's strategic plan for implementing the National Wildlife Refuge System Improvement Act ("Fulfilling the Promise," U.S. Fish and Wildlife Service 1999) places wildlife habitat "first and foremost." A public use plan for the refuge was adopted in 2001 that provides guidelines for wildlife-dependent uses and visitor facilities. Specific locations of facilities (except a three-season education shelter) have not been determined and won't be determined until more land is acquired and habitat work is planned and initiated.

Involvement of the Community and Landowners

The success of Whittlesey Creek NWR will not only be measured by the ecological restoration of the site, but also by our effectiveness in working with other agencies and individuals to preserve and enhance the biodiversity in Wisconsin, the Lake Superior basin and the nation.

Partners and interested publics have been and will continue to provide advice and assistance in planning and protecting the refuge. Their advice and assistance will continue to be sought for refuge development and management.

Many refuge activities are done and will continue to be done cooperatively with partners and with the use of volunteers. Activities such as clean up, education programs, monitoring and special events are examples of activities that are done cooperatively with the help of others. The Service welcomes the opportunity to continue to work with current partners and other groups. Whether or not partnerships are formalized, the Service and its partners will continue to work under the principles of trust, respect, and open communication.

Perhaps the most critical partnerships for Whittlesey Creek are those with private landowners. Without their cooperation, no one will be able to fully restore the fishery habitat in Whittlesey Creek. The Service's effectiveness within the refuge will be diminished without private landowner cooperation. All principles mentioned in the above paragraphs apply to private landowner relationships.

Permits, Licenses, and Other Compliance Required

The following describes how the Service will comply with various permits and other project review requirements.

Federal, State, and Local Permit Requirements

State permits under Wisconsin State Statutes chapters 29 and 30 will be obtained for in-stream habitat restoration activities. State permits under Wisconsin State Statutes chapters 29 would be obtained for stocking fish (29.535) and scientific collector permits for fisheries evaluations (29.17).

Compliance with Section 7 of the Endangered Species Act

The project area is within the breeding range of the bald eagle, gray wolf, Canada lynx and piping plover. Fassets locoweed is also identified as occurring in Bayfield County. An Intra-Service Section 7 consultation will be conducted for proposed projects. The following threatened and endangered species in the affected area are bald eagle, gray wolf and piping plover. Descriptions of their occurrences are provided in the "Affected Environment" section. No activities will be permitted that are likely to adversely affect any federally listed species or habitat that sustains them.

Cultural Resources and Historic Preservation Laws

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to consider the effects of their undertaking on properties meeting the criteria for the National Register of Historic Places. The regulations in 36 CFR Part 800 describe how federal agencies are to identify historic properties, determine effect on significant historic properties and mitigate adverse effects.

American Indian Religious Freedom Act of 1978 provides the right of Native Americans to free exercise of traditional religions and use of sacred places. Indian Sacred Sites (1996) Executive Order 13007 requires federal agencies to accommodate access to and ceremonial use of sacred sites, to avoid adverse effects and blocking access, and to enter into early consultation.

Service policy to comply with historic preservation laws requires the refuge manager to inform the Regional Historic Preservation Officer of any potential undertakings or other activities early enough to allow complete consultation with all involved parties.

Section 2. Alternatives for Management

Introduction

Three proposed management alternatives were developed during the course of planning. During the process, the Service identified Alternative A, Watershed Restoration, as the preferred alternative.

All three alternatives are summarized in Table 2. These alternatives are discussed in detail in this chapter. Section 4 evaluates the alternatives based on issues raised during the planning process.

Formulation of Alternatives

Three alternatives were considered. Factors considered in the development of alternatives were:

1. The purpose of the refuge and the mission of the National Wildlife Refuge System.
2. The fish and wildlife habitat goals developed for the refuge when it was established.
3. Current scientific knowledge and technical capabilities of restoring ecosystem functions.
4. Size limitation of the refuge, affecting natural resources of the refuge and concerns for public safety.
5. Coordination with surrounding public and private lands.
6. Issues identified in the scoping process.

Description of Alternatives

Table 2. Summary of Alternatives

Alternative A – No Action	Alternative B – Refuge Only Management	Alternative C – Management of Refuge and Watershed (Preferred)
The watershed and refuge work would continue as it currently is, using broad guidelines. No means to measure success or failure would be in place.	Goals and objectives would focus on improvements only within the refuge fee title acquisition boundary. Watershed work would be left to partners to conduct, so strategies would not include watershed work.	Goals and Objectives would be based on watershed improvement. Strategies would include restoration of habitats in the refuge and on lands of interested and willing private landowners within the refuge and watershed.

Alternative A - No Action

Present restoration and management decisions would continue under this alternative. Current conditions and trends of restoration and management would continue. The alternative serves as a baseline to compare the other two alternatives.

Habitat restoration decisions would be made on a tract-by-tract basis as the Service acquires land. The general guidance provided in the interim comprehensive conservation plan would be followed. No specific objectives or strategies would be developed or followed to measure success or failure of our actions from a scientific standpoint. The Service would measure progress based on acres restored and managed, and on dollars spent.

Habitat projects on private lands would continue with Bayfield County and/or Natural Resources Conservation Service taking the lead. The Service would provide funding and technical assistance to projects as resources are available. Success would not be measured on scientific objectives, but progress would be measured on dollars spent and acres restored/managed.

Alternative B – Refuge Only Management

This alternative would incorporate goals, objectives and strategies related to the refuge fee-title boundary.

Stream Habitat and Hydrology – Goals and objectives for improving stream habitat would focus on Reaches 1 and 2 of Whittlesey Creek and the portions of Little Whittlesey and Terwilliger Creeks that flow through the refuge (Figure 3). The Service would work to improve fish cover, but would not restore hydrologic functions of these streams, since this requires restoration work within the entire watershed. The channel of Whittlesey Creek at the mouth would freely meander and we would manage the vegetation to provide overhead cover of at least 75 percent.

Watershed Habitat and Hydrology – No goals or objectives for the watershed are included in this alternative. Hydrologic modeling, sediment modeling and habitat monitoring would not be done. Bayfield County would continue to work with landowners to improve watershed health and fish and wildlife habitat through their Whittlesey Creek Priority Watershed initiative. Bayfield County has been working to improve the Whittlesey Creek watershed periodically over the past 50 years, most recently by receiving Priority Watershed Project funding from the state since 1991. The state's funding will be discontinued in 2006, but the County plans to continue on a more limited basis to serve landowners within the watershed by using other funding sources. The Service would provide technical and financial assistance to landowners as time and funding allows.

Floodplain and Wetland Bird Habitat – The Service would restore degraded habitats to native swamp species and provide a diverse structure of habitats for several species of concern: northern waterthrush, veery, northern black current, marsh horsetail and black duck. Riparian zones would be restored and managed to recruit large woody debris into the stream. A significant part of this effort would include invasive species control.

Floodplain and Wetland Hydrology – The Service would work toward restoring hydrology of the floodplain and wetlands within the refuge boundary. This would include restoring overbank flooding and working with numerous infrastructure restrictions, such as bridges and roads, to accomplish this.

Brook Trout Population – The Service would continue with the experimental restoration of coaster brook trout in Whittlesey Creek, working cooperatively with the Wisconsin Department of Natural Resources. Habitat improvements would focus within the refuge; habitat improvements within the remainder of the watershed would not be strategically focused, but would continue on an opportunistic basis.

Alternative C — Management of Refuge and Watershed (Preferred Alternative)

Fish and wildlife habitats, hydrology and populations would be restored and managed as defined by refuge goals, objections and strategies developed in Sections VI and V of the Habitat Management Plan. This alternative is similar to Alternative B, but it includes watershed goals, objectives for all reaches of Whittlesey Creek and strategies for working on private lands with willing and interested landowners.

Stream and Watershed Habitat and Hydrology – Goals and objectives for improving stream habitat would focus on all reaches of Whittlesey Creek and the portions of Little Whittlesey and Terwilliger Creeks that flow through the refuge. Objectives would focus on reducing peak flood flows, sediment loads and improving in-stream cover for native species. Private lands projects would focus on reducing overland flow of water and reducing sediment inputs by restoring wetlands, planting trees and restoring hydrology of old fields. The Service would also attempt to provide a program for protection of riparian corridors to recruit large woody debris into the stream. The channel of Whittlesey Creek at the mouth would freely meander and the Service would manage the vegetation to provide overhead cover of at least 75 percent. Hydrologic modeling, sediment modeling and habitat monitoring would be done.

Bayfield County would continue to work with landowners to improve watershed health, and fish and wildlife habitat through their Whittlesey Creek Priority Watershed initiative as funding allows. The Service would provide focused technical and financial assistance to interested landowners and take an active leadership role in the watershed.

Floodplain and Wetland Bird Habitat – The Service would restore degraded habitats to native swamp species and provide a diverse structure of habitats for several species of concern: northern waterthrush, veery, northern black current, marsh horsetail and black duck. Riparian zones would be restored and managed to recruit large woody debris into the stream. A significant part of this effort would include invasive species control.

Floodplain and Wetland Hydrology – The Service would work toward restoring hydrology of the floodplain and wetlands within the refuge boundary, to include restoring overbank flooding. The Service would also work with transportation officials to address numerous bridges and roads that are restricting or affecting water flow and hydrological restoration.

Brook Trout Population – The Service will continue with the experimental restoration of coaster brook trout in Whittlesey Creek, working cooperatively with the Wisconsin Department of Natural Resources. Habitat improvements would focus within the refuge and watershed on a strategic basis, as noted above.

Management Common to all Alternatives

Invasive Species Management – Invasive species will continue to be managed under all three alternatives. Management will include mechanical (such as mowing), chemical (use of Service approved pesticides) and prescribed fire. The use of chemical pesticides on refuge lands and facilities is guided by Service and Departmental policies and directives (30 AM 12, 7 RM 14.2, 517 DM 1). It is the policy of the Department, the Service and Region 3 that all reasonable steps will be taken to minimize or, when feasible, eliminate dependence on chemical pest control agents. Service supervisors are responsible for ensuring that all Service employees who apply or oversee the application of pesticides are properly certified and are receiving the appropriate level of medical surveillance.

Pesticide use plans are written by the refuge annually prior to any pesticide application that year. Plans specify what the pesticide will be used to control, method of control and when it will be

used. Pesticide Use Reports are also submitted annually. These plans and reports ensure proper use and safety of applicators.

Prescribed Fire as a Management Tool - Prescribed fire can be a useful tool for restoring and maintaining natural conditions and processes at Whittlesey Creek NWR. As this is a new refuge, there has been no prescribed fire application. The broad goals of prescribed fire are: hazard fuel reduction to protect the watershed of Whittlesey, Little Whittlesey and Terwilliger Creeks; hazard fuel reduction to protect adjacent private property and reduce risk of wildland fire escape from the refuge; and manage fire-adapted habitats for trust species.

Specific management needs for the refuge as a whole and for specific areas will be determined annually based on habitat objectives. Research burning may also be conducted when determined to be necessary for accomplishment of research project objectives. Specific burn objectives, fire frequency rotation, firing methodology and prescriptions will vary from year to year.

All prescribed fire projects will have a burn plan approved by the Project Leader. Burn plans will be updated to reflect any annual variations. Actions included in the prescribed burn program include: the selection and prioritization of prescribed burns to be carried out during the year, prescribed burn plans, burn prescriptions, burn operations, documentation and reporting, and burn critiques. Each burn plan will include a systematic decision-making process, measurable objectives, predetermined prescriptions and an approved environmental compliance document.

Prescribed Fire Burn Plans must include components such as a GO/NO-GO Checklist, contingency actions to be taken in the event the prescription is exceeded, and the need for alerting neighbors and appropriate public officials to the timing and the planning of the burn. The refuge will comply with all applicable Federal, state and local air pollution control requirements as specified under Section 118 of the Clean Air Act, as amended (42 U.S.C. 7418).

All prescribed fires will follow these guidelines:

- Obtain any required State open burning permit.
- The operation will be conducted according to the terms and conditions of permits and the prescription in the plan.
- Prescriptions will be written to achieve mixing heights that will disperse smoke at sufficient altitude to minimize smoke impacts at ground level.
- No burning will occur if the state air quality agency or other government agency has issued an air pollution health advisory, alert, warning or emergency. This is expected to be an extremely rare occurrence.

Whittlesey Creek is dedicated to ensuring the safety of each visitor and to all residents and property within and adjacent to the refuge boundary. During prescribed burns, at least one burn team member will have first aid training. Local law enforcement, fire and emergency medical services will be notified prior to the ignition of any prescribed fire. Areas of fire activity will be clearly signed at the visitor center and refuge kiosks. Residents within and adjacent to the refuge will be notified in advance of any prescribed fire and if any fire poses a threat to burn outside the refuge boundaries.

Fire monitoring will be used to evaluate the degree to which burn objectives are accomplished. Prescribed fire activities will be reviewed annually. Necessary updates or changes to the Fire Management Plan will be accomplished prior to the next fire season. Any additions, deletions, or changes will be reviewed by the Project Leader to determine if such alterations warrant a re-approval of the plan.

All other details of prescribed fire management planning, monitoring and evaluation are provided in the Whittlesey Creek Fire Management Plan (U.S. Fish and Wildlife Service, 2003).

Alternatives Considered but not Further Developed

No other alternatives were considered.

Section 3. Affected Environment

The refuge includes 540 acres of land to be acquired in fee-title. To date, the Service has acquired about 220. The Service can also acquire up 1,200 acres of easements in the watershed, but no easements have been acquired as June 2006. A detailed description of the ecology of the refuge and Whittlesey Creek watershed is provided in the Habitat Management Plan. A summary is provided in here.

Landscape of Whittlesey Creek National Wildlife Refuge

The refuge is located in the coastal area of Lake Superior at the mouth of Whittlesey Creek, which is part of a large wetland complex that extends from just north of the mouth of Whittlesey Creek to the west edge of the City of Ashland, Wisconsin. This coastal wetland complex is a significant part of the wildlife habitat and aquatic resources of Chequamegon Bay. The area is used by many fish and wildlife species and is an important area for migrating birds.

The refuge also encompasses the mouth of Whittlesey Creek, so it is located at the downstream end of the Whittlesey Creek watershed. The Whittlesey Creek Priority Watershed Project plan provided a description of the watershed (Gardner and Malischke 1996). The Whittlesey watershed, including both groundwater and surface water drainages, covers 18 square miles. Characteristics include:

- Land uses in the watershed are agriculture and forest related. The area is dotted with farms and rural dwellings.
- Public lands within the watershed include about 7,600 acres within the Chequamegon National Forest boundary.
- Agricultural lands account for 14% of the total drainage area, and 50% of the total are National Forest lands. The remaining 36% of the area includes wetlands, woodlands, riparian lands and home sites.
- Although there has been a decline in the number of operations, agriculture is still an important land use in the watershed.
- Whittlesey Creek currently has good water quality and is classified as an outstanding resource water.
- The stream is a class I trout water supporting both salmonid and non-salmonid fish species. It is also a regionally important spawning area for potadromous trout and salmon from Lake Superior.

Vegetation

Lands within the fee-title boundary of the refuge are Lake Superior coastal wetlands, sedge meadow, lowland forest, riparian forest, created palustrine non-vegetated ponds and planted grassy fields. Whittlesey, Little Whittlesey and Terwilliger creeks flow through the refuge, collecting water from the many cold-water spring upwellings in the streams and bordering wetlands.

Fish and wildlife habitats in the refuge have been altered substantially by human use. Both bottom land forest and sedge meadow were converted for agricultural use in the early 1900's. Portions were altered further for construction of a golf course. Four non-vegetated ponds were

created during construction of the golf course and nonnative grasses and conifers were introduced. Changes in water regime as well as past land use have changed wetland vegetation; a majority of the open, low-lying acres are dominated by reed canary grass, a non-native invasive wetland plant. Some wet meadow acres, especially those that have been let unused for a decade or more, are regrowing to shrubs such as willow and alder, and might eventually regrow to lowland swamp with black ash and cedar.

Hydrology

The Whittlesey Creek watershed covers approximately 12,000 acres when both surface groundwater recharge and surface water contributing areas are included. The groundwater recharge portion of the watershed is found to the west in the upper reaches, which have deep sand deposits (Copper Falls Formation, see Figure 4). Most of this portion of the watershed is contained in the Chequamegon-Nicollet National Forest. This area moves surface water through a thick layer of sand (up 400 feet deep) that discharges into Whittlesey Creek at various points. This system provides year-round base flow in Whittlesey Creek of about 18 cubic feet per second (cfs).

The surface water contributing area is approximately 4,700 acres (Figure 2), which includes Whittlesey Creek, the North Fork of Whittlesey Creek, and numerous small tributaries that enter both. The elevation of the surface water contributing area changes from 1,100 feet mean sea level (msl) at the upper end, to about 600 feet msl at Lake Superior. Soils of the surface water area are dominated by heavy clays, which along with relatively steep terrain, gives rain and snowmelt little chance to infiltrate. The result is a very flashy stream that peaks quickly within 24 hours of a large rainfall or snowmelt.

In 1949, the Army Corps of Engineers dredged 4,500 feet of the Whittlesey Creek stream channel in an effort to dewater and stabilize the floodplain. Meanders were removed and a straight channel was constructed from Highway 13 to Lake Superior. In 1958, the channel was redirected toward its natural mouth because sand deposits had filled the dredged channel. Effects of this channelization are still seen today, with much of the lower end of Whittlesey Creek experiencing accretion from sediment build-up and unstable hydrology.

Fish and Wildlife

Fish - A species list compiled from information gathered by the Wisconsin DNR and Service's Sea Lamprey Management identified 21 species of fish, including seven salmonid species found in Whittlesey Creek. Whittlesey Creek supports a recreational fishery, primarily for brook trout and rainbow trout. It is also an important spawning stream for the naturalized coho salmon.

The Service and the Wisconsin DNR are conducting an experimental rehabilitation program for coaster brook trout in Whittlesey Creek. The experiment includes a stocking plan over seven years; the first stocking took place in 2003 and will continue each year until 2009.

Habitat degradation within Whittlesey Creek has lowered the productive capacity of this stream, particularly for brook trout. Substrate suitable for spawning and woody debris important as rearing habitat and for aquatic insect production have been degraded by high flows which erode

stream banks, remove woody debris and redeposit coarse materials in unsuitable areas. As the water level recedes, sedimentation results.

Birds – Area and Service biologists have identified 226 species of birds in the area, including waterfowl, neotropical migrants, raptors, grassland and shore birds. The 540 acres within the proposed refuge boundary will complement the 2,000 acres of coastal wetlands owned and managed by the Wisconsin DNR and City of Ashland. These wetlands, woodlands in the watershed and agricultural grasslands provide resting and breeding habitat for waterfowl and neotropical migratory birds. Piping plovers have been a rare sighting in the spring and fall at the mouth of Whittlesey Creek.

Mammals – Over 50 mammals have been noted in the area of and surrounding the refuge. Mammals that are notable for northern Wisconsin include black bear, gray wolf and fisher.

Reptiles and Amphibians – Fifteen amphibians and 11 reptiles have been noted from the region that could occur in the refuge. The wood turtle is listed as state threatened. Refuge staff are not sure whether the wood turtle is found in Whittlesey Creek, but staff assumes there is suitable habitat for it.

Federally Threatened and Endangered Species - Four federally listed threatened and endangered species occur in the Lake Superior region of northern Wisconsin: the bald eagle, gray wolf, Canada lynx and piping plover. Bald eagles nests within a couple miles of the refuge and use the refuge and surrounding wetlands as a food source. There are no eagle nests on the refuge. Numerous sighting of gray wolf have been made in or near the refuge. Occasional sightings of piping plovers have been made at the mouth of Whittlesey Creek during migration. Piping plovers have recently nested on select beaches of the Apostle Islands. No Canada lynx have been sighted in the refuge or vicinity.

Cultural Resources

Twenty two properties in Bayfield County had been placed on the National Register of Historic Places. None of the properties are located within the boundaries of the proposed refuge or within Barksdale township. There were thirteen buildings or farmstead complexes within the proposed boundary when it was established. Six of these have been removed once the Service acquired them. One of the homes remaining may have been the home of Asaph Whittlesey, founder of Ashland, Wisconsin, in 1860, and after whom Whittlesey Creek was named. Also within the proposed boundaries could be the site of the cabin built by Pierre Esprit Radisson in 1664 (Adams 1961 and Vestal 1940). The Refuge Manager considers potential impacts of management activities on historic properties, archeological sites, traditional cultural properties, sacred sites, human remains and cultural materials.

Public Use

The Whittlesey Creek NWR is open to wildlife-dependent public uses, including wildlife observation, wildlife photography, environmental education, interpretation, waterfowl hunting (east of Hwy. 13) and fishing. The refuge's headquarters and point of contact for visitors is the Northern Great Lakes Visitor Center, which is located immediately south of the refuge. In 2004, 160,000 visitors came to the Visitor Center, where they can access refuge information and view

the Whittlesey Creek exhibit, along with many other Great Lakes' exhibits. The Service also provides interpretive and education programs at the Visitor Center in cooperation with Center partners.

A three-season environmental education shelter with accessible trails and parking is the only visitor facility on the refuge. The Public Use Plan recommends that additional parking and trail facilities be built once lands are acquired and funds are available. The specific locations of these facilities aren't yet known, but they must be compatible with habitat restoration plans. No section of the refuge is closed to the public, so visitors can walk anywhere on refuge lands owned by the Service. Motorized vehicle use is prohibited except on public roads.

Section 4. Environmental Consequences

Effects Common to All Alternatives

Native Plant Species Restoration

Priority will be given to eliminating invasive species and restoring native plant species in all alternatives. Pesticide use will follow all Service guidelines and policies to minimize safety hazards and environmental effects.

Cultural and Historic Resources

There are no national historic registry or other known sites within the proposed refuge boundary. Prior to refuge undertaking that would disturb ground or potential sites, appropriate efforts would be made to identify known and unknown cultural resources within the area of potential effects, with avoidance of cultural resources being the preferred treatment.

Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Bill Clinton on February 11, 1994, to achieve the goal of environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and actions on minority and low-income populations. It is also intended to provide all citizens access to public information and participation in matters relating to human health or the environment, regardless of race or income.

None of the proposed management alternatives disproportionately place an adverse environmental, economic, social or health impact on minority or low-income populations.

Threatened and Endangered Species

The refuge is used for migratory and feeding habitat for the bald eagle, piping plover and gray wolf. In each alternative, care will be taken to provide for these species' needs. No activities are planned that would adversely impact potential habitat or food sources of these species.

Public Use

All public use must be appropriate and compatible with the purposes of the Whittlesey Creek NWR and as laid out in the Whittlesey Creek NWR Conceptual Plan for Public Use. Specific locations of facilities will not be determined until more land is acquired and habitat work is planned and initiated. This will not change with alternatives.

Prescribed Fire as a Management Tool

Prescribed burns will have an effect on the local public. Concern by the public is expressed whenever a fire is set. The effects of smoke on air quality and public safety is a concern and is addressed. Prescribed fires have habitat management benefits, which are described. Avoidance of impacts is an important aspect of any prescribed fire planning and implementation.

The effects of smoke on air quality are of moderate concern on this refuge. Because the refuge lies within ½ mile of a county highway (County G), a major U.S. highway (US 2) and is traversed by three town roads and a major state highway (WI 13), potential effects of smoke on travel is critical to consider. Smoke management is part of the planning process when developing prescribed fire plans. As burn units are quite small, most potential units are less than 20 acres, smoke is not expected to be a significant problem, but the public and the Service is concerned about any unexpected wind changes that could negatively affect residents and motorists.

Actions to manage smoke include: use of road guards and pilot car, signing, altering ignition techniques and sequence, halting ignition, suppressing the fire, and use of local law enforcement as traffic control. Burning will be done only on days that the smoke will not be blown across the community or traveled roads, or when the wind is sufficient as not to cause heavy concentrations. The Service will follow all federal, state and local air pollution control requirements.

The emotional impact of a prescribed fire on the local residents must also be considered. This concern can be relieved only by a concerted effort by refuge and Service personnel to carefully inform local citizens about the prescribed burning program. Prior to the ignition of any prescribed fire, information will be made available to visitors, local residents, and/or the press about what is scheduled to happen and why. On-site information will be provided to alleviate visitor concerns about the apparent destruction of resources by fire or the impairment of views due to temporary smoke. This information will include prescribed burn objectives and control techniques, current fire location and behavior, effects caused by the fire, impacts on private and public facilities and services, and restrictions and closures.

Prescribed fires affect vegetation, soils, wildlife and water quality of streams. Prescribed fires will be managed to improve native wildlife habitat and suppress invasive plant species. Temporary loss of vegetation is offset by an improvement in long-term habitat quality. Effort will be made to protect any plants listed as state threatened or rare from damage by prescribed fire.

The release of soil nutrients are temporarily increased after a fire. These nutrients are either taken up by plants, stored or dissolved with precipitation and enter waterways. Fires will be planned to avoid or minimize leaching into Whittlesey Creek and other streams in the refuge. Buffers and proper planning will also avoid/minimize the flow of ash into streams.

Alternative A – No Action Alternative

Fish habitat improvement

Habitat within the refuge and Whittlesey Creek may improve in the long-term, as long as work within the watershed continues. Success will be measured on an administrative basis only, not on a scientific basis since stream monitoring would not take place.

Fish and Wildlife Habitat in General

Improvements will take place, but on a tract-by-tract basis, rather than on an ecosystem basis. Habitat restoration and management would focus on the technique-de-jour rather than targeted

species of concern and ecosystem functions. Habitat for native species will improve, but our ability to measure success or failure will be limited.

Native Fish Restoration - Possible Conflicts with Naturalized Salmonids
Limited data on Lake Superior tributaries suggests that juvenile coho salmon may depress brook and brown trout populations (Stauffer 1977). Peck (2001) speculated that coho salmon might have a negative effect on the restoration of coaster brook trout in Lake Superior by competition in the stream environment. This is unknown, as coho introductions in Lake Superior occurred after coaster brook trout populations in the lake had already declined.

Inherent in the experiment to establish coaster brook trout in Whittlesey Creek is the belief that migratory brook trout can, if the proper strain is present and if protection is adequate, co-exist with non-native naturalized and stocked salmonines in Whittlesey Creek. Groundwater upwellings or springs are abundant in Whittlesey Creek, especially in the area near and upstream from the confluence of the main stem and North Fork. Brook trout, apparently more than any other salmonine, prefer upwellings for spawning habitat (Powers 1980, Curry and Noakes 1995). At the time of spawning, redd site selection is likely to result in some segregation of brook trout and non-indigenous salmonines in Whittlesey Creek.

The Service does not expect that stocking coaster strain brook trout will affect survival of coho salmon in Whittlesey Creek. Life requirements appear to be different enough that we can achieve restoration with naturalized salmonids present.

Community and Landowner Involvement
Our resources for landowner involvement will be opportunistic. Involvement of community interests would continue.

Alternative B – Refuge Only Management

Fish Habitat Improvement
Fish habitat in Whittlesey Creek within the refuge would be improved and managed only to provide additional cover. In-stream habitat would be monitored within the refuge. Sediment loading would not be dealt with. Upstream habitats would not be restored.

Fish and Wildlife Habitat in General
Habitat management in the refuge would focus on resources of concern and ecosystem functions that can be provided on refuge lands only. Monitoring of habitats would take place and be measured against objectives. Hydrology and habitat within the watershed would not be addressed. Fish and wildlife habitat in the watershed and Whittlesey Creek upstream may improve through private stewardship or it may decrease through increased development. There would be no monitoring to track changes.

Native Fish Restoration - Possible Conflicts with Naturalized Salmonids
Effects would be the same as Alternative A.

Community and Landowner Involvement
Landowners within the watershed would be minimally involved in the refuge. The community interests would remain active and involved.

Alternative C — Management of Refuge and Watershed (Preferred Alternative)

Fish Habitat Improvement
Fish habitat would improve to good quality (Simonson et al. 1993) over all reaches in Whittlesey Creek in the long term. Habitat for other aquatic species such as wood turtle and northern water shrew would also improve.

Fish and Wildlife Habitat in General
Habitat improvement within the refuge will focus on habitat needs for resources of concern. Monitoring will be done to measure specific objectives laid out in the Habitat Management Plan. Ecosystem functions such as hydrology will be addressed for the entire watershed, along with the refuge, which is critical for improving habitat conditions in the refuge. Infrastructure needs and their relation to habitat management will also be addressed.

Native Fish Restoration - Possible Conflicts with Naturalized Salmonids
The effects would be the same as Alternative A, with the addition of positive impacts from habitat improvements throughout the stream. This will likely benefit both brook trout and naturalized salmonids by improving resting habitat, providing more food for all species and improving the quality of spawning sites.

Community and Landowner Involvement
The Service will have resources and strategies to work with private landowners within the watershed who are interested. Involvement of community interests will continue.

Section 5. Public Involvement

See Section 1.6 – Scoping the Issues

Section 6. List of Preparers

Pam Dryer, Manager, Whittlesey Creek National Wildlife Refuge

Section 7. References

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Appendix F. Public Comments Received

The following comments were received from the public as part of the initial scoping, either through comment cards that were sent to about 400 people, at the open house in April 2004 or via the internet.

- Please consider habitat in-stream improvement including installing lunker structures. Whittlesey Creek lacks sufficient cover to protect trout from predators
- Thanks for keeping me posted.
- I am delighted with what's happening at the refuge so far. We of Audubon worked hard to get the refuge.
- What hunting, fishing and trapping will be allowed?
- I support this.
- How about reestablishing cedar and other native species in the refuge?
- How can we support your waste when the country can't even keep social security going?
- Good job. Keep it up.
- When a private property/house is purchased on the north side of the refuge, see if you can raise funds to use it as an educational stop and access to the refuge. It will give a different, lower-to-the-ground access to the refuge. Complement the NGLVC.
- Particularly interested in habitat restoration reestablishment efforts for coaster brook trout.
- Consider area as refuge for duck hunting to help "stop over" birds. I don't know if this has been shown to be helpful but may be good especially with increased open water hunting on the bay.
- Had the pleasure of a brief tour of the project area on 4/1/04 with Mike M. This is a unique stream and a valuable wetland/floodplain well worth preserving. Good luck in your endeavors.
- I would like to see the refuge accessible (trail system) but no interpretive/education/signage. The NGLVC provides adequate interpretation and an over-signed trail. There should be a place kept wild – that is what a refuge should be and sign-free!
- I don't know if it's too late, but . . . this area needs a x-country ski trail close to town and the topography (hills) are nice.
- I'm a 3rd generation landowner on Cherryville Rd. I manage timber in the U.S. Forest Service. The water that enters the ground on our land base provides water for Whittlesey Creek. I want this refuge to be sensitive to motorized publics, anglers, and hunters wherever possible.
- Is my property within the bounds of the primary 540 acre target refuge?
- Have been interested in lower end of Whittlesey Creek for over 70 years.
- The old house and trailers that you've bought at the end-of and along Cherryville Rd. are eye-sores!! When will they be removed?
- The coaster project is good in theory, but not if it comes at the expense of our naturalized and stocked trout fishery!! Could some funding be allocated to build up our stocks of inshore trout species which are at an all time low right now? Keep the Fishery first!
- I would like to speak to someone about the plan.

- Recommends cedar/bottomland conifer restoration – believes this was historic vegetation. Also believes further stream restoration is necessary before reintroduction of coaster brook trout.
- I feel the central and primary goal of all the Wildlife Refuges should (must) remain habitat preservation. Aldo Leopold taught us that habitat is sacred. How we treat this treasure is the only measure of our value as managers of the land. All "motorized toys" are foreign to and thus detrimental to this central objective. The existing snowmobile trail and any other motorized trails through the Whittlesey is a black mark on the central goal of wildlife habitat.
- As an organization, we support the USFWS effort to preserve and protect the Whittlesey Creek watershed. We also support the associated Coaster Brook Trout restoration project. Our point of concern, however, has to do with a non-native species. The Coho Salmon was introduced by the state of Michigan, but found Chequamegon bay, especially Whittlesey Creek to its liking. Over the past thirty years it has become a very important game fish, both recreational wise and economic wise, with fishermen traveling here to participate in the fishery. Estimates vary, but I have seen reports of up to 80% of all coho salmon in western Lake Superior coming from the spawning sites in Whittlesey Creek. Our comments/concerns are: 1) Have the important structures for coho salmon spawning been identified (in Whittlesey Creek)? 2) Are steps being taken to minimize disturbances and disruptions of these important areas? 3) If not, we support your doing so. Please feel free to contact me about our concerns. *Submitted by Apostle Islands Sport Fishermen's Association.*

The following comments were received from the public and agencies in review of the draft plan.

- Tom Galazan wrote: Greetings: As a lifelong area resident, I was pleased to witness the formation of the Whittlesey Creek National Wildlife Refuge a few years back. The recent draft management plan rightly considers the entire watershed and seeks to improve habitat there. I only hope that cost effective, minimally disruptive restoration and management projects can ensue. I'm particularly interested in seeing efforts to reestablish some of the original vegetation – white cedar, black spruce, etc. I trust those efforts will not involve the use of herbicides which can be detrimental to amphibians and other wildlife, the use of which runs counter to the restorative goals of the Refuge.
  Response: Our focus for restoration will be to restore native vegetation, including floodplain and lowland forest habitats where they once were. Tree planting is often very cost-effective. We must, however, first control invasive reed canary grass, and this might require minimal use of non-persistent pesticides (such as direct application of glyphosate using a weed wiper). We also plan to restore hydrology, which will be a challenge with the infrastructure in place (roads, bridges, homes). Because of this infrastructure, and because of the past history of Whittlesey Creek channelization, restoration of hydrology will not be cheap. The Service will be very cautious in our approaches and use the best research data and expertise we can before we move ahead with hydrological restoration.
- Terri Bahe wrote: Pam – Thank you for the Public Review Draft for the refuge. It is very good and I too favor your preferred alternative C which includes the watershed. I think it is very important to include this and to work closely with the private landowners, and continue to offer them technical and financial assistance. It was very unfortunate that part of the old golf course area was bought out from under you and still has that golf course look. I am

concerned that the Refuge will have to alter restoration plans. I would like to see the Refuge kept as natural as possible, with minimal signage, no further new buildings and a max of two parking areas. The possible Asaph Whittlesey historic home and Radisson site should be thoroughly researched and preserved if these are validated. You do not need to send me a final plan. Great job so far!
Response: Thank you for your support. As noted in the response to Mr. Gallazan, the hydrological restoration will be complex with existing infrastructure in place. All infrastructure will need to be considered. We have been and will continue to work with private landowners within the refuge boundary to conduct studies, map and control invasive species, and purchase lands.
Our public use plan is in sync with your ideas. No additional structures are planned and we are removing buildings as we acquire them. Public access is currently provided at the Coaster Classroom and we plan to provide access at one other location, which is to be determined. And, historic properties will definitely be researched once we acquire the appropriate tracts.

- Todd Naas from the Wisconsin DNR submitted comments – see attached letter.
Response: We have added a paragraph in the species of concern section that describes the eventual loss of grassland habitats within the refuge and the effect this will have on grassland species.
- Technical review comments were received from: Faith Fitzpatrick, U.S. Geological Survey; Dennis Pratt, Wisconsin DNR; staff of the Ashland Fishery Resources Office; and Steve Hoecker, U.S. Forest Service, Northern Great Lakes Visitor Center. There comments were incorporated where possible. Specific comments are on file at the refuge and can be obtained by contacting refuge headquarters (715-685-2678).