HABITAT MANAGEMENT PLAN

Minnesota Valley

National Wildlife Refuge

May 2018

Habitat Management Plans provide long-term guidance for management decisions; set forth goals, objectives, and strategies needed to accomplish refuge purposes; and, identify the U.S. Fish and Wildlife Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

The National Wildlife Refuge System, managed by the U.S. Fish and Wildlife Service, is the world's premier system of public lands and waters set aside to conserve America's fish, wildlife, and plants. Since the designation of the first wildlife refuge in 1903, the System has grown to encompass more than 150 million acres, 566 national wildlife refuges and other units of the Refuge System, plus 38 wetland management districts.

Habitat Management Plan
For
Minnesota Valley National Wildlife Refuge

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EXECUTIVE SUMMARY

This Habitat Management Plan (HMP), a step-down plan of Minnesota Valley National Wildlife Refuge and Wetland Management District's Comprehensive Conservation Plan (USFWS 2004a) and provides more precise guidance for habitat management on Refuge land. A separate HMP provides habitat management guidance for the Wetland Management District (USFWS, 2018). The Refuge HMP document will help facilitate development of specific management strategies to achieve Refuge habitat objectives. The plan was prepared according to guidelines for developing HMPs found in U.S. Fish and Wildlife Service's Habitat Management Plan policy (620 FW 1). The document also complies with all applicable laws, regulations, and policies governing the management of units of the National Wildlife Refuge System.

Minnesota Valley National Wildlife Refuge encompasses approximately 14,700 acres spread out over 13 management units. Twelve of these units are located along a 70-mile stretch of the Minnesota River southwest of the greater Minneapolis-St. Paul (Twin Cities) metropolitan area. The Round Lake Unit, a 157-acre lake basin with an area of permanent wetland located in the City of Arden Hills, Ramsey County, is separate from the rest of the Refuge.

The Refuge was established in 1976 through the Minnesota Valley National Wildlife Refuge Act ((*Public Law 94-466; October 8, 1976*). The Refuge purpose is to provide habitat for migratory birds, fish and other wildlife and environmental education along with wildlife dependent recreational opportunities. The location of the Refuge also makes it important for the conservation of native habitats within an urban landscape.

Through the HMP process, Refuge staff evaluated and selected 39 Resources of Concern (ROC) including 24 bird species or groups, four fish species, three invertebrate species, two reptile species, two mammal species, one plant species, and three native plant communities to represent the ecological integrity of the Refuge. Twelve broad habitat types were identified and included a range of wetland conditions, prairies, forests, small creeks, and the Minnesota River. The following six habitats are considered to be Priority 1 habitats for the Refuge:

- Permanent/Semi-permanent wetlands
- Deepwater wetlands
- Fen, wet meadow, carr
- Floodplain Forest
- Remnant prairie (both dry and wet/mesic)
- Oak savanna

Over the next 15 years, the Refuge will focus on completing management activities in Priority 1 habitats. Over the next 5 years, management activities will focus on:

- Gathering information to better understand the hydrology of the Minnesota River to help us manage priority habitats for Refuge Resources of Concern. More details will be discussed in the Refuge's upcoming Inventory and Monitoring Plan.
- Managing deepwater wetlands for urban fishing opportunities in partnership with the Minnesota Department of Natural Resources (MNDNR).

- Continuing to manage 1,900 acres of permanent/semi-permanent wetland to provide a mosaic of habitat for migratory waterfowl, shorebirds, wading birds, and other water birds.
- Protecting 1,600 acres of floodplain forest by promoting natural re-forestation on of over 300 acres and increasing block size were appropriate or where possibilities partnerships exist.
- Protecting remnant native prairie (dry and wet/mesic) habitat through invasive species control and applying prescribed disturbance on approximately 58 acres.
- Restoring 160 acres of remnant oak savanna through thinning, invasive species control, and prescribed fire.

Within the next 10 to 15 years, we will be gathering the information needed to gain a better understanding of the Minnesota River and its influence on Refuge habitats, beginning the implementation of any management actions identified through a greater understanding of Refuge hydrology, continuing to control invasive species where management actions can have a positive impact in protecting native plant communities, and continuing to protect and manage of remnant plant communities associated with prairies and oak savannas.

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ACRONYMS AND ABBREVIATIONS

BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BIDEH	Biological Integrity, Diversity, and Environmental Health
CCP	Comprehensive Conservation Plan
DNR	Department of Natural Resources
DOI	U.S. Department of the Interior
DUD	Duck Use Days
ETPBR	Eastern Tallgrass Prairie and Big Rivers
FMP	Fire Management Plan
HMP	Habitat Management Plan
IMP	Inventory and Monitoring Plan
IPM	Integrated Management Plan
LCC	Landscape Conservation Cooperatives
LML	Long Meadow Lake
LWCF	Land and Water Conservation Fund
MIM	Minnesota and Northeast Iowa Morainal Unit
MNDNR	Minnesota Department of Natural Resources
NAWMP	North American Waterfowl Management Plan
NLCD	National Land Cover Database
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NVCS	National Vegetation Classification System
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
ROC	Resources of Concern
ROCSTAR	Resources of Concern Selection Tool for America's Refuges
SCGN	Species of Greatest Conservation Need
SHC	Strategic Habitat Conservation
UMRGL JV	Upper Mississippi River and Great Lakes Region Joint Venture
UMVGL	Upper Mississippi Valley and Great Lakes
U.S.	United States
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WMD	Wetland Management District

CHAPTER 1.

INTRODUCTION

1.1 Scope and Purpose of Minnesota Valley National Wildlife Refuge
1.2 Legal Mandates and Service Policy
1.3 Habitat Management Planning Relationship to Other Plans

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1. INTRODUCTION

1.1 SCOPE AND PURPOSE OF MINNESOTA VALLEY NATIONAL WILDLIFE REFUGE

The National Wildlife Refuge System Improvement Act of 1997 established several important mandates that prepared the way for the development of a renewed vision for the future of National Wildlife Refuges (NWR). The legislation established a unifying mission of the National Wildlife Refuge System (NWRS) and directs the Secretary of the Interior to ensure that the mission of the NWRS and purposes of individual refuges are carried out. It also requires the Secretary of the Interior to maintain the biological integrity, diversity, and environmental health of the NWRS. Under the Act, the goals of the NWRS are:

- Wildlife comes first in the management of refuge lands
- Fulfill statutory duty to achieve refuge purpose(s) and further the System mission
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or are in threat of becoming endangered
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations
- Conserve a diversity of fish, wildlife, and plants
- Conserve and restore, where appropriate, representative ecosystems of the United States, including ecological processes characteristic of those ecosystems
- Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation

One of the mandates of the Act was that each unit of the NWRS shall develop a Comprehensive Conservation Plan (CCP). In September 2004, the U.S. Fish and Wildlife Service (USFWS) published the Final CCP for Minnesota Valley National Wildlife Refuge (Refuge) and Wetland Management District (District) (USFWS 2004a). As part of the planning and National Environmental Policy Act processes associated with the CCP, the USFWS evaluated the effects of implementing a broad range of fish, wildlife, plant, and habitat management programs and techniques to achieve both the Refuge and District missions, goals, and objectives. The CCP outlines how the Refuge and District will address USFWS trust resource responsibilities, maintain and, where appropriate, restore biological integrity, diversity, and environmental health, and support achievement of the NWRS mission 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.*

In addition to the NWRS mission, the purposes of the Refuge, as outlined in the CCP are to:

> *(1) Provide habitat for a large number of migratory waterfowl, fish, and other wildlife species;*

(2) Provide environmental education, wildlife recreational opportunities, and interpretive programs for hundreds of thousands of Twin Cities residents;
(3) Protect important natural resource areas from degradation;
(4) Protect the Valley's unique social, educational, and environmental assets.

As part of the 2004 CCP (USFWS 2004a), the Refuge developed a vision statement for both the Refuge and the Wetland Management District. After the 2004 CCP was completed the Refuge vision was revised slightly to reflect a change in the desired future condition of an unbroken corridor of floodplain and habitat along the Minnesota River to "just south of Henderson, Minnesota" instead of the original text of "to its origin at Big Stone Lake." The change was done to provide a greater focus to targeted conservation.

The vision for the Refuge (not including the District) is that the Refuge will add richness to the social, cultural, economic, and ecological communities by holding in public trust, a portion of the natural heritage of the Minnesota River Basin for the continuing benefit of the American people. Within its area of influence, the Refuge will make significant contributions toward:

- *Establishing an unbroken corridor of floodplain and hillside forest, wetlands, oak savanna, and native prairie along the Minnesota River beginning at historic Fort Snelling and proceeding up river just south of Henderson, Minnesota;*
- *Managing diverse and abundant native fish and wildlife populations that use healthy and productive native plant communities of the Minnesota River and its watershed;*
- *Providing Minnesota citizens the opportunity to revitalize their spirts through quality wildlife-dependent recreation such as hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation;*
- *Supporting a community-based effort where citizens, businesses, private conservation organizations, and local, state, and federal agencies combine their efforts to restore and protect the Minnesota River and the watershed for future generations.*

This Habitat Management Plan (HMP), a step-down plan of the Refuge and District CCP (USFWS 2004a), provides more precise guidance for habitat management on Refuge land. A separate HMP was developed to provide habitat management guidance for the District (USFWS 2018). The HMP document will help facilitate development of specific management strategies to achieve Refuge habitat objectives. Additionally, the HMP will form the basis from which the Refuge Inventory and Monitoring Plan will be developed.

The plan was prepared according to guidelines for developing HMPs found in USFWS Habitat Management Plan policy (620 FW 1). The document also complies with all applicable laws, regulations, and policies governing the management of units of the NWRS.

The lifespan of the HMP is 15 years from final approval. HMPs may be updated every five years, as necessary. The Refuge Manager may modify the CCP and/or HMP at any time if new information suggests these plans are inadequate or resources would benefit from changes and/or amendments.

1.2 Legal Mandates and U.S. Fish and Wildlife Service Policy

The Refuge was established by Congress in 1976 through the Minnesota Valley National Wildlife Refuge Act (*Public Law 94-466; October 8, 1976*) (Refuge Act). The 1976 Refuge Act authorized

the purchase of 9,500 acres for the Refuge. The Refuge Act also acknowledged the presence of the Minnesota Valley State Recreation Area and Trail to be administered by the Minnesota Department of Natural Resources (MNDNR). The approved Refuge acquisition boundary has been revised several times since 1976 to bring the total authorized acreage of the Refuge to 26,018 acres (as calculated from the Geographic Information System [GIS]). Currently over 12,900 acres are managed as fee title lands and 1,850 acres are managed under an agreement with partners. A more detailed explanation on the fee title and managed lands is provided in Chapter 2.

There are many key legal mandates that relate to the Refuge. The most important are mentioned below relative to planning for habitat management. For a detailed list of legal mandates and authorities, see the Refuge and District CCP (USFWS 2004a).

The Migratory Bird Conservation Act was established on February 19, 1929 (45 Stat. 1222) as amended, 16 (U.S.C. 715d, 715e, 715f, to 715k and 715l to 715r). The Act provides for the acquisition of lands determined to be suitable as an inviolate sanctuary for migratory birds.

U.S. Fish and Wildlife Service Policy

Important guidance for habitat management on refuges has already been provided by several key policies outlined by the USFWS. These policies are included within the USFWS Manual, which documents re-delegation of the Director's authority, prescribes the policies and procedures for administrative activities and program operations, and steps down our compliance with other requirements, such as statutes, Executive Orders, Departmental directives, and regulations of other agencies (USFWS 2012). Several policies are pertinent to the development of HMP's:

Habitat Management Planning Policy - 620 FW 1 (USFWS 2002)

This chapter of the USFWS Manual establishes Service policy for planning habitat management within the NWRS. The guidance in this chapter applies to the development of HMPs and Annual Habitat Management Plans (AHMPs) and discusses their relationship to refuge CCPs. The policy and guidance in this chapter describe strategies and implementation schedules for meeting CCP goals and objectives. The above referenced policy was used to direct the content and considerations addressed in this HMP.

Biological Integrity, Diversity and Environmental Health Policy - 601 FW 3 (USFWS 2003a)

This chapter provides policy for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health (BIDEH) of a unit of the NWRS. The policy is a System directive for refuge managers to follow while achieving the unit's purpose(s) and System mission. It provides guidance for conservation and management of the broad spectrum of fish, wildlife, and habitat resources found on NWRS lands and associated ecosystems. Further, it provides managers with an evaluation process to analyze their refuge/district and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with station purposes and System mission, restore lost or severely degraded components. The role of BIDEH was considered in this habitat management planning process to the extent that it supports the Refuge purpose, goals, and objectives.

Inventory and Monitoring Policy - 701 FW 2 (USFWS 2014)

This chapter provides guidance for developing an Inventory and Monitoring Plan (IMP) for a unit of the NWRS. It describes priorities for natural resource surveys, the selection and design of survey protocols, data storage and analysis, and reporting results. The policy accommodates all levels of natural resource surveys from the station level to participation in landscape, regional, national and international inventory and monitoring programs, both internal and external to the USFWS. Overall, this policy promotes consistency in the planning and implementation of inventory and monitoring throughout the Refuge System. The policy will be used as guidance to direct the development of inventory and monitoring strategies to be outlined in a future inventory and monitoring plan.

1.3 HMP Relationship to Other Plans

1.3.1 Interagency Plans

U.S. Department of the Interior Adaptive Management Guide (Williams et. al 2009)

The planning team used adaptive management principles in the development of this HMP. The Refuge will also use adaptive management to respond to changing conditions that impair the ability to measure and achieve habitat objectives. It should be noted that although aspects of the U.S. Department of the Interior's (DOI) adaptive management guide were used throughout the entire process of developing this HMP, it is not a required aspect of completing the HMP. As such, the processes outlined below were strictly used as guidance. Service policy (620 FW 1, 601 FW 3, 701 FW 2) for development of HMPs was the overarching direction used to complete the Refuge HMP. As defined by the DOI (Williams et al. 2009), adaptive management is:

> "...a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders."

There are two phases in implementing the DOI's adaptive management procedures; the "Set-up Phase" (Steps 1-5 below) where key components of the program are developed, and the "Iterative Phase" (Steps 6-9) where components of the program are put in practice and linked together in a data driven, results oriented sequential decision making process.

Strategic Habitat Conservation (SHC)

In 2006, the USFWS adopted Strategic Habitat Conservation as a business model for landscape conservation efforts (USFWS 2006). According to USFWS (2008b), SHC is a five-step iterative process that involves:

- *Biological planning* – Identifying priority trust resources and threats or limiting factors to their populations and using models to describe the relationship among habitat, limiting factors, and population levels.
- *Conservation design* – Developing decision-support tools such as maps and models based on the outcome of the biological planning step. Priority geographic areas and population-based objectives for habitats are additional outcomes of this step.
- *Conservation delivery* – Using the decision-support tools to implement conservation actions through programs and partnerships to achieve specific biological results.
- *Monitoring* – Collecting data to evaluate the effectiveness of conservation actions towards achieving the desired results and informing future planning and delivery.
- *Research* – Testing assumptions to the planning and design components that have the greatest impact on management decisions to provide feedback for future planning.

SHC is used to provide a landscape-level, big-picture framework for prioritizing where conservation work should occur. SHC is a form of adaptive management used for at the landscape scale.

1.3.2 Regional and International Plans

North American Waterfowl Management Plan (NAWMP)

The North American Waterfowl Management Plan was first signed in 1986 with subsequent revisions in 2000 and 2004. The most recent version states, "the purpose of the Plan is to sustain abundant waterfowl populations by conserving landscapes, through partnerships that are guided by sound science" (NAWMP, Plan Committee 2004).

U.S. Shorebird Conservation Plan, Northern Plains/Prairie Potholes Regional Shorebird Conservation Plan, Upper Mississippi Valley/Great Lakes Regional Conservation Plan and the Upper Mississippi Valley/Great Lakes Shorebird Habitat Conservation Strategy

The U.S. Shorebird Conservation Plan outlines shorebird conservation status, populations and priorities, national conservation strategies, recommends monitoring programs, and identifies regional conservation goals and strategies (Brown et al. 2001). The Prairie Potholes Regional Shorebird Conservation Plan (Skagen and Thompson 2013) and the Upper Mississippi Valley/Great Lakes Regional Conservation Plan (Ferene de Szalay 2013) and Habitat Conservation Strategy (Potter et al. 2007) provides similar information that is focused on these specific regions.

North American Waterbird Conservation Plan, Northern Prairie and Parkland Waterbird Conservation Plan and the Upper Mississippi Valley/Great Lakes Region Waterbird Conservation Strategy

The North American Waterbird Conservation Plan "provides an overarching continental framework and guide for conserving waterbirds" (Kushlan et al. 2002). It focuses on colonial-nesting waterbirds and sea birds, which are only a portion of the waterbird species that use the Prairie Pothole Region. The Northern Prairie and Parkland Conservation Plan (Beyersbergen et al. 2004) and the Upper Mississippi Valley/Great Lakes Region Waterbird Conservation Strategy

(Soulliere et al. 2007) are especially helpful for the Refuge area, as they specifically address species found here.

Partners in Flight (PIF) North American Landbird Conservation Plan, PIF Bird Conservation Plan for the Northern Tallgrass Prairie, Upper Mississippi and the Great Lakes Region Joint Venture Landbird Habitat Conservation Strategy

The PIF North American Landbird Conservation Plan was developed "to provide a continental synthesis of priorities and objectives that will guide landbird conservation actions at national and international scales" (Rich et al. 2004). PIF wrote a regional plan for the Northern Tallgrass Prairie (Physiographic Area 40; Fitzgerald et al. 1998), but more recently has updated its species assessment scores by Bird Conservation Regions (the Refuge is primarily in Bird Conservation Region (BCR23) Prairie Hardwood Transition). Scores can be found at http://www.rmbo.org/pif/pifdb.html. More specific landbird information can also be found in the Upper Mississippi and the Great Lakes Region Joint Venture Landbird Habitat Conservation Strategy (Potter et al. 2007).

Prairie Pothole Joint Venture Implementation Plan

The Prairie Pothole Joint Venture (PPJV) was established under the NAWMP, but has since expanded from a focus on waterfowl to planning for "all-bird" conservation. The most recent implementation plan (USFWS 2005) provides stepped-down objectives from the four major species group plans described above (waterfowl, shorebirds, waterbirds and landbirds).

1.3.3 State Plans

Minnesota Wildlife Action Plan (2015-2025)

The State of Minnesota recently updated its State Wildlife Action Plan (SWAP) in 2016 (MNDNR 2016). The updated plan replaced the 2006 plan, Tomorrow's Habitat for the Wild and Rare (MNDNR 2006a). This updated strategic plan guides management for species in greatest conservation need across the state. Species of Greatest Conservation Need (SGCN) are "native animals whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability" through a three-pronged approach. The three prongs include: sustaining and enhancing habitats for SGCN in the context of the larger landscape, identifying actions for prioritized SGCN or groups of SGCN whose needs cannot be addressed through habitat actions, and focusing on providing people with opportunities to enjoy wildlife and habitats to encourage engaged conservation. The 2016 updated plan lists 346 SGCN in Minnesota.

Minnesota DNR Long Range Duck Recovery Plan

The Minnesota Duck Recovery Plan (MNDNR 2006b) identifies both challenges and strategies to recover "historical breeding and migrating populations of ducks in Minnesota for their ecological, recreational, and economic importance to the citizens of the state." The plan sets a 50-year goal to sustain a breeding duck population of 1 million birds.

Minnesota Prairie Conservation Plan

In 2011, Minnesota's conservation partners in the Prairie Region of the state collaborated to develop a 25-year strategy for accelerating conservation. Prairie partners proposed permanent protection and restoration activities of native prairies, wetlands, and other habitats. They also highlighted enhancement of prairies and grasslands via prescribed fire, conservation grazing, haying and invasive species control and enhancement of wetlands and shallow lakes through control of invasive species and intensive water level management. The final suggestion was the incorporation of conservation into "working lands" (Minnesota Prairie Plan Working Group 2011).

1.3.4 Refuge Plans

Minnesota Valley NWR and Wetland Management District (WMD) Comprehensive Conservation Plan

As described above, the HMP is a step-down plan from the Refuge's CCP (USFWS 2004a). The CCP is a long-term, comprehensive plan that guides all aspects of conservation in the Refuge, including habitat management, public use, and operations. However, the CCP habitat goals and objectives (Appendix A) were not specific enough for the purposes of the HMP. The HMP focuses on and refines the broader habitat goals and objectives provided in the CCP. The habitat goals and objectives contained within the HMP support migratory bird conservation and help fulfill the purposes for which the Refuge was established. Habitat management strategies discussed in this document are also consistent with the actions outlined in the Preferred Alternative of the Environmental Assessment (USFWS 2004a) that accompanied the CCP.

Minnesota Valley NWR & WMD Wildland Fire Management Plan (FMP)

Fire is a key ecological process in prairie, forest, and wetland ecosystems. As such, prescribed fire is a primary habitat management tool for the Refuge. The Minnesota Valley FMP (USFWS 2007) is an operational guide for managing the Refuge and District wildland and prescribed fire program. It is written to comply with both DOI and Service-wide requirements that units of the NWR with burnable vegetation develop a fire management plan (620 DM 1). The FMP outlines a program that describes the safest, most cost effective, and ecologically responsible suppression of all wildland fires and use of prescribed fire to achieve habitat objectives.

Minnesota Valley NWR Landscape Plan

The Master Plan for the Refuge, which was completed in 1984, called for the establishment of grasslands and food plots (corn and soybeans) on the Refuge floodplain to enhance the area for waterfowl nesting and migration. However, in the early 1990's the Refuge reassessed its habitat restoration and management programs and, with the input of other conservationists, developed its Landscape Plan in 1993 (USFWS 1993). This plan set forth the philosophy of restoring plant communities to native species. It also identified the importance of using natural processes such as prescribed fire and water management to maintain the diversity and productivity of these communities. This philosophy was an integral part in the development of the Refuge CCP and the guiding principles will be reflected in this HMP. In brief, the Landscape Plan guides the Refuge's habitat restoration management program and can be summarized by the phrase "native species and natural processes."

Minnesota Valley NWR Agricultural Management Plan

The Refuge is currently in the process of preparing an Agricultural Management Plan, which will be completed by the end of the year. The Refuge does not currently or have future plans to use row-crop agriculture on any management units. The Agricultural Management Plan will be used to outline haying, mowing, and grazing practices, which will be used as an alternative when prescribed burning is not possible due to weather, site conditions, or societal reasons (i.e. proximity to roads, adjacent infrastructure).

Minnesota Valley NWR Compatibility Determinations

Through the CCP process, 21 compatibility determinations have been completed for the Refuge. A compatibility determination is a written document that signed by the Refuge Manager and Regional Refuge Chief that determines whether a proposed use on the Refuge is compatible or not within the UFWS mission and the Refuge's state purpose. Appendix B lists the completed compatibility determinations. Individual compatibility determinations are available at the Refuge.

CHAPTER 2.

BACKGROUND

2.1 Refuge Background
2.2 Changes from Historic Condition and Current Issues
2.3 Physical/Geographic and Historic Setting
2.4 Current Condition and Habitat Changes From Historic to Current
2.5 Prioritizing Areas for Management

Rapids on the Minnesota River, The Carver Unit (Photo courtesy of USFWS)

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2. BACKGROUND

2.1 REFUGE BACKGROUND

Minnesota Valley National Wildlife Refuge manages over 14,700 acres located in east-central Minnesota, with portions falling within the Minneapolis-St. Paul metropolitan area. The authorized boundary of the Refuge encompasses approximately 26,018 acres (calculated using GIS). Approximately 12,900 acres are currently owned by the Refuge in fee title or by the Minnesota Valley National Wildlife Refuge Trust (Trust). The Trust lands are managed by the Refuge through a Memorandum of Understanding (MOU). The mission of the Trust is to serve as a mitigation agent for the Metropolitan Airports Commission to replace Refuge lands that were impacted due to the expansion of the Minneapolis-St. Paul International Airport.

The Trust administers funds to acquire and protect habitat in support of Refuge purposes. The Trust assists in land acquisition and restoration. Lands purchased by the Trust are donated to the USFWS upon completion of habitat restoration activities. The Refuge also manages 1,850 acres that are owned by local governments or other agencies. These lands are managed as Refuge through MOUs. Both fee title/Trust-owned lands and MOU agreement lands are displayed in Figure 2-1. For the purpose of this HMP, acreage figures for management units or habitat totals consider fee title, trust-owned areas, and MOU areas equally. Acreages related to current ownership are specifically discussed when it impacts future management. As detailed in Chapter 4 and 5, priority will be given to lands owned by the USFWS over other lands, in particular MOU areas.

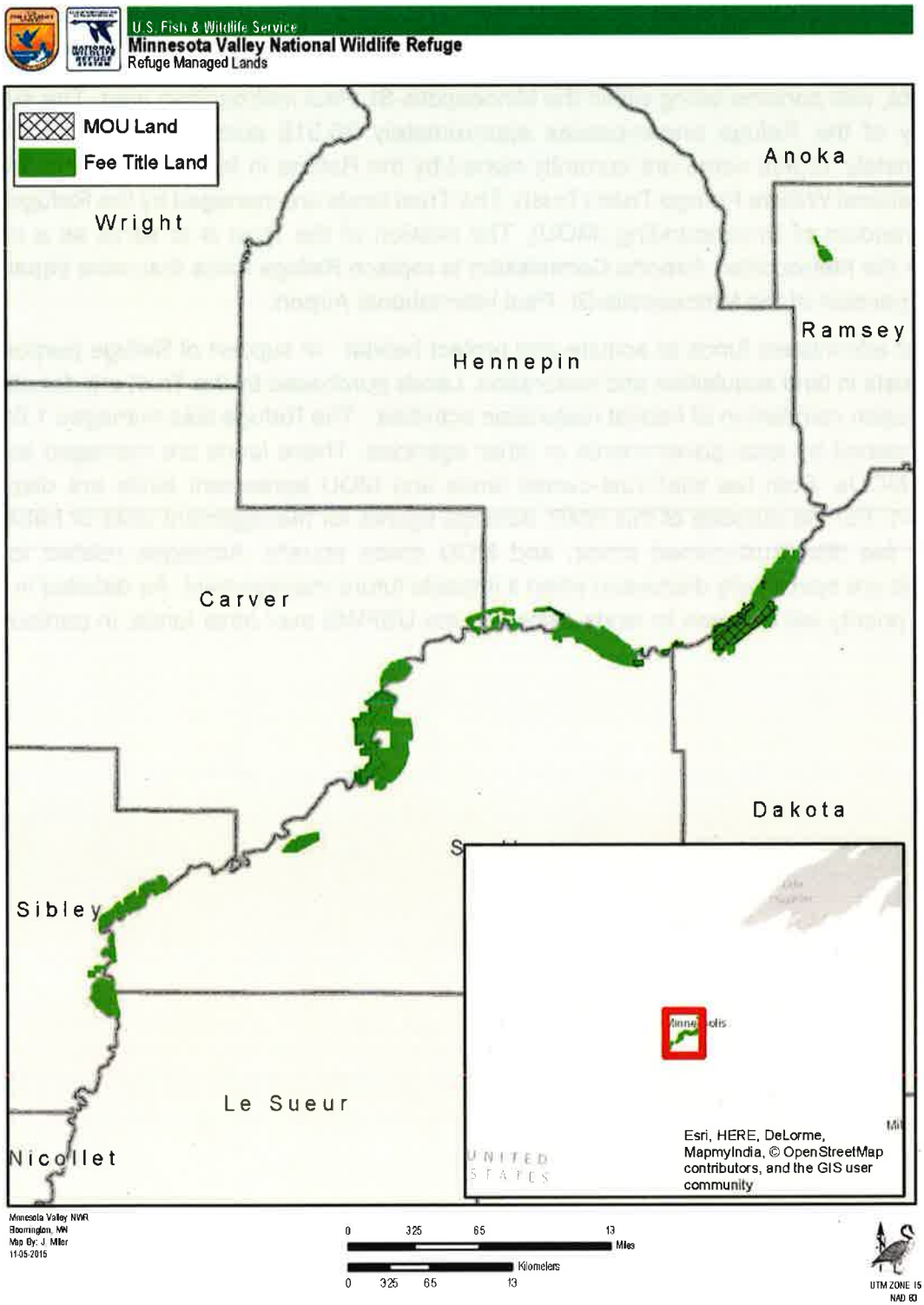

Figure 2-1 Lands Owned or Managed by Minnesota Valley NWR

The Refuge consists of thirteen units. Twelve units are along a 70-mile reach of the Minnesota River located between historic Fort Snelling and the City of Henderson, Minnesota (Figure 2-2). This stretch includes the Long Meadow Lake, Black Dog, Bloomington Ferry, Wilkie, Upgrala, Chaska, Louisville Swamp, Rapids Lake, San Francisco, St. Lawrence, Blakeley and Jessenland Units. The Round Lake Unit, a 157-acre lake basin with an area of permanent wetland located in the City of Arden Hills, Ramsey County, is separate from the rest of the Refuge.

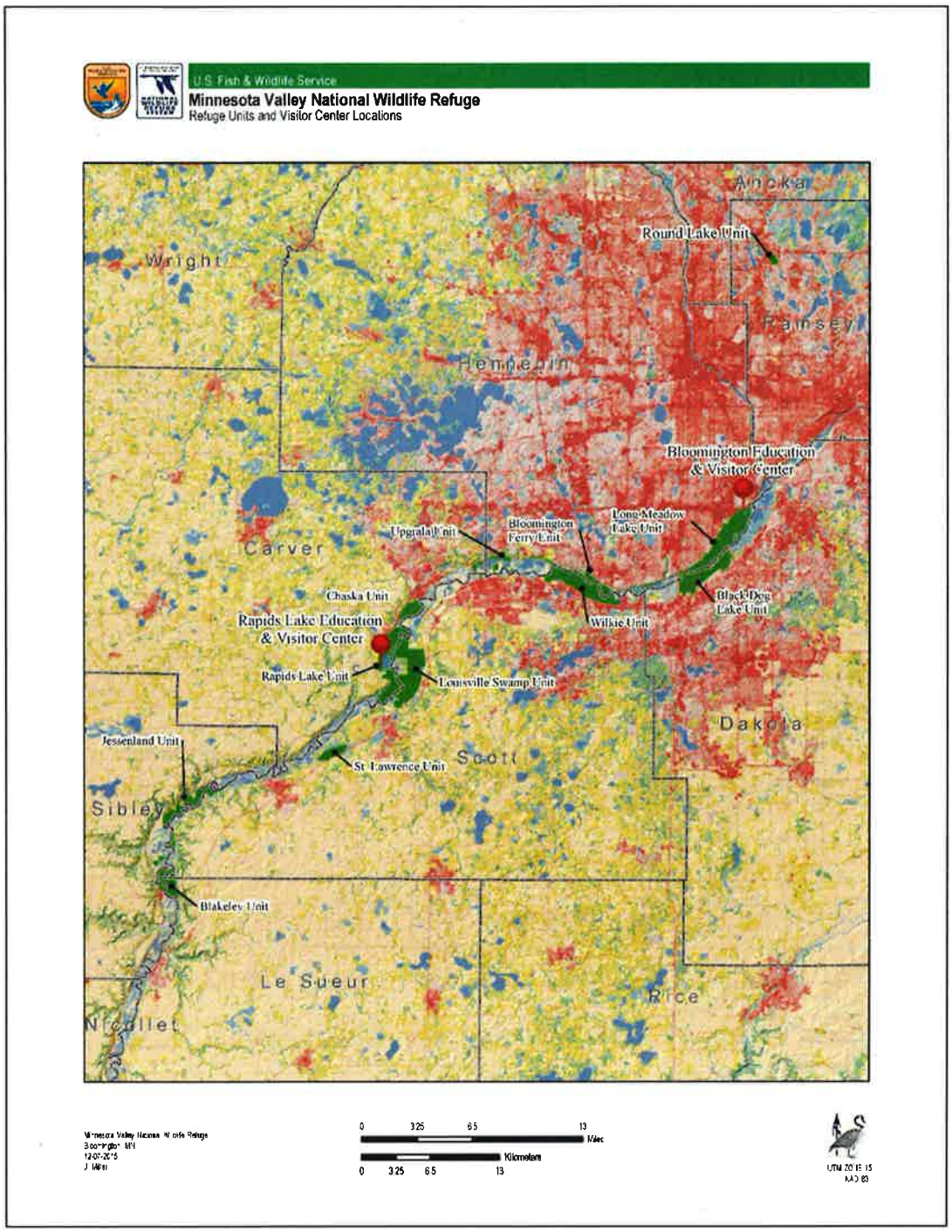

Figure 2-2 Minnesota Valley NWR Units and Visitor Center Locations

There are two visitor centers located on the Refuge. The Bloomington Visitor Center and Refuge headquarters is located in Bloomington, Minnesota just 10 miles south of downtown Minneapolis. The Rapids Lake Environmental Education and Visitor Center is located near Carver, Minnesota, approximately 35 miles southwest of Minneapolis (Figure 2-2). The Refuge manages land in Carver, Dakota, Hennepin, Le Sueur, Ramsey, Scott, and Sibley counties (Figure 2-3).

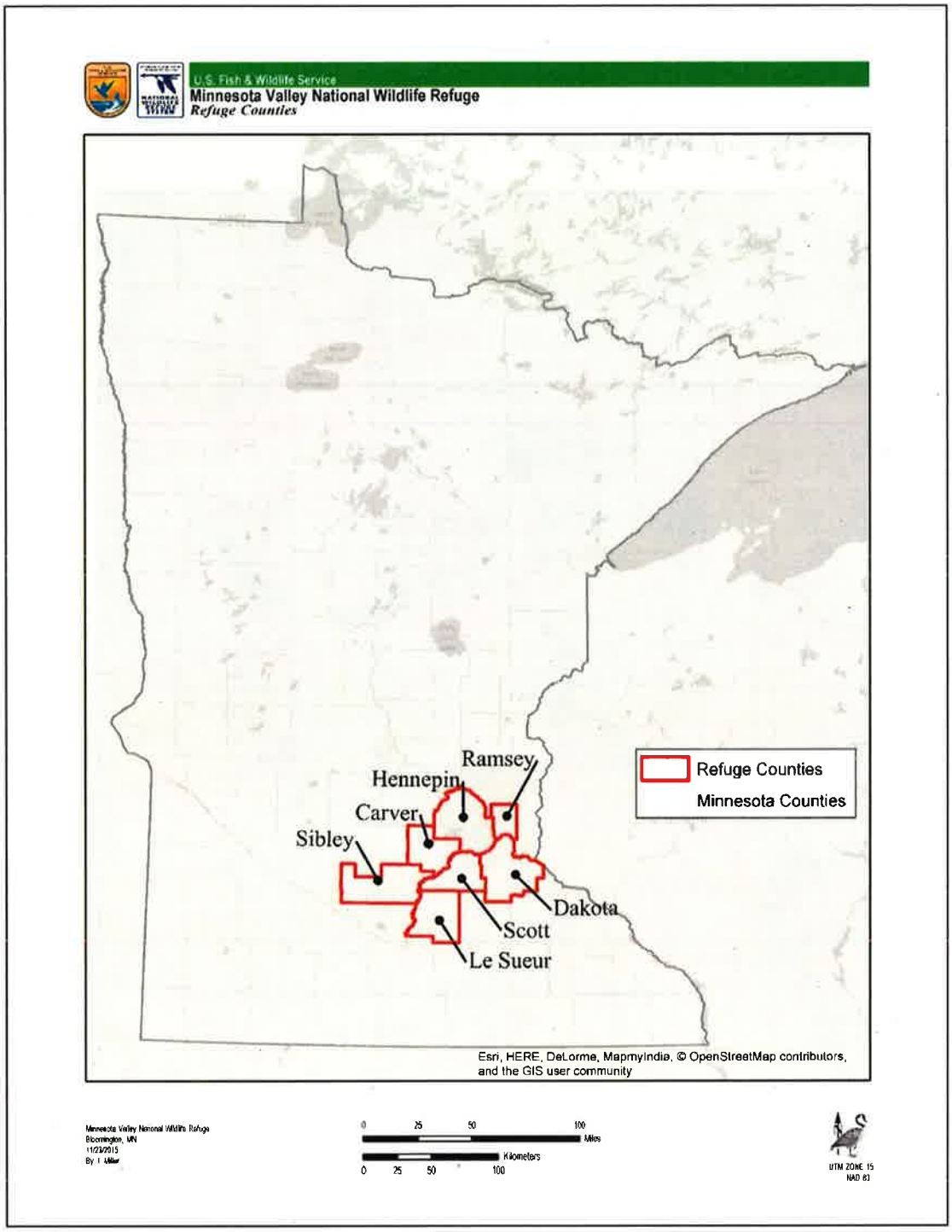

Figure 2-3 Minnesota Valley NWR Counties

The northwestern counties (Hennepin and Ramsey) encompass the Minneapolis-St. Paul metropolitan area with a population of 1.7 million and an average of 2,711 people per square mile (U.S. Census Bureau 2014). As these counties are highly influenced by urbanization and development, habitat restoration and protection is limited. The central counties (Carver, Scott, and Dakota) are primarily within the Minnesota River watershed. This glaciated area is characterized by many lakes, wetlands, and remnant habitats. However, the open space and agricultural land in this area is rapidly being converted to suburban development or rural residential communities. The southern counties (Le Sueur and Sibley) are rural with an average population of 32,722 and an average of 72 people per square mile (U.S. Census Bureau 2014). Topography in this area varies greatly due to glaciation and proximity to the river systems.

2.2 Refuge Management Units

Twelve of the 13 management units of the Refuge lie along the lower portion of the Minnesota River between historic Fort Snelling and the city of Henderson, Minnesota. Approximately 90% of the Refuge is located within the 100-year floodplain. The surrounding bluffs have slopes of 12 to 25% or more, and at the rim average 100 feet above the river valley. A natural levee along the river channel in several portions of the Refuge has created many wetlands and shallow lakes in the floodplain by impounding waters that top the levees during flood or high water events. These wetlands provide both food and resting habitat for over 30 species of migratory and resident waterfowl and waterbirds. A majority of these floodplain wetlands are recharged from groundwater seeps and springs along the toe of the river bluff. Small feeder creeks and streams are also common in the floodplain on or near several Refuge units. Consequently, these wetlands have high water quality where the natural flows and recharge areas have not been altered by development.

The Minnesota River is the largest tributary of the Upper Mississippi River. From its source near Big Stone Lake in western Minnesota, the Minnesota River flows southeast for 224 miles to Mankato, then northeast for 106 miles to its confluence with the Mississippi River at Fort Snelling, in the middle of the Minneapolis-St. Paul Metropolitan Area. The downstream boundary of the Refuge is about six river miles above the confluence of the Minnesota River and the Mississippi River. The river itself meanders through the valley with a slope of 0.8 foot drop in elevation per mile from Mankato to Carver. Its gradient is nearly level from Carver to its confluence with the Mississippi River. Along its course, the surrounding land uses are typical of a rural to urban land continuum.

Refuge management units contain a variety of wetlands ranging from shallow wet meadows and calcareous fens to permanently flooded, mixed emergent marshes. The Refuge management units adjacent to the river are dominated by the latter, where water is continuously present. Nearly all of these wetlands are spring-fed and most of these large riverine basins are surrounded by mature cottonwood, willow and silver maple-dominated plant communities. Water control structures have been installed on several basins. Water levels are manipulated to manage fish and improve the productivity of the aquatic communities. Many of these wetlands provide good nesting, brood rearing, feeding, or migration habitats for a host of resident and migratory bird species. They also provide spawning and nursery habitat for fish that inhabit the Minnesota River.

Floodplain forests historically dominated much of the floodplain along the Minnesota River and its tributaries. Today, this plant community remains on several of the Refuge management units. Typical tree species found in these seasonally flooded areas include silver maple, cottonwood, American elm, green ash, and box elder. The understory of these forests is generally open and in places, the groundcover consists of wood nettle. In the past several years, former Refuge croplands that were historically floodplain forest have been replanted with species typical of this community with limited success.

Oak forests dominated by bur and northern pin oaks are the most common upland forest community on the Refuge. These stands occur on nutrient-poor hillsides and well-drained sandy soils along the Minnesota River Valley. They also contain overstory trees such as ash, elm, and maple species. The shrub layer in these communities is frequently dense and commonly consists of American hazel, dogwood, and black raspberries. The control of common buckthorn, a prolific exotic in some of these plant communities, is a considerable challenge.

Oak savanna is critically imperiled throughout the Midwest. This plant community is characterized by scattered individuals and clumps of oaks (mainly bur oaks) with an understory dominated by prairie grasses and forbs. Many of today's oak forests were oak savanna prior to European settlement and the subsequent control of fires. Natural regeneration of this plant community without a natural fire regime is rare due to the inability of oak to reproduce under forest canopies. Many other historic savannas have been lost due to conversion to agricultural production or urbanization. Several oak savanna restoration sites have been identified on the Refuge. Restoration has been initiated on these sites through a combination of mechanical treatment and prescribed burning. Initial results are encouraging as evidenced by the return of an understory of native grasses and forbs.

Remnant native prairies are some of the most diverse and important plant communities that exist in the Midwest. These rare and unique grasslands on Refuge Units include wet, mesic and dry prairie and they are frequently interspersed with woodland areas, especially those forested sites protected from periodic fires. Mesic prairie is dominated by tall grasses including big bluestem and Indian grass. Medium-height grasses such as little bluestem and sideoats grama dominate dry prairies. Both mesic and dry prairies found on the Refuge contain shrubs such as leadplant and wild rose. Purple prairie clover and heath aster are also commonly found in both plant communities.

Native grassland restoration has been completed on upland sites within Refuge Units, conservation easements, and associated private lands. Former croplands are typically planted to native grass mixtures consisting of big bluestem, little bluestem, switch grass, sideoats, and Canada wild rye. Mixtures of forbs are also planted to enhance the biological diversity of many of these sites.

Several small streams exist on the Refuge. Some of these streams historically supported native brook trout. Some streams originate from springs within the bluff and bluff-floodplain transition zone of the Minnesota River. Several of these streams have a continual supply of cool, well-oxygenated groundwater and support a variety of aquatic organisms. The streams also serve as a water source for many of the Refuge wetlands. The origins of the larger streams, such as Sand

Creek, are in the watershed above the river valley, and are impacted by the dominance of agriculture throughout the watershed.

Horseshoe Lake on the Rapids Lake Unit is one of several deepwater wetlands on the Refuge. Historically, this lake was an oxbow of the Minnesota River, but it has since become disconnected from the main channel. The depth of this lake is unknown, as is the composition of its fishery. The Refuge shares ownership with private parties on Long Lake, another deepwater habitat on the Refuge, also on the Rapids Lake Unit. A 1998 fishery survey showed that 18 species of fish, and many large snapping turtles, occupied Long Lake. The most numerous species were black crappie, gizzard shad, black and brown bullhead and common carp. Aquatic exchange between these lakes and the Minnesota River does occur during spring flooding. The open water pools serve as a loafing area for waterfowl and other waterbirds. Other deepwater habitats include Black Dog Lake, Round Lake and several ponds on the Long Meadow Lake Unit of the Refuge.

Current habitats found on each unit are described below and a map of each unit is available in Appendix C. Table 2-1 also shows acres of each habitat type by unit.

Table 2-1 Total acreage by unit and habitat type for land managed by Minnesota Valley NWR

Refuge Unit	PSW	DWW	WM	RDP	RWP[1]	PDG	PWG	FPF	OS	UF	STR	DVD	Total
	Acres of Habitat (Fee-title, Trust-owned, and MOU lands combined)												
Long Meadow Lake	1,375	16	143	5	72	8	0	591	22	144	21	14	2,411
Black Dog Lake	246	513	486	0	2	0	0	168	0	34	0	22	1,471
Bloomington Ferry	116	0	36	2	0	0	0	143	16	30	1	3	347
Wilkie	958	0	231	14	109	0	0	602	69	11	3	43	2,041
Upgrala	16	0	23	63	0	0	0	282	1	17	0	13	414
Chaska	243	0	23	10	34	0	0	250	20	0	0	9	590
Louisville Swamp	827	0	215	146	56	0	0	1,014	79	268	17	1	2,623
Rapids Lake	343	37	118	30	242	175	125	698	52	192	4	10	2,026
San Francisco	1	0	0	0	1	0	0	48	0	0	0	0	50
St. Lawrence	201	0	2	0	34	0	80	2	97	35	0	2	452
Blakeley	24	21	114	0	127	0	0	822	0	0	5	1	1,115
Jessenland	26	0	80	0	93	0	189	674	0	0	4	0	1,065
Round Lake	0	140	0	0	0	0	0	0	0	8	0	4	152
Grand Total	4,376	727	1,471	270	770	183	394	5,294	356	739	55	122	14,757

[1] – Rock outcrop habitat is included with remnant dry prairie habitat acreage in the table above and in the existing conditions maps (Appendix C).

**Key to habitat abbreviations used in Table 2-1*

PSW – Permanent and semi-permanent wetland

DWW – Deepwater wetland

WM – Wet meadow

RDP – Remnant dry prairie

RWP – Remnant wet/mesic prairie

PDG – Dry planted grassland

PWG – Planted wet/mesic grassland

FPF – Floodplain forest

OS – Oak savanna

UF – Upland forest

STR – Streams (Non-MN River)

DVD - Developed

2.2.1 Long Meadow Lake Unit

Floodplain forest, a large, emergent marsh, spring-fed streams, deepwater fishing ponds and oak savanna are all part of the 2,411-acre Long Meadow Lake Unit (LML) (Appendix C). Stretching from the Refuge Visitor Center off 34th Avenue to the Russell A. Sorenson Landing on the most southern stretch of Lyndale Avenue in Bloomington, Minnesota, the Long Meadow Lake Unit is the most visited unit of the Refuge by birders, anglers, and hikers. Long Meadow Lake (over 1,200 acres) is an important resource to migratory birds. A water control structure enables the Refuge to manage the water levels of the marsh to attract shorebirds, wading birds, waterfowl and other waterbirds throughout the migratory season (depending on annual climatic conditions). The Refuge works with the City of Bloomington and several partners to protect the wetland habitat from degradation from stormwater inputs and other potential contaminants. There are also several groundwater-fed streams that discharge into this unit. Ike's Creek located in the Bass Ponds area of the LML Unit, was stocked with heritage strain brook trout in 2007, in partnership with the MNDNR and Trout Unlimited., Several restoration projects have occurred on the stream channel and adjacent lands. It is the only metro area stream that supports the sensitive brook trout. The fish have been successfully reproducing in the stream since their introduction in 2007.

The deepwater ponds including Hogback Pond, Youth Fishing Ponds and Cedar Pond are popular spots for anglers, and are accessible to people from the inner city neighborhoods. Oak savanna habitat and native pollinator gardens are restoration efforts that are taking place near the Refuge's Bloomington Education and Visitor Center and the Old Cedar Avenue Bridge. Several American Bald Eagle nests occur in the vicinity and use Long Meadow Lake and other smaller wetlands as feeding areas.

2.2.2 Black Dog Lake Unit

This 1,471-acre unit stretches on both sides of the Xcel Energy power plant in Burnsville, Minnesota, from interstate 35W on the west and Highway 77 on the east (Appendix C). The Black Dog Lake Unit is a fragile, yet enduring place, home to calcareous fen, wet meadow and native prairie. Most of this unit is not owned by the USFWS, but the Refuge manages the area as wildlife habitat via a MOU in cooperation with Xcel Energy. A popular bird found on this unit is the American Woodcock. Woodcock prefer woodland openings t of the Black Dog Lake Unit for their singing fields and aerial displays. Bell's Vireos and small white lady slippers are species of concern that are also found on this unit of the Refuge. Black Dog Lake has historically been an important resting area for migratory birds and waterfowl. The lake as well as the adjacent Minnesota River hosts unique gull species, Common and Hooded Mergansers and American White Pelicans. American Bald Eagles, Osprey and Peregrine Falcons also nest on this unit.

2.2.3 Bloomington Ferry Unit

The Bloomington Ferry Unit is a great place to escape the bustle of the metropolitan area and enjoy the 347-acres of floodplain forest and wetlands between the Minnesota River and nearby bluffs (Appendix C). This unit provides habitat for American Bald Eagles, Prothonotary Warblers and Wood Ducks.

2.2.4 Wilkie Unit

The Wilkie Unit comprises over 2,041-acres of emergent marsh, floodplain forest, native prairie and oak savanna habitat (Appendix C). Flanked on the west by Valley Fair Amusement Park and on the east by Central Harvest States Grain Company, the Wilkie Unit demonstrates the fragile balance of people and wildlife living together. Four large wetland basins (each > 200 acres) occupy this unit. Three of the basins Blue, Fisher and Rice contain water control structures and water is manipulated to manage for waterfowl and other waterbirds. Rice Lake is the only basin on this unit open to public waterfowl hunting. Blue Lake historically was home to one of the metropolitan areas largest colonial waterbird rookeries. However, the colony has been vacant since 2013. The unit has small areas of remnant prairie and oak savanna occupying the river bluffs, with emergent wetlands and floodplain forest in the river bottoms. The unit supports numerous waterfowl and waterbird species, including the American Bald Eagle, Prothonotary Warbler and river otters.

2.2.5 Upgrala Unit

The Refuge currently manages approximately 414 acres of the Upgrala Unit. However, there is still land left to acquire within the authorized boundary (Appendix C). The area's marshes and floodplain forest are important to migratory waterfowl, waterbirds and the Bald Eagle. The most important feature of this unit is the large native prairie remnant. This dry grassland habitat is important because it is one of the largest unbroken prairies in the metropolitan area, and supports numerous grassland birds, reptiles such as prairie skinks, bull snakes and western hognose snakes and several pollinator species. This unit is threatened often by projects such as the State highway 61 expansion.

2.2.6 Chaska Unit

Nestled in the floodplain between the river towns of Chaska and Carver, this 590-acre unit consists of several emergent marshes surrounded by floodplain forest and old farm fields (Appendix C). The old farm fields and former moist soil units are naturally reverting to floodplain forest, which is the future desired habitat condition for these areas. The large block of floodplain forest will benefit the American Bald Eagle, Prothonotary Warbler and Wood Duck. Chaska Lake is managed as an emergent marsh and depending on the water levels, attracts several species of concern including the American White Pelican, Blue-winged Teal, Mallard, Ring-necked Duck, Pied-billed Grebe, Greater and Lesser Yellowleg, Short-billed Dowitcher and Trumpeter Swan.

2.2.7 Louisville Swamp Unit

This 2,623-acre unit has a unique mix of emergent marshes, prairie remnants, oak savanna and oak forest, floodplain forest, rock outcrop and old stone farmsteads (Appendix C). Oak savanna, oak forest, emergent marshes and remnant prairie dominate this unit. An area near Jab's Dike supports many waterbird species including American White Pelican, several shorebird species including Greater and Lesser Yellowlegs and native fish species. In the uplands, oak savanna restoration is a priority. Not only is oak savanna a rare remnant habitat in the Midwest, but the area supports State threatened kittentails, Northern Flicker, Red-headed Woodpecker and other bird species. Oak forest supports many songbirds including the Eastern Wood-pewee, Northern Flicker, and Wood Thrush and also could be provide habitat for the Northern Long-eared Bat.

The main threat to the oak savanna and forest is invasion of exotic species, especially common buckthorn. Frequent spring flooding occurs in the floodplain of this unit. The Bald Eagle nest in several areas. A small area of rock outcrop, less than 1 acre, is also present on this unit, which provides habitat for the state threatened, Rough-Seeded Fameflower. Additional areas of rock outcrop habitat may be present within the dry prairie habitat, but need further delineation. Sand Creek meanders through this unit. Sand Creek supports several game fish species, and is a main water source to the unit's wetlands. The creek is highly impacted by agricultural land use throughout its watershed and frequently contributes to the flooding of the Louisville Swamp Unit. The Louisville Swamp Unit also contains Jailhouse Marsh, a 236-acre Northern Bulrush Marsh that is noted on the Rare Communities Inventory by the MNDNR.

2.2.8 Rapids Lake Unit

Restoration of prairie on old farm fields, as well as, habitat restoration of oak savanna and goat prairies clinging to steep bluffs is a priority on this 2,026-acre unit (Appendix C). Preserving and removing invasive species from the oak savanna and goat prairies is high priority, as well as the restoration of former agricultural fields through native prairie seeding and prescribed burning. The prairie and savanna areas support many species of grassland birds such as Bobolink, Grasshopper Sparrow, Henslow's and Lark Sparrows. Kittentails, a State Threatened plant, have also been found in the savanna areas. Rapids Lake, an emergent wetland, has a water control structure that allows water levels to be manipulated to support American White Pelican, Trumpeter Swan, Ring-necked Duck and other waterbirds. Shorebirds such as Greater and Lesser Yellowlegs have been seen on this unit as well as several families of river otters and nesting Bald Eagle. Long and Horseshoe Lakes are deepwater wetlands that support many species of game fish. Carver Creek, a freshwater stream running through the city of Carver, has one of the most diverse fish populations in the metropolitan area (Schmidt and Talmadge 2001).

2.2.9 San Francisco Unit

Currently the San Francisco Unit is comprised of almost 50-acres of floodplain forest (Appendix C). Since this has recently been acquired, inventory data has yet to be collected.

2.2.10 St. Lawrence Unit

The habitat of this 452-acre unit consists of rare, remnant mesic prairie and wet meadow, and remnant oak savanna that is degraded by invasive species (Appendix C). A large wetland and a mesic prairie that was converted from agricultural fields also comprise this unit. Once restored the savanna will support rare savanna species and the wet meadow could support many native sedge species, Sedge Wrens and other mesic prairie-dependent species such as the Northern Harrier.

2.2.10 Blakeley Unit

The 1,115-acre corridor of floodplain consists of a mosaic of mature northern floodplain forest and early successional forests in former agricultural fields, and to a lesser extent floodplain wetlands along the Minnesota River (Appendix C). The closed canopy floodplain forest provides habitat for species such as Prothonotary Warbler, Cerulean Warbler, Red-shouldered Hawk, Bald Eagle

and Wood Duck. Rare wildlife found in the river near this area includes the shovelnose sturgeon. This area coupled with the adjacent Jessenland Unit form a large, contiguous, and unfragmented corridor of floodplain for wildlife.

2.2.11 Jessenland Unit

This 1,065-acre corridor of floodplain land consists of a mosaic of mature to early successional floodplain forest, mesic prairie and wet meadow (Appendix C). Former agricultural fields have been planted to mesic prairie and will form a mosaic of prairie and floodplain forest in the future. Once the areas of floodplain forest mature, the closed canopy will provide habitat for a variety of resident species and forest birds such as Cerulean Warbler, Prothonotary Warbler, Red-shouldered Hawk, Bald Eagle and other floodplain species. The pockets of wet meadow and mesic prairie are important sources of native plant species that are important for pollinating insects.

2.2.12 Round Lake Unit

The Round Lake unit is a 152-acre unit containing a large permanent wetland located in the City of Arden Hills (Appendix C). This unit is administered as a remote part of the Refuge and plans are to manage the basin as a deepwater wetland that can support game fish species such as largemouth bass and piscivorous birds. Bald Eagles nest on this unit, while various waterfowl and waterbirds also use this area.

2.3 PHYSICAL/GEOGRAPHIC AND HISTORIC SETTING

All lands administered by Minnesota Valley National Wildlife Refuge are located in east central Minnesota. This portion of the State is characterized by the confluences of the Minnesota and the St. Croix rivers with the Mississippi River. These river systems lend a great deal of historic significance to this part of Minnesota. Today, it is the most populous portion of the state with more than 2.9 million citizens living within the seven-county Twin Cities metropolitan area. Its continued growth places additional development pressure on any remaining open space and natural resources. Consequently, many natural resource agencies and non-profit conservation organizations are doing what they can to save the most important natural resource sites in this area from development.

The Minnesota River watershed is approximately 16,900 square miles, of which 2,000 square miles are located in South Dakota and Iowa (Figure 2-4). Historically, most of the area was covered by tallgrass prairie with interspersed prairie pothole wetlands. Since development, modern day agriculture has converted over 99% and 90% of its historic grasslands and wetlands, respectively, to cropland.

Due in part to this dramatic change in land use, the Minnesota River (River) is subject to frequent flooding that has precluded most development within its floodplain. The River is one of Minnesota's most impaired watersheds along with over 1,000 water bodies listed by the MPCA as impaired for at least one designated use (MPCA 2017). Sources of pollution that affect the Minnesota River and its associated resources include turbidity from bank erosion and surrounding land uses, leachates from landfills, stormwater runoff, and untreated municipal waste (Minnesota State University and MPCA 2009). Situated in the lower portion of the Minnesota River, the

Refuge and its physical, biological, cultural, and historical features are greatly affected by the River's distinct hydrology.

Over 50 different soil types have been identified within the Refuge boundary and most are comprised of alluvial, marsh, and peat land soil types. Hayden, Estherville, and Peaty Muck are soil series typical of upland forests, dry prairies, and marshes, respectively (USFWS 2004).

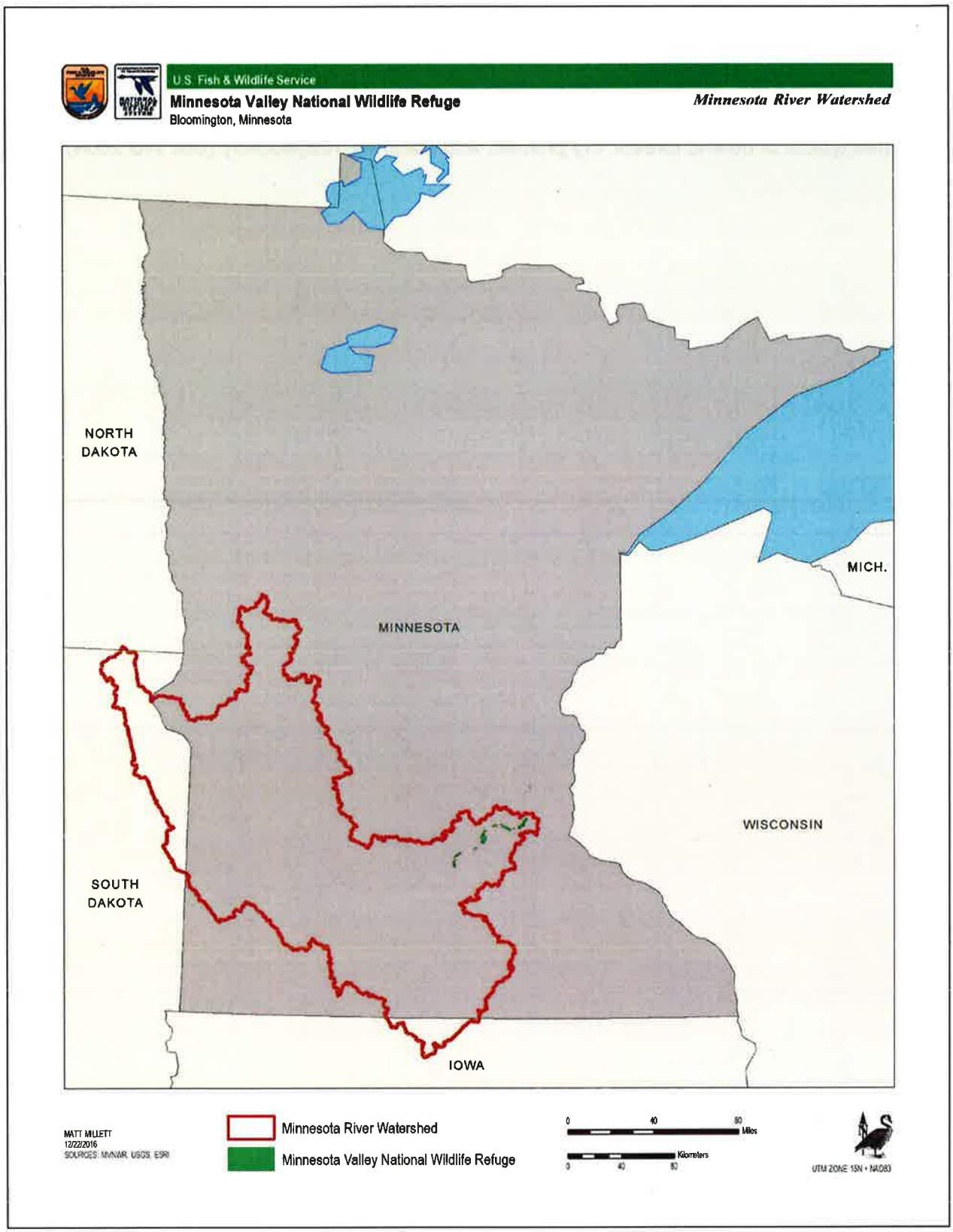

Figure 2-4. The location of Minnesota Valley NWR within the Minnesota River watershed

Description of Ecological Provinces and Sections found at Minnesota Valley NWR

A hierarchical ecological classification system (ECS) has been defined for Minnesota (MNDNR 2005). The ECS "is used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features..." and "...uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation" (MNDNR 2005). Using this system, the Refuge is part of the Eastern Broadleaf Forest Province, Minnesota and Northeast Iowa Morainal (MIM) Section (Figure 2-5). Detailed descriptions of this province and section within the Refuge are provided below. Note: The text for the italicized sections below are excerpted from the MN DNR's' Ecological classification system website: *http://www.dnr.state.mn.us/ecs/index.html (accessed March 2014).*

Eastern Broadleaf Forest Province

The Eastern Broadleaf Forest (EBF) Province traverses Minnesota, Iowa, Wisconsin, Michigan, Ohio, New York, Illinois, Indiana, Kentucky, Tennessee, Missouri, and Arkansas. In Minnesota, the EBF Province covers nearly 12 million acres of the central and southeastern parts of the state and serves as a transition, or ecotone, between semiarid portions of the state that were historically prairie and semi-humid mixed conifer-deciduous forests to the northeast. The western boundary of the province in Minnesota is sharply defined along much of its length as an abrupt transition from forest and woodland to open grassland. The northeastern boundary is more diffuse, with a gradual transition between eastern deciduous forests and the mixed conifer-hardwood forests of northern Minnesota.

The land surface of the province is largely the product of Pleistocene glacial processes. The northwestern and central portions of the province were covered by ice in the last glaciation and are characterized by thick (100–300 feet) deposits of glacial drift that is highly calcareous and of Wisconsin Age at its surface. Glacial lakes associated with the last glacial advance contributed large volumes of meltwater to rivers that cut deep valleys along the present course of the Minnesota, St. Croix, and lower Mississippi rivers. In the southeastern part of the province, which was not covered by ice in the last glaciation, headward erosion of streams draining into the deepening Mississippi valley dissected the flanking uplands, exposing Paleozoic bedrock and pre-Wisconsin drift. The waning stages of the glacial lakes contributed massive amounts of sediment to the river valleys and provided a source of silt that was re-deposited by wind as a mantle of loess over the eroded lands in the southeastern part of the province.

The EBF Province coincides roughly with the part of Minnesota where precipitation approximately equals evapotranspiration; it seems likely that this aspect of climate has an important influence on plants, as many forest species reach their western range limits and several prairie species reach their eastern range limits within the province. Precipitation in the province increases from about 24 inches annually in the northwestern portion to 35 inches in the southeast, while normal annual temperatures range from 38°F in the northwest to 46°F in the southeast.

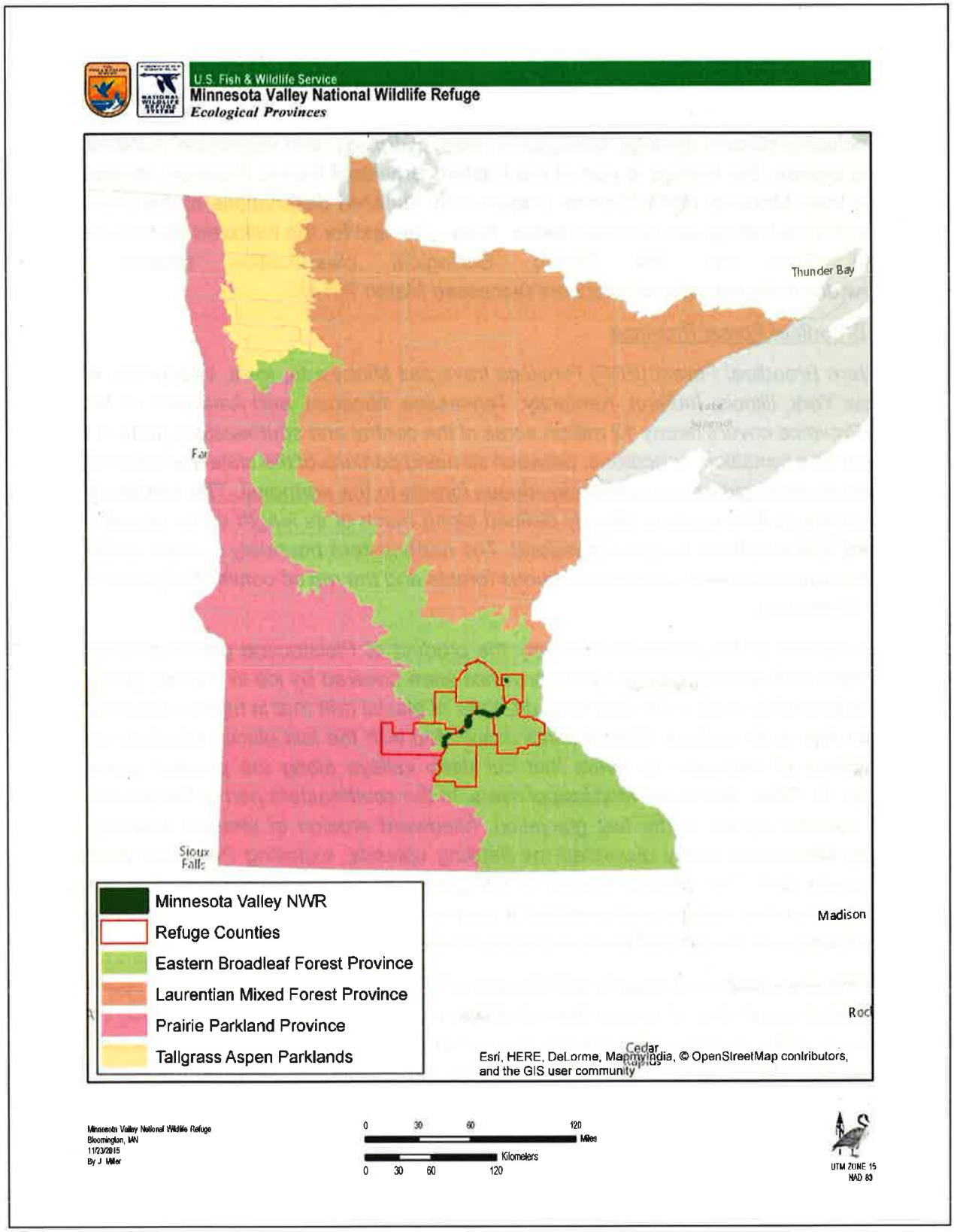

Figure 2-5. Ecological provinces within the Minnesota Valley NWR

Minnesota and Northeast Iowa Morainal Section

The MIM, part of the Eastern Broadleaf Forest Province, is a long band of deciduous forest, woodland, and prairie that stretches nearly 350 miles from Polk County in northwestern Minnesota to the Iowa border. Over half of this area consists of rugged to hummocky moraines deposited along the eastern margin of the Des Moines ice lobe during the last glaciation. Another quarter of the area consists of rolling till or basal till deposited as drumlins. Small sand plains occur locally within the moraines. A rather large sand plain, the Anoka Sand Plain, is present north of the Twin Cities metropolitan area. This level plain is formed from sand deposited by meltwater from the Grantsburg sublobe, a spur of ice emanating from the east flank of the Des Moines lobe.

The pre-settlement pattern of upland vegetation in the MIM reflects substrate texture and landform topography. These features affected plants directly through their influence on moisture and nutrient availability, insolation, and local temperature, and also indirectly through their influence on the frequency and severity of fires. Sandy flat areas were dominated by prairie, savanna, and oak and aspen woodlands. This is especially true of the Anoka Sand Plain and sandy terraces along the major rivers. In these areas, droughty soils and absence of impediments to the spread of fire promoted fire-dependent prairie and woodland vegetation. A large area of prairie, savanna, and oak woodland was also present on gently undulating glacial till in the southern part of the section, adjacent to the extensive prairie lands of western Minnesota. The low-relief landscape in this part of the section afforded few impediments to the spread of fire, including fires that spread into the section from the adjacent prairie region. Woodland and forest dominated sites in the section where fire was uncommon or rare. Fine-textured drift deposited in hummocky moraines supported mesic forests dominated by sugar maple, basswood, American elm, and northern red oak. Even small reductions in fire frequency afforded by streams, lakes, or topographic breaks permitted the formation of forest on finer-textured soils, and once formed these forests were highly resistant to burning.

Floodplain and terrace forests were present historically along the valleys of the major rivers, the Mississippi, Minnesota, and St. Croix, and are still prominent today along many stretches of these rivers. Forests of silver maple occupy the active floodplains, while forests of silver maple, cottonwood, box-elder, green ash, and elm occupy terraces that flood infrequently. These valleys are also characterized by herbaceous and shrubby river shore communities along shorelines and on sand bars, and in some areas by cliff communities on steep, rocky, river bluffs. Closed depressions that pond water in the spring provides open wetlands such as marshes, wet meadows, shrub swamps, and wet prairies. Peatlands are uncommon in the section and usually develop following formation of sedge or moss mats over sediments in former lake basins.

There are several habitat types located on the Refuge. These habitat types were described from the Field Guide to the Native Plant Communities of Minnesota (Field Guide), The Eastern Broadleaf Forest Province (MNDNR 2005). The specific habitat types are described in Table 2-2, and are also located in the Table 3-1 in Chapter 3. The National Wildlife Refuge System adopted the National Vegetation Classification System (NVCS) developed by The Nature Conservancy and the Natural Heritage Network as a standard for classifying plant communities (Natureserve 2014). The classification contains hierarchical levels of community specificity. The narrowest level within the classification is the Association. Table 2-2 crosswalks the Minnesota

native plant communities present on the Refuge to equivalent or similar NVCS associations. In Chapter 3, Minnesota native plant communities are further grouped into broader habitat classifications that are used for the remaining HMP because they represent habitat types at levels which management actions will occur.

The Eastern Broadleaf Forest province has undergone dramatic land conversion since European Settlement such as cultivation, drainage, development and deforestation leading to major habitat fragmentation. In addition, key ecological drivers like fire and grazing by large ungulates are missing from the natural ecosystem.

Figure 2-6 illustrates the pre-settlement vegetation within the Refuge. Francis J Marschner created the Original Vegetation of Minnesota (1930) from the U.S. General Land Office Survey Notes and it was later published in 1974 under the direction of M.L. Hein Selman of the U.S. Forest Service by the North Central Experiment Station in St. Paul, Minnesota. This map describes the original vegetation of Minnesota from the original land surveyors from 1847-1907.

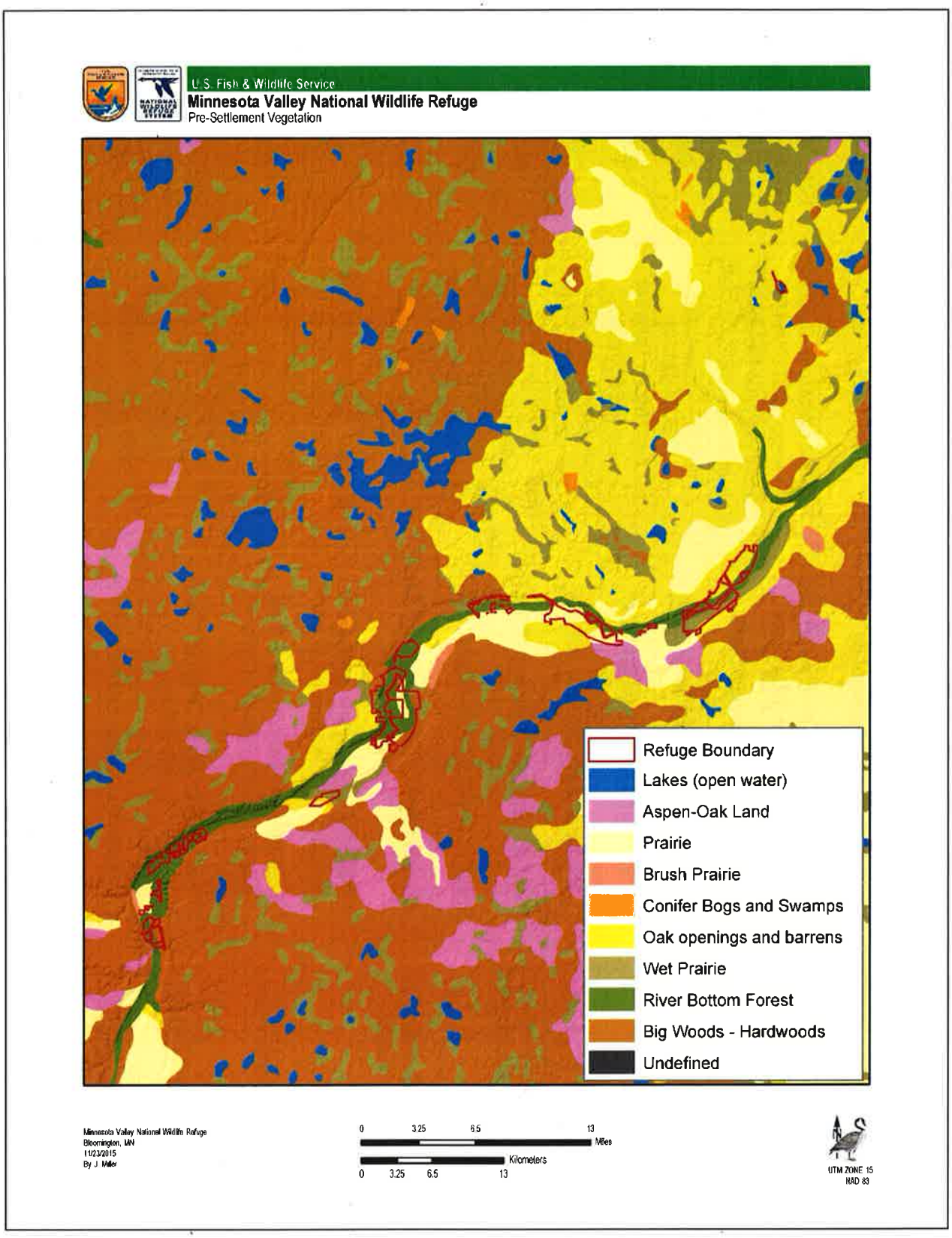

Figure 2-6 Pre-settlement Vegetation (original vegetation of MN from land surveyors 1847-1907 taken from Marschner 1974)

Table 2-2 Crosswalk between Minnesota native plant communities present on Minnesota Valley NWR and NVCS plant community associations

MN Ecological System	MN Native Plant Community Class	MN Native Plant Community Type	NVCS Association	NVCS and State Rank
Upland Grassland, Shrubland and Sparse Vegetation	Rock Outcrop	Crystalline Bedrock Outcrop (Prairie) Minnesota River (ROs12a1)	Midwest Limestone-Dolomite Outcrop (CEGL005498)	GNR (globally not ranked yet)/S2
	Upland Prairie	Southern Dry Prairie (UPs13)	Northern Little Bluestem Gravel Prairie (CEGL002499)	G2G3/S2
		Southern Dry Savanna (UPs14)	Northern Oak Barrens (CEGL002160)	G2/S1S2
		Southern Mesic Prairie (UPs23)	Northern Mesic Tallgrass Prairie (CEGL002202)	G2G3/S2
		Southern Mesic Savanna (UPs24)	North-Central Bur Oak Opening (CEGL002020)	G1/S1
Upland Forest and Woodland	Fire Dependent Forest/Woodland	Pin Oak – Bur Oak Woodland (FDs37b)	North-Central Dry-Mesic Oak Woodland (CEGL002142)	G3G4/S3
	Mesic Hardwood Forest	Southern Dry-Mesic Oak Forest (MHs37)	Midwestern White Oak - Red Oak Forest (CEGL002068)	G4?/S3S4
		Southern Mesic-Oak Basswood Forest (MHs38)	White Pine - (Red Pine) Driftless Bluff Forest (CEGL002378)	G2G3/S3
		Red Oak-Sugar Maple Basswood-(Bitternut Hickory) Forest (MHs38c)	Red Oak - Sugar Maple - Elm Forest (CEGL005017)	G?/S3
Wetland (Bottomland) Forest	Floodplain Forest	Southern Floodplain Forest (FFs68—mostly FFs68a-virginia creeper FF)	Midwestern Cottonwood - Black Willow - Silver Maple Forest (CEGL2018)	G3G4/S3
	Wet Forest*	Black Ash-Red-Maple Seepage Swamp (WFs57a)	Black Ash - Red Maple - Central Rich Swamp (CEGL005490)	GNR (globally not ranked yet)/S1S2
Wetland Grassland, Shrubland, and Marsh	Forest Rich Peatland*	Northern Rich Alder Swamp (FPn73)	Gray Alder Swamp (CEGL002381)	G5?/S3S4
	Open Rich Peatland	Calcareous Fen (Southeastern) Type (OPp93c)	Tussock Sedge Fen (CEGL005241)	G3G4/S1

MN Ecological System	MN Native Plant Community Class	MN Native Plant Community Type	NVCS Association	NVCS and State Rank
	Wet Meadow/Carr	Sedge Meadow Type (WMn82b)	Lake Sedge Wet Meadow (CEGL002256)	G4G5/S4S5
		Southern Seepage Meadow Carr (WMs83)	Lake Sedge Wet Meadow (CEGL002256)	G4G5/S3
	Marsh	Northern Mixed Cattail Marsh (MRn83)	Midwest Cattail Deep Marsh (CEGL002233)	G5/S2
		Northern Bulrush-Spikerush Marsh (MRn93a and MRn93b)	Bulrush - Cattail - Bureed Shallow Marsh (CEGL002026)	G4G5/S2S3
	Wetland Prairie	Southern Wet Prairie (WPs54)	Central Wet-Mesic Tallgrass Prairie (CEGL002024)	G2G3/S1S2
Small Streams	Unclassified	Unclassified	Unclassified	Unclassified
Large Rivers	Unclassified	Unclassified	Unclassified	Unclassified

*MN Native Plant Community Classes noted with an astrisk (*), although present on the refuge, will not be discussed or be managed specifically (i.e. no habitat objectives or ROC). These community components are minor and of limited extent on the Refuge.

2.4 CURRENT CONDITION AND HABITAT CHANGES FROM HISTORIC TO CURRENT

There have been dramatic changes to the Refuge landscape since pre-settlement. Increased agricultural activity in the 1800s led to the loss of vast tracts of native prairie, hardwood forests and wetlands (MNDNR 2006). Logging activities harvested much of the northern forestland in the state by the early 1900s. Rivers and streams were dammed and channelized, which altered the structure of their corridors, preventing the passage of some aquatic animals, and changing the natural cycle of water levels. During this time period, there was also rapid population growth and major shifts in the settlement pattern from rural locations to urban centers.

Today the landscape continues to change. Agriculture and forestry remain significant parts of the economy and urban areas continue to expand (MNDNR 2006). Natural areas are pressured by development and population growth, however there are also tremendous opportunities to work with others to improve the quality and diversity of habitats on both public and private lands.

2.4.1 Existing Habitat Conditions

Data from the MNDNR's Minnesota Land Cover Classification System (MLCCS) and aerial photographs from the USDA's National Agricultural Imagery Program (NAIP) were used to classify Refuge acres into ten existing habitat types. These include: floodplain forest, small rivers, remnant wet/mesic prairie, planted wet/mesic grassland, permanent/semi-permanent wetland, upland forest, wet meadow, remnant dry prairie, planted dry grassland, deepwater wetlands and developed areas. Maps of these habitats by unit are presented in Appendix C and acreages of each of the habitat types present in each unit are provided in Table 2-1. These habitat classifications reflect an attempt to categorize the current habitat at a single point in time on a broad scale. As such, some of the acreage exists on a continuum based on plant succession, hydrologic cycles and greater detailed information. We are unable to restore all the habitat types listed in this HMP. However, Table 1, Appendix D lists the focus areas for habitat restoration in Priority 1 habitats, and describes the location of the associated habitats.

Less than 1% of Minnesota's original tallgrass prairie remains (Samson et al. 1998). The Refuge manages about 946 acres of remnant, unbroken dry and mesic prairie, with varying levels of quality. Most of these prairies are degraded by exotic invasive species and non-desirable woody species. The greatest threats to prairie integrity are a lack of disturbance and invasion or existence of non-native cool season grasses that were introduced for forage of livestock during the settlement era. The lack of disturbance plays a substantial role in the invasion by woody vegetation (both native and exotic species), and exotic, cool-season grasses such as smooth brome and Kentucky bluegrass. Grasses invading wetter prairies also include reed canary grass and quack grass.

In comparison to Figure 2-6, the Marschner Map, it is evident that the landscape has been dramatically altered. Figure 2-7 illustrates the prairie conversion throughout the Refuge from Marschner's pre-settlement vegetation compared to the National Land Cover Database (NLCD) Landcover classification of 2006.

In addition to remnant prairie, the Refuge manages 3,884 acres of planted grasslands. These grasslands are usually dominated by warm season native species such as big bluestem, switchgrass, Indian grass, sideoats grama and little bluestem. Some planted grasslands are former pastureland. Newer prairie plantings are more highly diverse prairie reconstructions using local ecotype seed sources with up to 40 species planted. Other habitats on lands managed by the Refuge include upland forest, floodplain forest, oak savanna, fen/wet meadow/carr, small streams and deepwater, permanent/semi-permanent wetlands and temporary/seasonal wetlands.

Wetlands have also undergone dramatic losses and degradation since European settlement. It has been estimated that Minnesota has lost approximately half of its original pre-settlement wetlands due to draining and filling for agriculture and development, with some regions of the state having lost more than 90% of their original wetlands (Anderson and Craig 1984). In addition to a loss of wetlands, the remaining wetlands are often in a degraded state. These wetlands are often impacted by sedimentation from adjacent cropland, pesticide and herbicide use, and colonization by invasive species such as reed canary grass, invasive cattail, unnatural populations of common carp, low water quality (excessive phosphorus/nitrogen) and artificially deep water levels. Since many of the Refuge wetlands lie within the floodplain, they are frequently subjected to flooding from the Minnesota River, which can impact the quality of these wetlands. Siltation and prolonged or frequent flooding destroy beneficial aquatic plants and cause abnormally high water levels to be maintained.

Due to the Refuge's position in the landscape, much of the habitats that remain have been degraded or fragmented. Natural drainage patterns have been altered throughout the landscape. These alterations include an, increase in the frequency, intensity, and duration of water flowing into many of the wetlands. Siltation, nutrient loading, and contamination from stormwater and other point and non-point sources of pollution are also a concern on many of the units.

Changes in the overall landscape, land use, and vegetative communities clearly had dramatic consequences for the native flora and fauna. Many species of wildlife have been altogether extirpated from the region, such as bison. In addition, grassland birds have declined more extensively in the Midwest than any other group of birds (Herkert 1995).

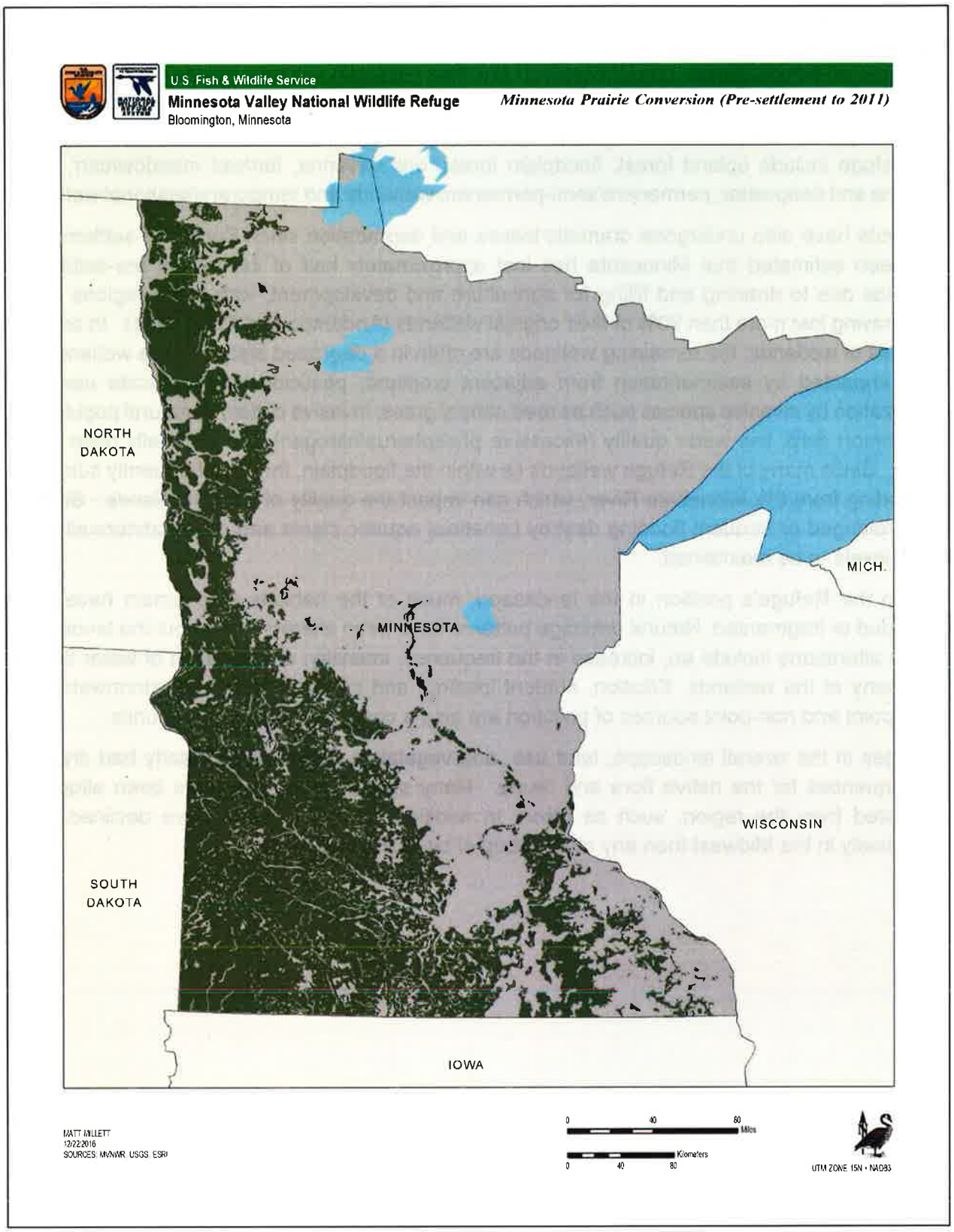

Figure 2-7. Prairie conversion from pre-settlement compared to 2011 Land Cover. Dark green areas indicate native prairie lands that have been converted to agriculture

2.4.2 Climate Change

Climate change will only compound the challenges and threats described above. Predicted climate changes for the Midwest includes increasing extreme heat events, heavy downpours and more frequent flooding that will affect infrastructure, health, agriculture, forestry, transportation and air and water quality (National Climate Assessment 2016). The extreme heat-producing, abnormal drought conditions, followed by abnormal precipitation events and flooding will disrupt the natural cycle of wetlands and could impact waterfowl and other waterbirds. The composition of the region's forests is also expected to change as rising temperatures shift the distribution of many tree species northward (NCA 2016). Changes in forest composition will cause nesting birds to shift in search of suitable habitat. Invasive species are also expected to thrive under these new climate conditions, whereas water quality is predicted to decline. All of these factors need to be considered when developing restoration plans for Refuge habitats.

2.4.3 Other Protected Lands

The Refuge also manages a Wetland Management District (District) that restores wetland and grassland habitat in a 14-county metro area including Blue Earth, Carver, Chisago, Dakota, Hennepin, Le Sueur, Nicollett, Ramsey, Rice, Scott, Sibley, Steele, Waseca and Washington counties, which increases the acreage managed as part of the Minnesota Valley Refuge Complex. In addition, the Complex has a strong Partners for Fish and Wildlife Program (PFW). The PFW program provides technical assistance to private landowners to restore, manage and protect their land to provide for wildlife. The emphasis in the District is to restore and enhance prairie and wetland complexes for a host of migratory birds with an emphasis on waterfowl. Due to the changing landscape, proximity to the Twin Cities and other metropolitan areas, and > 75% of the land in private ownership, there is great interest in habitat improvement on privately owned lands. This creates opportunities to work with landowners to improve habitat on their land in support of the USFWS mission. Since 1988, the PFW program has worked with more than 3,000 landowners to restore more than 25,000 acres of habitat on privately owned land throughout the District. Habitat work in the District is described in the Minnesota Valley Wetland Management District Habitat Management Plan (USFWS in preparation). The work within the District complements restoration work done within the Refuge.

The Refuge along with the District has many conservation partners working on other permanently protected lands in our area (Figure 2-8). Conservation partners include MNDNR who administers Wildlife Management Areas (WMAs), Scientific and Natural Areas (SNAs), State Parks, Aquatic Management Areas and Prairie Bank Easements, USDA, who administers Wetland Reserve Program Easements (WRP), the Minnesota Board of Water and Soil Resources (BWSR), who manages Conservation Reserve Enhancement Program (CREP) and Reinvest In Minnesota Easements (RIM) properties, and the Three Rivers Park District in the Twin Cities Metropolitan Area.

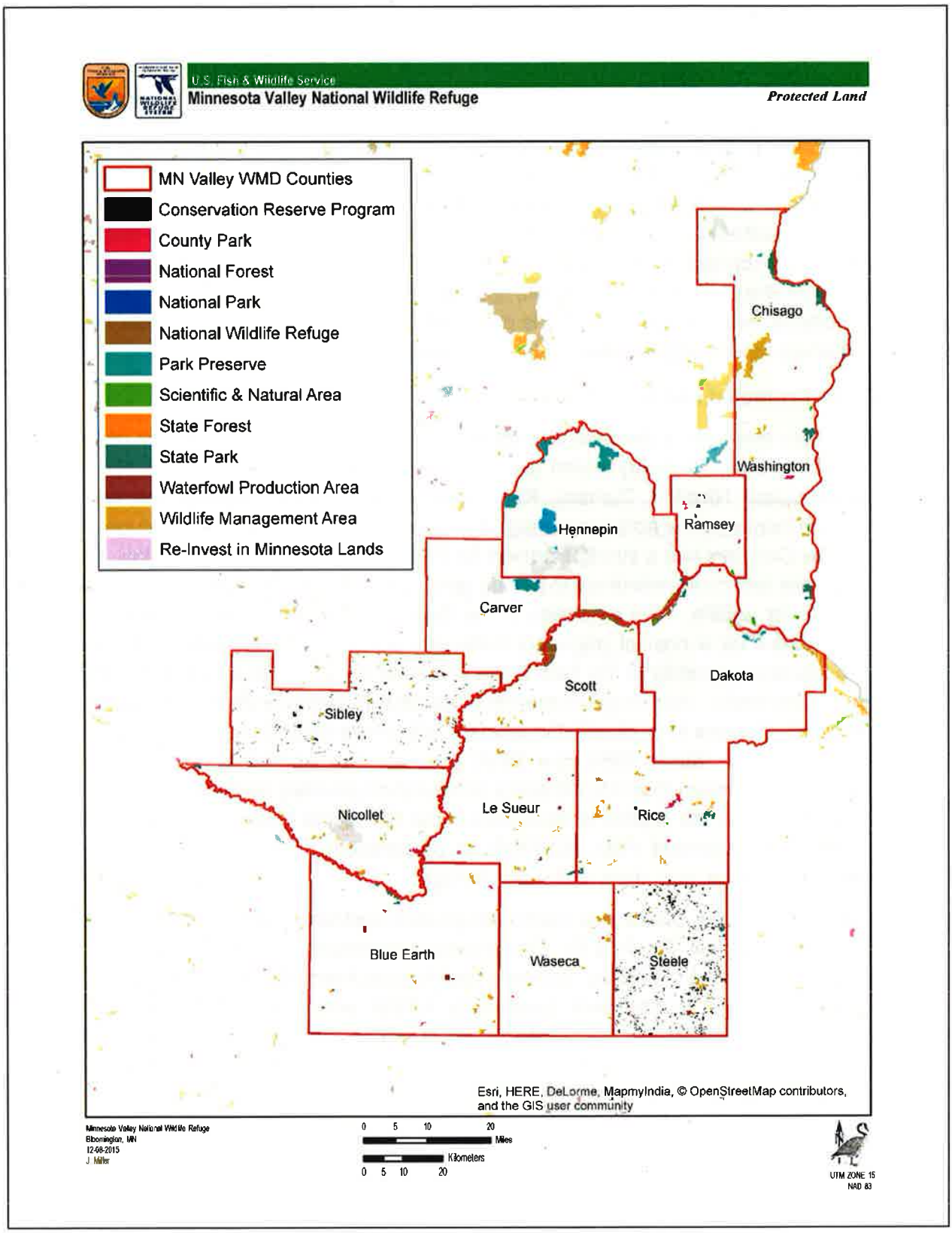

Figure 2-8. Permanently protected lands near Minnesota Valley National Wildlife Refuge as of 2015

2.5 Prioritizing Areas for Management

In the past, the Refuge has struggled with prioritizing habitat management projects. Having general purposes of providing habitat for a large number of migratory waterfowl, fish, and other wildlife species and protecting important natural areas from degradation made it difficult to prioritize and further refine goals and objectives in this HMP. However, there are tools that partnering agencies have developed that can help us focus habitat management efforts.

The Minnesota Biological Survey has conducted natural resources inventories that can aid in making informed decisions based on the location of rare plant and animal species. The Natural Heritage Information System (NHIS) GIS database for Minnesota also provides locations on Minnesota's rare plants, animals, native plant communities and other rare features on and off Refuge lands. Although the general location and habitat descriptions in these layers are quite accurate, some of the information is out of date and does not completely reflect current presence and location, so it needs to be supplemented with other information. A combination of the NHIS Data, the Native Plant Community Type information in the MNDNR's (2005) "Field Guide to the Native Plant Communities of Minnesota", staff knowledge of Refuge habitats, and the habitat requirements of the Refuge's Resources of Concern (ROC) that will be identified in this HMP, will help to identify unique native communities on Refuge land that are the highest priority to restore and protect. The MNDNR's Field Guide (MNDNR 2005) also contains details on vegetation structure and composition, landscape setting, and natural history. This information will be used by Refuge staff as a guide and decision making tool to help develop management plans and evaluation methods for Refuge habitats.

Throughout the development of the HMP, we will be providing suitable habitat for our unique Resources of Concern. We also will include very rare habitats as Resources of Concern and will discuss protecting and restoring these habitats. Habitat areas prioritized for management action in this HMP are discussed in Chapter 4, but specific focus areas are described in Appendix D.

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CHAPTER 3.

RESOURCES OF CONCERN

3.1 Introduction
3.2 Identification of Refuge Resources of Concern
3.3 Biological Integrity, Diversity, and Environmental Health
3.4 Priority District Resources of Concern
3.5 Habitat Types and Associated Priority Species
3.6 Conflicting Habitat Management
3.7 Adaptive Management

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3. RESOURCES OF CONCERN

3.1 INTRODUCTION

3.1.1 Defining Resources of Concern (ROC)

ROC are the focal point of a HMP. The HMP policy (620 FW 1) defines "resources of concern" as

> "All plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect migrating waterfowl and shorebirds. Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts."

The USFWS is entrusted by Congress to conserve and protect migratory birds, federally listed threatened and endangered species, inter-jurisdictional fish, and certain marine mammals (trust species) for the benefit of the American people. Each refuge also has its own specified purpose(s) for which it was created that guides its management goals and objectives. Within these purposes, Refuges support other elements of biological diversity such as locally rare plant, invertebrate, and vertebrate species, natural communities, and the ecological processes that contribute to the biological integrity and environmental health at the refuge, ecosystem, and broader scales (601 FW 3).

3.1.2 Importance of Defining Resources of Concern to Guide Refuge Activities

Identifying ROC aids Refuge managers in developing management objectives aimed at maintaining, increasing, and/or improving the specific habitats required by trust resources and populations identified in the refuges' purpose. The ROC process facilitates a targeted approach to identifying priority areas and gaps in management that may require additional resources such as information (data collection and monitoring) or staff and equipment. Species respond to habitat management differently and therefore identifying ROC allows for a more focused management approach that yields the greatest benefit to trust resources, while complimenting biological integrity, diversity, and environmental health (BIDEH).

The first step of developing a focused habitat management strategy is to define a refuge's comprehensive list of ROC in light of the multiple mandates, purposes, policies, and regional/national plans applicable to that management unit. The following details the development of the ROC at the Minnesota Valley National Wildlife Refuge.

3.2 IDENTIFICATION OF REFUGE RESOURCES OF CONCERN

International, national, and regional conservation plans relevant to the Minnesota Valley National Wildlife Refuge were identified and used in ROC selection. A comprehensive list of species known to use the Refuge was compiled by season and relative abundance (Appendix E). Each species' conservation significance was then weighted using the number of conservation plans, which included that species. The comprehensive list of ROC was narrowed by selecting species

most likely to represent a suite of habitat needs for other species (i.e., surrogate species) using the process later defined in section 3.4.1. This subset of ROC is referred to as priority resources.

3.2.1 Refuge Purposes and Resources of Concern

As discussed in Chapter 2, the Refuge was established in 1976 in part because of its local and regional public concern for the diverse and abundant fish, wildlife and plant communities of the Lower Minnesota River Valley. The Refuge currently encompasses more than 14,700 acres distributed across numerous habitat types, including wetlands, wet meadows, floodplain forests, upland forests, grasslands, prairie, oak savanna, the Minnesota River and various tributaries, and rock outcrops.

The purposes for the Refuge are:

- Provide habitat for a large number of migratory waterfowl, fish and other wildlife species;
- Provide environmental education, wildlife recreational opportunities, and interpretive programs for hundreds of thousands of Twin Cities residents;
- Protect important natural resource areas from degradation;
- Protect the valley's unique social, educational, and environmental assets.

3.2.2 Refuge System and USFWS Resources of Concern

USFWS Trust Resources

While the designated purpose is the foremost determinant of a particular Refuge's management focus, managing trust resources is also a priority for all Service lands. Trust resources relevant to Minnesota Valley NWR include:

Migratory Birds

A list of all species of migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703–711) and subject to the regulations on migratory birds is contained in subchapter B of title 50 CFR §10.13. The USFWS Division of Migratory Bird Management maintains lists of priority bird species of concern at national, regional, and ecoregional (Bird Conservation Region) scales www.fws.gov\\migratorybirds. The primary sources of information used to identify potential migratory bird species of concern include:

- State and Federal Listed Species
- USFWS Migratory Bird Program Strategic Plan (USFWS 2004d)
- USFWS North American Waterfowl Management Plan
- Partners in Flight Bird Conservation Plan for the Upper Great Lakes Plain
- Upper Mississippi and Great Lakes Region Joint Venture Conservation Plans
- Minnesota State Wildlife Action Plan
- Status and trend information for Refuge bird surveys and regional assessments

Interjurisdictional Fish

The primary sources of information the Refuge used to identify potential fish species of concern include:

- State and Federal Listed Species
- Minnesota State Wildlife Action Plan
- Interjurisdictional Fishes of the Mississippi River Basin (MICRA 2009)

Threatened and Endangered Species

The Endangered Species Act (16 U.S.C. 1531–1544, December 28, 1973, as amended 1976-1982, 1984 and 1988) states in Sec. 8A.(a) that:

> "The Secretary of the Interior... is designated as the Management Authority and the Scientific Authority for purposes of the Convention and the respective functions of each such Authority shall be carried out through the United States Fish and Wildlife Service."

The act also requires all Federal departments and agencies to conserve threatened and endangered species and to utilize their authorities in furtherance of the purposes of this Act.

Federal threatened or endangered species were identified for inclusion in this HMP by reviewing the Federal threatened and endangered species list and relevant recovery plans for listed species (USFWS ECOS 2017).

3.3 Biological Integrity, Diversity, and Environmental Health

3.3.1 Defining Biological Integrity, Diversity, and Environmental Health

The National Wildlife Refuge System Improvement Act of 1997 states that, in administering the System, USFWS shall "ensure that the biological integrity, diversity, and environmental health of the System are maintained..." The USFWS's policy discusses the role of BIDEH. It also provides managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with refuge purposes and system mission, restore lost or severely degraded components (601 FW 3, USFWS 2003a). The USFWS defines BIDEH as follows:

- Biological Diversity - The variety of life and its processes, including the variety of living organisms, the genetic differences between them, and the communities and ecosystems in which they occur.
- Biological Integrity - Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.
- Environmental Health - Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.

3.3.2 Identifying BIDEH within the Refuge

The USFWS will manage for priority species and their habitats that exist along a continuum of vegetation structure and hydrologic regimes present on the Refuge. The USFWS has reviewed historic information regarding habitats, management, and species use within the refuge authorized boundaries. The planning team has reviewed relevant literature describing requirements of selected priority species and ecosystem processes that regulate natural

communities, to assess current and future potential conservation status for the refuge. The following resources were used to describe baseline environmental, abiotic, and biotic conditions on the refuge:

- Reports and associated data on site history and capabilities
- Maps of existing landscape conditions displaying watershed boundaries, habitat connectivity (or isolation), as well as land use conditions and ownership surrounding the refuge
- Maps of existing and pre-Refuge vegetation types
- Soil surveys of counties within refuge boundaries
- Global/regional trends in climate change and water quality
- State-level information on threatened, endangered and special concern species
- State-level native or natural plant community information and National Vegetation Classification System) natural community descriptions
- State of Minnesota's Wildlife Action Plan
- Status and trend information for potential species of concern as documented in regional and state assessments and reports

Based on a review of the existing and historical data listed above, a list of habitat types that contain elements of BIDEH was developed to evaluate processes that influence the ecological and biological integrity of habitat types within the Refuge (Table 3-1). Table 3-1 is important because it outlines how Refuge staff organize and think about habitat management for the Refuge and relates these broad habitats to ecological classifications, processes, attributes, and threats.

Table 3-1 Summary of Habitats that Represent Existing BIDEH on Minnesota Valley NWR

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Deepwater Wetland	Not applicable	Not applicable	Submerged aquatic plant communities within the littoral zone including pondweed species, northern watermilfoil, and wild celery, and other species. Plant growth can be limited to the bottom of wetlands, a mix of plants and open spaces within the water column, or dense stands or mats.	Water clarity that allows for plant growth. Stable water levels and little to no wave action.	Development, invasive species
Permanent and Semi-permanent Wetlands	Northern Mixed Cattail Marsh (MRn83)	Midwest Cattail Deep Marsh	Emergent marsh dominated by cattail, also lake sedge, and hydrophytic forbs such as broadleaf arrowhead and bidens spp. Occurs in shallow basins, river backwaters and lakeshores. Substrate is usually muck or well-decomposed peat. Areas of open water. No shrub or tree cover.	Standing water year-round. Stable water levels and little to no wave action.	Change in hydrology, invasive species
Temporary and Seasonal Wetland	Sedge Meadow (WMn82b)	Lake Sedge Wet Meadow	Open wetlands with abundant broad-leaved graminoids and shrub cover typically < 25%. Moderate inundation during spring runoff and high precipitation with periodic drawdowns in the summer. Water levels prevent tree (and some shrub) establishment. Little to no standing water during the growing season.	Periods of inundation in spring followed by drawdown later in summer	Change in hydrology, invasive species

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Temporary and Seasonal Wetlands	Northern Bulrush-Spikerush Marsh (MRn93a and MRn93b)	Bulrush - Cattail - Burreed Shallow Marsh	Broadly defined type intergrading with wet meadows and deep marshes, present along shorelines where wave action prohibits peat formation. Vegetation varies within type due to fluctuating water levels, exposure to disturbance and substrate. Bulrush, bur-reed and arrowhead. Open water contains some floating-leaved vegetation such as duckweed. No shrub or tree cover.	Standing water present most of year; stable water table; protected from wave action.	Alteration of water table due to human activity; succession. Siltation and sedimentation of wet areas. Invasion by narrow-leaved or hybrid cattails.
Fen, Wet Meadow, Carr	Calcareous Fen (Southeastern) Type (OPp93c)	Tussock Sedge Fen	Open graminoid-dominated fen present mostly on side slopes of erosional features and sometimes on terraces within valleys. Typically dominated by sterile sedge, mat muhly grass, and big bluestem. Shrub layer is absent to sparse.	Constant upwelling of cold, anoxic groundwater, peat formation.	Change in hydrology; invasive species
Fen, Wet Meadow, Carr	Black Ash-Red-Maple Seepage Swamp (WFs57a)	Black Ash - (Red Maple) Seepage Swamp Type	Wet hardwood forest on mucky or peat soils where groundwater seepage is present, often on stream or river terraces. Tree canopy is of patchy to interrupted and dominated by black ash, basswood, and red maple. Shrub layer is sparse and ground layer has raised, peaty hummocks with open pools and rivulets.	Groundwater influence, peat formation, lack of catastrophic disturbance.	Change in hydrology, invasive species
Fen, Wet Meadow, Carr	Southern seepage meadow/carr (WMs83)	Lake Sedge Wet Meadow	Open wetland dominated by dense cover of hummock-forming broad-leaved sedges or tall shrubs. Typically dominated by tussock sedge with bluejoint grass, lake sedge, and fowl manna grass. Shrub cover is variable and includes red-osier dogwood and willows. Associated with groundwater seepage areas at bases of river terraces and beach ridges or on gentle slopes.	Periods of inundation in spring followed by drawdown later in summer. Mineral inputs from groundwater.	Change in hydrology, invasive species

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Floodplain Forest	Southern Floodplain Forest (FFs68a)	Midwestern Cottonwood - Black Willow - Silver Maple Forest	Interrupted to continuous silver maple canopy on sandy or silty alluvium; annually flooded along medium to large rivers. Sparse ground layer due to scour and erosion due to flooding. Climbing plants and vines include poison ivy, and wild grape.	Annual flooding, ice scour	Hydrologic regime change; conversion to agriculture
Upland Forest	Pin Oak – Bur Oak Woodland (FDs37b)	Northern Pin Oak – (Bur Oak) Forest	Dry-mesic hardwood forest on river bluffs, often on south and west-facing slopes. Fire was a common feature of this habitat. Topsoil layer is thin due to surface erosion. Canopy is dominated by northern pin oak and bur oak. Subcanopy is not well differentiated from the canopy. Shrub layer is dense and composed of prickly ash, chokecherry, American hazelnut, gray dogwood and prickly gooseberry.	Frequent fire, both crown and surface.	Fire suppression or natural fire breaks; non-native shrub invasion
Upland Forest	Southern Dry-Mesic Oak Forest (MHs37)	Midwestern White Oak-Red Oak Forest	Dry-mesic closed-canopy hardwood forests, on glaciated rolling topography, often on thin, wind-deposited silt. Ground and shrub layers varied and diverse including dogwood and currant. Canopy is dominated by white oak and red oak.	Minimal fire, partial tree loss	Non-native species invasion

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Upland Forest	Sugar Maple-Basswood-(Bitternut Hickory) Forest. MHs39)	North-Central Maple - Basswood Forest	Mesic hardwood forest protected from fires on hummocky stagnation moraines, on till plains along the Minnesota River. Canopy and subcanopy is interrupted to continuous and dominated by sugar maple, basswood, and northern red oak. Shrub layer is variable, ranging from rare to interrupted and includes sugar maple and bitternut hickory. Ground layer is interrupted to continuous and includes Virginia waterleaf, bloodroot, yellow violet, and wild leek.	Minimal fire, partial tree loss	Non-native species invasion
Upland Forest	Red Oak-Sugar Maple Basswood-(Bitternut Hickory) Forest (MHs38c)	Red Oak - Sugar Maple - Elm Forest	Mesic hardwood forest with interrupted to continuous canopy and subcanopy comprised of basswood, northern red oak, and sugar maple. Ground and shrub layers are patchy to interrupted and include sugar maple, ironwood, prickly gooseberry and chokeberry.	Periodic tree loss; fires rare	Non-native species invasion
Dry Grassland	Southern Dry Prairie (UPs13)	Northern Little Bluestem Gravel Prairie	Grass-dominated herbaceous communities on level to steeply sloping sites with droughty soils. Patchy to continuous mid-height and shortgrass species are prominent; little bluestem may dominate. Also side-oats grama, prairie dropseed, and porcupine grass. Graminoid cover is patchy to continuous (50–100% cover). Sparse (5–50%) diverse forbs. Sparse (< 5%) shrubs; trees absent or occasional.	Dry conditions, lower soil fertility, and recurring fire.	Fire suppression. Smooth sumac and eastern red cedar invasion. Heavy grazing.

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Wet Mesic Grassland	Southern Mesic Prairie (UPs23)	Northern Mesic Tallgrass Prairie	Grass-dominated but forb-rich herbaceous communities on loam soils on level to gently rolling sites. Uniform, predominantly tallgrass with some mid-height grass. Graminoid cover is usually continuous, dominated by big bluestem, prairie dropseed, and Indian grass. Forbs include goldenrods, asters, coneflower, and leadplant.	Loam soils allow moisture retention; recurring fire.	Conversion to row crops. Fire suppression. Kentucky bluegrass and smooth brome invasion. Heavy grazing. Pocket gophers promote brome.
Wet Mesic Grassland	Southern Wet Prairie (WPs54a and WPSb)	Northern Cordgrass Wet Prairie	Grass-dominated, forb-rich herbaceous community on poorly-drained loam soils formed in lacustrine sediments, unsorted glacial till, or outwash deposits. Graminoid cover is usually continuous (75–100%). Tall grasses with some low grasses and sedges, including cordgrass, switchgrass, and narrow reedgrass. Sparse to patchy forbs (5–50% cover) include Canada goldenrod, sunflowers, blazing star, asters, and dogbane. Shrubs are sparse (5–25% cover); trees absent.	Flooded for brief periods at most; upper part of rooting zone is not saturated for most of growing season, but saturation persists in lower zone for much of season. Episodic grazing or recurring fire.	Fire suppression, heavy grazing. Ditching, tiling, draining for agriculture.
Oak Savanna	Southern Mesic Savanna (UPs24)	Northern Bur Oak Openings	Tallgrass dominated landscape with sparse tree cover found on rolling to moderately sloping sites on glacial till and outwash. Often continuous graminoid cover includes big bluestem, Indian grass, and prairie dropseed. Tree cover often patchy to continuous, dominated by bur oak, sometimes with pin oak.	Drier conditions and recurring fire.	Fire suppression, leading to woody/non-native invasion.

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Oak Savanna	Southern Dry Savanna (Ups14a and UPs14b)	Northern Oak Barrens	Sparsely treed communities with scattered individuals or scattered clumps of tall, typically open-grown bur oak, northern pin oak, and sometimes black oak and jack pin on sandy sites. Grasses dominate the herbaceous ground layer and includes little bluestem, porcupine grass, big bluestem, and Indian grass. Forbs are sparse to patch.	Drier conditions and recurring fire.	Fire suppression, leading to woody/non-native invasion.
Creeks and Small Rivers	Not applicable	Not applicable	Small to moderately-sized stream channels. Substrate is a combination of silt, sand, and mud in slow moving areas and hard substrate such as gravel and cobble in fast moving areas. Logs and downed trees provide cover for fish and other aquatic organisms.	Groundwater and surface water inputs; sediment transport	Watershed development resulting in sedimentation and altered hydrology, channelization, habitat degradation.
Minnesota River	Not applicable	Not applicable	Large river system. Primarily influenced by surface water inputs (or through agricultural drainage). Substrate is a combination of silt, sand, and mud in slow moving areas. Hard substrate is limited to areas of scour. Logs and downed trees have less overall influence on habitat than in small streams, but still provides critical aquatic organism habitat.	Groundwater and surface water inputs; sediment transport	Watershed development resulting in sedimentation and altered hydrology resulting from impoundments and dredging, habitat degradation through bed degradation and bank sloughing.

Broad Habitat Type	MN Native Plant Community[1]	NVCS Association Classification[2]	Populations and Habitat Attributes	Natural Processes	Limiting Factors and Stressors
Rock Outcrop	Crystalline Bedrock Outcrop (Prairie) Minnesota River (ROs12a1)	Northern Tallgrass Quartzite-Granite Rock Outcrop	Occasional on granite, gneiss, or diorite along the Minnesota River valley between Ortonville and New Ulm, locally present downstream on sandstone between Mankato and the Twin Cities. Rainwater pools present downstream on sandstone between Mankato and the Twin Cities. Rainwater pools present on many occurrences. Deeper pools often support submergent aquatic plants, such as mudwort and pondweeds.	Environmental extremes including rapidly fluctuating temperatures and low moisture conditions	Development, Sand mining, invasive species.

3.3.3 Maintaining and Restoring BIDEH

In the early 1890s, the lower Minnesota River watershed was developed for agricultural production. Wetlands were drained and streams and creeks were widened to provide increased drainage. Bluffs along the Minnesota River valley were developed for houses and private hunt clubs. A 9-foot navigational channel from Shakopee to the confluence with the Mississippi River was established to allow for commercial shipping and transportation. As the Minnesota River valley was being developed, local interest in protecting the natural resources of the valley also developed leading to local stakeholders to push for the establishment of the Refuge in 1976 (USFWS 2004a). Today, the land around the Refuge has been or is in the process of being converted to urban land uses. Intensive water management throughout the entire Minnesota River watershed is still being conducted in an effort to increase agricultural production. However, within the 26,018-acre acquisition boundary, Refuge staff along with partners are attempting to further the mission of the Refuge by protecting remnant habitats and restoring native plant communities.

3.4 Priority Refuge Resources of Concern

3.4.1 Priority Resources of Concern Selection

The potential ROC table (Appendix E) contains a comprehensive list of species with a broad array of habitat needs that occur within the Refuge. This list was refined and reduced to identify priority resources representing the spectrum of habitat needs for species included in Appendix E. The USFWS selected priority resources using the USFWS's Identifying Refuge Resources of Concern and Management Priorities: A Handbook (Handbook) (Taylor and Paveglio 2017), as well as aspects of Strategic Habitat Conservation (SHC), which is an iterative process developed by the USFWS to support strategic decisions on habitat conservation for species on landscape-level scales (USFWS 2008). The selection process outlined within the Handbook and SHC guidance uses a focal resource concept.

Potential ROC were evaluated in a systematic way using a spreadsheet-based decision tool called Resources of Concern Selection Tool for America's Refuges (ROCSTAR) (Salas and Pranckus 2015). ROCSTAR was developed to assist managers at National Wildlife Refuges, waterfowl production areas, wetland management districts, and other conservation lands in identifying priority resources for management and monitoring. This tool is intended to assist managers and planners in completing the selection process outlined within the Handbook. The ROCSTAR tool allows the planning team to review the applicable filters required when considering priority ROC selection. It also provides a decision support framework that allows users to compare various resources and their ability to address the selection considerations outlined in the Handbook (Taylor and Paveglio 2017), and also incorporates aspects of the surrogate species concept as described in Caro (2010) and USFWS (2012b). The tool results in a series of resource scorings sorted by habitat type. Based on the scoring results, the planning team can then make an informed decision on the number and type of priority ROC to select for each habitat type managed on the Refuge. The results of the ROCSTAR scoring evaluation is provided in Appendix E.

The goal of the Handbook and ROCSTAR is to select priority Refuge-specific ROC that can be used as indicators of overall habitat quality and benefits to other species using the same habitat types. The Handbook guides the selection of priority Refuge ROC by considering which resources best address the following considerations:

1. Relevance to Legal Mandates
2. Management Significance
3. Ecological Significance

Relevant Legal Mandates:

Candidate priority resources were evaluated for their ability to be managed in order to fulfill the Refuge purpose and associated Service policies and mandates.

Contribution to Refuge purpose – Achieving Refuge purposes and managing for trust resources as well as BIDEH can be addressed through habitat requirements of focal species, i.e., species that may represent guilds that are associated with important attributes or conditions within habitat types. The use of focal species is particularly valuable in addressing Service trust resources such as migratory birds. By selecting focal species, Refuge staff can document the Refuge-specific contribution to migratory bird conservation.

Contribution to listed species – Species listed at the state or federal level have historically occupied the Lower Minnesota River Valley. Based on review of previous restoration efforts and habitat conditions necessary for these and other rare or imperiled species, the USFWS believes that continued repatriation of listed species is worthwhile. Addressing listed species in this plan is a way that we can address this important Service mandate.

Contribution to Refuge System – The conservation of priority resources within the Refuge has an important role in supporting the mission of the NWRS. By selecting priority resources that can be used as a measure of management success, these resources can be used to develop our inventory and monitoring program. This will help Refuge staff to evaluate the effectiveness of management and communicate the success and challenges with others. In doing so, this will aid in providing long-term support for the NWRS.

Management Significance:

Candidate priority resources were evaluated for their management significance to the Refuge. A species was considered significant if it had the following characteristics: 1) species have a direct application to key management decisions or effectiveness of past management activities, 2) species are reliant on habitat management to provide suitable or improved conditions, 3) management and protection of the species or its habitat is recognized as important (i.e. presence in regional conservation plans and lists noted previously) by managers, researchers, policy makers and the public. Evaluating the management significance is important to the Refuge as data on the species and its habitats can help inform management decisions and progress toward achievement of Refuge goals.

Habitat requirements of priority species – Habitat suitability and availability may limit the capability of the refuge to support or manage for a priority species of concern. The following species-specific factors were evaluated:

- Historic habitat use and abundance on the Refuge
- Connectedness and species utilization of habitat types
- Environmental conditions including soils, hydrology, disturbance patterns, contaminants, predation, and invasive species
- Specific life history needs, such as habitat needs for breeding, migrating, and overwintering stages.

Habitat management for selected priority species – Observations and institutional knowledge of Refuge personnel were used to determine the feasibility for the Refuge to support a particular species throughout the annual life cycle (e.g., breeding, migration, overwintering).

The need for management and protection of the priority species is recognized – Chapters 1 and 2 highlighted numerous national, regional, and state conservation plans used to identify conservation priorities for the Refuge. Species on the comprehensive ROC list were initially ranked based on the sum of conservation plans in which they were found. Ranked species were then evaluated during the partner outreach effort for their relative seasonal (breeding, migrating, wintering) abundance on the Refuge. In doing so, some species that ranked high on conservation plans, but were only incidental on the Refuge, were not included in the priority species selection since they presumably could not be effectively managed for.

Contribution to inventory and monitoring - Candidate priority species were evaluated for their potential contribution to the development of the Refuge's inventory and monitoring program. Priority species must be able to provide indicators of habitat quality by responding to management actions through increased use, improved breeding, presence/absence, or by another measure. Each candidate was reviewed for its ability to be monitored, amount of existing data specific to the station, and the likelihood of the species being affected positively through management.

Ecological Significance:

Candidate priority resources were evaluated through a series of planning team meetings and literature reviews, for their ecological significance to the Refuge. Ecological significance was defined as a species 1) having a strong, defensible link to overall ecological function of the landscape or be strongly associated with a critical resource of the Refuge, 2) sensitive to larger landscape or habitat changes so that it can act as an indicator of potential change, and 3) status of the species or its habitat is representative of other priority species, ecological processes or biological organizations. Evaluating the ecological significance of candidate priority species helps ensure that management and monitoring activities associated with priority species and their habitats contribute to the BIDEH of the Refuge. Priority resources can be used as an indicator of BIDEH based on their presence, absence, abundance, or relative well-being in a given habitat niche. In doing so, it serves as a marker of overall health of its required habitat type.

Using these criteria, the planning team refined the list of potential ROC based on continued review of the criteria previously described. Thirty-nine priority resources including 25 bird species or

groups, one terrestrial invertebrate group, one aquatic invertebrate group, two reptiles, two mammals, four fish species, one plant species and three native communities for the Refuge were selected by the planning team (Table 3-2). During this iterative process, some candidate priority resources that effectively duplicate the habitat requirements and/or potential management response of other species were not included. In most cases, these "redundant" species were

removed because the selected priority resources were preferred for management and/or monitoring purposes, according to available datasets, literature review, and/or professional judgment by the planning team. A list of these species, general habitat requirements, and other benefitting species can be found in Table 3-3. Discussion of the selection considerations for each priority ROC can be found following the table.

Table 3-2 Resources of Concern and associated broad habitat type(s) for Minnesota NWR

Resource of Concern	Broad Habitat Type(s)	Taxa Group
American White Pelican	Permanent and semi-permanent wetland	Bird
Blanding's Turtle	Permanent and semi-permanent wetland; Fen, wet meadow, carr; Wet mesic grassland; Creeks and small rivers	Reptile
Blue-winged Teal	Permanent and semi-permanent wetland; Temporary and seasonal wetland; Wet mesic grassland	Bird
Greater Yellowlegs	Permanent and semi-permanent wetland; Temporary and seasonal wetland	Bird
Lesser Yellowlegs	Permanent and semi-permanent wetland; Temporary and seasonal wetland	Bird
Mallard	Permanent and semi-permanent wetland; Temporary and seasonal wetland; Dry grassland; Wet, mesic grassland	Bird
Pied-billed Grebe	Permanent and semi-permanent wetland; Temporary and seasonal wetland	Bird
Ring-necked Duck	Permanent and semi-permanent wetland	Bird
Short-billed Dowitcher	Permanent and semi-permanent wetland	Bird
Trumpeter Swan	Permanent and semi-permanent wetland	Bird
Bluegill	Deepwater wetland	Fish
Largemouth bass	Deepwater wetland	Fish
Northern pike	Deepwater wetland	Fish
Piscivorous birds	Deepwater wetland	Bird; Great Blue Heron
River otter	Deepwater wetland	Mammal
Small white lady's-slipper	Fen, wet meadow, carr	Plant
Sedge Wren	Temporary and seasonal wetland	Bird
Bald Eagle	Floodplain forest; Minnesota River	Bird
Prothonotary Warbler	Floodplain forest; Creeks and small rivers	Bird
Wood Duck	Floodplain forest; Permanent and semi-permanent wetland	Bird

Resource of Concern	Broad Habitat Type(s)	Taxa Group
American Woodcock	Upland forest; Floodplain forest; Wet mesic grassland; Fen, wet meadow, carr	Bird
Eastern Wood-peewee	Upland forest	Bird
Golden-winged Warbler	Upland forest	Bird
Northern Flicker	Upland forest	Bird
Northern long-eared bat	Upland forest	Mammal
Wood Thrush	Upland forest; Creeks and small rivers	Bird
Bobolink	Dry grassland	Bird
Grasshopper Sparrow	Dry grassland	Bird
Lark Sparrow	Dry grassland	Bird
Monarch	Dry grassland; Wet mesic grassland	Invertebrate - Terrestrial
Plain's hog-nosed snake	Dry grassland	Reptile
Northern Harrier	Wet mesic grassland; Permanent and semi-permanent wetland; Temporary and seasonal wetland; Dry grassland;	Bird
Rusty patched bumble bee	Dry grassland; Wet mesic grassland	Invertebrate - Terrestrial
Remnant prairie	Dry grassland; Wet mesic grassland	Native plant community
Remnant oak savanna	Oak savanna	Native plant community
Brook trout	Creeks and small rivers	Fish
Native mussels	Minnesota River	Invertebrate - Aquatic
Common Merganser	Minnesota River	Bird
Rock outcrop	Rock outcrop	Native plant community

Table 3-3 Priority ROC and Their Habitat Associations for Minnesota Valley NWR

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
American White Pelican	Permanent and semi-permanent wetland	Forage in shallow marshes, rivers and lake edges	Islands where periodic flooding restricts woody vegetation. Variety of shallow water wetlands (Fritz and Evans 2004)	Not applicable	Sensitive to human disturbance during courtship and nesting (Knopf and Evans 2004)
Blanding's turtle	Permanent and semi-permanent wetland	Variety of wetland grasses and sedges and marsh species	Diverse wetland complexes, calm and shallow preferred. Often associated with rivers and streams. (MNDNR 2015) Typically overwinter in water at least 3 feet deep (Ross and Anderson 1990)	Not available	Require sandy uplands near wetland complex, which serves as nesting area. Habitat fragmentation between wetlands and uplands should be avoided
Blue-winged Teal	Permanent and semi-permanent wetland	Seasonal and semi-permanent shallow wetlands with much emergent and submergent vegetation; farm fields and cropland for foraging (Lokemon et al. 1990, Austin and Miller 1995, Johnson 1995, Ryder and Alisauskas 1995, Dubowy 1996, Leschack et al. 1997, Austin et al. 1998, Mowbray 1999, Mowbray et al. 2000, Drilling and McKinney 2002, Rohwer et al. 2002, Roy et al. 2012)	High density stands of short to moderate grasses within 450 feet of water for nest sites; shallow water, farm fields used for foraging	Not available	None

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Greater Yellowlegs	Permanent and semi-permanent wetland	Mudflats, lakes, small ponds, slow flowing rivers, seasonal wetlands, swamps, meadows, sewage ponds and flooded agricultural fields(Elphick and Tibbits 1998)	Relatively shallow water with adjacent open mudflats. Sometimes wet meadows	Not applicable	None
Lesser Yellowlegs	Permanent and semi-permanent wetland	Mudflats, pools, shores, fields and seasonal wetlands (Tibbits and Moskoff 2014)	Shallow flooded habitat with adjacent open mudflats or seasonally flooded farm fields; soft substrates	Not applicable	None
Mallard	Permanent and semi-permanent wetland	Grasslands, marshes, bogs, riverine floodplains; great variety of habitat and vegetation used including cropland. Principal foods: smartweed, sedges, and invertebrates.	Variety of dense cover, usually upland, close w/in 450 feet of water; ephemeral, seasonal, and semi-permanent ponds and marshes for breeding pair, feeding, and brood habitat	Not available.	Little consistency with which wetland type selected and it is often used in proportion to availability. Important to restore and maintain wetland complexes in the landscape.

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Pied-billed Grebe	Permanent and semi-permanent wetland	Forages in open water, among rooted aquatic plants, among emergent vegetation close to shore, and beneath mats of floating vegetation	Seasonal or permanent ponds; dense stands of emergent or aquatic vegetation. Non-moving riverine backwaters. (Martin and Storer 1999)	> 0.5 acres	None
Ring-necked Duck	Permanent and semi-permanent wetland (and Deepwater wetland	Wild rice, wild celery, bulrush, pondweed, naiad, pickerelweed, etc. (Lapp 1995).	Deep to shallow marshes primarily, bogs and fens; water depths typically 1.3 – 6 feet and fairly stable (Korschgen et al. 1988).	Not available	None
Short-billed Dowitcher	Permanent and semi-permanent wetland	Wetland grasses and emergent vegetation where water levels recede enough to expose ground	Mudflats and shallow ponds, wet meadows and stagnant pools (Sibley 2000, Takekawa and Warnock 2000)	None	Migratory species, significant overlap with Long-billed Dowitcher which looks very similar
Trumpeter Swan	Permanent and semi-permanent wetland	Marshes with hardstem bulrush or cattail; agricultural fields and cropland for foraging (Mowbray et al. 2002, Mitchell and Eichholz 2010)	Marshes with muskrat houses or other elevated nesting sites; easy access to water in proximity to abundant food source such as low grasses, sedges, and adjacent farm fields	Semi-permanent or permanent impoundments of 2.5 to 3,700 acres	None

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	**Vegetative Structure**	**Patch Size**	**Special Considerations**
Bluegill	Deepwater wetland	Submergent and emergent vegetation	Mosaic of aquatic vegetation beds and open water to provide feeding and cover opportunities. Too dense of vegetation can limit feeding and spawning	Not applicable	Uses shallow water for spawning and feeding, but needs deeper water for overwintering
Largemouth bass	Deepwater wetland	Submergent and emergent vegetation	Mosaic of aquatic vegetation beds and open water to provide feeding and cover opportunities. Clear water. Soft substrates.	Not applicable	Uses shallow water for spawning and feeding, but needs deeper water for overwintering
Northern pike	Deepwater wetland	Submergent and emergent vegetation (Dehring and Krueger 2008)	Dense submergent aquatic vegetation beds with access to deep water	Not applicable	Active in early spring. Females lay eggs on flooded vegetation. Access to deeper water during the summer is important as activity decreases due to temperature. Can tolerate low dissolved oxygen conditions.
Piscivorous birds	Deepwater wetland	Submergent and emergent vegetation	Mosaic of aquatic vegetation beds and open water to provide feeding opportunities	Not applicable	None

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
River otter	Deepwater wetland	Not applicable	Hollow logs, fallen trees, overhanging vegetation, abandoned beaver lodges (NatureServe 2015)	20 to 30 miles (Jackson 1961)	Highly mobile species that has increased on the Refuge due to increased water quality
Small white lady-slipper	Fen, wet meadow, carr	Not applicable	Deep soil mesic prairies; wet prairies, sedge meadows and calcareous fens. (MNDNR 2015)	None	Slow-growing, long-lived plant (estimated 12 years to maturity)
Sedge Wren	Temporary and seasonal wetland	Upright sedges and fine grasses (Herkert et al. 2001)	Graminoids with medium shrub density; avoids sparse, flooded, open, and cattail vegetation	Not available	Nesting habitat highly susceptible to drying or flooding and transitory; low site tenacity and fidelity
Bald Eagle	Floodplain Forest	Mature floodplain forest (Buehler 2000)	Open or diverse-height canopy near water, especially rivers with suitable foraging opportunities	Typically nest > 330 feet from development or disturbance (Andrew and Mosher 1982)	None
Prothonotary Warbler	Floodplain Forest	Floodplain forest, forest near standing water or other seasonally flooded woodland. Typical overstory trees include willows, maples, and ashes	Presence of water near wooded area with suitable cavity nest sites. Nests often over water, or very near. Can include standing or moving water, swamps and large rivers or lakes (Petit 1999).	Forests > 250 acres Waterways with wooded borders >100 feet wide	None

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Wood Duck	Floodplain forest	Flooded shrubland, water-tolerant trees, small areas of open water, emergent plants such as bur-reed, arrow arum, arrowhead, smartweed, and American lotus (Dugger et al. 2009, Hepp and Bellrose 2013)	Living or dead deciduous trees with cavities; scrub/shrub wetland with overhead cover of downed timber; dense stands of emergent plants; mixture of shallow freshwater wetland types in close proximity	Not available	Needs cavities for nesting
American Woodcock	Upland forest	Young hardwoods and mixed woods with shrubs, especially alder, aspen, and birch (McAuley et al. 2013)	Young forest and abandoned farmland mixed with forest. Forest clearings or old fields for displaying males. Shrub cover high (> 75%) (Morganweck 1977)	> 3 acres (Dunford and Owen 1973 via McAuley et al. 2013)	Requires moist soils for feeding
Eastern Wood-pewee	Upland Forest	Variety of forest communities, associated with forest clearings and edges, riparian areas in the Midwest (McCarty 1996)	Habitat suitability increased with tree density 0-250 trees/acre, leveling off after reaching 3950 trees/acre (Best and Stauffer 1986 via McCarty 1996)	4 to 1500 acres (McCarty 1996)	None
Golden-winged Warbler	Upland Forest	Young hardwoods and mixed woods, i.e. alder and aspen (Stucker, MNDNR; Wildlife Society 2001)	Early successional wooded habitats, young deciduous forests with shrubby openings. (Stucker 2009)	30 to 50 acres of managed area, with some edge habitat and early successional forest dominating (Frost 1995, Huffman 1997)	Post clear-cutting vegetation structure potentially creates habitat (Martin et. Al. 2007, Swarthout et al. 2009)

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Northern Flicker	Upland Forest and Oak savanna	Variable tree species, but aspen is preferred when available. (Wiebe and Moore 2008)	A wide variety of structures wet or riparian forests, swamps, recently burned areas, farm woodlots, and settled areas. Prefer to forage in more open or savanna-like habitats. (Wiebe and Moore 2008).	Not available	None
Northern long-eared bat	Upland Forest	Mature trees over a variety of understories. Often roosts under peeling bark of ashes and maples. (WIDNR 2014).	Trees with suitable habitat in bark or cavities. Variable understory and often near water or wetlands. (USFWS 2016).	> 40 acres fragments (Henderson, Farrow and Broders 2008)	Threatened by white-nose syndrome
Wood Thrush	Upland forest	Common tree species include red maple, American hornbeam, and oaks (Evans et al. 2011)	Trees > 50 feet tall, diverse deciduous trees, moderate subcanopy and shrub density and shade, with a fairly open forest floor. (USFWS 2016)	Patches > 3 acres	None
Bobolink	Dry grassland	Tallgrass or mixed-grass prairie, or old fields > 8 years and converted from cropland to perennial grassland cover (Martin and Gavin 1995)	Fields comprised of a mixture of grasses and forbs with little woody vegetation. Tolerates some shrubs up to 1m tall.	Fields ≥ 74 acres	Low tolerance for woody species in or surrounding grassland
Grasshopper Sparrow	Dry grassland	Tallgrass and shortgrass prairie and grassland species (Vickery 1996)	Open grassland with patchy bare ground; minimal shrub component	74 to 250 acres	None

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Lark Sparrow	Dry grassland	Grass/herbaceous cover and sparsely covered wood lots, deciduous preferred over conifer (Martin and Parrish 2000)	Varied, including open grasslands, cultivated fields, and ecotones where fields and prairie grades into wooded or shrubby areas	Not available	None
Monarch butterfly	Dry grassland	Fields and parks where milkweed and native plants grow. Feed on nectar of various plants, but larvae feeds exclusively on milkweed plants (MNDNR 2015).	Prairie and old field habitats with milkweed component	Not available	Management for milkweed and diverse prairie plants critical
Plains hog-nosed snake	Dry grassland	Variety of native prairie and savanna species	Open, sparsely vegetated habitats on well-drained soil and pocket gopher burrows (MNDNR 2005)	Not available	Vulnerable to habitat segmentation and urban encroachment. Consideration needed during prescribed burns.
Northern Harrier	Wet, mesic grassland	Typically mesic or wet meadows and prairies. Ground nesters. (Smith et al. 2011)	Open, thickly vegetated meadows and prairies with occasional shrub cover, but very few trees	> 250 acres (Johnson & Igl, 2001)	Vulnerable to disturbance as agriculture removes suitable habitat, or haying destroys nests
Rusty patched bumble bee	Dry and wet, mesic grassland	Variety native prairie and woodland flowering species.	Undisturbed nesting sites such as abandoned rodent burrows or clumps of grass near nectar sources and overwintering sites of undisturbed soil for hibernating queens (Goulson et al. 2015; Potts et al. 2010).	Not available	Requires flowering species spring through autumn to meet nutritional requirements (McFarlane et al. 1994)

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	Vegetative Structure	Patch Size	Special Considerations
Native prairie remnants	Dry and wet, mesic grassland	Native upland and wet prairie remnants	Native herbaceous vegetation made up of varying heights and densities	Not applicable	Contains rare and unique plant and animal species. Very few remnant prairies remaining in metro.
Remnant oak savanna	Oak Savanna	Oak species, most commonly bur oak	Sparse open-grown oaks typically with tallgrass dominated ground cover	Not applicable	Contains rare and unique plant and animal species. Very rare habitat in Midwest.
Brook trout	Creeks and small rivers	Not applicable	Spring-fed waters that are cool and clear with sand and gravel substrate. Moderate amount of submergent aquatic vegetation.	Not applicable	Restricted to cool water streams
Native mussels	Minnesota River	Not applicable	Sand and gravel substrates	Not applicable	Sensitive to frequent or rapid water elevation changes
Common Merganser	Minnesota River	Not applicable	Open water areas with abundant small fish and invertebrates (Pearce et al. 2015)	Not available	Uses open water portions of the river during fall and winter until freeze up

Priority Resource	Habitat	Key Habitat Relationships			
		Vegetative Composition	**Vegetative Structure**	**Patch Size**	**Special Considerations**
Rock outcrop	Rock Outcrop	Lichens are typically dominant plant life. Thin grass cover where soil is present. (MNDNR 2005).	Exposed bedrock with sparse lichens, graminoids, or shrubs	Not applicable	Contains rare and unique plant and animal species

3.4.2 Priority Refuge Resources and Relation to Refuge BIDEH

Permanent and Semi-permanent wetland

Birds

American White Pelican is listed in the SWAP for Minnesota. It was selected as a priority resource because it uses permanent and semi-permanent wetlands on the Refuge for foraging, mainly during migration.

Blue-winged Teal is a good representative of late-nesting dabbling ducks that use shallow permanent and semi-permanent wetlands and vegetated mud flats on the Refuge. They were selected as a priority resource because they are relatively abundant, easy to monitor, and good representatives of waterfowl that require a grassland/wetland complex. They also nest on the Refuge.

Greater Yellowlegs is a priority resource because it uses the shallow open water component of permanent and semi-permanent wetlands on the Refuge. Greater Yellowlegs' populations are declining due to habitat loss and are recognized by the USFWS Region 3 as a species of conservation concern.

Lesser Yellowlegs use the Refuge during spring and fall migration periods. The Lesser Yellowlegs is listed as a priority species in the USFWS Region 3 Birds of Conservation Concern (BCC) list. Providing for the migratory habitat needs of Lesser Yellowlegs also benefits many other species of shorebirds and waterbirds.

Mallard is an opportunistic user of many different types of habitats on the Refuge. Although it is a very common waterfowl species, it is a priority for the UMRGL and a species of concern on the USFWS Region 3 BCC list. The Mallard is a good representative for early nesting dabbling ducks and is abundant enough to monitor. It is a habitat generalist that uses a wide variety of habitats when they are available and thusly can act as an indicator of habitat use by a wide suite of waterfowl. As a dabbling species of waterfowl, their presence could also indicate that suitable habitat exists for waterbirds and shorebirds as well as many other species of waterfowl.

Pied-billed Grebes use permanent and semi-permanent wetlands that are in proximity to deepwater marshes, or wetlands that have a mix of both emergent and submergent vegetation. They are important indicators of diverse hemi-marsh conditions on the Refuge. Providing habitat variability within permanent and semi-permanent wetlands benefits a wide range of species that depend on open water, standing vegetation, or a mix of both.

Ring-necked Ducks are abundant diving ducks that primarily use Refuge wetlands during migration. This allows staff to conduct monitoring activities on this species as well as other migratory waterfowl.

Short-billed Dowitcher is a shorebird that forages in mudflats associated with emergent wetlands on the Refuge during its migration between Canada and the South American coasts. It is listed as a SGCN in the Minnesota SWAP (MNDNR 2006) and is designated as a high priority in several BCR shorebird plans.

Trumpeter Swan nests in small marshes and ponds. Once abundant in Minnesota, overhunting and habitat loss resulted in the species being listed as state threatened. Today, lead poisoning is a threat to individuals. Providing nesting habitat on the Refuge for this species contributes to the state goal of maintaining a viable population.

Reptiles

Blanding's turtle, a threatened species in Minnesota, requires emergent wetlands with shallow, clear pools with soft, muddy substrate. Blanding's Turtles may be indicative of healthy ecological processes that are important for non-bird species in emergent wetlands.

Deepwater wetland

Birds

Piscivorous birds including species such as great blue heron use deeper water wetland habitats to forage for fish.

Fish

Bluegill is an abundant, widely distributed fish species that provides both angling opportunities and forage for predators including large fish and bird species. Bluegill forage on small invertebrates along submergent aquatic vegetation beds and around underwater structures such as downed logs and piers. They represent one of the best angling opportunities for young or inexperienced users, as they are easy to catch, abundant and are found in a wide variety of aquatic habitats that offer a mix of aquatic vegetation and water either deep enough or well-oxygenated enough to overwinter.

Largemouth bass is a top-level predator that spawns in the shallow portions of deeper water wetland habitat and forages in a submergent aquatic vegetation and deeper water, preying on small fish. It can tolerate turbid water, but prefers clear water. Largemouth Bass present an angling opportunity for Refuge users.

Northern pike are top-level predators that rely heavily on submergent aquatic vegetation in deeper water wetlands for spawning and foraging. Maintaining their presence on the Refuge is an indicator of well-oxygenated, cooler (< 65° F) deeper water wetlands.

Mammals

River otter is a fur-bearing mammal with a diet that consists of fish, turtles, mussels, and occasionally terrestrial small mammals (mice, young rabbits). Absent for nearly a century from its southern range in Minnesota, it is making a comeback due to regulated harvest and habitat protection, as well as water quality improvements.

Temporary and seasonal wetland

Birds

Sedge Wren is a grassland species that is listed in Minnesota's SWAP (MNDNR 2006) as a SGCN. Much of the species decline is presumably due to the loss and degradation of wetlands, caused by suburbanization, intensive agricultural development, and natural succession. This species prefers large, contiguous blocks of tallgrass prairie situated in areas that tend to hold

water for varying periods of time. In Minnesota, the average nesting territory is 0.5 acres and the average male territory is approximately 3,200 acres (Encyclopedia of Life 2016).

Short-billed Dowitcher is a shorebird that prefers mudflats and shallow ponds, wet meadows and stagnant pools (Sibley 2000, Takekawa and Warnock 2000) where water levels recede to exposure soft substrate. For the Refuge, it acts as an ecological indicator species for seasonal wetland hydrologic changes, specifically dry down and mudflat exposure.

Fen, wet meadow, carr

Plants

Small white lady's-slipper is found on mesic prairies. It can also be found in wet prairies, some sedge meadows and fens. Its distribution within the state of Minnesota has been reduced due to habitat fragmentation, overgrazing by domestic livestock and competition from invasive species.

Floodplain forest

Birds

Bald Eagle, although de-listed as a federally endangered species, remains as a priority species in many regional and state conservation plans and is protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). On the Refuge, Bald Eagles nest in canopies of cottonwoods or other tall trees adjacent to open water. Because they require both mature trees for nesting and perching and open water for feeding, they indicate a diversity of high quality forested and open water habitats on the landscape and at the Refuge.

Prothonotary Warbler is listed in the SWAP for Minnesota and is a priority species in the Eastern Tallgrass Prairie BCR and the Upper Great Lakes Plain PIF plans. It is representative of species that require trees capable of producing nest cavities near or over standing water in dense understory.

Wood Duck is a dabbling duck listed as a USFWS Region 3 priority species. Wood Ducks use shallow, muddy emergent wetland habitats on the Refuge that are close in proximity to mature standing trees in forested areas. Wood Ducks use cavities in these trees for nesting. As such, they are indicators of the successional development of both mature forested wetlands and permanent and semi-permanent wetlands on the Refuge.

Upland forest

Birds

American Woodcock is forest-dwelling shorebird that is listed as a high conservation priority in all the BCR Shorebird Plans, as well as a SGCN in Minnesota's SWAP (MNDNR 2016). It requires the transitional (shrub to forest) habitat present in upland areas currently being reforested on the Refuge through natural regeneration.

Eastern Wood-pewee is a small flycatcher common to a variety of forest conditions. It is listed as a SGCN in the Minnesota SWAP. It is easily monitored due to its characteristic song. Eastern

Wood pewee is a representative of common forest songbirds that have shown a recent trend in declining populations.

Golden-winged Warbler is a Neotropical migrant songbird that prefers dense vegetation in early successional forest habitat. It is listed as a SGCN in the Minnesota SWAP. The Upper Midwest of Minnesota and Wisconsin represent the core of its breeding territory in the U.S.

Northern Flicker is a cavity nester that uses open areas, woodlands and forest edges, all of which can be found on the Refuge. It represents other species such as woodpeckers that require standing dying and dead trees from which to forage for insects and for nesting habitat.

Wood Thrush is a small Neotropical migrant bird that commonly nests in the deciduous upland and mesic forests on the Refuge. They prefer a dense tree canopy and a fairly well-developed deciduous understory, especially where moist. The Wood Thrush is a focal species as recognized by the Upper Mississippi River and Great Lakes (UMRGL) JV, two USFWS conservation lists, and as a SGCN in the Minnesota SWAP.

Mammals

Northern Long-eared Bat is a tree-roosting bat that uses forested habitats near wetlands. Females form maternity colonies during the summer to rear young. Winter hibernacula has been impacted by white-nosed syndrome, which has resulted in declining populations. It is listed as a Federally-threatened species and a species of special concern in the state of Minnesota.

Dry grassland

Birds

Bobolink is listed as a Highest Priority species in several PIF BCRs and is listed on Minnesota's SWAP as a SGCN (MNDNR 2006). Bobolinks prefer transitional areas between wet and dry prairie within large patch landscapes. Managing grassland habitat for the Bobolink benefits many other species of grassland birds that prefer large, mesic patches of prairie.

Grasshopper Sparrow is a priority species of the grassland habitats for the Refuge. It is listed as a priority species in BCR 22 Eastern Tallgrass Prairie. The state of Minnesota has it listed as a SGCN in its SWAP (MNDNR 2006). It was selected as a representative for large patches of high quality upland prairie habitat.

Lark Sparrow is a grassland bird that prefers areas adjacent to forested areas. It is a good representative for grassland birds that require or can tolerate a woody vegetation component to the landscape.

Invertebrates

The Monarch butterfly is a pollinator, which is imperative for a fully functioning prairie ecosystem. Monarchs represent the native pollinator community of the Refuge and are indicators that forb diversity including their preferred milkweed species, in Refuge grasslands. Monarchs also use a variety of habitats for different portions of their life cycles.

The rusty patched bumble bee is a federally-listed endangered species that can be found in a variety of habitats ranging from dry prairie to mesic wet prairie and can also be found in woodlands and savannas. It requires a constant and varying source of nectar from the spring through the fall.

The Refuge was five management units (Black Dog, LML, Chaska, Round Lake, and Upgrala) that are within 6 miles of known species occurrences within the greater metro area.

Reptiles

Plains hog-nosed snake is listed as a SGCN in the Minnesota SWAP. It prefers sandy, gravelly soils and would be representative of species that utilize the sand prairies found on the Refuge.

Native plant communities

Remnant native prairie is a priority acquisition and habitat management priority for the Refuge. Very little remnant prairie remains relative to its historical distribution. Although prairie may be reconstructed through vegetation management and seeding with local ecotypes, remnant, unbroken prairie is extremely important because it may contain elements necessary to the ecological integrity of prairie systems.

Wet, mesic grassland

Birds

Northern Harrier is a slender, medium-sized raptor that breeds in large, undisturbed tracts of wetlands and grasslands with low, thick vegetation. It is listed as a SGCN in Minnesota's SWAP. Northern Harriers nest on the ground in dense, brushy vegetation within the grassland/wetland complex. This species commonly nests on the Refuge and is a good indicator of a healthy grassland/wetland complex with a shrub component.

Native plant communities

Similar to dry remnant prairie, the amount of native, unbroken wet, mesic prairie has been greatly reduced from its relative historical abundance and distribution. Remnants are important to provide information and the blueprints for future prairie reconstruction and to protect and preserve elements to wet, mesic prairies that are not understood at this point.

Oak savanna

Native plant communities

Savanna, particularly oak savanna in the Upper Midwest, is one of the most altered ecosystems in the world with < 1% remaining (Nuzzo 1986). Identifying, protecting, and restoring these native plant communities on the Refuge will be important to contribute to both state, regional, and global conservation.

Creeks and small rivers

Fish

Brook trout is a native coldwater fish species found in well-oxygenated streams with water temperatures between 57 and 60° F. Ike's Creek on the Refuge supports one of the only populations of brook trout in an urbanized watershed in the Minneapolis/St. Paul area.

Minnesota River

Birds

Common Merganser is a large, duck with a long, narrow serrated bill that mainly eat fish, amphibians and invertebrates. Open water of the Minnesota River provides important stopover and foraging habitat for this migratory waterfowl species.

Invertebrates

At one point, the Minnesota River basin contained approximately 40 native mussel species. Through habitat and water quality degradation, approximately two-thirds of those species have been lost. Protecting and providing habitat for native mussels helps to conserve what remains of an important group of aquatic species.

Rock outcrop

Native plant communities

Rock outcrop native plant community is open and sparsely vegetated. Trees are nearly absent and vegetation is adapted to harsh conditions of temperature extremes, desiccation and exposure to sun and wind. This is a unique community with limited distribution around the state and through the Refuge. Protecting this community adds to local, state and regional conservation of native plant communities.

3.4.3 Priority Refuge Resources, Habitat Use on the Refuge and Other Benefitting Resources

Table 3-4 summarizes how priority resources likely use habitats within the Refuge and the surrounding landscape based on a literature review, management experience and professional judgment. Several priority resources use more than one habitat type at one or more times of the year, thus emphasizing the importance of integrated habitat management. Selected priority resources primarily use the Refuge for migration, breeding and/or foraging purposes. Bird abundance significantly drops during the wintertime period as many of the priority bird species have migrated south.

Management activities associated with a priority species has direct and indirect benefits for other resources that have similar habitat requirements. Table 3-4 lists other resources each priority resource represents. In many cases, activities to benefit the priority species will likely result in benefits for other species that are conservation priorities. The species listed in the "Other Benefitting Resources" in Table 3-4 is not an all-inclusive list. The species listed were derived from reviewing the previously mentioned regional plans, Refuge staff and researcher observations, and selecting species of conservation concern that are rated as relatively high priority species across the region.

Table 3-4 Priority ROCs and Key Habitat Relationships for Minnesota Valley NWR

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
American White Pelican	Permanent and semi-permanent wetland	Freshwater lakes and isolated islands with low cover density	Migration, foraging	Bald Eagle Black Tern Canvasback Caspian Tern Channel catfish Common Loon Common snapping turtle Forster's Tern Green-winged Teal Hooded Merganser Least Bittern Lesser Scaup Northern Shoveler Northern pike Osprey River otter Virginia Rail Native invertebrate pollinators
Blanding's turtle	Permanent and semi-permanent wetland	Wetland complexes with adjacent sandy areas	Nesting, brood rearing, foraging	
Blue-winged Teal	Permanent and semi-permanent wetland	Hemi-marsh and high-density short-to-moderate height grass meadows	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Greater Yellowlegs	Permanent and semi-permanent wetland	Mudflats, seasonal wetlands, wet meadows, flooded agricultural fields	Migration, foraging	(Cont. from previous) Bald Eagle Black Tern Canvasback Caspian Tern Channel catfish Common Loon Common snapping turtle Forster's Tern Green-winged Teal Hooded Merganser Least Bittern Lesser Scaup Northern Shoveler Northern pike Osprey River otter Virginia Rail Native pollinator community
Lesser Yellowlegs	Permanent and semi-permanent wetland	Mudflats, seasonal wetlands, wet meadows, flooded agricultural fields	Migration, foraging	
Mallard	Permanent and semi-permanent wetland	Dense, herbaceous vegetation near water. Open parklands and variety of grasslands with dense cover, adjacent to shallow wetlands	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Pied-billed Grebe	Permanent and semi-permanent wetland	Seasonal ponds, dense stands of emergent or aquatic vegetation	Migration, nesting, brood rearing, foraging	(Con't from previous) Bald Eagle Black Tern Canvasback Caspian Tern Channel catfish Common Loon Common snapping turtle Forster's Tern Green-winged Teal Hooded Merganser Least Bittern Lesser Scaup Northern Shoveler Northern pike Osprey River otter Virginia Rail Native pollinator community
Ring-necked Duck	Permanent and semi-permanent wetland	Shallow marshes, fens, and bogs with abundant submerged or floating aquatic plants	Migration, foraging	
Short-billed Dowitcher	Permanent and semi-permanent wetland	Mudflats and shallow ponds, wet meadows and stagnant pools	Migration, foraging	
Trumpeter Swan	Permanent and semi-permanent wetland	Shallow water with irregular shoreline and abundant emergent vegetation	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Bluegill	Deepwater wetland	Shallow littoral zones with patches of open water and submergent aquatic vegetation. Access to deep water	Nesting, nursery, and foraging	Common snapping turtle, Smooth softshell turtle, Common mudpuppy
Largemouth bass	Deepwater wetland	Shallow littoral zones with patches of open water and submergent aquatic vegetation. Access to deep water	Nesting, nursery, and foraging	
Northern pike	Deepwater wetland	Flooded vegetation in early spring and shallow water with submergent aquatic vegetation with access to deep water	Egg laying, nursery, and foraging	
Piscivorous birds	Deepwater wetland	Patches of open water with good water clarity	Foraging	
River otter	Deepwater wetland	Open, deep water and banks with structure.	Foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Small white lady's-slipper	Fen, wet meadow, carr	Mesic prairies, wet meadows	Whole life	Bell's Vireo Common Yellowthroat Short-eared Owl Swamp Sparrow Willow Flycatcher Native pollinator community
Sedge Wren	Temporary and seasonal wetland	Wet meadows with medium shrub density	Migration, nesting, brood rearing, foraging	Blanding's turtle Greater Yellowlegs Green-winged Teal Killdeer Lesser Yellowlegs Northern Shoveler Semipalmated Sandpiper Short-billed Dowitcher Solitary Sandpiper Virginia Rail Wilson's Phalarope Native pollinator community
Bald Eagle	Floodplain forest	Well-developed floodplain forest with super-canopy trees and some openings	Migration, nesting, brood rearing, foraging	Beaver Blue Gray Gnatcatcher Cerulean Warbler Downy Woodpecker Eastern fox snake Gray Catbird Great crested Flycatcher Hairy Woodpecker
Prothonotary Warbler	Floodplain forest	Floodplain forest with sparse understory, streams and seasonal ponds throughout	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Wood Duck	Floodplain forest	Interspersed flooded shrubs, trees, and open areas, most often near streams	Migration, nesting, brood rearing, foraging	Northern prairie skink Northern Shoveler Pileated Woodpecker Red-shouldered Hawk
American Woodcock	Upland forest	Wetland with well-developed shrub cover interspersed with forest and grassland openings	Migration, nesting, brood rearing, foraging	Baltimore Oriole Gray Catbird Least flycatcher Red-shouldered Hawk Veery Native pollinator community
Eastern Wood-pewee	Upland forest	Variety of woodlands, most often near openings or edges	Migration, nesting, brood rearing, foraging	
Golden-winged Warbler	Upland forest	Woodlands with dense patches of herbs and shrubs, multi-level structure	Migration, foraging	
Northern Flicker	Upland forest	Open forests and woodland edges	Migration, nesting, brood rearing, foraging	
Northern long-eared bat	Upland forest	Variety of forest types, often near wetlands	Brood rearing, foraging	
Wood Thrush	Upland forest	Well-developed forest with diverse shrub layer available; dense stream-side vegetation	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Bobolink	Dry grassland	Mixture of grasses and forbs with little woody vegetation	Migration, nesting, brood rearing, foraging	Dickcissel Eastern hog-nosed snake Field Sparrow Gopher snake Henslow's sparrow Northern Flicker Northern prairie skink Plains pocket mouse Prairie vole Plains prickly pear Regal fritillary Savanna Sparrow Sedge Wren Smooth green snake Vesper Sparrow Western Meadowlark Native pollinator community
Grasshopper Sparrow	Dry grassland	Open grassland with patchy bare ground; minimal shrub component.	Migration, nesting, brood rearing, foraging	
Lark Sparrow	Dry grassland	Short grass fields and prairies; cultivated fields.	Migration, nesting, brood rearing, foraging	
Monarch butterfly	Dry grassland	Fields and parks with milkweed spp. Prairies with native plants.	Annual life cycle	
Plains hog-nosed snake	Dry grassland	Open/sparse vegetation.	Whole life	
Northern Harrier	Wet, mesic grassland	Open wetlands, wet meadows, dry grasslands, and old fields; very little shrub component.	Migration, nesting, brood rearing, foraging	

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Rusty patched bumble bee	Dry and wet, mesic grassland	Flowering species from spring through fall with undisturbed abandoned rodent burrows or clumps of grass near nectar sources and undisturbed soil areas near woodlands	Whole life	Dickcissel Eastern hog-nosed snake Field Sparrow Gopher snake Henslow's Sparrow Monarch Northern flicker Northern prairie skink Plains pocket mouse Prairie vole Plains prickly pear Regal fritillary Savanna Sparrow Sedge wren Smooth green snake Vesper Sparrow Western Meadowlark Native pollinator community
Remnant prairie	Dry and wet, mesic grassland	Short grass to tall grass mixture of forbs and grasses; little to no shrub or tree cover.	Not applicable.	
Remnant oak savanna	Oak savanna	Sparse to patchy canopy cover over tallgrass prairie.	Not applicable.	Eastern hog-nosed snake Gopher snake Kittentails Monarch butterfly Northern Flicker Northern long-eared bat Plains hog-nosed snake Plains pocket mouse Prairie skink Red-headed Woodpecker Whip-poor-will Native pollinators

Priority Resource	Habitat	Habitat Structure	Life History Requirement	Other Benefitting Resources
Brook trout	Creeks and small rivers	Clear, cool spring-fed streams	Whole life	Bald Eagle Blue sucker Common snapping turtle Hooded Merganser Least Sandpiper Mallard Native mussels Northern prairie skink River otter
Native mussels	Minnesota River	Fast moving water with sand and gravel substrates	Whole life	American White Pelican Blue sucker Channel catfish Common snapping turtle Hooded Merganser Lake sturgeon Mallard Northern pike Osprey Paddlefish River otter Walleye
Common Merganser	Minnesota River	Open water in deep areas of the river	Migration, foraging	
Rock outcrop	Rock outcrop	Sparsely vegetated exposed bedrock	Not applicable.	Northern prickly pear Brittle prickly pear Rough-seeded fame flower Native pollinator community

3.5 HABITAT TYPES AND ASSOCIATED PRIORITY SPECIES

Refuge personnel focus on managing habitats to benefit a suite of priority species, plants, or animals. The priority habitat types of the Refuge were identified based on examination of historic conditions, current vegetation, site capability, and conservation needs of benefitting species (Table 3-5).

Because all potential management activities cannot be concurrently implemented, habitat types have been prioritized based on the following ranking factors:

- Where management actions would provide the greatest conservation benefit to identified priority species,
- Current habitat conditions and the urgency of needs for active management, and
- The ability of a habitat type to be positively affected through management.

In general, Priority 1 habitats are areas that provide the greatest (or greater from a relative standpoint) benefit to the conservation of priority resources of concern or require and positively respond to active management activities. In other words, our Priority 1 habitats are where management actions will be focused over the next 15 years to protect, maintain, and enhance the habitat for the selected resources of concern and ecological integrity of the Refuge. Priority 2 habitats are those that do not require or respond to active management or have elements or conditions that are beyond current resource level.

Though some habitats may be ranked as Priority 2, this should not be interpreted as meaning they do not provide valuable habitat to a variety of species or contribute to Refuge BIDEH. These habitats may not require active management, represent areas where there is limited management capability, or under current conditions, may exhibit a limited response to habitat management. If conditions change in the future or additional funding or resources become available, Priority 2 habitats may be elevated to Priority 1 status during the scheduled HMP review.

Table 3-5 Priority Habitats and Their Potential Limiting Factors on Minnesota Valley NWR

Habitat	Rationale for Designation	Limiting Factors/Threats
Priority 1 Habitats		
Permanent and semi-permanent wetland	Provides important shallow water feeding habitat for migratory waterfowl and other waterbirds during the fall and spring periods. The Refuge is a large contributor of this habitat at the local landscape scale.	Invasive plant species can outcompete native species. Unpredictable seasonal flooding on the Minnesota River can limit or undo habitat management activities on an annual basis.
Deepwater wetland	Provides important migratory habitat for waterfowl and piscivorous birds during the fall and spring periods. Supports the Refuge mission of being an urban Refuge by providing angling opportunities to local residents.	Poor water quality due to urban land uses within the watershed.
Fens, wet meadow, carr	This is a rare habitat in the landscape of the Refuge that is often affected by development or a disruption in the natural processes that allow it to persist on the landscape.	Invasive plant species can outcompete native species. Altered hydrology can change conditions that make this habitat more susceptible to woody vegetation encroachment and establishment.
Floodplain forest	Floodplain forests comprise the majority of the Refuge's property and thus have a substantial impact on the Refuge's wildlife and habitat connections. Many of the Refuge's ROCs and various migrating and breeding songbirds use this habitat for part or all of their stay.	Development can fragment forest block size and increase edge effect. Disturbance can increase invasive species pressure.
Remnant grassland (both dry and wet, mesic)	Grasslands with remnant plant communities are important because they contain BIDEH elements that may be impossible to restore or replicate elsewhere.	The loss of fire and grazing by large herbivores allows woody species to increase and results in altered habitat conditions.
Oak savanna	Remnant oak savanna, like remnant prairies, is extremely rare. Both remnant oak savanna and restoration sites have remnant components. It will be important to maintain this ecological element on the landscape.	Lack of fire allows woody species encroachment, leading to loss of historic herbaceous ground cover. Invasive species also shade or outcompete native species.
Priority 2 Habitats		
Temporary and seasonal wetland	Provides seasonal habitat not common in the region for migrating shorebirds and overwintering habitat for Blanding's turtle.	Development such as sand mines and drainage can alter water tables and hydrology. Sedimentation can reduce water depth while changes that increase the amount of water in the wetland can create deeper, more permanent wetlands.
Planted grassland (both dry and wet, mesic)	The landscape surrounding the Refuge is a combination of urban/developed and agriculture. Grassland habitat is lacking in the landscape. Non-native grassland cover does provide structure for several nesting grassland bird species.	Invasive species and woody species encroachment influences habitat quality and the amount of habitat that can be restored or maintained on an annual basis.

Habitat	Rationale for Designation	Limiting Factors/Threats
Creeks and Small Rivers	Ike's Creek, a brook trout stream, is a unique resource in the urban environment of the Minneapolis/St. Paul area. Other creeks and small rivers provide a connection between the Minnesota river and adjacent wetland habitats. Provides fishery habitat and host fish for native mussels.	Stream habitat is driven by water quality resulting from land uses in the urbanized and increasingly developed watersheds. Changes to stream temperature and water quality/quantity can alter habitat quality.
Upland forest	Provides habitat for forest songbird species that require or are sensitive to forest block size for nesting.	Development can fragment forest block size and increase edge effect. Disturbance can increase invasive species pressure.
Minnesota River	The Minnesota River drives much of the major influences within the Refuge. The seasonal and variable changes in flow influence the type of wetlands present on the Refuge. Allows access for aquatic species, both native and invasive.	Invasive fish and mussels outcompete native species. Management is difficult due to upstream and downstream influences.
Rock Outcrop	Unique native community to the region and the Refuge. It is a relatively small component of the Refuge that can go unnoticed or underappreciated. Protecting this community supports the Refuge BIDEH.	Invasive plant species and disturbance can alter the plant community.

3.6 Conflicting Habitat Management

Given the diversity of goals, purposes, mandates, and conservation priorities for the NWRS, it is not uncommon to have conflicting management priorities at a Refuge. Balancing the types and proportion of habitats (and their management) requires special consideration and a process for determining the best course of action. The Refuge contains habitat and management decisions that require such consideration. Below are several examples of potential conflicting habitat needs that were be considered during the selection of ROC and the development of habitat management objectives (Chapter 4):

- Cooperation by the Refuge during urban and utility infrastructure development in the landscape around and through the Refuge while maintaining habitat conditions for species that could be negatively impacted through development.
- Managing dead and dying standing and downed trees resulting from an invasion of the emerald ash borer to provide a safe public user environment while allowing dead trees to go through the natural cycle of providing habitat for cavity nesting birds and contributing to forest nutrient cycling.
- Maintaining fish in deepwater wetlands to provide urban fishing opportunities rather than managing in them a manner to promote migratory waterfowl habitat.
- Providing trails for public use and access throughout the Refuge without fragmenting habitat. In addition to fragmenting habitat, trails and roads are also a pathway for the spread of invasive species.

3.7 ADAPTIVE MANAGEMENT

Priority species and their respective habitat attributes were used to develop habitat objectives. Refuge habitat management objectives must be achievable, and factors may reduce or eliminate the ability of the Refuge to achieve objectives. Although these factors were considered during the development of management objectives, conditions may change over the next 15 years and beyond, requiring the use of adaptive management principles as outlined in Chapter 1.

The planning team identified specific management areas where we anticipate an ongoing need for adaptive management to maximize the Refuge's biological benefits. These considerations may require an accelerated iteration and alteration of management actions (Steps 9 and 6 respectively of the adaptive management cycle, Chapter 1) outside of the anticipated 5-year HMP review. For example, our initial water management goals and objectives may change based on our understanding of the frequency and timing of flooding events along the Minnesota River and the overall vegetative response to the drawdowns of our emergent wetlands. We also need to be able to adjust objectives and strategies based on significant changes in the abundance of existing or new invasive species, to protect our priority habitats.

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CHAPTER 4.

HABITAT GOALS, OBJECTIVES, AND MANAGEMENT STRATEGIES

4.1 Background
4.2 HMP Goals, Objectives, and Management Strategies

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4. HABITAT GOALS, OBJECTIVES & MANAGEMENT STRATEGIES

4.1 BACKGROUND

The goals in a CCP represent broad statements of the desired future condition of the Refuge. The CCP objectives are developed as concise ideas that specify what needs to be achieved, how much needs to be achieved, when and where it needs to be achieved, and who is responsible for the work (602 FW 1.6). Goals and objectives provide a framework for Refuge management over a 15 year timeframe (602 FW 1.4A). The CCP goals and objectives for the Refuge were developed in 2004. Strategies, which are specific actions, tools, or techniques required to achieve objectives, will also be discussed in Chapter 4 (602 FW 1.6).

During initial development of the HMP, the planning team reviewed the CCP goals and objectives to determine if they were still representative of existing Refuge habitats, current Service policies and desired future habitat conditions. After detailed review and discussion, the planning team determined that it was necessary to combine numerous objectives under goals from both the CCP and ones developed during the HMP process. HMP policy allows for revision of CCP objectives and strategies (620 FW 1.8). The planning team updated the objectives in the HMP to make implementation clear and concise.

The USFWS requires habitat objectives be developed using the SMART criteria, meaning that the objectives need to be Specific, Measurable, Achievable, Result-oriented, and Time-fixed. In preparation of this HMP, the planning team identified objectives needing refinement in order to meet the requirements of SMART criteria. Rationale is provided for each habitat objective in order to summarize the scientific information, expert opinion and professional judgment used to formulate each objective.

The planning team reviewed the USFWS's Writing Goals and Objectives Handbook (USFWS 2004c) and its guidance on hierarchical relationships of Refuge goals and objectives to other aspects of the planning process. In doing so, it was found that some of the original objectives were either outdated, or did not apply directly to habitat management, lacked a defined timeframe, or explicit result-orientation related to priority Refuge resources. The newly revised objectives provide refined specificity and bring objectives into compliance with policy.

The 2004 CCP contains four habitat-specific goals with numerous objectives under each goal and one land protection goal with objectives that have elements that relate to overall habitat management on the Refuge. Appendix A summarizes the goals and objectives as they appear in the CCP and provides updated goals and objectives revised in this HMP. Section 4.2 lists goals and objectives as used in the HMP and a rationale for their inclusion as management directives.

In addition to updating CCP habitat objectives for wetlands, floodplain forests, upland forests, grasslands and oak savanna, objectives for the Minnesota River, creeks and small rivers and rock outcrop habitats were developed in greater detail during the HMP process.

4.2 HMP GOALS, OBJECTIVES AND MANAGEMENT STRATEGIES

Habitat totals reported in the objectives reflect the combined total of fee-title acres and lands currently owned by others, but managed by the Refuge. See chapters 1 and 2 for additional

information on management agreements and Table 2-1 for a listing of habitat acreages by management unit.

In chapter 3, habitats were assigned as being a Priority 1 or Priority 2 habitat (Table 3-5). As a brief summary, Priority 1 habitats are areas with management actions over the next 15 years will be focused because they contain relatively greater potential benefit to the conservation of priority resources of concern and/or require and positively respond to active management activities. Priority 2 habitats are typically do not require or respond to active management and/or have elements or conditions that are beyond current control. In most cases, Priority 2 habitats will only be managed if additional resources are available to support the work.

After the rationale for each objective, a list of strategies to achieve the objective are provided. The brief description that accompanies each strategy is meant to provide context into why the strategy is important and how it will be implemented.

4.2.1 Minnesota River and Tributaries (Priority 2 Habitat)

Minnesota River and Tributaries Goal 1:

Minnesota River corridor functions in a manner that sustains river and floodplain ecosystems. *(CCP Goals 1, 2 and 5).*

Minnesota River and Tributaries Objective 1a:

Within the first five years of plan implementation, gain a better understanding of local and watershed hydrological processes needed to sustain a range of riverine and riparian habitats and resources of concern.

Minnesota River and Tributaries Objective 1b:

Manage, restore and protect the hydrologic function of the Minnesota River to mimic important processes such as sheet flow, connectivity, wet and dry cycles, sedimentation and water quality to sustain a range of riverine and riparian habitats and species conducive to local and watershed-scale hydrological processes.

Minnesota River and Tributaries Rationale:

During the HMP process, the Minnesota River and Tributaries was determined to be a Priority 2 Habitat based on the Refuge's ability to manage or influence the River itself for specific Resources of Concern. However, a better understanding of the hydrologic function of the River is needed in order for the Refuge to restore, manage and protect Priority 1 habitats such as wetlands and floodplain forests, as well as streams and small creeks (a Priority 2 habitat). The goals, objectives and strategies for the Minnesota River outlined here, will provide the information necessary to better manage all habitats within the floodplain.

As its name suggests, Minnesota Valley NWR is located along the lower reaches of the Minnesota River corridor. It encompasses both riverine and floodplain areas that are defined, in part, by processes associated with the large upstream watershed. As such, riverine hydrology is a primary driver for habitats across the Refuge, from the seasonal flooding of the Minnesota River to spring-fed tributaries throughout the floodplain, to localized fluctuations of floodplain wetlands. The hydrology of this system is influenced by both agricultural development in the upper portion of the

watershed and urban development in the area surrounding the Refuge, making this already complex hydrologic system much harder to predict and manage.

Minnesota River and Tributaries Management Strategies:

Information Gathering

The Refuge has many restoration and management tools at its disposal to restore, mimic and protect hydrologic function on Refuge lands. However, before strategies can be developed to use these tools, the Refuge needs to better understand ecosystem function and current conditions and trends at both the site specific and Refuge-wide scale. We will conduct an internal workshop to determine what information is needed, what we need the information for (e.g. What decisions it will inform), who can provide it, and a timelime for obtaining the information. Answers to our questions will help inform restoration, management, infrastructure and visitor use decisions into the future. Information needed may include abiotic and biotic inventory and monitoring data, and modeling and ecosystem evaluations (such as hydrogeomorphic evaluations). Gathering this information will help us to better understand the connection between groundwater, streams and rivers, Refuge wetlands and the floodplain.

Assess infrastructure to determine condition and feasibility.

Once a better understanding of River hydrology is obtained, it may be necessary to remove or breach levees, create openings in roads and other obstructions, etc. to ensure flood waters can enter and exit sites via sheet flow and mimic the rising and receding limb of the River's hydrograph. Once this information is gathered, attention needs to be given to existing infrastructure especially water control structures. Much of the Refuge wetland infrastructure is not functioning properly due to its condition or being undersized for its intended purpose. There needs to be a determination whether the current infrastructure is appropriate to achieve the biological objectives for each wetland and decide whether to maintain or abandon control structures and other infrastructure. This task will also be mentioned under wetland strategies.

Minnesota River and Tributaries Goal 2:

To restore, protect and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of the Minnesota River within the Eastern Broadleaf Forest. (*CCP Goals 1,2 and 5*).

Minnesota River and Tributaries Objective 2a:

Over the next 15 years, protect, maintain and enhance 70 miles of riverbank habitat along the Minnesota River to provide foraging and overwintering habitat for bald eagle, nesting habitat for Prothonotary Warbler and overwintering habitat for Common Merganser, as well as the full life cycle needs for native mussels (fish passage/fish hosts). Over the next 15 years, the following issues will be addressed:

Minnesota River and Tributaries Rationale:

The Minnesota River flows 335 miles from Big Stone Lake on the Minnesota/South Dakota border to the confluence of the Mississippi River, just six miles downstream of the northeastern border of the Refuge (Kudelka et al. 2010). The entire watershed is approximately 10 million acres made up of 12 major subwatersheds, primarily dominated by agricultural in the free-flowing upper and

middle portions. Urban land use increases as it flows into the greater Minneapolis-St. Paul metro area and becomes impounded. The Refuge is located in the Lower Minnesota River, which runs from north of St. Peter to the confluence with the Mississippi River. Portions of the Minnesota River along with several smaller streams within the Refuge are on the Minnesota Pollution Control Agency's 2014 Proposed Impaired Waters List. The listing means the waterbody fails to meet one or more of the state's water quality standards (Musser et al. 2009). The list is updated every two years and most of the impairments on Refuge waters are based on the effects to aquatic life. Turbidity, high chloride levels, and sometimes fecal coliform levels are beyond the recommended levels in these systems (MPCA 2014).

The Minnesota River and its adjacent riparian area is important for fish and wildlife. Bald eagles use trees along the river for nesting and as perches for hunting. During the winter, bald eagles will congregate in trees along open portions of the river to fish. Common mergansers also congregate in open water portions of the river during the winter and use those areas to fish until cold weather pushes them to migrate further south. Trees and small shrubs near and over water are used by Prothonotary Warblers as nest sites (Petit 1999). Historically, 41 of the 48 mussel species native to Minnesota were found in the Minnesota River watershed (Musser et al. 2009). Today, only 23 species are present. Most of those species are at imperiled population levels. Causes of decline include pollution, sedimentation, altered hydrology and competition from invasive species.

Other elements of the Minnesota River within the Refuge provides habitats for other species, as well. Sandbars within the river channel provide foraging and loafing habitat for birds using the river corridor. Backwater channels and channels that are temporarily disconnected between flooding events also contribute deepwater wetland habitat as well as spawning and nursery grounds for riverine fish species. Erosion of river banks is common and has a negative impact on aquatic life and water quality. However, eroding banks do provide habitat for burrowing species such as swallows and muskrats.

The Minnesota River influences the surrounding floodplain habitats including the emergent, deepwater, and semi-permanent wetlands and floodplain forest. According to the Refuge's 1992 Landscape Plan (USFWS 1992), a key part of habitat management for the Refuge is to allow natural processes to drive habitat conditions. However, we acknowledge that working in the floodplain of a large river system requires us to balance between the maintenance and improvement of river/floodplain connectivity and managing Refuge habitats under multiple flood stage levels (USFWS 2009).

Although our opportunities to directly manage the Minnesota River are limited, we can help improve the quality of the Minnesota River by working with partners to enhance the water quality throughout the watershed. We believe our opportunities for improvement of water quality are the greatest for small streams and rivers that directly feed into the Minnesota River. Improvements in water quality will benefit the Minnesota River, associated small streams and rivers, and other associated habitats that are hydrologically connected to the river. Water quality improvements will protect foraging habitat for Bald Eagles and Common Merganser and improve habitat for native mussels. We can stabilize stream banks and reduce erosion by focusing on protecting and maintaining large trees and shrubs along the banks. These trees will provide nesting and perching

habitat for Bald Eagles and Prothonotary Warblers. Streambank stabilization will also help reduce sedimentation and overall water quality of local streams.

The Minnesota River has a significant influence on the Refuge. However, there are gaps in our knowledge about the level of influence of the River. Strategies under Goal 1, will help us better understand the hydrology of the Minnesota River floodplain. Additionally, little is known about native mussel species on the Refuge. Gathering information on the mussel diversity and the presence of their host organisms (fish) is needed to help understand the Refuge's capacity to provide their habitat requirements and needs.

Minnesota River and Tributaries Management Strategies:

Work with adjacent landowners to improve water quality and bank erosion of streams that input into Refuge wetlands and the Minnesota River.

Many of the streams that run through the Refuge have most of their acreage off Refuge. Most of the negative impacts to these streams occur off of the Refuge, but affect the streams coursing through Refuge land and depositing sediments and nutrients in Refuge wetlands or the Minnesota River. It is imperative to work with partners and landowners upstream of the Refuge to protect Refuge resources.

Work with with local governments and agencies to decrease the volume and increase the quality of stormwater reaching Refuge streams, wetlands or the Minnesota River.

Continue to work with adjacent local government agencies and potential developers to divert stormwater away from Refuge resources or improve the quality of stormwater using best management practices such as landscaping with native species, reduction of deicing salts to decrease chlorides, etc.

Identify and work with partners to reduce sedimentation and improve water quality throughout the watersheds to enhance the quality of the Minnesota River.

The first step to improving the water quality of the Minnesota River is to gather data that are being collected by others, and determine roles for partners wanting to improve the quality of the Minnesota River. Since the Minnesota River watershed is so large, we need to determine where to focus our efforts. It may be important to focus on a stream like Sand Creek that a lot of partners are interested in, and pool our resources to improve the quality of the Minnesota River. A good example of this is already occurring on Ike's Creek on the Refuge's Long Meadow Lake Unit (see description under *Creeks and Small Rivers Management Strategies*). Several partners are working together to determine baseline stream flow and chloride concentration of Ike's Creek and will continue periodic monitoring as the area along the stream is developed.

Complete a native mussel inventory of Refuge wetlands and riverine habitats. Work with partners to update information or data on native mussels in the Minnesota River. Many of our native mussels are considered extirpated, but we would like to determine if any of the native mussels still exist in the Minnesota River.

Support fish passage and increased habitat connectivity for aquatic organisms between the Minnesota River and floodplain wetlands.

Maintaining the connection to the Minnesota River is important for the management of our wetlands. We want to make sure that natural pathways for spawning fish and other aquatic organisms remain open, and that we do not block them when conducting our management. This connectivity is taken into consideration when designing new water control structures and when developing water level management plans for specific basins.

4.2.2 Creeks and Small Rivers (Priority 2 Habitat)

Creeks and Small Rivers Goal:

Over the next 15 years, protect, enhance, and maintain at least 4 miles of streams and waterways on the Refuge and adjacent lands with the help of partners. Our goals are to reduce sedimentation, protect water quality, reduce the effects of extreme flows from the watersheds, and improve hydrologic connection between the stream and floodplain. (CCP G*oals 1,2 and 5*).

Creeks and Small Rivers Objective:

Maintain or improve quality in Refuge creeks and small rivers to provide foraging habitat for Prothonotary warbler and Wood Thrush, stream habitat for brook trout and a diversity of fish species, and the complete life cycle requirements for Blanding's turtle in the next 15 years to the following conditions:

1. Ike's Creek and Eagle Creek will maintain a thermal regime that classifies them as coldwater streams (maximum daily temperature of 69°F or less) and have suitable .oxygen levels that will support the presence of trout species.
2. Carver Creek will maintain an Index of Biological Integrity (IBI) score of 60 or greater and will show improvements in turbidity and fecal coliform parameters as measured by MPCA water quality standards.
3. Work with partners to improve quality of Refuge streams so that they can be removed from MPCA's Impaired Waters list.

Creeks and Small Rivers Rationale:

A variety of streams flow through the Refuge such as Carver Creek, which has a diverse assemblage of warmwater fish species; and several coldwater streams including the greater Minneapolis/St. Paul metro area's only brook trout stream, Ike's Creek. Unfortunately, several streams are on the Minnesota Pollution Control Agency's 2014 Proposed Impaired Waters List for failing to meet one or more of the state's water quality standards. Most of the impairments to the streams on the Refuge are due to negative impacts to aquatic life including turbidity, high chloride levels, and sometimes high fecal coliform levels (MPCA 2014).

Most of the streams within the Refuge have a thermal regime that classifies them as warmwater streams with their maximum daily temperature >76° F (Lyons et al. 2009). Warmwater streams are typically more diverse than coldwater streams (Lyons et al. 2010). Carver Creek, located on the Rapids Lake unit in Carver County, had one of the greatest species richness scores in a 2001 MNDNR Report (Schmidt and Talmage 2001). Carver Creek also had one of the highest IBI

scores of any metro area streams (60 out of a maximum possible score of 100). This stream has a very diverse warmwater fish population (Schmidt and Talmage 2001), but is also on the State's impaired waters list for high turbidity and fecal coliform (EPA 2016). There may be opportunities to work with partners to decrease the turbidity and sediment load caused by eroding banks along the Refuge and the County roadway (County Road 40).

Sand Creek is a tributary to the Minnesota River that runs through the Louisville Swamp Unit. Sand Creek drains approximately 274 square miles of mixed agricultural land, open space, bluff land, and urban areas through Le Sueur, Rice, and Scott counties (Met council 2014). Nine stream reaches of the creek are on the MPCA's impaired waters list. Three for impairments for aquatic life due to turbidity and others for stressors affecting the fish community, or for high chloride levels. Sand Creek is an integral part of the Louisville Swamp Unit and acts as the water source for some wetland habitats at Jab's Farm. Along with threats to water quality are vulnerabilities of the stream to groundwater withdrawals. During regional analysis, several basins within the watershed were identified as vulnerable to groundwater withdrawals, including Louisville Swamp (Met Council 2010). It will be important for the Refuge to partner with other agencies to improve the quality of Sand Creek and protect it from development and groundwater withdrawals so that habitat for our Resources of Concern can be provided.

Ike's Creek, located in Long Meadow Lake management unit, is one of the coldwater streams on the Refuge. It is the only stream in the metro area that supports native brook trout. Coldwater streams usually have a maximum daily temperature of < 69° F and can support trout year-round (Lyons et al. 2009). The Refuge partnered with MNDNR and Minnesota Trout Unlimited to complete fish stocking in 2007 as well as several habitat restoration projects on the stream over the past decade. The presence of brook trout is considered an indicator of good water quality (UMN 2012). Brook trout require cold, clear waters with silt-free bottoms. Eagle Creek, located on the Wilkie management unit is another coldwater stream that supports brown trout and is actively managed as a sport fishery by the MNDNR. Both these and the other coldwater streams are fed by groundwater. They also have characteristics such as an intact riparian system with a closed tree canopy that keeps the water temperature down in the summer to help support trout species.

Although the trout in Ike's Creek is a healthy, self-sustaining population, the stream is located within a watershed dominated by urban development including the Mall of America. Working with partners including the City of Bloomington and property owners to manage stormwater and land use will be important for protecting this unique metro resource from degradation. In a similar fashion, working with partners on other coldwater streams to protect and improve water quality from stormwater inputs and increasing temperatures should be a focus for the Refuge.

Besides fish, streams on the Refuge are important to Blanding's turtles, a state threatened species that depends on slow moving water areas of local rivers, streams, channels, and ditches as movement corridors, as well as seasonal aquatic refugia (Lang 2003). Prothonotary Warblers nest in trees and shrubs over the water within the riparian corridor (Petit 1999). Maintaining and improving the habitat quality and connectivity of Refuge streams will benefit Blanding's turtles. Protecting the riparian forest corridor from fragmentation and retaining trees with nest cavities and snags and stumps in riparian and floodplain forest habits will benefit Prothonotary Warblers.

Prothonotary Warblers use the floodplain forest subcanopy for foraging (Petit 1999) and nest in cavities of dense, often dead shrubby material typically between than 1.5 feet and 10 feet off of the ground (Cooper 2009). Floodplain forest use by prothonotary warblers will be discussed in further detail in the floodplain forest habitat section of this document.

Due to the proximity of the large, urban area, there are many potential threats to the hydrology of the Refuge. Streams can be negatively impacted by stormwater that may contain heavy metals, chlorides, and high levels of nutrients. Groundwater sources can also be threatened by dewatering or withdrawals. Hydrology can be changed by industries such as silica ("frac") sand mining and other businesses that use significant amounts of water derived from groundwater sources in their operations, as well as municipal water supplies in parts of the metropolitan area. The Refuge needs to gain an understanding of groundwater hydrology to better comprehend the future impacts to both the streams and wetland habitats of the Refuge. This understanding is critical to protecting the natural hydrology of both permanent streams as well as ephemeral/intermittent streams and wetlands on the Refuge.

Although the Refuge has, some information on streams that flow into the Refuge, there is limited understanding of the extent these streams contribute to the overall quality and quantity of water of Refuge habitats. Inventorying streams, stormwater inputs, artesian wells, and surface flows; and gathering existing data on water quality to prioritize protection and restoration work on small streams, is a critical need. The Refuge will continue to protect important stream habitats (Appendix D, Table 2 for focus areas) from channelization, stormwater inputs, sedimentation, and other threats to water quality and quantity. It will be important to work with adjacent landowners, USFWS Partners for Fish and Wildlife Program, local governments, and other agencies, to protect creeks from channelization and impacts from development.

Creeks and Small Rivers Management Strategies:

<u>Conduct a Water Resources Inventory and Assessment (WRIA)</u>

Conduct a WRIA to develop a stream inventory, stormwater inputs, artesian wells, surface flows and existing data on water quality to prioritize protection and restoration work on small streams within the first ten years of this plan.

<u>Assess the biological, physical, and chemical properties of all streams on the Refuge to provide a baseline for future management.</u>

Information is known about a few Refuge streams. However, there are others where the Refuge and supporting partners likely have very little to no data. Collecting information on the biological community, the physical habitat and chemical properties of Refuge streams will allows protection of areas with good water quality and target those that need improvement. Using standard protocols developed by MPCA will allow for the best comparison across other streams in the region. A good example of how partnerships can be used to collect baseline data is already occurring on Ike's Creek. Several entities including the Refuge, Minnesota DNR, City of Bloomington, the Lower Minnesota River Watershed District, and the Metropolitan Council have recently joined forces to determine flow and baseline chloride levels. The group is sharing expertise, manpower and equipment and will monitor changes as the area around Ike's Creek is

developed. This approach can also be used to gather information on other streams adjacent to the Refuge in the future.

Develop Partnerships to Improve Quality of Carver Creek

As stated above, Carver Creek has a very diverse warmwater fish population and is also on the State's impaired waters list for high turbidity and fecal coliform. There have also been groups interested in moving the creek and adjacent roadway. Partnerships in the future will be necessary to both protect and improve the quality of Carver Creek in the future. There also may be opportunities to work with partners to decrease the turbidity and sediment load caused by eroding banks along the Refuge and the County roadway (County Road 40).

Identify and work with partners to reduce sedimentation and improve water quality of Sand Creek.

The first step to improving the water quality of Sand Creek is to determine potential partners and stakeholders that are interested in improving the quality of Sand Creek. Once partners are identified we can work together to identify data needs and roles for each partner.

Continue Partnerships on to Protect Ike's Creek

Ike's Creek is the only self-sustaining brook trout stream in the metropolitan area. Many partners are interested in protecting this stream from impacts from future development of hotels and businesses. Development in this area could impact the amount of flow into the stream, increase the water temperature, and increase chlorides in the water from the use of deicing chemicals used on parking lots. Using the resources of many partners makes it possible to track changes in flow, stream temperature and water quality, in order to protect the brook trout and other species that depend on this stream.

4.2.3 Wetlands – Deepwater, Permanent/Semi-Permanent, and Temporary/Seasonal

Goals and objectives for deepwater wetlands, permanent/semi-permanent wetlands, and temporary/seasonal wetlands are listed separately below along with individual strategies. Existing acreages by habitat for each Refuge Unit were estimated by combining data from the Minnesota DNR's Native Plant Communities, aerial image interpretation from the Minnesota Land Cover Classification System (MLCCS) and the National Agricultural Imagery Program (NAIP) and staff experience. This existing habitat data yields a broad description of habitat seen at a point in time on the Refuge. The broad wetland habitat reflected on the existing maps as emergent wetland or open water in Appendix C, will be further defined when describing Priority 1 restoration areas in Chapter 5. The restoration habitat types will follow the habitat categories outlined in Chapter 4. For example, Priority 1 wetland restoration areas will either be permanent/semi-permanent wetlands or deepwater wetlands, and will be managed differently. The Refuge is currently managing about 12 basins of these habitat types on a rotational basis (See specific basins by wetland type in Appendix D: Table 1). Available data did not permit the remote delineation of temporary/seasonal wetlands on existing habitat maps. Temporary seasonal basins are a Priority 2 habitat for the Refuge, and will need to be delineated before decisions on restoration areas could occur.

Management activities to maintain, enhance, and restore the deepwater wetlands, permanent/semi-permanent wetlands and temporary/seasonal wetlands on the Refuge will

provide benefits to both the ecological integrity of the Refuge and many wildlife species that use these habitats. Minnesota has lost approximately 42% of an estimated 15 million acres of wetlands that were present during pre-settlement times (Dahl 1990). Within the Minnesota River watershed, this number is actually close to 97% loss (http://mrbdc.mnsu.edu/wetlands; access September 9, 2016).

4.2.3.1 Deepwater Wetlands (Priority 1 Habitat)

Deepwater Wetlands Goal:

Manage and enhance deepwater wetland systems throughout the Minnesota Valley National Wildlife Refuge to provide habitat for native fish species and diverse habitat for other deeper water-dependent wildlife such as piscivorous birds and wetland-dependent mammals while preserving the ecological integrity of the wetland in the Eastern Broadleaf Forest Province. *(CCP Goal 2).*

Deepwater Wetlands Objective:

Manage or maintain at least 50% of the existing 727 acres* of deepwater wetland habitat for recreational fish such as bluegill, northern pike, and largemouth bass, river otter, and piscivorous birds over the next 15 years to achieve the following conditions:

1. Maintain water levels in the limnetic zone at deeper than 6.6 feet to provide overwintering habitat for native fish species.
2. Provide a littoral fringe of < 30% cover of emergent vegetation along the shoreline consisting of cattail and bulrush species.
3. Maintain a submergent and floating-leaved plant community dominated by native species with coverage of native submergent vegetation between 10 and 60% during the growing season.
4. Eradicate, control, and prevent the expansion of invasive plants and animals such as purple loosestrife that have impacts on native plant diversity and natural communities to < 10% of total cover.

*Actual basins managed are noted in Appendix D: Table 1 and include portions of Black Dog Lake, Hogback Pond, Youth Fishing Pond, Cedar Pond, Horseshoe and Long Lakes on the Rapids Lake Unit and Round Lake. Only 50% are currently managed due to inadequate infrastructure. Until adequate infrastructure is obtained, management will focus on Cedar, Hogback and Youth Fishing Ponds in partnership with the MNDNR's Fishing in the Neighborhood Program.

Deepwater Wetlands Rationale:

Deepwater wetlands are classified under the Lacustrine System in the Cowardin Classification Scheme (Cowardin et al. 1979). These wetlands and deepwater habitats are typically situated in a depression or a dammed river channel; lack trees, shrubs, and persistent emergent vegetation; and total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling < 20 acres are also included if the water depth in the deepest part of the wetland basin exceeds 6.6 feet at low water. Deepwater wetlands of the Refuge contain the Lacustrine System's two subsystems that are defined by water depth. The first subsystem is the littoral or shallow water

zone, where wetlands extend from the shoreline to a depth of 6.6 feet below low water or to the extent of non-persistent emergent plants such as arrowheads, wild rice, or bulrush. The limnetic or deepwater zone is where water is deeper than 6.6 feet (Tiner 1994).

The Black Dog Lake (513 acres) and Round Lake (140 acres) units represent approximately 89% of the total deepwater acres on the Refuge (Table 2-1). The remaining acres are distributed across three management units including 16 acres on the Long Meadow Lake Unit, 37 acres on the Rapids Lake Unit and 21 acres on the Blakeley Unit.

Deepwater wetlands on the Refuge represent lakes with water depths > 6.6 ft. These habitats support fish populations such as bluegill, northern pike and largemouth bass. In addition, wildlife that consume fish species such as river otter and piscivorous bird species also use these sites. These deepwater areas also provide angling opportunity for many visitors to the Refuge, as several of the wetlands are located in easily accessible areas.

Winter fish kills on deepwater wetlands may occur due to the decay of aquatic vegetation. Fish kills typically occur when the dissolved oxygen is < 4 ppm (Dowling and Wiley 1986) or when the water column freezes to a depth that habitat is limited (such as freezing to the bottom during extremely cold winters with little to no snow cover). A MNDNR study of local Fishing in the Neighborhood ponds, found that basins > 10 acres with a depth of at least 10 feet were less susceptible to winter fish kills (Mark Nemeth 2015, personal communication). However, small basins could support fish if seeps or springs were present. Several of the deepwater wetlands on the Refuge are smaller than 10 acres and shallower than 10 feet. These wetlands can still provide habitat for overwintering fish. The majority of the deepwater wetlands on the Refuge including Hogback Pond and Youth Fishing Pond, have either warm water inputs from surface and stormwater runoff, or groundwater seeps and springs that prevent them from freezing to the bottom.

Bluegill, northern pike, and largemouth bass require a combination of open water habitat to forage and travel and pockets of submerged aquatic vegetation to either spawn, forage, or take cover from predators. Extremes on either side of the spectrum are detrimental to fish habitat. According to Valley et al. (2004), when submerged aquatic vegetation cover is < 10% or > 60%, habitat conditions for game fish deteriorates. For most of the basins on the Refuge, the concern is having too much vegetation along the fringe and within the body of the basin, resulting in decreased habitat quality. In basins where water level management is possible, water levels can be manipulated to create the desired mosaic of open water and vegetation cover. In basins where water level management is not possible, additional active management techniques such as periodic weed harvesting or cattail control may be required to achieve the desired conditions.

Invasive species can also negatively impact the habitat quality of the deepwater wetlands. Non-native and hybrid cattails and purple loosestrife can create monotypic stands throughout the basin, choking out native vegetation. Invasive plants such Eurasian watermilfoil and curly-leaf pondweed can dominate the submerged vegetation, choking off the open water habitat. It is important to monitor basins for the presence of invasive species and control or limit their spread at known current locations while preventing the spread and establishment to new locations.

Deepwater Wetland Management Strategies:

Control Invasive Species and Non-Desirable Vegetation to create desired open water and emergent wetland conditions for deep-water species.

Deepwater wetlands are important to provide habitat for native fish species and to provide recreational fishing opportunities. These wetlands also provide habitat for river otters and feeding areas for piscivorous birds. Controlling invasive undesirable vegetation is an important strategy for these wetlands. The Refuge manages all invasive species under the Integrated Pest Management (IPM) approach as defined in the Refuge Manual (7 RM 14). This approach includes managing pest and invasive species by combining mechanical, chemical and cultural tools in a way that minimizes economic, health, and environmental risks [Federal Insecticide, fungicide, and Rodenticide Act (FIFRA, 7 U.S.C. 136r-1)]. The Refuge also prepares an annual IPM plan that outlines priorities for invasive species management for that year. The overall plan for invasive species control is focused on Early Detection Species (newer outbreaks of species where there is still hope for containment), small areas of new infestations of the most invasive species, and restoration areas in priority habitats.

In our wetlands, the primary invasive species are purple loosestrife, reed canary grass, non-native cattail, and common reed. Reed canary grass, nonnative cattail, and in some cases common reed, are widespread throughout the Refuge, and control is limited to priority habitat restoration areas. Purple loosestrife infestations on Refuge wetlands are controlled by biocontrol insects, mainly leaf-feeding beetles, *Galerucella sp.* New small outbreaks however, are either treated with chemical or cut to prevent the spread of the species. We also look for narrowleaf bittercress, an Early Detection Species found in mesic areas, and attempt to control it when it is located. All areas and species targeted for invasive species control are reviewed annually and documented in an annual work plan table.

Continue Managing Fish Communities in Deepwater Basins

Partnerships with the MNDNR Fishing in the Neighborhood Program and the USFWS La Crosse Fish and Wildlife Conservation Office to manage fish populations in deep-water wetlands to provide diverse native fish communities and opportunities for recreational fishing.

4.2.3.2 Permanent/Semi-Permanent Wetlands (Priority 1 Habitat)

Permanent/Semi-Permanent Wetlands Goal:

Manage and enhance permanent/semi-permanent wetland systems throughout the Minnesota Valley National Wildlife Refuge to provide habitat for waterfowl, shorebirds and other waterbirds. Provide diverse habitat for other wetland-dependent wildlife while preserving the ecological integrity of the wetland in the Eastern Broadleaf Forest Province. *(CCP Goal 2).*

Permanent/Semi-Permanent Wetlands Objective:

Manage and enhance at least 50% of the existing 4,376* acres of permanent/semi-permanent wetlands (maximum depth 6.6 feet) within the floodplain for migrating waterfowl and other waterbirds such as Blue-winged Teal, Mallard, Ringed-neck Duck, and Pied-billed Grebe, American White Pelican and Trumpeter Swan, Greater Yellowlegs and Lesser yellowlegs, and

life cycle requirements for Blanding's turtle over the next 15 years to achieve the following conditions:

1. Restore and maintain natural hydrologic regimes at a depth < 6.6 feet to promote a community dominated by a combination of 80% native emergent, submergent, and floating-leaved aquatic vegetation and associated fauna.
2. Provide a mosaic of habitat conditions ranging from mud flats to open water annually for a diversity of wildlife resources.
3. Maintain a submergent plant community with > 75% cover by native species with a total species richness of at least six native species, basin-wide including sago pondweed.
4. Eradicate, control or prevent spread of invasive plants and animals such as purple loosestrife that have adverse impacts on native vegetation and communities to < 25% of total cover.
5. Assess condition of water control infrastructure within 5 years.

*Actual basins managed are noted in Appendix D: Table 1 and include: portions of Black Dog Lake, Long Meadow Lake, Orchard Springs, Kidder Marsh, Hogback Marsh, Jab's-Louisville Swamp, Louisville Swamp Frog Pond, Jailhouse Marsh, Rapids Lake and Rice, Fisher and Blue Lakes and Continental Grain Marsh on the Willkie Unit. Only about half of these basins are routinely managed due to the condition of the infrastructure and what we can realistically manage annually.

Permanent/Semi-Permanent Wetlands Rationale:

The Palustrine System in the Cowardin Classification Scheme (Cowardin et al. 1979) includes all nontidal wetlands dominated by trees, shrubs, persistent emergent vegetation and emergent mosses or lichens. The Palustrine System includes vegetated wetlands that are traditionally called marsh, swamp, bog, etc., but can also include water bodies often called ponds and wetlands on river floodplains. Also included in this group for HMP purposes are shallow lakes, as defined by the MNDNR (2016), which have permanent or semi-permanent water regimes and are typically dominated by wetland habitat. Shallow lakes are a critical habitat component for Minnesota's wildlife and are characterized by aquatic plants and are generally < 15 feet deep (MNDNR 2016). For this HMP, the habitat type that is dominated by persistent vegetation are permanent/semi-permanent wetlands. Temporary/seasonal wetlands also are a type of emergent wetland but are separated out in this HMP since management goals, objectives and priorities are different.

The Refuge contains approximately 4,376 acres of permanent/semi-permanent wetlands across all the management units except the Round Lake Unit. Approximately, 72% (3,160 acres) can be found on the Long Meadow Lake (1,375 acres), Wilkie (958 acres), and Louisville Swamp (827 acres) Units (Table 2-1). The remaining permanent/semi-permanent wetland acres are distributed across nine other management units ranging from as small as 1.0 acre (San Francisco Unit) to 343 acres (Rapids Lake Unit) in size.

The permanent/semi-permanent wetlands on the Refuge are important to spring and fall migratory waterfowl, waterbirds and shorebirds. The Refuge is a part of the Mississippi River Flyway, which is used by millions of birds as a migration corridor. Based on unpublished Refuge data collected annually, approximately 14 species of ducks (including Mallard, Wood Duck, American Coot Hooded Merganser, Ring-necked Duck, Green-winged Teal, Northern Shoveler, and Northern Pintail) along with Canada Geese and Trumpeter Swans are observed annually on a consistent

basis. White Pelicans, Great Blue Herons and Great Egrets are also seen in large numbers during migration. Between three and eight species of shorebirds, depending on the water conditions (not consistently), are seen each year.

Under ideal conditions, the wetlands fill up with water in the spring to provide shallow water habitat with invertebrates and seeds for foraging birds. Later in the year, mudflats are created as water depth decreases and the basins and are colonized by annual native vegetation such smartweeds and beggarticks. In areas where water depth is reduced, sago pondweed, duckweed, wild rice, and common arrowhead grow. During the fall, the water level in emergent wetlands is lower than early spring; thereby creating mudflat habitat for foraging shorebirds such as Greater and Lesser Yellowlegs. Fall rain events re-fill the basins and provide invertebrates and seeds for migrating waterfowl such as Blue-winged Teal, Mallard, and Ringed-neck Duck. Deeper portions of the basins provide habitat for American White Pelican and Tundra Swans.

The Refuge has the ability to capture and manage water levels in 14 basins located in 7 management units (however, note that only just over half of these basins have adequate infrastructure at this time). Water is captured during high water events when the river floods and water flows across the floodplain, and during precipitation events. Water level management allows the Refuge to extend or shorten the duration of inundation and water depths thereby promoting beneficial plant and invertebrate communities for waterfowl and other waterbirds. Summer drawdowns are utilized to promote plant growth and invertebrate development, while flooding of the basins during the fall provides open water conditions for migrating waterfowl. Although the Refuge has water level management ability, there are many years when flooding on the Minnesota River overwhelms annual management with extended periods of inundation. For example, an extended flood in July does not allow vegetation to re-grow prior to the fall migration season

The annual management actions for each individual basin are guided by data collected from shallow lakes and wetland health surveys that are kept in Refuge wetland records. The overall goal is to provide the appropriate vegetation and water levels for the selected resources of concern. Additionally, it is important to provide a mosaic of habitat conditions annually through natural influences from the Minnesota River and by mimicking natural processes through water level management. The selected resources of concern have varying preferred habitat conditions. In general, several basins each year will be managed for depths < 12 inches for migrating waterfowl, access to areas of open water for Trumpeter Swans and American White Pelicans and mudflats for shorebirds such as Greater and Lesser Yellowlegs. Specific management for each basin is developed annually in a water management plan. This plan is developed by reviewing the previous year's water management attempts and accomplishments, aquatic vegetation data, and waterfowl use information. Basins that the Refuge currently manages on a rotational basis on located in Appendix D, Table 1.

Permanent Semi-Permanent Wetland Management Strategies:

<u>Understand the influence of river hydrology by identifying the effect different river stage scenarios have on the inundation levels of Refuge habitats.</u>

This strategy is also noted under Minnesota River Strategies "Information Gathering". Once a better understanding of River hydrology is gained, we will understand the inputs of water into the

Refuge, where our low spots are in the basins, and how bounces in the Minnesota River affect our habitats.

Assess water management infrastructure to determine condition and feasibility.

Much of the Refuge wetland infrastructure is not functioning properly. There needs to be a determination whether the current infrastructure is appropriate to achieve the biological objectives for each wetland and decide whether to maintain or abandon control structures and other infrastructure. This strategy was also noted as a strategy for the Minnesota River associated with information gathering. The information gathered about the hydrology of the Minnesota River or and data obtained from a Refuge WRIA (Water Resources Inventory and Assessment), will help the Refuge determine where water management is feasible.

Wetlands rely on cycles of wet and dry periods to be productive. The natural hydrological cycles of wetlands have been altered significantly on the Refuge and these alterations have reduced wetland productivity. Wetland systems often deteriorate during periods of high water or absence of drought. Often, to restore the function of a wetland, water control systems need to be installed and maintained. Functioning water control structures can be used to manipulate water levels to mimic natural drought periods and timed flooding. Drawdowns are incorporated to help reestablish emergent and submergent vegetation, consolidate bottom sediments, and decompose organic material, and are typically timed to benefit shorebirds, wading birds, waterfowl and other waterbirds. Generally, slow (over several weeks) drawdowns will provide a greater diversity of moist-soil plants than faster (over a few days) drawdowns (Frederickson and Taylor 1982). Drawdowns can also be conducted to facilitate vegetation manipulation through prescribed fire or mechanical means.

High water levels can be used to help set back emergent vegetation, like dense stands or river bulrush and cattail, by drowning them out. To manipulate the aquatic vegetation, the high water must be maintained throughout the growing season and through the fall. Since we have very few cases where we can distribute water to our wetlands, we need to rely on precipitation to provide the needed water. Often the high water needs to be maintained for several years to accomplish the objectives. Where possible, the best management practice would be to pre-treat the vegetation by either crushing with equipment, mowing, disking or burning before flooding.

Control or prevent invasive species and non-desirable vegetation to create desired open water and emergent wetland conditions for permanent/semi-permanent wetland resources of concern.

The Refuge manages all invasive species under the Integrated Pest Management (IPM) approach as defined in the Refuge Manual (7 RM 14). This approach includes managing pest and invasive species by combining mechanical, chemical and cultural tools in a way that minimizes economic, health, and environmental risks [Federal Insecticide, fungicide, and Rodenticide Act (FIFRA, 7 U.S.C. 136r-1)]. The Refuge also prepares an annual IPM plan that outlines priorities for invasive species management for that year. The overall plan for invasive species control is focused on Early Detection Species (newer outbreaks of species where there is still hope for containment), small areas of new infestations of the most invasive species, and restoration areas in priority habitats.

In our wetlands, the primary invasive species are purple loosestrife, reed canary grass, non-native cattail, and common reed. Reed canary grass, nonnative cattail, and in some cases common reed, are widespread throughout the Refuge, and control is limited to priority habitat restoration areas. Purple loosestrife infestations on Refuge wetlands are controlled by biocontrol insects, mainly leaf-feeding beetles, *Galerucella sp.* New small outbreaks however, are either treated with chemical or cut to prevent the spread of the species. We also look for narrowleaf bittercress, an Early Detection Species found in mesic areas, and attempt to control it when it is located. All areas and species targeted for invasive species control are reviewed annually and documented in an annual work plan table.

Manage permanent/semi-permanent wetland water levels to provide a mosaic of habitat conditions on the Refuge.

Wetlands with control structures will be drawn down every 5 to 7 years to consolidate or aerate bottom sediments, break down organic material, and stimulate diverse aquatic plant growth. Triggers for drawdowns will be decreases in plant diversity determined from wetland plant assessments and projections of imminent drought conditions. Wetland drawdowns will be rotated to provide a variety of conditions within the wetland complex. Although full drawdowns are the goal, full drawdowns rarely occur due to the influx of groundwater and stormwater into our wetlands.

Partial drawdowns can be effective to maintain aquatic habitat and water quality and can reduce the need for most time-consuming full drawdowns. They can also provide access to food for waterfowl, waterbirds and other wildlife. Specific management for each basin is developed in an annual water management plan. This plan is developed by reviewing the previous year's water management attempts and accomplishments, aquatic vegetation data, and waterfowl use information. Please see Appendix D, Table 1 for Permanent/Semi-permanent Basins that are being managed on the Refuge.

Maintain and create partnerships to protect the quality of wetlands.

Due to the proximity to the urban area, wetland quality is threatened by stormwater inputs and other contaminant sources. We need to continue to work with adjoining cities, nonprofit groups and other agencies to protect Refuge wetlands from stormwater inputs and other potential contaminant sources. Stormwater can affect Refuge resources by contributing heavy metals and high levels of nutrients to the basin, and may raise overall water temperatures. These changes could harm plants and wildlife that depend on these habitats.

Protect wetlands from excess sedimentation due to eroding stream banks, flooding, and other watershed sources both within and outside of the Refuge.

Sedimentation of our wetlands occurs from erosion in the watershed from stream banks, upstream agricultural uses, and Minnesota River flood events. Most of the impacts to Refuge wetlands involve the accumulation of sediment into our water control system channels. In some cases, the channel siltation is so severe that water level manipulation is not possible and sediment removal through the channel and into the wetland is necessary.

Sediment excavation requires proper planning to ensure that the placement of the removed material will not negatively impact the wetland. Material should be either transported off site or

spread in the uplands. Consideration should be given to the seed bank within the removed sediment layer. Undesirable plant species such as reed canary grass may be present and infest habitats were the material was placed. In the case of channel excavation a large excavator or backhoe is often used.

4.2.3.3 Temporary/Seasonal Wetlands (Priority 2 Habitat)

Temporary/Seasonal Wetlands Goal:

Protect, restore and manage temporary/seasonal wetlands throughout the Minnesota Valley National Wildlife Refuge to provide foraging habitat for waterfowl, shorebirds, and other waterbirds, diverse habitat for other wetland-dependent wildlife, and preserve the ecological integrity of the wetland in the Eastern Broadleaf Ecological Province. *(CCP Goal 2).*

Temporary/Seasonal Wetlands Objective:

Over the next 15 years, protect all, and restore and enhance up to 10% (if additional resources become available) temporary and seasonal wetlands annually. Where possible allow or mimic natural hydrologic processes that allow for cycling of wet/dry periods to promote a variety of vegetation and open water conditions for foraging waterfowl, shorebirds, and northern harrier and nesting habitat for sedge wren.

1. In temporary/seasonal wetlands, incorporate management actions to promote desired conditions that favor diverse native wetland vegetation.
2. For temporary/seasonal wetlands in an upland setting:
    a. Provide vegetation structure consisting of emergent vegetation and open water. Vegetation represented with at least 75% early successional herbaceous species (e.g., sedges and smartweeds) or residual vegetation with associated benthic macroinvertebrates and water depth between 4 and 12 inches during spring and fall migration.
    b. Prevent establishment and reduce reed canary grass and other invasive species coverage to < 15%.
    c. Native trees and shrubs > 3.3 feet in height will be < 15% of the cover.
3. For temporary/seasonal wetlands in the floodplain:
    a. Maintain native vegetation cover > 50% consisting of species such as annual smartweeds (*Polygonum* spp.) and beggarticks (*Bidens* spp.).
    b. Reduce reed canary grass and other invasive species coverage to < 50%.
    c. Restore the water depth and bottom contours of shallow, depressional areas that have filled with sediment. Typical water depths will be between 4 and 12 inches.
    d. Previously managed moist soil units will naturally be reverted to floodplain forest.

*Actual areas suggested for management are noted in Appendix D: Table 2. Since this is a Priority 2 Habitat, temporary/seasonal basins will be managed if additional resources or partnerships are available. The first step to managing these basins will be delineating where they occur and which have the highest potential for restoration and management.

Temporary/Seasonal Wetlands Rationale:

There are many temporary/seasonal wetlands located on the Refuge, both within and outside of the floodplain. As previously mentioned, the total acreage of non-permanent wetlands was not calculated, as these areas are small, indistinguishable via remote analysis, or often integrated into the matrix of other habitats. Although it is currently difficult to quantify the amount of this habitat on the Refuge, they provide significant habitat value to species at critical times of the year. They provide habitat during the early part of the breeding season when permanent wetlands are still frozen (Steward and Kantrud 1971). Seasonally flooded wetland habitats also support higher densities of benthic macroinvertebrates that are important for waterfowl (Krapu et al. 1997). Beyond direct wildlife benefits, temporary/seasonal wetlands are responsible for storing water during rain events and reducing the impacts on an urbanized watershed. Although temporary/seasonal wetlands are a Priority 2 habitat in this HMP, it will be important for the Refuge to map these wetlands and delineate important areas of temporary/seasonal habitat in the future.

Temporary/Seasonal Wetlands Management Strategies:

Identify temporary/seasonal wetland habitat and delineate important restoration areas.

Temporary wetlands provide significant habitat value to species at critical times of the year. They provide habitat during the early part of the breeding season when more permanent wetlands are still frozen (Steward and Kantrud 1971). The Refuge needs to delineate important temporary/seasonal wetlands and investigate if restoration is needed.

These wetlands often have no surface water by mid-summer and therefore direct vegetation management like mechanical manipulation (mow, hay or crushing), scraping sediment, disking, prescribed fire or herbicide application, can be used to improve the quality of these wetland areas. Managing vegetative structure in the fall or winter when the basin is dry is easier. Spring runoff will then flood the basin in time for spring migratory bird use. Since temporary/seasonal basins are a priority two habitat and direct treatments are time consuming and costly, we need to prioritize and apply the treatments only on sites where we expect to see great benefit.

Protect wetlands from excess sedimentation due to eroding stream banks, flooding, and other watershed sources both within and outside of the Refuge.

Sedimentation of our wetlands occurs from erosion in the watershed from stream banks, upstream agricultural uses, and Minnesota River flood events. Most of the impacts to Refuge wetlands involve the accumulation of sediment into our water control system channels. In some cases, the channel siltation is so severe that water level manipulation is not possible and sediment removal through the channel and into the wetland is necessary.

Sediment excavation requires proper planning to ensure that the placement of the removed material will not negatively impact the wetland. Material should be either transported off site or spread in the uplands. Consideration should be given to the seed bank within the removed sediment layer. Undesirable plant species such as reed canary grass may be present and infest habitats were the material was placed. In the case of channel excavation, a large excavator or backhoe is often used.

Sedimentation can also occur in temporary/seasonal wetlands. Under dry conditions, a bulldozer or scraper can be used to remove 2 to 4 inches of sediment. Scrapes in areas impacted by

sediment, can be a low cost way to restore temporary/seasonal wetlands. Although we have discussed doing this on the Refuge, it has not been a high enough priority for us in the past.

4.2.4 Fen/Wet Meadow/Carr (Priority 1 Habitat)

Fen/Wet Meadow/Carr Goal:

Restore, protect and manage fen, wet meadow and carr habitat throughout the Minnesota Valley National Wildlife Refuge to provide diverse habitat for fen, wet meadow, and carr-dependent wildlife that depend on these habitats, while preserving the ecological integrity of these habitats within the Eastern Broadleaf Forest Ecological Province. (*CCP Goal 2*).

Fen/Wet Meadow/Carr Objective:

Over the next 15 years, restore, protect, and manage 1,471 acres (Appendix D, Table 2) of fen/wet meadow/carr for the full life cycle requirements of Small White Lady's Slipper and other native species according to the following conditions:

1. Vegetative cover will be dominated by native grasses, sedges, and forbs (> 75%). Invasive species cover will be ≤ 25%.
2. In areas being restored, reduce invasive species cover to < 25%. In other areas, keep reed canary grass from spreading beyond existing cover.
3. Determine whether or not small white lady's slipper is present on the Black Dog Unit, and prevent over shading from invasive species encroachment and disturbance from Refuge infrastructure (trails, roads).
4. Native tree and shrub cover will be ≤10% and distributed in sparse to scattered clumps.
5. Inventory similar habitats for other white lady's slipper populations and record in GIS.
6. Determine location and condition of fen/wet meadow carr habitat.

*Actual focus areas for management are noted in Appendix D, Table 2. The first step to manage these areas will be delineating their location and management.

Fen/Wet Meadow/Carr Rationale:

The Refuge contains approximately 1,471 acres of fen/wet meadow/carr habitat across the management units. Black Dog, Wilkie, Louisville Swamp, Long Meadow Lake, Rapids Lake, and Blakeley Units, in decreasing order, contain approximately 90% (1,299 acres) of this habitat ranging from 114 to 486 acres per management unit (Table 2-1). Another 162 acres are spread across other units. It is difficult to quantify the exact acreages of this habitat since it is often included in another habitat type such as floodplain forest or mesic prairie. Based on notes in the original Public Land Office surveyor's notes, at the time of the original survey, the Lower Minnesota River floodplain was covered in 40% wet meadow (USFWS 1992).

Fen/wet meadow/carr habitat on the Refuge is classified as either Southern Seepage Meadow/Carr (WMs83), or Northern Wet Meadow/Carr (WMn82) (MNDNR 2005). Southern Seepage Meadow/Carr is described as being open wetlands dominated by a dense cover of hummock-forming broadleaved sedges or tall shrubs. Graminoid cover is interrupted to continuous (50 to 100%) and dominated by sedges. Forb cover is variable (5 to 75%) and includes Joe-pye weed, swamp milkweed, giant sunflower and touch-me-nots. The shrub cover

is variable and includes red-osier dogwood, pussy willow, and slender willow. Northern Wet Meadow/Carr is very similar to WMs83, except characterized by open wetlands dominated by a dense cover of broad-leaved graminoids (sedges) or tall shrubs. Moss cover is most often < 5%. The graminoid layer consists of dense stands of mostly broad-leaved graminoids such as bluejoint, lake sedge and tussock sedge. Forbs include tufted loosestrife, water smartweed, and cut-leaved bugleweed. Shrub cover consists of willows, red-osier dogwood and speckled alder. Prairie Extremely Rich Fen (OPp93) may also be represented. OPp93 is an open graminoid fen on permanently saturated peat sustained by mineral-rich groundwater discharge, with little influence from surface water.

Fen/wet meadow/car habitat on the Refuge supports a variety of native species including the small white lady's slipper. It has been found on the Black Dog Unit, but may be present on other units with similar habitat. Small white lady's slipper is a state-listed species of concern that has declined over 95% from its range due primarily to habitat loss of wet prairies, fens, wet meadows, and carr (MNDNR 2016). Since 1980, over 200 locations of small white lady's slipper have been documented in Minnesota, making the state a stronghold for the species. The species is a member of the orchid family and produces a small seed that can be spread great distances by wind. The seed requires the right soil moisture conditions and the presence of a specific mycorrhizal soil fungus to germinate. Where present, adequate light is a primary limiting factor in its distribution, growth, and abundance as stated in the *Recovery Strategy for the Small White Lady's Slipper in Canada* (Environment Canada 2014). Shading caused by encroaching invasive species as well as native woody species pose an ongoing threat. Preventing earth-moving disturbance and protecting the local hydrology are also important to its conservation on the Refuge.

Shrub and woody vegetation management in fen/wet meadow/carr habitat on the Refuge can be in conflict between providing for the needs of other species such as Bell's Vireo and American Woodcock that prefer shrubs while small white lady's slipper prefers open, adequate light. Bell's Vireo is a Minnesota Species of Special Concern (MNDNR 2006). Based on the Minnesota Breeding Bird Survey (BBS) data, Bell's Vireo populations have been decreasing since 1966. Today only 15 breeding locations are known in the state including Dakota County (Pfannmuller 2014). Bell's Vireo nests in shrubs and small trees between 1 to 5 feet off the ground surrounded by dense vegetation that provides good nest concealment. Nests are typically located near water (Niemi and Hankowski 1992). Unfortunately for Bell's Vireo, the habitat that it prefers, typically classified as early forest successional or shrubs with dense surrounding vegetation, is relatively ephemeral in nature and often transitions to taller shrubs with less dense ground layer vegetation on the way to mature forest or is managed as a grassland (removal of shrubs through mowing, burning, grazing, or conversion to row crop agriculture). In addition, land management actions have increased the overall landscape patchiness of shrub habitat making the Bell's Vireo more susceptible to brown-headed cowbird parasitism (Kus et al. 2010).

Currently, the Black Dog Unit is the only management unit where Bell's vireo has been observed Refuge unpublished data 2005. In cases where Bell's Vireo is present, Refuge staff will determine if white lady's slipper is also present or has suitable habitat and will use a balanced approach to protect and provide habitat for one or both species. The distribution of small white lady's slipper is limited on the Refuge. Protecting and managing these locations within the Refuge will be a

priority. Since Bell's Vireo is more mobile and better able to respond to changing locations of adequate habitat, areas with dense ground vegetation and shrubs will be encouraged apart from areas where small white lady's slipper populations are known to be present. Habitat management in areas where Bell's Vireo is present will strive for native shrub cover between 30 and 50%, with patches of dense vegetation between 1 and 5 feet tall and will be distributed in patches > 0.5 acres. Other fen/wet meadow/carr habitat will support conditions that are suitable for white lady's slipper.

Reed canary grass, buckthorn and other invasive species can have a negative impact on the habitat quality of both species. In areas where reed canary grass cover is > 25%, complete control may not be possible. The Refuge's resources are better spent monitoring and managing reed canary grass in areas where reed canary grass equals < 25% of total cover and is not flooded regularly.

Fen/Wet Meadow/Carr Management Strategies:

Gather more information on quantity and quality of source water to help delineate fen and wet meadow habitat types.

Earlier in this document we identified the need to gather more information on how hydrology affects Refuge habitats. This will be a critical need to help us identify where fen and wet meadow habitats occur on the landscape. We hope to gather this information within the first five years of plan establishment.

Control invasive species according to trigger points noted in above objectives, through integrated pest management including mowing, burning, spraying, biological control, and actively altering habitat conditions to promote native species.

The Refuge controls all invasive species under the Integrated Pest Management (IPM) approach as defined in the Refuge Manual (7 RM 14). This approach includes managing pest and invasive species by combining mechanical, chemical and cultural tools in a way that minimizes economic, health, and environmental risks [Federal Insecticide, fungicide, and Rodenticide Act (FIFRA, 7 U.S.C. 136r-1)]. The Refuge also updates an invasive species work plan annually, which outlines priorities for invasive species management.

The fen/wet meadow/carr habitats on the Refuge are infested with invasive species in varying amounts. Some of the areas have been encroached with undesirable woody species such as buckthorn, sumac, honeysuckle, etc. Historically, natural disturbances like fire and grazing maintained open prairies. As those natural disturbances have been suppressed (fire) or eliminated (grazing), trees have encroached in wet meadow habitats throughout Minnesota. Prescribed burning and potentially grazing are used to control woody vegetation, but the effectiveness of these techniques decline as the tree size increases. Other strategies are required to remove woody encroachment. It is important to realize however, that native shrubs are a component of wet meadow/carr habitat, so effort should be focused on removing nonnative woody vegetation and managing habitats to provide habitat structure for the resources of concern. Techniques to control undesirable woody vegetation include manually cutting and stump treatment with chemical, tree girdling, and mechanical treatment of large areas with saws, skid

steer attachments, tree shears, fecon, timber-ax chippers, rotary mowers, or wet blades. Additionally, woody vegetation could be controlled by basal bark or foliar chemical treatment.

Herbaceous species that invade Refuge fen/wet meadow/carr include Canada thistle, leafy spurge, purple loosestrife, reed canary grass, and phragmites. According to the Refuge IPM plan, small outbreaks of some species such as leafy spurge, purple loosestrife, or Canada thistle will be treated with chemical or cut. Large infestations will be treated with biocontrol agents like *Apthona sp.* for leafy spurge and *Galerucella sp.* for purple loosestrife. Care will be taken to use the most appropriate technique that protects special concern plants and other native vegetation. Some of our fen/wet meadow/carr habitat is dominated by reed canary grass and common reed. Small infestations of these invasive plants will be controlled to prevent spread into native vegetation and to protect species of special concern such as the small white lady slipper from shading. Where reed canary dominates across the unit, treatment priority will be given to areas adjacent to native habitats.

Develop a baseline inventory of the presence and abundance of reed canary grass in combination with flood maps. Treatment priority will be given to areas known to have no or limited reed canary grass infestation, areas adjacent to native remnants, and habitats with lower flood frequency.

Mapping the location and abundance of reed canary grass infestations will help us focus control efforts on areas adjacent to remnant native habitats, or areas of habitat for our ROC.

Map, assess and document all locations and habitat conditions of known small white lady's slipper populations on the Refuge.

It is important to GPS the locations of small white lady's slippers so we can protect them from being mowed or trampled while we are conducting trail maintenance or restoration activities. Having the locations documented will also help us prioritize restoration locations in order to prevent overshading of the small white lady's slipper.

Locate and map source water for seeps and few/wet meadow/carr habitat to help determine mosaic of habitat types.

Identifying the source water and mapping of these habitats will be important in determining where these habitats occur on the landscape.

Use mowing, cutting, and other techniques to prevent overshading of small white lady's slipper populations. Use the appropriate control techniques to limit spread of invasive species into known populations of small white lady's slipper.

Once the locations of small white lady's slipper is documented, invasive species control efforts can be used to prevent the spread of invasive plants and undesirable tree species from shading out the small white lady slipper locations. Small white lady slipper populations will be assessed every few years to document extent of woody encroachment. Care will be taken to minimize the effects to native plants species including state special concern species. The use of chemical control should be limited to the dormant season if it is found to be the best technique to control the invasive species.

4.2.5 Floodplain Forest (Priority 1 Habitat)

Floodplain Forest Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of floodplain forests within the Eastern Broadleaf Forest Province. *(CCP Goal 1 and 5).*

Floodplain Forest Objective:

Over the next 15 years, protect, maintain and enhance approximately 5,200 acres of floodplain forest. Forest blocks at least 250 acres in size are especially important as they provide breeding and migratory stopover needs for Prothonotary Warbler, nesting habitat for Bald Eagle and Wood Duck, and brood rearing and foraging habitat for American Woodcock. Seek opportunities to create larger forest blocks through partnerships. Existing and enhanced forests will have the following conditions:

1. Protect and connect large blocks of habitat (through partnerships) where feasible, especially where block sizes are > 250 acres.
2. The shrub layer and subcanopy are mostly sparse (0 to 25% cover) and sometimes patchy (25 to 50% cover). The canopy is interrupted to continuous (50 to 100% cover) and strongly dominated by silver maple with occasional green ash, cottonwood, or American elm.
3. Allow for continued hydrologic connection to the Minnesota River under normal flooding conditions so that the river can spread out across the floodplain unimpeded and drain efficiently post-flood.
4. Maintain the natural productivity cycle on the floodplain where possible and allow for periodic drought and flood conditions.
5. Maintain at least 75% of total tree cover in a continuous (75 to 100%) mature canopy. Provide a mixture of early successional and mid-successional forest composed of species such as silver maple, cottonwood, and boxelder through natural processes.
6. Maintain and protect dead standing and downed woody material on the forest floor for ecosystem processes such as nutrient cycling, foraging habitat for woodpeckers, and cover for reptiles and amphibians.
7. Prevent an increase in invasive species colonizing areas affected by significant green ash mortality due to Emerald Ash Borer infestations.
8. Design and conduct a snag inventory within the next 10 years to determine habitat quality for cavity nesting birds. Objectives for cavity nesters will be refined following the inventory.
9. Provide a dense shrub and subcanopy layer (25 to 50% cover) near standing water for Prothonotary Warbler nesting, and allow snags to remain during restoration activities.
10. Maintain and protect existing and potential cavity trees > 28 in. dbh and > 30 ft. in height, for wood duck nesting.
11. Protect super canopy trees, mature trees that stick out above the plane of the forest canopy, for Bald Eagle nesting and/or mature trees near water for bald eagle perching and foraging.

12. Invasive species such as buckthorn, reed canary grass, purple loosestrife, and narrowleaf bittercress will be < 20% of the total cover in mature forest stands and < 50% in early and mid-successional forest stands.
13. Floodplain forest will be restored using natural succession, and rarely involve planting of trees in the floodplain. Former moist soil units adjacent to Chaska and Fisher Lakes will be abandoned and allowed to naturally revert to floodplain forest.

*Priority management for floodplain forest will be to maintain and protect it from habitat degradation. Focus areas for floodplain forest enhancement are located in Appendix D, Table 1. Priority will be given to large blocks of floodplain and forests identified as a rare community by the MNDNR.

Floodplain Forest Rationale:

The Refuge contains approximately 5,294 acres of floodplain forest. Outside of the Round Lake management unit, each of the 12 other management units has at least some floodplain forest acreage. Approximately 83% (or approximately 4,401 acres) of the floodplain forest acres are in six management units (Louisville Swamp, Blakeley, Rapids Lake, Jessenland, Long Meadow Lake and Wilkie) (Table 2-1). Floodplain forest acreages in these six management units range from 572 acres up to almost 1,000 acres. The remaining six management units have floodplain forest totals ranging from two acres up to 280 acres per management unit.

Based on information in the original Public Land Office surveyor's notes, at the time of the original survey, the Lower Minnesota River floodplain was covered in 30% forest, 30% marsh and 40% wet meadow (USFWS 1992). A GIS-based data layer of Marschner's 1974 interpretation of the original vegetation of Minnesota classifies the area primarily as floodplain forest (MNDNR 1994; accessed: https://gisdata.mn.gov/dataset/biota-marschner-presettle-veg). Following European settlement of the Lower Minnesota River floodplain, trees were harvested for timber and firewood. Areas were further cleared of trees for agricultural uses. By 1992, only 16% of the floodplain forest remained, while 20% of the floodplain was in row-crop agriculture (USFWS 1992).

The floodplain forests of the Refuge are classified as Southern Floodplain Forest (FFs68) (MNDNR 2005). The ground layer of FFs68 is very sparse during the spring due to inundation by floodwaters. However, by midsummer the cover is variable (5 to 50% cover) and characterized by annual or flood-tolerant perennial species such as false nettle, Virginia wild rye, cut grasses, wood nettle and mad dog skullcap. Climbing plants and vines are present including wild grape and poison ivy. The shrub layer and subcanopy are mostly sparse (0 to 25% cover) and sometimes patchy (25 to 50% cover). Silver maple, green ash, American elm, and hackberry are the most common subcanopy trees. Canopy is interrupted to continuous (50 to 100% cover) and strongly dominated by silver maple with occasional green ash, cottonwood, or American elm. In 2010 and 2012, a forest inventory was completed using the Region's standard Rapid Ecological Assessment Method for Forests (Minnesota Valley NWR, unpublished data, 2010 and 2012). The inventory indicated that the tree species found in the upper canopy of the floodplain forests of the Refuge (silver maple, green ash, cottonwood with some box elder and willow) are comparable to FFs68 community type. The subcanopy contained buckthorn, dogwood and cherry species along

with elm and hackberry. The ground layer was composed of occasional recordings of garlic mustard, burdock and narrowleaf bittercress.

Since its establishment, the Refuge has been involved in maintaining and restoring floodplain forest in some fashion or another. In former cropland, the Refuge has actively planted a mix of trees that were characteristic of floodplain forest to varying degrees of success. Floodplain forest has also been and is currently being restored through natural succession in areas where Refuge activities to maintain the habitat in another land cover such as non-permanent wetlands ceased. These are areas that are difficult to maintain and have a strong connection to the river. In most cases, allowing the natural process of floodplain succession to occur has allowed for the establishment of trees. Today, there is a mix of mature floodplain forest present on the Refuge. Some of this was present before the Refuge's establishment in 1976, and there are young, early successional stands that are developing due to both passive and active restoration. Due to the prohibitive cost and lack of success of forest establishment via tree planting in the floodplain, natural succession will be the most likely management strategy to restore floodplain forest habitat on the Refuge. This approach varies from the original ideas presented in our CCP (USFWS 2004a). Most of the management of this habitat will be protecting large blocks of habitat and those areas identified as a rare community by the MNDNR (over 1,500 acres identified in Appendix D, Table 1). However, we also will include letting over 200 acres of moist soil units at Chaska and Fisher Lakes revert to floodplain forest, rather than managing these areas for moist soil plants (Appendix D, Table 1).

Increasing the amount of Refuge floodplain forest via natural succession may have a positive impact on species that are sensitive to forest block size such as the Prothonotary Warbler and Cerulean Warbler. Prothonotary Warblers typically avoid nesting in forest blocks < 250 acres (Robbins et al. 1989) and riparian areas along waterways < 100 feet wide (Kahl et al. 1985). However, providing habitat near or over water with a dense understory and cavities in large trees (Bushman and Therres 1988) may provide limited nesting habitat despite limited forest blocks > 250 acres on the Refuge. Nesting block size for cerulean warbler varies from 50 acres to over 1,700 acres and depends on the landscape characteristics (Buehler et al. 2013). In landscapes with less floodplain forest, Cerulean Warblers become more sensitive to local-scale habitat fragmentation effects such as increased Brown-headed Cowbird parasitism (Buehler et al. 2013). The landscape surrounding the Refuge is primarily urban and agricultural. Increasing forest block size and decreasing forest fragmentation will benefit nesting Cerulean Warblers on most of the management units containing floodplain forest.

Due to the linear nature of the Refuge, there are limited areas that contain floodplain forest blocks > 250 acres that can benefit nesting Prothonotary Warblers. However, through continued restoration (both active and passive), it may be possible to achieve additional blocks in the future. Additionally, block size of > 250 acres may be protected by land acquisition or management agreements with partners that own adjacent lands. Maintaining and increasing floodplain forest block size will also benefit other area-sensitive species such as the Red-shouldered Hawk.

In addition to providing habitat for area sensitive bird species, the Refuge floodplain forests provide diverse habitat conditions that are critical for many different wildlife species. The Refuge has species that use the canopy, subcanopy, and ground layer of the floodplain forests. American

Bald Eagles and Wood Ducks nest in large, mature trees. 93% of the Bald Eagle nests observed in the Upper Mississippi River National Wildlife and Fish Refuge (NWFR) were in super canopy trees, trees that stick out above the existing forest canopy, primarily consisting of cottonwoods and silver maples (Mundahl et al. 2013). Large cottonwoods and silver maples are equally important to providing natural cavities for Wood Duck nests. In a study of floodplain forest in west central Illinois, approximately 74% of Wood Duck nests were found in large silver maples (Yetter et al. 1999). In north central Minnesota, no trees < 11 inches dbh contained a cavity used by ducks (Gilmer et al. 1978). In addition, cavity entrances were not < 13 feet above the ground and 54% of the used cavities were at least 30 feet above the ground (Gilmer et al. 1978). Besides the canopy, the subcanopy and ground layer is important for wildlife species of the Refuge. Prothonotary Warblers use the floodplain forest subcanopy for foraging (Petit 1999) and nest in cavities of dense, often dead shrubby material typically between than 1.5 feet and 10 feet off of the ground (Cooper 2009). American Woodcock rely on the moist-soils of the sparsely vegetated ground layer for brood rearing and feeding on worms.

A strong hydrologic connection with the Minnesota River is important to maintaining Refuge floodplain forests. Seasonal flooding reduces the ground layer and provides the sparse cover preferred by foraging Prothonotary Warblers and American Woodcock. Extended periods of flooding and large flood events cause tree mortality and create early forest successional openings that nesting American Woodcock and Bell's Vireo use.

Activities such as dredging or channel development or increased flood flows through local and large-scale watershed development and alteration can impact the natural hydrologic regime between the river and the floodplain forests. Other refuges such as those on the Mississippi River and Union Slough NWR in Iowa have documented changes in the floodplain forest community such as lack of tree seedling recruitment and conversion to wet meadow habitat when the natural process is disrupted (Urich et al. 2002).

Ash trees comprise a sizable amount of canopy cover in floodplain forest stands on the Refuge. During a recent Forest Inventory (2010-2012), biologists found 11 to 15% of the upper canopy and 17 to 21% of the subcanopy of our floodplain forest were made up of ash trees. At some point in the future, floodplain forest stands where ash are present are likely to be impacted by loss of ash trees due to infestation and subsequent death by the emerald ash borer. First discovered in 2002 in southeast Michigan, the beetle has spread across the Midwest (Emerald Ash Borer Information Network 2016). In 2009, it was first discovered in Minnesota. Currently, the State of Minnesota maintains a quarantine in ten counties, including the area within the Refuge that prohibits the transport of ash trees or material to reduce the spread of the pest (MDA 2016). When infested, ash trees will likely die, creating a significant amount of standing snags and eventually downed wood and small to large forest gaps. The creation of snags and downed wood will provide Wood Duck and Prothonotary Warbler nesting habitat and foraging habitat for Red-headed Woodpeckers.

Although the death of ash trees will provide habitat for several resources of concern, there will also be negative impacts. Gaps in the canopy will create opportunities for invasive species such as buckthorn, reed canary grass, purple loosestrife, and narrowleaf bittercress to either expand or become established. Reed canary grass in the floodplain habitats of the Upper Mississippi

River is preventing natural regeneration of the floodplain forest (Urich et al. 2002). Invasive species monitoring and control will be important to ensure invasive species are not negatively impacting the Refuge's floodplain forest due to die off of ash trees. Hazard tree removal and downed wood management may be a future strategy to reduce impacts to floodplain forests due to emerald ash borer infestation. A balance needs to be maintained between keeping as much snag and downed wood habitat as possible and removing trees and wood only in areas where public safety or infrastructure is threatened.

Floodplain Forest Management Strategies:

Identify existing areas of floodplain forests within the Refuge boundaries that have a block size of 250 acres or greater. Also consider areas where a combined block size between Refuge management and adjacent property is > 250 acres.

Birds such as Prothonotary warblers typically avoid nesting in forest blocks < 250 acres (Robbins et al. 1989). By identifying large blocks of floodplain, we can focus efforts on protecting these large blocks of habitat. Where smaller blocks of Refuge land occur, we can work on acquiring land adjacent to these parcels, or enter management agreements with partners to help increase block size of floodplain forest habitat.

Identify areas where reforestation through natural regeneration could result in a forest block size > 250 acres.

Allowing natural regeneration to occur in riparian areas adjacent to the Minnesota River and mature floodplain forest (noted in our priority restoration areas table), will help add to the block size of mature floodplain forest as succession occurs. This will provide age and structural diversity to support several resources of concern including Prothonotary Warblers, Wood Ducks and American Bald Eagles.

Account for the loss of green ash due to emerald ash borer as a component of floodplain forests through snag and downed woody material management.

Ash trees are a significant component to floodplain forest stands on the Refuge. During a recent Forest Inventory (2010-2012), biologists found that 11 to 15% of the upper canopy and 17 to 21% of the subcanopy of our floodplain forest was made up of ash trees. At some point in the future, floodplain forest stands where ash are present are likely to be impacted by loss of infected and dying trees due to infestation by the emerald ash borer. When infested, ash trees will likely die, creating a significant amount of standing snags and eventually downed wood and small to large forest gaps. The creation of snags and downed wood will provide wood duck and Prothonotary Warbler nesting habitat and foraging habitat for Red-headed Woodpeckers. Although these snags will provide habitat for wildlife, gaps in the canopy will create opportunities for invasive species such as buckthorn, reed canary grass and purple loosestrife. It will be important to track loss of green ash to EAB, and to be proactive about controlling invasive species that may move into the newly created openings.

Control invasive species through integrated pest management including mowing, spraying, and actively altering habitat conditions to promote native species according to the trigger points outlined in the above objectives.

The Refuge manages all invasive species under the Integrated Pest Management (IPM) approach as defined in the Refuge Manual (7 RM 14). This approach includes managing pest and invasive species by combining mechanical, chemical and cultural tools in a way that minimizes economic, health, and environmental risks [Federal Insecticide, fungicide, and Rodenticide Act (FIFRA, 7 U.S.C. 136r-1)]. The Refuge also has an Integrated Pest Management Plan, which outlines priorities for invasive species management. Since we are letting floodplain forest naturally regenerate, we will control invasive species when we note new outbreaks. The biggest threats to our floodplain forest is buckthorn, reed canary grass, and purple loosestrife. In most cases we will treat these new infestations with herbicide to prevent the spread throughout our floodplain forest habitat.

Maintain hydrologic connection with the Minnesota River.

A strong hydrologic connection with the Minnesota River is important to maintaining Refuge floodplain forests. Seasonal flooding reduces the ground layer and provides the sparse cover preferred by foraging Prothonotary Warblers and American Woodcock. When natural processes are disrupted, changes in the floodplain forest community can occur and lead to loss of habitat for floodplain dependent species.

Describe natural functions and fluctuations of the Minnesota River.

The Minnesota River is an important influence on floodplain forest habitat of the Refuge. Under current conditions, flood frequency and duration has increased making active floodplain forest restoration difficult. Increased periods of inundation in the future may result in decreased natural (or passive) reforest and increased herbaceous vegetation coverage. Understanding and describing the natural function and hydrology will aid in determining the appropriate management direction and additional strategies.

4.2.6 Upland Forest (Priority 2 Habitat)

Upland Forest Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of upland forests within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 3).*

Upland Forest Objective:

Protect 75% of new and existing upland forest and manage up to 25% of the existing 739 acres of upland forest throughout the Minnesota Valley National Wildlife Refuge for American Woodcock, nesting Wood Thrush, Northern Flicker, Eastern Wood-pewee, and Golden-winged Warbler and roosting habitat for the northern long-eared bat.

1. Canopy (overstory) is interrupted to continuous (50 to 100% cover) characteristic of maple-basswood or oak forest, as determined by site conditions.

2. Where feasible, such as through partnerships or acquisition, promote large contiguous forested patches > 250 acres.
3. Understory comprised of a ground layer with 50 to 100% cover and a shrub layer of varying cover characteristic of maple, basswood, or oak forest, as determined by site conditions.
4. Where ecological restoration activities have occurred or will occur in adjacent areas or habitats, eradicate, reduce or control invasive plants and animals that have adverse impacts on native vegetation by 50% from current levels.

*Suggested focus areas for upland forest habitat restoration are described in Appendix D, Table 2. These may incorporated if additional resources become available to manage Priority 2 habitat.

Upland Forest Rationale:

The Refuge contains approximately 739 acres of upland forest with approximately 270 and 190 acres at Louisville Swamp and Rapids Lake management units, respectively (Table 2-1). The Long Meadow Lake unit has about 140 acres while the remaining upland forest acres are scattered throughout six other management units in acreages totaling < 50 acres per unit. The Blakeley, Chaska, Jessenland, and San Francisco units do not currently contain any upland forest.

The Refuge contains both oak-dominated forests/woodlands on dry, sandy sites and maple-basswood forest stands where soil moisture and/or soil nutrients are higher. Pin Oak-Bur Oak Woodland (FDs37b) has a canopy that is interrupted to continuous (50 to 100%) with abundant northern pin oak and bur oak in the canopy; and a subcanopy of bur oak, black cherry, and green ash. Southern Dry-Mesic Oak Forest (MHs37) has an interrupted to continuous (50 to 100%) canopy, with northern red oak, white oak, and basswood in the canopy, and a patchy subcanopy of basswood, black cherry, northern red oak, white oak, and shagbark hickory. Sugar Maple-Basswood Forest (MHs39) is strongly dominated by sugar maple, with basswood, northern red oak, and occasionally American elm in the canopy; and sugar maple, ironwood, basswood, and bitternut hickory in the subcanopy. Southern Mesic Oak-Basswood Forest (MHs38c) is a mesic hardwood forest on steep, mostly north-facing slopes on thin silt over bedrock. Northern red oak and sugar maple are the most abundant canopy trees; basswood is also common. Ironwood and sugar maple are the most abundant subcanopy and shrub-layer species.

Forest block size and the availability of forest corridor habitat are two important factors that influence habitat quality for three of the selected resources of concern: Wood Thrush, Eastern Wood-pewee, and American Woodcock. Wood Thrush prefer large blocks of mature upland forest (trees > 40 ft in height) for nesting, but may also nest in smaller semi-urban parks and woodlots as small as 2.5 acre (Evans et al. 2011). Eastern Wood-pewee can be found in a variety of forest block sizes ranging from approximately 4 acres up to over 1,400 acres (Blake and Karr 1987). American Woodcock require multiple forest successional stages, connected together. Like other forest habitats through Minnesota, most maple-basswood habitats in the Eastern Broadleaf Forest Province have been fragmented by agriculture and development (MNDNR 2006). Due to the linear nature of the Refuge and proximity to the Minnesota River, the Refuge has relatively small blocks (e.g. < 250 acres) of scattered maple-basswood forest and other upland forest habitat. Protecting and promoting large forest blocks on the Refuge and through partnerships on adjacent

lands will support the habitat needs of forest area-sensitive birds such as Eastern Wood-pewee and American Woodcock.

American Woodcock, as mentioned, requires all stages of successional forest. In high density young forest stands with moist soil between 15 and 80%, woodcock forage for earthworms, a principal food source (Reynolds et al. 1977, Morgenweck 1977). Loss of early succession forest habitat is responsible for declines in American Woodcock recruitment and the overall population status (Kelley et al. 2008). The American Woodcock Conservation Plan calls for the creation of nearly 21 million acres of new habitat to stabilize and return populations within the United States to levels in the 1970s, before they started to decline (Kelley et al. 2008). Golden-winged warblers also depend primarily on early successional habitats for nesting (Confer et al. 2011). According to Buehler et al. (2007), early successional forest habitat availability is a key factor limiting Golden-winged Warbler populations as many of the habitat attributes required by the species are ephemeral in nature, i.e. early successional forest transitions to mid successional forest. Although Golden-winged Warblers are rare and uncommon on the Refuge, they may migrate through the area and have been found just outside the Refuge boundaries. Landscape-level natural processes that created early successional forest such as forest fires are no longer present (Askins 2001). Woodcock use early to mid-successional forest stands for nesting and brood rearing, with older broods typically occurring in more mature forest stands (McCarthy et al. 2013). Eastern wood-pewee abundance declines in higher density, younger forest stands (up to 1600 trees/ha) and high shrub densities between 12 and 23 feet. (Best and Stauffer 1986). Their abundance increases as tree density decreases. Wood thrush prefers mature, open forest with trees >16m in height and a moderate subcanopy and shrub development (Evans et al. 2011). Implementing forest management practices on the Refuge that provides early, mid, and late (or mature) successional forest will benefit American Woodcock, Golden-winged Warbler, Eastern Wood-pewee, Wood Thrush, and other species that prefer a mosaic of forest successional stages. We need find a balance in providing large blocks of closed canopy forest, with providing areas of mixed successional forest in areas where it is possible to achieve habitat conditions for several different species of concern.

Disease or forest pest outbreaks and subsequent tree die-offs, is one natural process responsible for creating early successional habitat. Some upland forests on the Refuge contain up to 17% ash species, which will likely be impacted at some point in the future by the emerald ash borer. Once infested, ash trees will likely die, creating small to large forest gaps. Although these gaps provide an opportunity to increase early successional habitat in the upland forests, active management may be required to prevent them from becoming dominated by invasive species such as garlic mustard, buckthorn, and honeysuckle.

Besides creating forest gap openings, tree mortality will provide dead tree snags and downed wood that are used for foraging by Northern Flicker and woodpecker species, roosting habitat for the northern long-eared bat and other bat species, and as cover habitat for forest herptiles. Similar to floodplain forest management, removal of snags and downed wood should be limited to areas where public safety or damage to Refuge or public infrastructure is a threat. In most other areas, standing dead trees and downed wood should be left to provide habitat for foraging birds, roosting bats, and forest herptiles.

The upland forest on the Refuge is in moderate to good condition. Since it is a priority 2 habitat the main management will be protection of these upland forest blocks from development. If additional resources or new partnerships are obtained, the restoration focus will be to remove invasive woody species (such as buckthorn) from upland forest areas. Upland forest that will be a focus for restoration include areas that are designated by the MN DNR as rare plant communities. These areas are listed in Appendix D, Table 2, and include Red Oak, Sugar Maple, Basswood Forest (MHs38c), Red Oak, White Oak and Sugar Maple, Basswood, Bitternut Hickory Forest, MHs39 and Pin Oak, Bur Oak Woodland, (FDs37b). We also will continue to explore partnerships that will enable us to project and manage larger blocks of upland forest.

Upland Forest Management Strategies:

Prioritize areas that will receive management activities if funds were to become available over the next 15 years.

Since Upland Forest is a priority two habitat, if additional resources are found, focus will be given to areas adjacent to other high quality habitats, and where there is opportunity to add to block size. See Appendix D, Table 2 for suggested restoration areas.

Identify existing areas of upland forests within the Refuge boundaries that have a block size of 250 acres or greater. Also identify areas where a combined block size between Refuge management and adjacent property is > 250 acres.

Forest block size and the availability of forest corridor habitat are two important factors that influence for several ROCs including: wood thrush, eastern wood-peewee, and American woodcock. Since the Refuge itself is linear in nature, block sizes > 250 acres on the Refuge alone are rare. We will continue to partner with other agencies, local governments and non-profit groups to acquire or manage habitats adjacent to us, to increase block size. Would like to identify these important areas as part of the first 10 years of our inventory and monitoring plan.

Control invasive species through integrated pest management including cutting, burning, and spraying.

Woody invasive species and garlic mustard are two species that have impacted our oak upland forest habitat. Cutting and treating non-desirable woody vegetation and treatment of garlic mustard by pulling or using herbicide, will provide openings for native vegetation. Since upland forest is a priority 2 habitat, invasive species removal will focus on areas that are adjacent to priority 1 restorations such as remnant oak savanna projects.

Plan for the loss of ash due to emerald ash borer as a component of upland forests through snag and downed woody material and invasive species management.

Ash trees are a significant component of upland forest on the Refuge. During a recent Forest Inventory (USFWS 2010, unpublished data collected by Minnesota Valley NWR staff), biologists found that ash made up about 17% of the upper canopy and subcanopy of the upland forest; however, the sample size was relatively small. At some point in the future, the forest stands where ash are present are likely to be impacted by loss of infected and dying trees due to infestation by the emerald ash borer. When infested, ash trees will likely die, creating a significant amount of standing snags and eventually downed wood and small to large forest gaps. It is important for us

to leave the snags and downed wood to provide foraging habitat for Northern Flicker and woodpecker species, roosting habitat for the Northern long-eared bat and other bat species, and as cover for forest herptiles. Although these snags will provide habitat for wildlife, gaps in the canopy will create opportunities for invasive species such as buckthorn, honeysuckle and garlic mustard. It will be important to track loss of green ash to EAB, and to be proactive about controlling invasive species that may move into the newly created openings. We are currently working with volunteers to document EAB on the Refuge, and are working with Minnesota Department of Agriculture to use biocontrol agents to reduce the spread of EAB.

Protect Northern Long-eared Bat Maternity Roost Trees

Known maternity roost trees for Northern long-eared bats will be protected while conducting restoration activities, according to guidelines under the Endangered Species Act.

4.2.7 Remnant Prairie and Planted Grassland – Dry and Mesic/Wet

Two separate goals and objectives were developed for remnant prairie and planted grassland separating them by hydrology. Remnant prairie is defined as prairie that has no documented history of being cultivated or receiving contemporary ground surface disturbance. Planted grassland includes areas where previous plantings occurred or where restorations are planned using native species. For simplicity, dry and wet/mesic remnant prairie objectives share a common rationale and habitat management strategies. Additional information about individual strategies and how they pertain to a particular objective can be found following the rationale. Planted grasslands are addressed in separate objectives and rationale.

4.2.7.1 Remnant Dry Prairie (Priority 1 Habitat)

Remnant Dry Prairie Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant dry prairie within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 4).*

Remnant Dry Prairie Objective:

Enhance and manage 58 acres of remnant dry prairie (Upgrala and Rapids Lake Units) and protect the remaining 200+ acres of existing dry remnant prairie throughout the Minnesota Valley National Wildlife Refuge. Emphasis is on increasing the amount of remnant prairie protected or managed within or adjacent to the authorized boundary over the next 15 years to achieve the following conditions:

1. > 50% of the cover is dominated by native species. Graminoid coverage is patchy to contiguous at 50 to 100%; forb cover is sparse to patchy at 5 to 50%. Cover of non-native species such as smooth brome and Kentucky bluegrass < 50%.
2. Litter depth ranges between zero and 6 inches
3. Native trees and shrubs > 3.3 feet tall will comprise < 5% of the total vegetative cover in the Southern Dry Prairie (UPs13) plant community type.
4. Eradicate, reduce, or control invasive plants and animals that have adverse impacts on native vegetation to < 50% of total vegetation cover. High quality remnants Rapids Lake (goat prairies) and Upgrala are first priority for management.

5. Where feasible, such as through partnerships or acquisition, promote larger contiguous upland prairie remnants to increase block size for resources of concern (> 25 acres for some species, other species need even larger block sizes).
6. Identify additional locations and quality of remnant dry prairie on and adjacent to Refuge land.

*Focus areas for remnant dry prairie management are located on the Rapids Lake, Wilkie and Upgrala Units (Appendix D, Table 1).

4.2.7.2 Remnant Wet/Mesic Prairie (Priority 1 Habitat)

Remnant Wet/Mesic Prairie Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant wet prairie within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 2).*

Remnant Wet/Mesic Prairie Objective:

Enhance and manage 359 acres and protect the additional 411 acres of remnant wet/mesic prairie throughout the Minnesota Valley National Wildlife Refuge. Emphasis is on increasing the amount of remnant prairie protected or managed within or adjacent to the authorized boundary over the next 15 years to achieve the following conditions:

1. > 50% of the cover is dominated by native species. Cover of gramnoids is contiguous (75 to 100%); and forb coverage is sparse to patchy at 5 to 50% of total cover.
2. Litter depth ranges between zero and 6 inches
3. Trees generally absent but shrubs sparse at 5 to 25% of the total vegetative cover in the Southern Mesic Prairie (UPs23) habitat type.
4. Eradicate, reduce or control invasive plants (such as reed canary grass) and animals that have adverse impacts on native vegetation to < 50% of total vegetation cover.
5. Where feasible, such as through partnerships or acquisition, promote larger contiguous wet/mesic prairie remnants.

*Focus areas for wet/mesic prairie are located on the Blackdog, Jessenland, St. Lawrence, and Wilkie Units (Appendix D, Table 1).

Remnant Dry and Wet/Mesic Prairie Rationale:

Prior to European settlement, approximately one-third or 18 million acres of Minnesota was prairie (Marshner 1978). The majority of this acreage was concentrated in the west, southwest and southeast corners of the state. Within the current boundaries of the Refuge, prairie was found in pockets on slopes and soils that limited tree development or encouraged regular fires. Today, approximately 99% of the prairie in the state has been lost primarily due to agricultural conversion and development. Minnesota has 1.3% or 235,000 acres of remnant prairie remaining (MN Biological Survey 2010; Minnesota Prairie Plan Working Group 2011). Locally, remnant prairies have been limited to areas preserved by Federal, State, or local governments through fee

ownership or easements on private property, have limited development or agricultural potential, or have been used as pasture for livestock by private landowners.

The loss of prairie affected many native plant and wildlife species. Large herds of herbivores, like bison and elk, are no longer present on the landscape. Native plant diversity in remaining prairies and existing grasslands is reduced or threatened by invasive species. Grassland-dependent birds have also been impacted by loss of grassland habitat on the landscape. Grassland bird populations have declined up to 40% (Knopf 1994; North American Bird Conservation Initiative, U.S. Committee 2009). Today, grassland-dependent birds within the Midwest depend upon agricultural landscapes and other artificial habitats to maintain populations. Federal farm programs such as the Conservation Reserve Program (CRP), military installations, airports, golf courses, parks, recreational fields, and other man-made and maintained grasslands provide some modified types of this habitat.

Remnant dry prairie on the Refuge is classified as Southern Dry Prairie (Ups13) and is characterized by 50 to 100% patchy to continuous graminoid cover, 5 to 50% sparse to patchy forb cover, and a sparse shrub layer (< 5% cover of mostly semi-shrubs like leadplant), where trees are absent or consist of occasional bur oak (MNDNR 2005). Remnant wet/mesic prairie on the Refuge is Southern Wet Prairie (Wps54) or Southern Mesic Prairie (UPs23), which are characterized by graminoid dominated cover 75 to 100%, sparse to patchy forb cover (5 to 50%), and a sparse shrub layer (5 to 25%; MNDNR 2005). Maintaining or returning the ecological drivers that sustained prairies in this condition will be important to remnant prairie management. Historically, the combination of fire (both naturally-occurring and those set by Native Americans) and grazing by large herds of herbivores maintained the diversity of the prairies and limited woody vegetation. On a landscape-scale, the potential for both processes to continue are somewhat limited. However, both prescribed fire and grazing can be used to maintain and enhance the existing prairie and grassland habitat on the Refuge.

Some shrubs historically existed on native prairie, but were sparse and made up < 5% of the vegetation cover (MNDNR 2005). In previous studies, an over-abundance of woody vegetation has demonstrated negative impact on grassland nesting birds (Grant et al. 2004). Woody vegetation removal has been shown to significantly improve upland nesting waterfowl such as Mallard nest success (Thompson et al. 2012). In wet/mesic prairie areas, the presence of some shrubs will provide habitat for species like the Bell's Vireo and American Woodcock.

Approximately 59% of the Refuge's 453 acres of dry grassland habitat and approximately 66% of the 1,164 acres of wet/mesic grassland is remnant. Most of this prairie is highly degraded due to invasion by woody vegetation and invasive species such as reed canary grass, leafy spurge or Canada thistle. However, in areas such as the Upgrala Unit, the remnant prairie contains a large number of native species. Reducing invasive species such as leafy spurge and controlling woody vegetation can vastly increase the quality of this habitat. The Upgrala and Rapids Lake Units have the most remnant dry prairie habitat. Mesic/grassland prairie remnants are found on almost every unit except Upgrala. However, some of this mesic/wet grassland habitat may be currently characterized as wet meadow habitat, since often these areas contain a mosaic of several different habitats. Also, much of the remnant dry grassland on the Refuge may be classified as oak savanna and is represented in the more open areas of the oak savanna habitat type. The

UMRGL JV (Soullierre et al. 2007) set a goal to maintain and protect approximately 257,000 acres of prairie and grassland habitat in Minnesota and to restore and enhance an equal amount for grassland-dependent birds. The plan identifies breeding grassland birds as the most important species associated with this habitat. The amount of prairie and grassland habitat the Refuge can contribute to the UMRGL JV goal is relative small (approximately 1,600 acres), but the contribution to grassland bird habitat and conservation is important as the Refuge is located along a migration corridor. The Refuge provides grassland habitat in a landscape dominated by urban development and agriculture. Additionally, the prairie and grassland habitat is adjacent to other natural habitats, which increases the block size of this habitat type.

Management of remnant prairie is a high priority for the Refuge. There is a small amount of remnant prairie in the metropolitan area and much of it is fragmented. The Refuge has approximately 1,040 acres of remnant dry and wet/mesic prairie. Although this amount of acreage is likely too small to significantly impact the selected resources of concern, it is very important to protect the remnant prairie on the Refuge as it represents the ecological integrity of native prairie and is irreplaceable. Furthermore, prairie sod that has not been altered by plowing may represent ecological processes such as soil-microbe-plant-invertebrate interactions that are not currently understood. Managing and protecting prairie remnants aligns with the statewide goal to protect all remaining prairie remnants in the state (Minnesota Prairie Plan 2011). Protecting remnant prairie from disturbance due to road, utility, or other infrastructure projects is important as although the prairie evolved with disturbances such as herbivores, fire, and drought earth disturbance through construction has the potential to permanently alter its ecological integrity. Controlling or reducing invasive species in prairie remnants is also important because these species can disturb ecological processes and displace native species.

Over the lifetime of the HMP, it will not be possible to restore and maintain all the existing remnant prairie in a state of high native species diversity. Over the foreseeable future, a portion of both the dry and wet/mesic remnant prairie habitat will remain in a degraded state dominated by non-native species such as smooth brome and Kentucky bluegrass (dry) and reed canary grass (wet/mesic) because the sites are difficult to access, the Refuge has limited funds and resources to implement management actions, or other contributing factors. Although this is not a preferred state, these habitats do provide nesting cover for grassland-dependent waterfowl such as Mallards and Blue-winged teal. In addition, these areas are being protected from soil disturbance that keeps the remnant component intact and makes future restoration activities possible.

Native pollinator populations have been in decline due to habitat loss through conversion to row-crop agricultural, agricultural practices, and urbanization (Cane and Tepedino 2001; Spivak et al. 2011). In June 2014, the President of the U.S. issued a memorandum requiring the development of a federal strategy to reverse the loss of the country's pollinator populations (White House 2014). Native invertebrate pollinators including bees and butterflies like the monarch will benefit from improving the native plant diversity on remnant prairies. The monarch butterfly relies solely on milkweed species during critical periods of its life cycle (NatureServe 2014). Prairie milkweed and butterfly milkweed bloom around the same time in early summer, however butterfly milkweed is typically more abundant later in the growing season than prairie milkweed. Monarchs also rely on common milkweed as their principal larval food plant (Brower et al. 2012). Increasing the number of milkweed species in grasslands will extend the food availability over the growing

season for monarch butterflies and other grassland obligate butterfly species. It will also help address issues of habitat loss and fragmentation identified in the North American Monarch Conservation Plan (CEC 2008). Maintaining or restoring high diversity prairie and grassland habitat will benefit other native invertebrate pollinators that rely on a specific plant species, or forb generalists, to meet life cycle requirements of foraging, overwintering, or reproduction.

The Refuge selected a suite of grassland bird species including Bobolink, Grasshopper Sparrow, Lark Sparrow, Northern Harrier and nesting waterfowl (Mallards), as resources of concern to represent the range of grassland conditions found on the Refuge. Routine management actions such as prescribed fire or mowing to simulate historical disturbance, or focused management actions to control invasive species or woody vegetation on remnant prairies will result in varying conditions in litter depth, vegetation height, and vegetation density that these species prefer. Immediately following a prescribed burn or a grazing event, vegetation height and litter depth is reduced. In the first few growing seasons after a management action, vegetation will be dense, litter depth low to moderate, and woody vegetation decreased. Species such as Bobolink, are more commonly observed during the first five years of management (Johnson and Temple 1986, Sample 1989, Kimmel et al. 1992, Anstey et al. 1995, Hull et al. 1996, Madden 1996). Grasshopper Sparrows, which prefer mid- height, clumped vegetation with patches of bare ground (Dechant et al. 2002) increased in occurrence after prescribed burning or moderate grazing two to four years after management action (Klute 1994, Madden 1996; Johnson 1997). Northern Harriers represent species that prefer relatively undisturbed areas with dense vegetation and deep litter (Duebbert and Lokemoen 1977; Kantrud and Higgins 1992). Although Northern Harriers prefer undisturbed areas, management actions are recommended every three to five years to maintain their habitat and their principal small rodent prey (Lemen and Clausen 1984, Hands et al. 1989, Kaufman et al. 1990). Lark sparrow prefers a variety of grassland and woodland edge habitat conditions (Martin et al. 2000) and represent species that benefit from the presence of woody vegetation along the edge habitat at the grassland-forest transition zone.

In addition to responding to habitat composition and structure, many grassland-dependent species such as Bobolink and Grasshopper Sparrow depend on large blocks of grassland habitat (Johnson and Igl 2001; Ribic et al. 2009). The minimum grassland block size for Bobolink and Grasshopper Sparrow in Illinois tallgrass prairie fragments was between 25 and 75 acres (Herkert 1991). Henslow's sparrows require a minimum block or patch size of at least 75 acres, but is more common in patches 135 acres or greater (Zimmerman 1988; Herkert 1994). The Rapids Lake unit provides the best opportunity for managing large blocks of both dry and wet/mesic grasslandhabitat. However, several other management units with patches > 25 acres contribute to providing habitat needs for Bobolink and Grasshopper Sparrow. Maintaining or increasing grassland patch size through management agreements on adjacent lands, partnerships, or acquisition of property is an important strategy to providing additional habitat as well as enhancing the existing potential of the Refuge to support area-sensitive grassland-dependent species.

Maintaining and enhancing prairie habitat on the Refuge also supports the needs of other grassland species. Specifically, the dry, upland prairies of the Refuge provide habitat for plain's hog-nosed snake. The snake is listed as a Species of Greatest Conservation Need by the State of Minnesota (MNDNR 2006) and uses sparsely vegetated areas within upland prairies and grasslands of the Refuge.

Remnant Dry and Wet/Mesic Prairie Management Strategies:

Use prescribed fire to reduce cool season invasive grasses when the target species are actively growing but before native warm season species are present.

Prescribed fire can be used to set back smooth brome and is the best strategy for reducing/killing Kentucky bluegrass. Also use fall burns to control and set back woody species encroachment.

Remove woody vegetation > 2m tall from remnant and dry prairies through a combination of mowing, cutting, other defoliation techniques, prescribed fire, and herbicide application.

Historically, natural disturbances such as fire and grazing maintained an herbaceous-dominated vegetation community in prairie habitat. As those natural disturbances have been suppressed, trees have encroached in grasslands throughout Minnesota. Although prescribed burning, grazing and mowing can be used to control woody vegetation, once the trees get larger these techniques are less effective.

Larger trees in prairies are often hand cut or cut by equipment. Often contractors can be incorporated to brush mow, cut, shear and grind woody species that are just getting established into grasslands. Depending on the size and abundance of the trees, the wood is either removed from site or scattered and burned throughout the site. When removed from the site the trees are often chipped and the wood is used for pulp or biofuels. We also ensure that all stumps are treated immediately with a triclopyr to prevent resprouting.

Incorporate grazing according to the refuge's agricultural management plan in suitable areas to control species such as smooth brome, reed canary grass, Canada thistle and other species.

Prescribed grazing is used to mimic the natural effects of ungulate and other grazing wildlife that were present during pre-settlement times. Grazing can be an effective management tool, but careful planning on the timing, species and number of livestock used needs to be carefully considered. Specific details about Refuge grazing is found in the Refuge Agricultural Management Plan (Minnesota Valley NWR 2018).

Monitor and control invasive species through integrated pest management including cutting, mowing, herbicide treatment, biological control, prescribed fire, and potentially grazing, to promote growth of native grasses and forbs.

As addressed above, non-desirable woody vegetation can shade out native species and it is important to cut and treat these species either by hand-cutting or by use of equipment Other species that can degrade a savanna such as leafy spurge, and Canada thistle that often encroach and become dominant as woody invasives are removed. Cutting, pulling, and in some cases chemical treatment can be used to reduce these species. Biocontrol agents can also be used to reduce leafy spurge.

Caution should be used before enhancing prairie remnants with additional seeding.

In areas with a remnant seed bank, extreme caution should be taken before supplementing with additional seed. In most cases, it is necessary to wait several years after intense management

before making a decision to seed. Seeding with an annual cover crop after intense invasive species removal may be appropriate to carry a prescribed fire through the restoration area, and to help promote a response from the native seed bank. If seeding native species is found to be necessary, the first priority should be to collect seed from a nearby savanna or prairie remnant habitat.

Acquire remnant native prairie of any size, especially where adjacent to other refuge prairie habitat, to increase habitat for grassland dependent species.

There is little high quality native remnant prairie located on and adjacent to the Refuge. Since there is so little remaining, it is important to consider even adding small areas of native prairie remnant to the refuge to add to the prairie acreage. Even small plots of remnant prairie can provide a refuge to grassland dependent birds, monarchs and other pollinators, and reptiles, however many of the species do prefer larger block size. Priority should be to acquire blocks that already are adjacent to refuge land, to add to the block size.

Provide defoliation treatment (burning, grazing, haying or mowing), on a 3-7 year cycle to promote native grasses and forbs.

Frequent management will be needed to keep woody vegetation from invading into a remnant prairie. Since prescribed fire is dependent on specific weather conditions, other management method.

4.2.7.3 Planted Dry Grassland (Priority 2 Habitat)

Planted Dry Grassland Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of planted dry grassland within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 4).*

Planted Dry Grassland Objective:

Restore, enhance, and manage 80% of the existing 183 acres of planted dry grassland over the next 15 years to provide a mosaic of vegetation heights through management actions such as mowing, burning, or a custom seed mix for nesting grassland bird species such as Bobolink, Grasshopper Sparrow, Lark Sparrow, waterfowl species such as Mallard, foraging Northern Harrier, and the full life cycle habitat requirement of plain's hog-nosed snake and monarch butterfly.

Existing and newly planted dry grassland will have the following:

1. Cover is dominated by at least 75% native species. Graminoid coverage is patchy to contiguous at 50 to 100%; forb cover is sparse to patchy at 5 to 50%. Cover of non-native species such as smooth brome and Kentucky blue grass is < 25%.
2. Litter depth ranges between 0 and 6 inches.
3. Native trees and shrubs > 3.3 feet tall will comprise < 5% of the total vegetative cover.
4. Up to 30% of the existing planted dry grassland will be less diverse (< 15 species), but will provide vegetative structure and litter depths for a variety of grassland-dependent species.
5. At least 70% of the existing 183 acres of dry planted grassland will be enhanced to promote native species diversity, which, as measured by species richness, will increase

by at least 15 species through management techniques, custom seed mix selection, and over seeding.

a. Seed with a high diversity mix where forbs comprise at least 20% of the mix (seeds/ft^2). A minimum of 20 forb species and 5 grass species should be represented in the seed mixes to promote structural and species diversity that bloom throughout the growing season.
b. Planted dry grassland seedlings should express at least 50% of the planted seed mix within five growing seasons.
c. Eradicate, reduce, or prevent expansion of invasive plants and animals that have impacts on native plant diversity and natural community integrity to < 20% of total vegetation cover within 3 years after establishment.

*Focus areas for planted dry grassland are located in Appendix D, Table 2. This is a priority 2 habitat and will not be managed annually, however, all of our planted grasslands will be managed on a rotational basis within the 15 years of this plan.

4.2.7.4 Planted Wet/Mesic Grassland (Priority 2 Habitat)

Planted Wet/Mesic Grassland Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of planted wet/mesic grassland within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 2).*

Planted Wet/Mesic Grassland Objective:

Restore, enhance, and manage 80% of the existing 394 acres and newly acquired planted wet/mesic grassland in the next 15 years to achieve the following conditions:

Existing and newly planted wet/mesic grassland will have the following:

1. Cover is dominated by at least 75% native species. Cover of graminoids is contiguous (75 to 100%); and forb coverage is sparse to patchy at 5 to 50% of total cover.
2. Litter depth ranges between zero and 6 inches.
3. Native trees and shrubs > 3.3 ft. tall will comprise < 5% of the total vegetative cover.
4. Up to 30% of the existing planted wet/mesic grassland will be less diverse (< 15 species), but will provide vegetative structure and litter depths for a variety of grassland-dependent species.
5. At least 70% of the existing 394 acres of planted wet/mesic grassland will be enhanced to promote native species diversity, which, as measured by species richness, will increase by at least 15 species through management techniques such as prescribed burning, custom seed mix selection, and overseeding.
    a. Seed with a high diversity mix where forbs comprise at least 20% of the mix (seeds/ft^2). A minimum of 20 forb species and 5 grass species should be represented in the seed mixes to promote structural and species diversity that bloom throughout the growing season.
    b. Planted wet/mesic grassland seedings should express at least 50% of the planted seed mix within five growing seasons.

c. Eradicate, reduce, or control invasive plants (such as reed canary grass) and animals that have impacts on native plant diversity and natural communities to < 20% of total vegetation cover within three years after establishment.

*Focus areas for planted wet/mesic grasslands are located in Appendix D, Table 2.

Planted Dry and Wet/Mesic Grasslands Rationale:

The Refuge contains approximately 183 acres of planted dry grassland and 394 acres of planted wet/mesic grassland (Table 2-1). Under current mapping techniques, it is difficult to delineate between remnant prairies and old-field grasslands due to the degraded quality of remnant prairies. In general, the majority of the grassland habitat on the Refuge is believed to be remnant, but is in varying stages of degradation. Over the next 15 years, the resources dedicated to prairie and grassland management will be primarily focused on the remnant prairies first, and then as opportunities and resources become available, shifted towards the planted grasslands. Remnant prairies that will received management focus are listed in Appendix D, Table 1. However, we will still manage our planted grasslands through techniques such as prescribed burning to set back tree invasion. Planted grasslands receiving management focus are in Appendix D, Table 2 since they are a priority 2 habitat.

Planted grassland on the Refuge consist of areas that were likely prairie at one point before being cropped or converted to another land cover for a period of time and were restored back to native species before or after the Refuge took over ownership or management. The intent of planted grassland is to provide grassland habitat composed of native plant species to benefit wildlife resources and improve the ecological integrity of the Refuge. In most cases, plantings are considered prairie restorations, if at least a portion, if not all, of the seed mixes are based on the natural or remnant prairie plant community. It is considered a Priority 2 habitat for the Refuge as it is limited in size and requires a lot of resources to maintain in a desired condition.

The Refuge has actively planted prairie species in old crop fields in management units and easements for many years. Most early plantings used a low diversity seed mix composed primarily of warm season grasses such as big bluestem, little bluestem, switch grass, sideoats grama, Canada wild rye, and a handful of native forbs like black-eyed Susan and wild bergamot. Recently, the Refuge has been using higher diversity seed mixes with more forbs to increase the ecological integrity of grassland restorations, prevent and reduce invasive species, increase the habitat suitability for pollinators and provide habitat for a larger suite of grassland-dependent wildlife and organisms. The Refuge plans to continue to use high diversity seed mixes customized to match the hydrology and individual site conditions in future grassland restorations. Based on management and monitoring results of remnant prairies in the Upgrala Unit, achieving the species diversity outlined in the objective will likely be possible. See the Remnant Prairie rationale for additional information.

Planted grassland habitat on the Refuge requires resources for maintenance and enhancement. It is well understood by land managers that prairies take several years to become "established" and that "weediness" is a common challenge the first few years. Schramm (1990) discussed four different stages of prairie establishment, with black-eyed Susan and other prairie annuals in the

first stage (years 1 through 3), yellow coneflower and false sunflower in the second stage (years 2 through 5), rattlesnake master and compass plant in the third stage (years 6 through 12), and finally lead plant and prairie dropseed in the fourth stage (years 13 through 20 plus). During the "weediness" that is associated with the first stage of prairie restoration, invasive species are one of the primary issues that need to be addressed. Success in achieving the desired conditions in both new plantings and enhanced plantings will demand significant investments of time and labor. Science and experience suggests, however, that once established, high diversity prairies offer greater resistance to invasive species (Bakker and Wilson 2004; Larson et al. 2013). Without control, invasive species can degrade habitat quality for resources and require additional Refuge resources to rehabilitate to a suitable condition.

The planted grasslands of the Refuge along with contributions from remnant prairie provide the opportunity to address two habitat issues facing grassland-dependent wildlife today; 1) the lack of suitable plant species composition and structure and 2) adequate habitat patch or block size that was discussed in the rationale for remnant prairie. For breeding birds, vegetation structure (height, density, patchiness, and canopy) are more important factors of habitat quality than the actual plant species (Nickens 2010). However, some native invertebrate pollinators such as the monarch butterfly are responding to the actual plant species composition for feeding and reproductive habitat.

With the priority on remnant prairie management, it will not be possible over the lifetime of the HMP to restore and maintain all the existing planted grassland habitat in a state of highly diverse, native species. Over the foreseeable future, a portion of both the planted dry and wet/mesic grassland habitat will be dominated by non-native species such as smooth brome and Kentucky bluegrass (dry) and reed canary grass (wet/mesic). Although this is not a preferred state, these habitats do provide nesting cover for grassland-dependent waterfowl such as Mallards and blue-winged teal. Maintaining this habitat to provide the appropriate litter depth and limiting or reducing either woody vegetation and/or other invasive species that degrade nesting habitat quality will be a management focus as resources allow. The Refuge would consider increasing management activities or enhancing these habitats if more resources were available and Priority 1 habitats were in a condition to meet their objective's criteria.

Similar to remnant prairie, planted grasslands benefit a suite of grassland bird species including Bobolink, Grasshopper Sparrow, Lark Sparrow, Northern Harrier; and nesting waterfowl including Mallard. Because this habitat will receive less frequent management, species that prefer deeper litter and relatively undisturbed grasslands such as Grasshopper Sparrows and Northern Harriers, will likely be more abundant in this habitat (Duebbert and Lokemoen 1977; Kantrud and Higgins 1992). Lark Sparrow prefers a variety of grassland and woodland edge habitat conditions (Martin et al. 2000) and represents species that will benefit from the increased woody vegetation resulting from frequent management actions in planted grasslands.

Planted Dry and Wet/Mesic Grasslands Management Strategies:

<u>Use prescribed fire to reduce cool season invasive grasses when the target species are actively growing but before native warm season species are present.</u>

Prescribed fire can be used to set back smooth brome and is the best strategy for reducing/killing Kentucky bluegrass. Also use fall burns (September-December) to control and set back woody species.

Incorporate grazing according to the Refuge's Agricultural Management Plan in suitable areas to control species such as smooth brome, reed canary grass, Canada thistle and other species.

Prescribed grazing is used to mimic the natural effects and ungulate and other grazing wildlife that were present during pre-settlement times. Grazing can be an effective management tool, but careful planning on the timing and species of livestock used needs to occur in order to be successful. Specific details about Refuge grazing is found in the Refuge Agricultural Management Plan.

Control invasive and non-desirable plant species through integrated pest management including cutting, mowing, herbicide treatment, biological control, prescribed fire, and potentially grazing, to promote growth of native grasses and forbs.

As addressed above, non-desirable woody vegetation can shade out native species and it is important to cut and treat these species either by hand-cutting or by use of equipment. There are also other species that can degrade a grassland such as leafy spurge and Canada thistle that often encroach as woody invasives are removed. Smooth brome and Kentucky blue grass also can degrade dry areas, and reed canary grass can often quickly dominant wet/mesic grasslands. Cutting, pulling, and in some cases chemical treatment can be used to reduce these species. Biocontrol agents can also be used to reduce leafy spurge.

Control woody vegetation through a combination of mowing, cutting, other defoliation techniques, prescribed fire, and herbicide application.

Historically, natural disturbances such as fire and grazing maintained an herbaceous-dominated vegetation community in prairie habitat. As those natural disturbances have been suppressed, trees have encroached in grasslands throughout Minnesota. Although prescribed burning, grazing and mowing can be used to control woody vegetation, once the trees get larger these techniques are less effective.

Larger trees in prairies are often hand cut or cut by equipment. Often contractors can be used to brush mow, cut, shear and grind woody species that are just getting established into grasslands. Depending on the size and abundance of the trees, the wood is either removed from site or scattered and burned throughout the site. When removed from the site the trees are often chipped and the wood is used for pulp or biofuels. Stumps are treated immediately with a triclopyr to prevent resprouting.

Provide defoliation treatment (burning, grazing, haying or mowing), on a 3-7 year cycle to promote native grasses and forbs.

Frequent management will be needed to keep woody vegetation from invading into prairie habitats. Since prescribed fire is dependent on specific weather conditions, other management methods like cutting or grazing may need to be used to keep woody species from colonizing.

Use high diversity, local seed sources (< 150 mile radius) whenever possible for prairie restoration, with the seed mix containing at least 50% of the species listed in the MNDNR's Natural Plant Communities Field Guide (MNDNR 2005).

Refuge lands may be cropped upon acquisition, so the first step is to restore or plant native vegetation at these sites. In some instances, previously planted grasslands become so infested with noxious weeds that the most efficient restoration approach is to start over and re-seed the site. Selection of species to be planted and local sources of seed (< 150 mile radius) is a critical step in restoration of grassland habitat. While many species of grass and forbs are commercially available for grassland restoration, few are from local sources. Using local ecotype seed is important in restoration as plants have wide genetic diversity and differing photoperiods across geographic areas. To determine the appropriate seed mix for an area, we will use the guidelines from the Natural Plant Communities Field Guide (MNDNR 2005), specific refuge guidance, state statutes, soil type, and regional maps.

Use appropriate seeding methods and timing for optimal success.

Broadcast seeding followed by culti-packing is used to increase seed to soil contact. Seeding can be done in late fall (October) through late spring (June). One broadcast technique used more commonly is over snow seeding in February-March with a Vicon broadcast seeder to mimic natural processes. Another method of seeding warm season grasses is with a no-till drill. Whether drilling or broadcasting on tilled soil, it is essential to culti-pack the seeding to improved seed to soil contact. Each seeding is designed specifically for each site, taking into consideration soil type and other factors. Forb species are selected to ensure blooming throughout the growing season to provide food for pollinators.

Monitor the effectiveness of management strategies and adjust using adaptive management techniques.

Monitoring of plantings will be important to make sure we are reaching desired goals. If desired species are not being expressed, adaptive management techniques will be incorporated to increase the quality of the seeding.

4.2.8 Remnant Oak Savanna (Priority 1 Habitat)

Remnant Oak Savanna Goal:

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant oak savanna within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 4).*

Remnant Oak Savanna Objective:

Restore, protect, and manage 70% of the existing 356 acres of oak savanna throughout the Minnesota Valley NWR over the next 15 years to achieve the following conditions:

1. Oak trees cover < 70% (typically 25 to 50%) and are scattered individuals or small clumps, with the shrub layer typically patchy (25 to 50% cover) of low (< 20 inches) and taller (> 6 feet tall) shrubs. Low shrubs consist of leadplant and prairie rose while chokecherry, American hazelnut, and smooth sumac are the most important tall shrubs.

2. Graminoid cover is patchy to continuous (25 to 100%) with little bluestem, and porcupine grass generally dominant. Taller grasses such as big bluestem and Indian grass are often common. Forb cover is sparse to patchy (5 to 50%), with western ragweed, Virginia ground cherry, gray goldenrod, white sage and other species represented.
3. Eradicate, reduce, or control invasive plants that have impacts on native plant diversity and natural communities to < 50% of total vegetation cover.
4. Reseed only after many attempts of burning (may take up to 10+ years) if native species cover does not increase. If seeding needed, collect native seed from adjacent site.
5. Native oak tree seedlings are naturally recruited in savanna habitats.
6. Dead standing trees and dead branches on live trees (snags) will be present to provide habitat for red-headed woodpeckers and other cavity nesting species. Red-headed woodpeckers are most common in oak savannas and prairie-forest transition areas; also found in bottomland hardwood forests. It nests most often in cavities of dead trees, but also will use cavities in living trees. Densities average 12 birds/km2 (12 birds/247.11 acres) with maximum densities reaching 60 birds/km2 (60 birds/247.11acres) (Potter et al. 2007).
7. Management activities will target existing savanna remnant projects that have already been started, areas where significant benefits could be achieved for little effort and where large blocks of savanna exist or can be restored on the Louisville Swamp, Rapids Lake, St. Lawrence and Wilkie Units (Appendix D, Table 1).

Remnant Oak Savanna Rationale:

Savanna represents a transition habitat between the western prairie and the eastern forests as increased average annual precipitation moving to the east provides favorable conditions for the establishment and maintenance of trees (Anderson 1998). Historically, savanna covered between 27 million and 32 million acres in the Midwest including 4.5 million acres in Minnesota prior to European settlement (Marschner 1974; Wendt 1983; Nuzzo 1986). Currently only 0.02% of intact savanna exists throughout the pre-settlement range in the Midwest (Nuzzo 1986). Savanna was lost during and following settlement due to fire suppression, overgrazing and then lack of grazing, cropland conversion, and invasive species establishment (Anderson 1998).

The MNDNR's Natural Heritage Program defines savanna as a grassland community with single or clumped trees with a tree cover of 10 to 80% (Wendt 1983). Refuge remnant oak savanna is UPs14 (Southern Dry Savanna) or UPs24 (Southern Mesic Savanna). UPs14 is a sparsely treed community with patchy to continuous graminoid cover (25 to 100% with mid-height grasses being most important).It also has sparse to patchy forb cover (5 to 50%). The shrub layer is patchy (25 to 50% cover), and trees consist of scattered oak trees (bur oak being the most common, but also northern pin oak) as individuals or in clumps (< 70% total cover, more typically 25 to 50%). Climbing plants and vines such as wild grape are frequently present (MNDNR 2005). UPs24 is similar to Ups14, except that the shrub layer is more developed and is more susceptible to succession by trees and shrubs following fire suppression and lack of grazing due to higher soil moisture and potential productivity (MNDNR 2005).

The Refuge contains approximately 356 acres of oak savanna. Approximately 85% of the oak savanna acreage is on four management units having between 50 and 100 acres each (St.

Lawrence, Louisville Swamp, Wilkie and Rapids Lake, in decreasing order) (Table 2-1). Five management units have 30 acres or less of oak savanna habitat while the Black Dog, Jessenland, Round Lake and San Francisco management units do not have any oak savanna habitat (Table 2-1).

Much of the Refuge savanna habitat is degraded by buckthorn and other woody invasive species, as well as native trees (such as red cedar) and shrubs (sumac sp.) that have dominated in the absence of frequent fires and grazing. Additionally, fire suppression and the lack of grazing allowed for additional tree establishment, converting the open-canopy savanna into a closed-canopy woodland, as has been common throughout Minnesota (MNDNR 2005). Reducing woody invasive species and native trees and shrubs that prevent light penetration will help promote native graminoid and forb growth. The desired outcome of savanna restoration on the Refuge will be to decrease invasive species, increase native species, and increase the fire-adapted (heliophile) plant species in the understory such as kittentails.

Although highly impacted from lack of management, research indicates that savanna restoration may be possible, as savannas appear to be highly resilient once ecological processes are restored (Brudvig and Asbjornsen 2009). Savanna restoration includes providing frequent fires, internal environmental patchiness, low competition from native C_4 grasses, a mosaic of sunny and shady microsites (Leach and Givnish 1999) and reducing woody vegetation encroachment (Brudvig and Asbjornsen 2009). To achieve these conditions, a combination of returning the ecological drivers that historically maintained oak savanna (fire, haying and grazing) and management actions to return the altered habitat to a more natural state (tree harvest, invasive species control, and seeding) will be required. The first step in many cases will be to remove the buckthorn and other woody invasive species followed by a thinning of the canopy. Historically, frequent, low intensity fires in savannas reduced the woody understory vegetation while creating grubs (oak re-sprouts generated from massive and potentially old root stocks). Infrequent, large, high-intensity fires created or maintained canopy openings, which provided gradients in sunlight and soil moisture (Bowles and McBride 1998). Unfortunately, large fires to create the canopy openings is not a likely management option, but can be done on a smaller scale. However, the Refuge does have experience using tree harvest techniques to create forest openings after woody understory vegetation is mechanically removed. In addition to tree removal, fire should be used to help restore the savanna. A short-term study in Michigan indicated that a combination of burning and thinning produced an increase in light at the ground level, higher forb bloom abundance and diversity, and a decrease in shrub and canopy cover over burning alone (Lettow et al 2014). Peterson and Reich (2001) reported that a fire frequency of three or more times per decade in savanna habitat in Minnesota's Anoka Sand Plain prevented the development of the sapling layer and canopy ingrowth. Low-frequency burning (fewer than two fires per decade) produced stands with dense sapling thickets. To maintain savanna prescribed fire should be frequent to decrease saplings, but balanced to achieve additional objectives for native grasses and forbs.

Savanna restoration requires patience. Previous Refuge experience indicates that it may take several years or more of management to determine whether the restoration is successful. In areas with a remnant seed bank, extreme caution should be used when considering whether to enhance the restoration through additional seeding. In most cases, it may be necessary to wait several

years after intense management before making a decision to seed. Seeding with an annual cover crop after intense invasive species removal may be appropriate and necessary to carry a prescribed fire through the restoration area and to stimulate a response from any native seed bank. If seeding native species is necessary, an attempt to collect native seed from nearby savanna or remnant prairie habitats should be made.

Historically, oak savanna and prairie were intermingled resulting from the interplay of environmental conditions, annual and period trends in precipitation, and disturbance (intensity and time of recovery). Contemporary management, both prior to Refuge establishment and by Refuge management activities such as fences and fire breaks, has resulted in distinct breaks between the two habitats. One desired outcome is to "soften" the edges between oak savanna and prairie on the Refuge. One strategy is to establish young oak trees in prairie areas adjacent to savanna restoration areas. It may be necessary to reduce frequency of fire, modify the burn timing, and other management techniques in these areas to "feather" natural oak recruitment into these areas. Tree planting of native oak species may be needed to further restore these habitats to savanna.

The environmental gradients in sunlight, soil moisture, and nutrient cycling found in oak savannas are important for supporting high plant diversity (Leach and Givnish 1999; Brudvig and Asbjornsen 2009). Remnant savannas totaling < 125 acres in Wisconsin support one-quarter of the native plant species in Wisconsin (Leach and Givnish 1999). Kittentails, a state threatened species, is present in some Refuge oak savannas where canopy openings allow enough sunlight penetrate to the savanna floor. The environmental gradients that result in high plant diversity also provide habitat conditions that make oak savannas important as wildlife habitat. Grundel and Pavolvice (2007) found that more bird species were found in higher densities in savannas than in grasslands, shrublands and forests. Bird species such as red-headed woodpecker and northern flicker are attracted to one or more distinctive habitat features of savannas including scattered mature trees, standing dead trees (snags), and presence of both shrubby and grassland vegetation. Davis et al. (2000) reported that savanna in Central Minnesota restored through burning alone resulted in a decrease in insectivorous birds that use the upper canopy (leaves and air space), but an increase in omnivorous birds that use the ground layer and lower canopy such as Baltimore Oriole, Eastern Kingbird, Vesper Sparrow, Field Sparrow, and Lark Sparrow.

Red-headed Woodpecker is one species that will benefit from savanna restoration on the Refuge. It is a habitat specialist that requires a savanna-type landscape, characterized by a large open landscape with an open understory and small clusters of mature trees (www.redheadrecovery.org). The presence of large dead trees or "snags" with large limbs to accommodate cavities for nesting, roosting, and food-caching activities is a key component to quality red-headed woodpecker habitat (www.redheadrecovery.org). In a study in a Wisconsin savanna, red-headed woodpeckers selected snags and trees with greater dead limb length and nested in areas with greater basal area, cavity density, snag density, limb-tree density and total dead limb length (King et al. 2008). The reported optimum density of snags per acre varies widely from 2 to 13 snags/acre. However most agree that Red-headed Woodpeckers respond negatively to snag removal. At Cedar Creek, the birds also tended to prefer trees with an average dhb of 14-16 inches (www.redheadrecovery.org).

A reduction in the tree canopy through tree harvest will be necessary for savanna restoration. Impacts to Red-headed Woodpeckers would occur as the result of removal of existing and future snag trees. One possible management strategy may be to leave more trees standing after the initial harvest operations and then kill the standing trees over time to provide a continual recruitment of snags for cavity nesters like Red-headed Woodpeckers (Dickson et al. 1983). In addition, leaving some dead, fallen material will provide habitat for other savanna species such as reptiles that use the decaying material for foraging and cover.

Although much of the oak savanna on the Refuge is severely degraded or has been fragmented, it is important to restore and protect this habitat as it is difficult to replace. Many species such as Red-headed Woodpeckers, Northern Flickers, kitten-tails, and several species of reptiles depend on this habitat. To maximize oak savanna acreage, it will be necessary to work with partners on restoration and protection of this rare habitat. Oak savanna restoration is a long process and will take many years of intensive management. Appendix D shows where the Refuge will focus on savanna restoration actions over the next 15 years.

Remnant Oak Savanna Management Strategies:

Define and map restorable remnant oak savanna on Refuge lands.

Although areas of oak savanna have been identified in this HMP (Appendix D, Table 1), it will be important to delineate actual areas needing restoration and come up with a management plan for the area within the first ten years of this plan.

Remove wood understory vegetation and in some cases canopy trees, to achieve the desired canopy cover outlined in the objectives. Use a combination or hand crews and mechanical removal based on the slope and soil characteristics of the site. Contractors may need to be consulted for work on steep slopes.

In most cases, the understory of our savannas is choked with invasive species such as buckthorn and honeysuckle. However, some savannas may also have native trees that grow quickly and increase the canopy cover and shade out native grasses in forbs. In some cases we need to remove native species that are impeding the oak savanna restoration. For example, the Rapids Lake savanna has been encroached with fast growing pin oak trees. It may be necessary to remove fast growing pin oak in areas where there are dominating the subcanopy, in order to decrease canopy cover and prevent shading of native grasses and forbs. Stumps will be treated to prevent re-growth. Cedar trees and sumac can also have this effect in the understory. It is important however, to maintain snags and dead downed woody vegetation for use by wildlife such as woodpeckers. A useful technique is to girdle non-desirable trees and leave them standing for wildlife use.

Burn oak savanna areas frequently (several times per decade) using varied timing to decrease invasive and non-desirable species and promote native grasses and forbs.

Although initial oak savanna restoration efforts incorporate cutting and treatment of invasive species and other non-desirable woody species, it is important to maintain these restorations with fire. Prescribed fire is an important management tool that can be used to prevent woody encroachment and promote native species. Fire should be conducted frequently and at varied times of the year. Even patchy burns can provide important openings for native species.

Control invasive species through integrated pest management including hand cutting, mowing, spraying, fire, and potentially grazing, to promote growth of native grasses and forbs.

As addressed above, non-desirable woody vegetation can shade out native species and it is important to cut and treat these species either by hand-cutting or by use of equipment. There are also other species that can degrade a savanna such as leafy spurge and Canada thistle that often encroach as woody invasives are removed. Cutting, pulling, and in some cases chemical treatment can be used to reduce these species. Biocontrol agents can also be used to reduce leafy spurge.

Work with partners to pursue grant funding to complete restoration work.

Oak savanna can take many years to restore. It is often difficult to find enough resources to complete the restoration since it is a long process. In most cases we do not have the staff resources, equipment or expertise to complete the restoration on steep slopes. Working with partners to obtain grants for restoration work on savannas is critical, so resources can be pooled rto make progress on oak savanna restorations on a larger scale. In some cases restoration projects may need to be prioritized based on the availability of partnerships.

Protect areas containing sensitive kittentail plants.

Kittentails are a State threatened species that are found in some Refuge oak savanna areas where canopy openings allow enough sunlight to penetrate to the savanna floor. Removing encroaching woody vegetation will benefit the kitttentail. Extra care should be taken when cutting and treating near known kittentail populations (tracked in GIS). Tree and brush removal and chemical treatment should be restricted to hand-cutting only in the dormant season.

Use caution before supplementing grassland areas through additional seeding.

Savanna restoration requires patience. In areas where a remnant seed bank is present extreme caution should be taken before supplementing with additional seed. In most cases it is necessary to wait several years after intense management before making a decision to seed. Seeding with an annual cover crop after intense invasive species removal may be appropriate to carry a prescribed fire through the restoration area, to help promote a response from the native seed bank. If seeding native species is found to be necessary, the first priority should be to collect seed from a nearby savanna or prairie remnant habitat.

Promote recruitment of oak trees into planted grasslands adjacent to current savanna habitats, to soften artificial breaks between savanna and grassland habitats. This can be accomplished by reducing frequency or timing of prescribed fire.

Many of our savanna restoration areas have been delineated based on fire breaks or fence lines, where savanna is on one side of the break and planted grasslands or prairie on the other. Historically oak savanna and prairie were intermingled. Removing artificial fence lines and fire breaks that dissect savanna and promote establishment of young oak trees will add to our savanna habitat.

4.2.9 Rock Outcrop (Priority 2 Habitat)

Rock Outcrop Goal:

To restore, protect, and maintain natural species and geologic diversity while supporting priority wildlife and plants characteristic of rock outcrop within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 4).*

Rock Outcrop Objective:

Over the next 15 years, protect and maintain at least 5 acres of rock outcrop habitat on the Louisville Swamp Unit to prevent disturbance, development and degradation by invasive species (Appendix D, Table 2).

1. Tree and shrub cover is absent to sparse (0 to 25%). Desirable shrub species include sand cherry and blackberries. Open-grown oak trees, especially bur oak, are often present on bedrock outcrop complexes.
2. Herbaceous plant cover is sparse to patchy (5 to 50%). Characteristic species in crevices and areas with shallow soil (< 1 inch deep), where biomass is low, include small-flowered fameflower, brittle prickly pear, and rock spikemoss. Areas with deeper soil between bedrock exposures have great plant biomass and support many prairie species, including blue grama, little bluestem, big bluestem, harebell and prairie wild onion.
3. Lichen and brypophyte cover is high. On exposed bedrock, crustose and foliose lichens predominate.

Rock Outcrop Rationale:

Southern bedrock outcrop (ROs12) consists of dry, open lichen-dominated plant communities on areas of exposed bedrock (see Appendix D, Table 2 for known location). Woody vegetation is sparse, and vascular plants are restricted to crevices, shallow soil deposits, and rainwater pools. In general, rock outcrop habitat is high lichen and bryophyte cover, sparse to patchy herbaceous cover (5 to 50%), with tree and shrub cover absent to sparse (0 to 25%; MNDNR 2005). Characteristic species in crevices and areas with shallow soil may include small-flowered fameflower, brittle prickly pear and rock spikemoss.

Very little is known about the distribution and condition of this habitat on the Refuge. To protect and understand the distribution and condition of this rare habitat, areas need to be mapped and evaluated to determine their condition. Our priority would is to start on rock outcrop habitat on the Louisville Swamp unit, since this has been identified by the MNDNR as rare habitat with fragile cactus species The Refuge will consult with partners such as the MNDNR, when managing these areas and the unique plants associated with this habitat.

Rock Outcrop Management Strategies:

<u>Map and evaluate Southern Bedrock Outcrop on the Refuge to determine the ecological condition beginning with the Louisville Swamp Unit within the first 10 years of this plan.</u>

Map all areas of bedrock outcrop habitat. Develop detailed plans to protect this unique Refuge resource.

Protect rare rock outcrop habitat from degradation resulting from disturbance or development.

Some of the plants that occupy rock outcrop habitat can be fragile. Care should be taken to project these areas from development including roads, structures and trails. Management techniques such as cutting, herbicide treatment and prescribed fire should be reviewed by the biologist to make sure there is adequate protection of rare or fragile species.

Monitor rock outcrops invasive species. Control invasive plants to < 10% of total vegetation cover.

Since rock outcrop is a unique habitat, encroachment from all invasive species should be discouraged. Staff and volunteers conducting treatments must be trained on how to spot a rare plant, and how to safely treat the area without impacting the plant community.

CHAPTER 5.

IMPLEMENTATION

5.1 Introduction
5.1.2 Habitat Management Prioritization

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5. IMPLEMENTATION

5.1 INTRODUCTION

5.1.1 Priority 1 and 2 Work Areas and Implementation of the Management Activities

The goals, objectives, and strategies outlined in chapter 4 describe overall desired future conditions of the Refuge habitats along with elements of what habitat management success should look like (objectives) and management activities that can be used to achieve the objectives. As part of the HMP process, Refuge staff spent considerable time reviewing information about the Refuge and HMP objectives to develop a table and supporting maps that identify areas within the Refuge where management activities to support Priority 1 and Priority 2 habitats will occur (Appendix D). This process was completed by reviewing existing habitat conditions in conjunction with rare species maps (Appendix F) and identifying locations where management could restore, enhance or protect Priority 1 habitats based on information about native plant communities of Minnesota (MNDNR 2005).

This information will be used to develop Annual Habitat Work Plans and plan management activities over a period of years. Table 5-1 provides a road map to implement the HMP in phases over the next 3, 5, and 10 year periods to achieve the objectives outlined in chapter 4. Management strategies and direction may change as new information is developed such as the results of an HGM assessment or new ways to control invasive species. Table 5-1 outlines management target activities throughout the HMP and these targets generally align with information in Appendix D.

5.1.2 Habitat Management Prioritization

Although this HMP will help prioritize work over the next 15 years, a timeline still needs to be established. For this prioritization, timeline concentration will be on projects within Priority 1 habitats only. Work may be done on Priority 2 habitats, if additional resources are obtained or under the direction of new Service initiatives. Outlined below are Refuge priorities discussed in management phases. The first phase will be projects recommended to be completed within the first 5 years of this plan, phase two projects will occur within the second 5 years of the plan, and phase three projects will be initiated within the later 5 years of the plan.

Table 5-1. Habitat management implementation priorities over the next 5, 10, and 15-year time periods.

Objectives	Implementation Priorities
Phase 1 – Within 5 Years	
4.2.1 Minnesota River and Tributaries	Within the first 5 years of this plan, gather information to better understand the hydrology of the Minnesota river and its effect on Refuge resources. This information is key to setting the direction for many Priority 1 habitats.
4.2.3.1 Deepwater Wetlands	Manage approximately 16 acres of deepwater wetland habitat at Cedar, Hogback and Youth Fishing Ponds for native fish species and diverse habitat for water dependent wildlife according to management plans developed in partnership with the MNDNR's Fishing in the Neighborhood Program.
4.2.3.2 Permanent/Semi-Permanent Wetlands	Where current infrastructure allows, continue managing water levels on up to 1,900 acres of semi-permanent and permanent wetlands to provide a mosaic of habitats on the Refuge for waterfowl, shorebirds, wading birds and other waterbirds. Wetlands are listed in Appendix D, Table 1, and include: Long Meadow Lake, Orchard Springs, Hogback Marsh, Kidder Marsh, Rice Lake, Chaska Lake, and Jailhouse Marsh. Assess condition of current water control infrastructure to determine if it capable of meeting our habitat goals for each basin.
4.2.4 Fen/Wet Meadow, Carr	Prevent invasive species and undesirable woody encroachment and disturbance from Refuge trails on small white lady slipper populations on the Black Dog Unit.
4.2.5 Floodplain Forest	Let the Chaska Moist Soil Unit and areas along the Minnesota River (124 acres) revert to floodplain forest through natural succession to add to the block size of floodplain forest in this area. Protect areas of floodplain forest designated as rare communities by the MNDNR such as the 1,488 acres on the Blakeley and Jessenland Units and the 77 acres on the Bloomington Ferry Unit. Determine areas on the Refuge where block size is > 250 acres and investigate areas where block size could be increased through acquisition or manage agreements.

Objectives	Implementation Priorities
4.2.7.1 Remnant Dry Prairie	Protect and manage 58 acres of remnant dry prairie at the Upgrala and Rapids Lake Units to promote and protect native species through invasive species control and prescribed burning.
4.2.7.2 Remnant Wet/Mesic Prairie	Protect and manage remnant wet/mesic prairie at the Black Dog and St. Lawrence Units to promote and protect native species through invasive species control and prescribed burning.
4.2.8 Remnant Oak Savanna	Manage and initiate restoration on over 160 acres of degraded oak savanna habitat on the Rapids Lake and Louisville Swamp Units. Work will included removal and treatment of undesirable woody species and prescribed burning.
Phase 2 – Within 10 Years	
4.2.1 Minnesota River and Tributaries	Use information gathered on hydrology of the Minnesota River to guide future water management and habitat restoration on the Refuge. This information will help us determine where to prioritize water management and restoration activities based on the feasibility and chance of success.
4.2.3.1 Deepwater Wetlands	Maintain deepwater habitats at Cedar, Hogback and Youth Fishing Ponds and look for opportunites to develop additional deepwater habitats at Round Lake and on Horseshoe and Long Lake on the Rapids Lake Unit.
4.2.3.2 Permanent/Semi-Permanent Wetlands	Make improvements and repairs of water control infrastructure for high priority wetlands identified during infrastructure and hydrologic assessments conducted during the first 5 years of this plan. May include basins such as Jab's Farm, Blue Lake or Fisher Lakes that had failing infrastructure at the time this HMP was initiated.
4.2.4 Fen/Wet Meadow, Carr	Delineate specific habitat types using data from hydrology assessments conducted in first 5 years and continue invasive species control on fen, wet meadow, carr and mesic prairie mosaic habitats at the Black Dog and St. Lawrence Units, especially where small white lady slipper populations and other rare wet meadow/prairie species are observed. Protect wet meadow habitat at the Jessenland Unit and determine if restoration is needed.

Objectives	Implementation Priorities
4.2.5 Floodplain Forest	Continue protection of floodplain forest designated as rare communities by the MNDNR such as the 1,488 acres on the Blakeley and Jessenland Units and the 77 acres on the Bloomington Ferry Unit. Design and conduct a snag inventory to determine habitat quality for cavity nesting birds.
4.2.7.1 Remnant Dry Prairie	Continue invasive species control and fire management in the Upgrala Unit remnant prairie and Rapids Lake goat prairies based on collected vegetation monitoring data.
4.2.7.2 Remnant Wet/Mesic Prairie	Delineate specific habitat types using data from hydrology assessments conducted in first 5 years and continue invasive species control on fen, wet meadow, carr and mesic prairie mosaic habitats at the Black Dog and St. Lawrence Units. Same as Fen/Wet Meadow/Carr habitat described above.
4.2.8 Remnant Oak Savanna	Maintain restoration areas at the Rapids Lake and Louisville Swamp savanna restoration areas through burning and control of invasive species. Initiate restoration for an additional 120 acres of savanna adjacent to the Rapids Lake and Louisville Swamp areas that were begun in the first five years of this plan (Appendix D, Table 1).
Phase 3 – Within 15 Years	
4.2.1 Minnesota River and Tributaries	Continue repair and installation of infrastructure identified as high priority in hydrology assessment conducted in the first 5 years of plan implementation (see this also under permanent/semi-permanent wetlands).
4.2.3.1 Deepwater Wetlands	Initiate management timeline for high quality deepwater habitats if identified as high priority during hydrology and infrastructure assessments conducted prior to year 10 of this plan.
4.2.3.2 Permanent/Semi-Permanent Wetlands	Continue repair or installation of water control infrastructure for high priority wetlands identified in hydrology and infrastructure assessments conducted in the first 10 years of plan implementation. May include Continental Grain Marsh and other basins with failing infrastructure (Appendix D, Table 1).

Objectives	Implementation Priorities
4.2.4 **Fen/Wet Meadow, Carr**	Continue with restoration of fen, wet meadow, carr and mesic prairie mosaic habitats at the Black Dog and St. Lawrence Units. Follow management outline in Chapter 4 (4.2.4) taking into consideration habitat requirements for Resources of Concern. Locate and determine quality of other fen/wet meadow/carr habitats and propose restoration timelines. Protect wet meadow habitat at the Jessenland Unit and determine if restoration is needed.
4.2.5 **Floodplain Forest**	Continue protection of floodplain forest designated as rare communities by the Minnesota DNR such as the 1488 acres on the Blakeley and Jessenland Units, 77 acres on the Bloomington Ferry Unit and over 400 acres on the Wilkie Unit. Continue to explore partnerships to manage and protect areas of floodplain forest adjacent to Refuge land, to provide larger blocks of habitat for Resources of Concern.
4.2.7.1 **Remnant Dry Prairie**	Continue detection and control of undesirable woody species through prescribed burning in remnant dry prairies at the Upgrala and Rapids Lake Units, according to guidelines in Chapter 4 (4.2.7.1). Determine location and quality of additional remnant dry prairies within Refuge boundaries.
4.2.7.2 **Remnant Wet/Mesic Prairie**	Determine habitat boundaries and quality of remnant mesic prairie along Stagecoach Road and Rex Gun Club on the Wilkie Unit.
4.2.8 **Remnant Oak Savanna**	Develop restoration timeline for the Bloomington Visitor Center, and Wilkie and St. Lawrence Unit oak savannas (Appendix D, Table 1).

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APPENDIX A
GOALS AND OBJECTIVES FROM MINNESOTA VALLEY NWR CCP AND ASSOCIATED HMP GOALS AND OBJECTIVES

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Goals and Objectives from Minnesota Valley NWR and WMD CCP (2004a) and Associated HMP Goals and Objectives

Goal 1 – Floodplain Forest

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of floodplain forests within the northern tallgrass prairie ecosystem.

Objective 1.1 – Floodplain Forest

By 2017, provide 4,700 acres of floodplain forest along the Minnesota River and major tributaries to benefit Bald Eagles, cavity-nesting birds such as Wood Ducks, colonial-nesting wading birds and rare plant communities (Figures 9-12).

Goal 2 – Wetlands

To restore, protect, and maintain natural species diversity while emphasizing priority fish, wildlife and plants characteristic of wetlands within the northern tallgrass prairie ecosystem.

Objective 2.1 – Wetlands

By 2017, provide 7,400 acres of wetlands within the floodplain of the Minnesota River and 4,600 acres of prairie pothole wetlands in the Wetland Management District to benefit priority waterfowl species, marsh, shore and wading birds and healthy aquatic ecosystems.

Note: The acreage estimates include lands within the authorized boundary of the Refuge and existing and future Waterfowl Production Areas. New Refuge units along the Minnesota River would provide additional wetland acres.

Objective 2.2 – Wetlands

Control and ultimately reduce the distribution of exotic plant species on wetlands primarily through biological control methods.

Objective 2.3 – Wetlands

Control wildlife populations at levels consistent with available habitat to address public safety concerns and to allow effective management of wetlands.

Objective 2.4 – Wetlands

Maintain Round Lake at full basin water level (2001 level) to provide migration habitat for Bald Eagles, waterfowl such as Canvasbacks, and Common Loons. Maintain the capability to actively manage water levels in the future upon assurances that periodic drawdowns and reflooding would not cause undue risk to the ecosystem.

Goal 3 – Upland Forest

To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of upland forests within the northern tallgrass prairie ecosystem.

Objective 3.1 – Upland Forest

By 2017, provide 1,000 acres of upland forest along the Minnesota River, in 50-acre or larger blocks throughout the Wetland Management District, to ensure migration and nesting habitat for Bald Eagles, Red-headed Woodpeckers and songbirds.

Note: The acreage estimates include lands within the authorized boundary of the Refuge and existing and future Waterfowl Production Areas. New Refuge Units along the Minnesota River would provide additional upland forest habitats.

Objective 3.2 – Upland Forest
Control and ultimately reduce the distribution of exotic plant species on upland forests primarily through biological control methods.

Objective 3.3 – Upland Forest
Control wildlife populations at levels consistent with available habitat to address public safety concerns and to allow effective land management.

Goal 4 – Grasslands and Oak Savanna
To restore, protect, and maintain natural species diversity while emphasizing priority grassland-dependent wildlife and plants characteristic of the northern tallgrass prairie ecosystem.

Objective 4.1 – Grasslands and Oak Savanna
By 2017, provide 800 acres of original native prairie and 8,700 acres of restored native grasses in block sizes of over 50 acres and with varying grass height, density and grass/forb ratios to benefit grassland-dependent wildlife such as Boblinks, Grasshopper Sparrows and five-lined skinks.

Note: The acreage estimates include lands within the authorized boundary of the Refuge and existing and future Waterfowl Production Areas. New Refuge Units along the Minnesota River would provide additional native grasslands.

Objective 4.2 – Grasslands and Oak Savanna
Control spread and ultimately reduce the distribution of exotic or nuisance plant species on grasslands and oak savannas primarily through biological control methods.

Goal 5 – Land Protection
To enhance the integrity of lands within the authorized boundary of the Refuge and contribute to the protection and restoration of fish and wildlife habitats within the Minnesota River watershed.

Objective 5.1 – Land Protection
By 2017, achieve the appropriate conservation status necessary for permanent protection and management viability of any remaining lands within the original authorized boundary. This will also address existing and future threats to resources within the authorized Refuge boundaries.

Objective 5.2 – Land Protection
By 2017, and in cooperation with many others, contribute to the restoration of the Minnesota River by acquiring fee or conservation easements on up to 10,737 additional acres of high quality fish and wildlife habitat within or adjacent to the Minnesota River Valley beyond the existing Refuge boundary and proceeding upstream to Mankato, Minnesota.

Objective 5.6 – Land Protection
Protect Refuge lands and resources from damaging uses adjacent to Refuge boundaries.

Table 1. HMP Goals and Objectives Compared to Minnesota Valley NWR and WMD CCP (2004a) Goals and Objectives

HMP Goals and Objectives 2018	Comparative CCP Goals 2004
4.2.1 Minnesota River and Tributaries (Priority 2 Habitat) *Minnesota River and Tributaries Goal 1:* Minnesota River corridor functions in a manner that sustains river and floodplain ecosystems. *Minnesota River and Tributaries Objective 1a:* Within the first five years of plan implementation, gain a better understanding of local and watershed hydrologic processes needed to sustain a range of riverine and riparian habitats and resources of concern. *Minnesota River and Tributaries Objective 1b:* Manage, restore and protect the hydrologic function of the Minnesota River to mimic important processes such as sheet flow, connectivity, wet and dry cycles, sedimentation and water quality to sustain a range of riverine and riparian habitats conducive to local and watershed-scale hydrologic processes. *Minnesota River and Tributaries Goal 2:* To restore, protect and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of the Minnesota River within the Eastern Broadleaf Forest. *Minnesota River and Tributaries Objective 2a:* Over the next 15 years, protect, maintain and enhance 70 miles of riverbank habitat along the Minnesota River to provide foraging and overwintering habitat for bald eagle, nesting habitat for Prothonotary Warbler and overwintering habitat for Common Merganser, as well as the full life cycle needs for native mussels (fish passage/fish hosts).	**Goals, 1, 2 and 5: Floodplain Forest, Wetlands and Land Protection.**

4.2.2 Creeks and Small Rivers (Priority 2 Habitat) *Creeks and Small Rivers Goal:* Over the next 15 years, protect, enhance, and maintain at least 4 miles of streams and waterways on the Refuge and adjacent lands with the help of partners. Our goals are to reduce sedimentation, protect water quality, reduce the effects of extreme flows from the watersheds, and improve hydrologic connection between the stream and floodplain. *Creeks and Small Rivers Objective:* Maintain or improve quality in Refuge creeks and small rivers to provide foraging habitat for Prothonotary warbler and Wood Thrush, stream habitat for brook trout and a diversity of fish species, and the complete life cycle requirements for Blanding's turtle in the next 15 years to the following conditions: 1. Ike's Creek and Eagle Creek will maintain a thermal regime that classifies them as coldwater streams (maximum daily temperature of 69°F or less) and have suitable .oxygen levels that will support the presence of trout species. 2. Carver Creek will maintain an Index of Biological Integrity (IBI) score of 60 or greater and will show improvements in turbidity and fecal coliform parameters as measured by MPCA water quality standards. 3. Work with partners to improve quality of Refuge streams so that they can be removed from MPCA's Impaired Waters list.	**Goals, 1, 2 and 5: Floodplain Forest, Wetlands and Land Protection.**
4.2.3.1 Deepwater Wetlands (Priority 1 Habitat) *Deepwater Wetlands Goal:* Manage and enhance deepwater wetland systems throughout the Minnesota Valley National Wildlife Refuge to provide habitat for native fish species and diverse habitat for other deeper water-dependent wildlife such as piscivorous birds and wetland-dependent mammals while preserving the ecological integrity of the wetland in the Eastern Broadleaf Forest Province. *Deepwater Wetlands Objective:* Manage or maintain at least 50% of the existing 727 acres* of deepwater wetland habitat for recreational fish such as bluegill, northern pike, and largemouth bass, river otter, and piscivorous birds over the next 15 years to achieve the following conditions: 1. Maintain water levels in the limnetic zone at deeper than 6.6 feet to provide overwintering habitat for native fish species. 2. Provide a littoral fringe of < 30% cover of emergent vegetation along the shoreline consisting of cattail and bulrush species. 3 Maintain a submergent and floating-leaved plant community dominated by native species with coverage of native submergent vegetation between 10 and 60% during the growing season.	**Goal 2: Wetlands**

4 Eradicate, control, and prevent expansion of invasive plants and animals such as purple loosestrife, that have impacts on native plant diversity and natural communities to < 10% of total cover.	
4.2.3.2 Permanent/Semi-Permanent Wetlands (Priority 1 Habitat) *Permanent/Semi-Permanent Wetlands Goal:* Manage and enhance permanent/semi-permanent wetland systems throughout the Minnesota Valley National Wildlife Refuge to provide habitat for waterfowl, shorebirds and other waterbirds. Provide diverse habitat for other wetland-dependent wildlife while preserving the ecological integrity of the wetland in the Eastern Broadleaf Forest Province. *(CCP Goal 2).* *Permanent/Semi-Permanent Wetlands Objective:* Manage and enhance at least 50% of the existing 4,376* acres of permanent/semi-permanent wetlands (maximum depth 6.6 feet) within the floodplain for migrating waterfowl and other waterbirds such as Blue-winged Teal, Mallard, Ringed-neck Duck, and Pied-billed Grebe, American White Pelican and Trumpeter Swan, Greater Yellowlegs and Lesser yellowlegs, and life cycle requirements for Blanding's turtle over the next 15 years to achieve the following conditions: 1. Restore and maintain natural hydrologic regimes at a depth < 6.6 feet to promote a community dominated by a combination of 80% native emergent, submergent, and floating-leaved aquatic vegetation and associated fauna. 2. Provide a mosaic of habitat conditions ranging from mud flats to open water annually for a diversity of wildlife resources. 3. Maintain a submergent plant community with > 75% cover by native species with a total species richness of at least six native species, basin-wide including sago pondweed. 4. Eradicate, control or prevent spread of invasive plants and animals such as purple loosestrife that have adverse impacts on native vegetation and communities to < 25% of total cover. 5. Assess condition of water control infrastructure within 5 years.	**Goal 2: Wetlands**
4.2.3.3 Temporary/Seasonal Wetlands (Priority 2 Habitat) *Temporary/Seasonal Wetlands Goal:* Protect, restore, and manage temporary/seasonal wetlands throughout the Minnesota Valley National Wildlife Refuge to provide foraging habitat for waterfowl, shorebirds, and other waterbirds, diverse habitat for other wetland-dependent wildlife, and preserve the ecological integrity of the wetland in the Eastern Broadleaf Ecological Province.	**Goal 2: Wetlands**

Temporary/Seasonal Wetlands Objective: Over the next 15 years, protect all, and restore and enhance up to 10% (if additional resources allow) temporary and seasonal wetlands annually. Where possible provide hydrologic processes that mimic natural hydrologic processes that allow for the cycling of wet/dry periods to promote a variety of vegetation and open water conditions for foraging waterfowl, shorebirds, and northern harrier and nesting habitat for sedge wren. 1. In temporary/seasonal wetlands, incorporate management actions to promote desired conditions that favor diverse native wetland vegetation. 2. For temporary/seasonal wetlands in an upland setting: a. Provide vegetation structure consisting of emergent vegetation and open water. Vegetation represented with at least 75% early successional herbaceous species (e.g., sedges and smartweeds) or residual vegetation with associated benthic macroinvertebrates and water depth between 4 and 12 inches during spring and fall migration. b. Prevent establishment and reduce reed canary grass and other invasive species coverage to < 15%. c. Native trees and shrubs > 3.3 feet in height will be < 15% of the cover. 3. For temporary/seasonal wetlands in the floodplain: a. Maintain native vegetation cover > 50% consisting of species such as annual smartweeds (Polygonum spp.) and beggarticks (Bidens spp.). b. Reduce reed canary grass and other invasive species coverage to < 50%. c. Restore the water depth and bottom contours of shallow, depressional areas that have filled with sediment. Typical water depths will be between 4 and 12 inches. d. Previously managed moist soil units will naturally be reverted to floodplain forest.	
4.2.4 Fen/Wet Meadow/Carr (Priority 1 Habitat) *Fen/Wet Meadow/Carr Goal:* Restore, protect and manage fen, wet meadow and carr habitat throughout the Minnesota Valley National Wildlife Refuge to provide diverse habitat for fen, wet meadow, and carr-dependent wildlife that depend on these habitats, while preserving the ecological integrity of these habitats within the Eastern Broadleaf Forest Ecological Province. *Fen/Wet Meadow/Carr Objective:* Over the next 15 years, restore, protect, and manage 1,471 acres of fen/wet meadow/carr for the full life cycle requirements of Small White Lady's Slipper and other native species according to the following conditions:	**Goal 2: Wetlands**

1. Vegetative cover will be dominated by native grasses, sedges, and forbs (> 75%). Invasive species cover will be ≤ 25%. 2. In areas being restored, reduce invasive species cover to < 25%. In other areas, keep reed canary grass from spreading beyond existing cover. 3. Determine small white lady's slipper is presence on the Black Dog Unit, and prevent over shading from invasive species encroachment and disturbance from Refuge infrastructure (trails, roads). 4. Native tree and shrub cover will be ≤10% and distributed in sparse to scattered clumps. 5. Inventory similar habitats for other white lady's slipper populations and record in GIS. 6. Determine location and condition of fen/wet meadow carr habitat.	
4.2.5 Floodplain Forest (Priority 1 Habitat) *Floodplain Forest Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of floodplain forests within the Eastern Broadleaf Forest Province. *Floodplain Forest Objective:* Over the next 15 years, protect, maintain and enhance approximately 5,200 acres of floodplain forest. Forest blocks at least 250 acres in size are especially important as they provide breeding and migratory stopover needs for Prothonotary Warbler, nesting habitat for Bald Eagle and Wood Duck, and brood rearing and foraging habitat for American Woodcock. Seek opportunities to create larger forest blocks through partnerships. Existing and enhanced forests will have the following conditions: 1. Protect and connect large blocks of habitat through partnerships where feasible, especially where block size is > 250 acres. 2. The shrub layer and subcanopy are mostly sparse (0 to 25% cover) and sometimes patchy (25 to 50% cover). The canopy is interrupted to continuous (50 to 100% cover) and strongly dominated by silver maple with occasional green ash, cottonwood, or American elm. 3. Allow for continued hydrologic connection to the Minnesota River under normal flooding conditions so that the river can spread out across the floodplain unimpeded and drain efficiently post flood. 4. Maintain the natural productivity cycle on the floodplain where possible and allow for periodic drought and flood conditions. 5. Maintain at least 75% of total tree cover in a continuous (75 to 100%) mature canopy. Provide a mixture of early successional and mid-successional forest composed of species such as silver maple, cottonwood, and boxelder through natural processes.	**Goals 1 and 5: Floodplain Forest and Land Protection**

6. Maintain and protect dead standing and downed woody material on the forest floor for ecosystem processes such as nutrient cycling, foraging habitat for woodpeckers, and cover for reptiles and amphibians. 7. Prevent an increase in invasive species colonizing areas affected by significant green ash mortality due to Emerald Ash Borer infestations. 8. Design and conduct a snag inventory within the next 10 years to determine habitat quality for cavity nesting birds. Objectives for cavity nesters will be refined following survey. 9. Provide a dense shrub and subcanopy layer (25 to 50% cover) near standing water for Prothonotary Warbler nesting, and allow snags to remain during restoration activities. 10. Maintain and protect existing and potential cavity trees > 28 in. dbh and > 30 ft. in height, for wood duck nesting. 11. Protect super canopy trees, mature trees that stick out above the plane of the forest canopy, for Bald Eagle nesting and/or mature trees near water for bald eagle perching and foraging. 12. Invasive species such as buckthorn, reed canary grass, purple loosestrife, and narrowleaf bittercress will be < 20% of the total cover in mature forest stands and < 50% in early and mid-successional forest stands. 13. Floodplain forest will be restored using natural succession, and rarely involve planting of trees in the floodplain. Former moist soil units adjacent to Chaska and Fisher Lakes will be abandoned and allowed to naturally revert to floodplain forest	
4.2.6 Upland Forest (Priority 2 Habitat) *Upland Forest Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of upland forests within the Eastern Broadleaf Forest Ecological Province. *Upland Forest Objective:* Protect 75% of new and existing upland forest and manage up to 25% of the existing 739 acres of upland forest throughout the Minnesota Valley National Wildlife Refuge for American Woodcock, nesting Wood Thrush, Northern Flicker, Eastern Wood-pewee, and Golden-winged Warbler and roosting habitat for the northern long-eared bat. 1. Canopy (overstory) is interrupted to continuous (50 to 100% cover) characteristic of maple-basswood or oak forest, as determined by site conditions. 2. Where feasible, such as through partnerships or acquisition, promote large contiguous forested patches > 250 acres. 3. Understory comprised of a ground layer with 50 to 100% cover and a shrub layer of varying cover characteristic of maple, basswood, or oak forest, as determined by site conditions.	**Goal 3: Upland Forest**

4. Where ecological restoration activities have occurred or will occur in adjacent areas or habitats, eradicate, reduce or control invasive plants and animals that have adverse impacts on native vegetation by 50% from current levels. **4.2.7.1 Remnant Dry Prairie (Priority 1 Habitat)** *Remnant Dry Prairie Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant dry prairie within the Eastern Broadleaf Forest Ecological Province. *Remnant Dry Prairie Objective:* Enhance and manage 58 acres of remnant dry prairie (Upgrala and Rapids Lake Units) and protect the remaining 200+ acres of existing dry remnant prairie throughout the Minnesota Valley National Wildlife Refuge. Emphasis is on increasing the amount of remnant prairie protected or managed within or adjacent to the authorized boundary over the next 15 years to achieve the following conditions: 1. > 50% of the cover is dominated by native species. Graminoid coverage is patchy to contiguous at 50 to 100%; forb cover is sparse to patchy at 5 to 50%. Cover of non-native species such as smooth brome and Kentucky bluegrass < 50%. 2. Litter depth ranges between zero and 6 inches 3. Native trees and shrubs > 3.3 feet tall will comprise < 5% of the total vegetative cover in the Southern Dry Prairie (UPs13) plant community type. 4. Eradicate, reduce, or control invasive plants and animals that have adverse impacts on native vegetation to < 50% of total vegetation cover. High quality remnants Rapids Lake (goat prairies) and Upgrala are first priority for management. 5. Where feasible, such as through partnerships or acquisition, promote larger contiguous upland prairie remnants. 6. Identify additional locations and quality of remnant dry prairie on and adjacent to Refuge land.	**Goal 4: Grasslands and Oak Savanna**
4.4.7.2 Remnant Wet/Mesic Prairie (Priority 1 Habitat) *Remnant Wet/Mesic Prairie Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant wet prairie within the Eastern Broadleaf Forest Ecological Province. *Remnant Wet/Mesic Prairie Objective:* Enhance and manage 359 acres and protect the additional 411 acres of remnant wet/mesic prairie throughout the Minnesota Valley National Wildlife Refuge. Emphasis is on	**Goal 2: Wetlands**

increasing the amount of remnant prairie protected or managed within or adjacent to the authorized boundary over the next 15 years to achieve the following conditions: 1. > 50% of the cover is dominated by native species. Cover of gramnoids is contiguous (75 to 100%); and forb coverage is sparse to patchy at 5 to 50% of total cover. 2. Litter depth ranges between zero and 6 inches 3. Trees generally absent but shrubs sparse at 5 to 25% of the total vegetative cover in the Southern Mesic Prairie (UPs23) habitat type. 4. Eradicate, reduce or control invasive plants (such as reed canary grass) and animals that have adverse impacts on native vegetation to < 50% of total vegetation cover. 5. Where feasible, such as through partnerships or acquisition, promote larger contiguous wet/mesic prairie remnants.	
4.4.7.3 Planted Dry Grassland (Priority 2 Habitat) *Planted Dry Grassland Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of planted dry grassland within the Eastern Broadleaf Forest Ecological Province. *Planted Dry Grassland Objective:* Restore, enhance, and manage 80% of the existing 183 acres of planted dry grassland over the next 15 years to provide a mosaic of vegetation heights through management actions such as mowing, burning, or a custom seed mix for nesting grassland bird species such as Bobolink, Grasshopper Sparrow, Lark Sparrow, waterfowl species such as Mallard, foraging Northern Harrier, and the full life cycle habitat requirement of plain's hog-nosed snake and monarch butterfly. Existing and newly planted dry grassland will have the following: 1. Cover is dominated by at least 75% native species. Graminoid coverage is patchy to contiguous at 50 to 100%; forb cover is sparse to patchy at 5 to 50%. Cover of non-native species such as smooth brome and Kentucky blue grass is < 25%. 2. Litter depth ranges between 0 and 6 inches. 3. Native trees and shrubs > 3.3 feet tall will comprise < 5% of the total vegetative cover. 4. Up to 30% of the existing planted dry grassland will be less diverse (< 15 species), but will provide vegetative structure and litter depths for a variety of grassland-dependent species.	**Goal 4: Grasslands and Oak Savanna**

5. At least 70% of the existing 183 acres of dry planted grassland will be enhanced to promote native species diversity, which, as measured by species richness, will increase by at least 15 species through management techniques, custom seed mix selection, and over seeding. a. Seed with a high diversity mix where forbs comprise at least 20% of the mix (seeds/ft^2). A minimum of 20 forb species and 5 grass species should be represented in the seed mixes to promote structural and species diversity that bloom throughout the growing season. b. Planted dry grassland seedlings should express at least 50% of the planted seed mix within five growing seasons. c. Eradicate, reduce, or prevent expansion of invasive plants and animals that have impacts on native plant diversity and natural community integrity to < 20% of total vegetation cover within 3 years after establishment.	
4.2.7.4 Planted Wet/Mesic Grassland (Priority 2 Habitat) *Planted Wet/Mesic Grassland Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of planted wet/mesic grassland within the Eastern Broadleaf Forest Ecological Province. *(CCP Goal 2).* *Planted Wet/Mesic Grassland Objective:* Restore, enhance, and manage 80% of the existing 394 acres and newly acquired planted wet/mesic grassland in the next 15 years to achieve the following conditions: Existing and newly planted wet/mesic grassland will have the following: 1. Cover is dominated by at least 75% native species. Cover of graminoids is contiguous (75 to 100%); and forb coverage is sparse to patchy at 5 to 50% of total cover. 2. Litter depth ranges between zero and 6 inches. 3. Native trees and shrubs > 3.3 ft. tall will comprise < 5% of the total vegetative cover. 4. Up to 30% of the existing planted wet/mesic grassland will be less diverse (< 15 species), but will provide vegetative structure and litter depths for a variety of grassland-dependent species. 5. At least 70% of the existing 394 acres of planted wet/mesic grassland will be enhanced to promote native species diversity, which, as measured by species richness, will increase by at least 15 species through management techniques such as prescribed burning, custom seed mix selection, and overseeding. a. Seed with a high diversity mix where forbs comprise at least 20% of the mix (seeds/ft^2). A minimum of 20 forb species and 5 grass species should be represented in the seed mixes to promote structural and species diversity that bloom throughout the growing season.	**Goal 2: Wetlands**

b. Planted wet/mesic grassland seedings should express at least 50% of the planted seed mix within five growing seasons. c. Eradicate, reduce, or control invasive plants (such as reed canary grass) and animals that have impacts on native plant diversity and natural communities to < 20% of total vegetation cover within three years after establishment.	
4.2.8 Remnant Oak Savanna (Priority 1 Habitat) *Remnant Oak Savanna Goal:* To restore, protect, and maintain natural species diversity while emphasizing priority wildlife and plants characteristic of remnant oak savanna within the Eastern Broadleaf Forest Ecological Province. *Remnant Oak Savanna Objective:* Restore, protect, and manage 70% of the existing 356 acres of oak savanna throughout the Minnesota Valley NWR over the next 15 years to achieve the following conditions: 1. Oak trees cover < 70% (typically 25 to 50%) and are scattered individuals or small clumps, with the shrub layer typically patchy (25 to 50% cover) of low (< 20 inches) and taller (> 6 feet tall) shrubs. Low shrubs consist of leadplant and prairie rose while chokecherry, American hazelnut, and smooth sumac are the most important tall shrubs. 2. Graminoid cover is patchy to continuous (25 to 100%) with little bluestem, and porcupine grass generally dominant. Taller grasses such as big bluestem and Indian grass are often common. Forb cover is sparse to patchy (5 to 50%), with western ragweed, Virginia ground cherry, gray goldenrod, white sage and other species represented. 3. Eradicate, reduce, or control invasive plants that have impacts on native plant diversity and natural communities to < 50% of total vegetation cover. 4. Reseed only after many attempts of burning (may take up to 10+ years) if native species cover does not increase. If seeding needed, collect native seed from adjacent site. 5. Native oak tree seedlings are naturally recruited in savanna habitats. 6. Dead standing trees and dead branches on live trees (snags) will be present to provide habitat for red-headed woodpeckers and other cavity nesting species. Red-headed woodpeckers are most common in oak savannas and prairie-forest transition areas; also found in bottomland hardwood forests. It nests most often in cavities of dead trees, but also will use cavities in living trees. Densities average 12 birds/km2 (12 birds/247.11 acres) with maximum densities reaching 60 birds/km2 (60 birds/247.11acres) (Potter et al. 2007).	**Goal 4: Grasslands and Oak Savanna**

7. Management activities will target existing savanna remnant projects that have already been started, areas where significant benefits could be achieved for little effort and where large blocks of savanna exist or can be restored on the Louisville Swamp, Rapids Lake, St. Lawrence and Wilkie Units (Appendix D, Table 1).	
4.2.9 Rock Outcrop (Priority 2 Habitat) *Rock Outcrop Goal:* To restore, protect, and maintain natural species and geologic diversity while supporting priority wildlife and plants characteristic of rock outcrop within the Eastern Broadleaf Forest Ecological Province. *Rock Outcrop Objective:* Over the next 15 years, protect and maintain at least 5 acres of rock outcrop habitat on the Louisville Swamp Unit to prevent disturbance, development and degradation by invasive species (Appendix D, Table 2). 1. Tree and shrub cover is absent to sparse (0 to 25%). Desirable shrub species include sand cherry and blackberries. Open-grown oak trees, especially bur oak, are often present on bedrock outcrop complexes. 2. Herbaceous plant cover is sparse to patchy (5 to 50%). Characteristic species in crevices and areas with shallow soil (< 1 inch deep), where biomass is low, include small-flowered fameflower, brittle prickly pear, and rock spikemoss. Areas with deeper soil between bedrock exposures have great plant biomass and support many prairie species, including blue grama, little bluestem, big bluestem, harebell and prairie wild onion. 3. Lichen and brypophyte cover is high. On exposed bedrock, crustose and foliose lichens predominate.	**Goal 4: Grasslands and Savanna**

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APPENDIX B
LIST OF COMPATIBILITY DETERMINATIONS

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List of Compatibility Determinations for Minnesota Valley NWR

1. Access to Minnesota Valley National Wildlife Refuge for persons with disabilities.
2. Collection of Wild Plant Materials for Personal Use.
3. Cooperative Farming as a Habitat Management Tool to Enhance and Restore Refuge Grasslands.
4. Controlled Grazing on Minnesota Valley National Wildlife Refuge, Waterfowl Production Areas and Conservation Easements.
5. Haying for Habitat Management on Minnesota Valley National Wildlife Refuge.
6. Groundwater Monitoring Wells.
7. Installation of Bluebird Boxes, Henhouses, Wood Duck Boxes, or other Nesting Structures By the Public, Individuals or Groups.
8. Non-Refuge Sponsored Special Events.
9. Research, Scientific Collecting and Surveys by Third Parties.
10. Short-term Upland Disturbance for Highway or Other Public Interest Projects with No Right Of Way Expansion and Full Restoration.
11. Trapping of Furbearers.
12. Wood Cutting and Timber Removal.
13. Access to State Trail through the Refuge via Snowmobile and Horseback.
14. Commercial Recording (photography, videography, filming, and audio recording).
15. Interpretation and Environmental Education.
16. Right of Way for Construction and Maintenance of the State Trail.
17. Placement of Wetland Accesses/Ramps in Support of Priority Public Uses.
18. Permanent Right of Way to City of Chaska for Flood Protection Levee.
19. Special Youth Hunt for Wild Turkey.
20. Non-motorized Recreational Trail Use by Walking, Hiking, Jogging, Walking a Leashed Animal, Bicycling, Cross-Country Skiing, Snowshoeing and Horseback Riding.
21. Use of Biocontrol Agents to Control Invasive Insects and Weeds and Enhance Native Flora and Fauna on Lands within the Fourteen Counties Containing Minnesota Valley National Wildlife Refuge.

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APPENDIX C
EXISTING CONDITIONS MAPS

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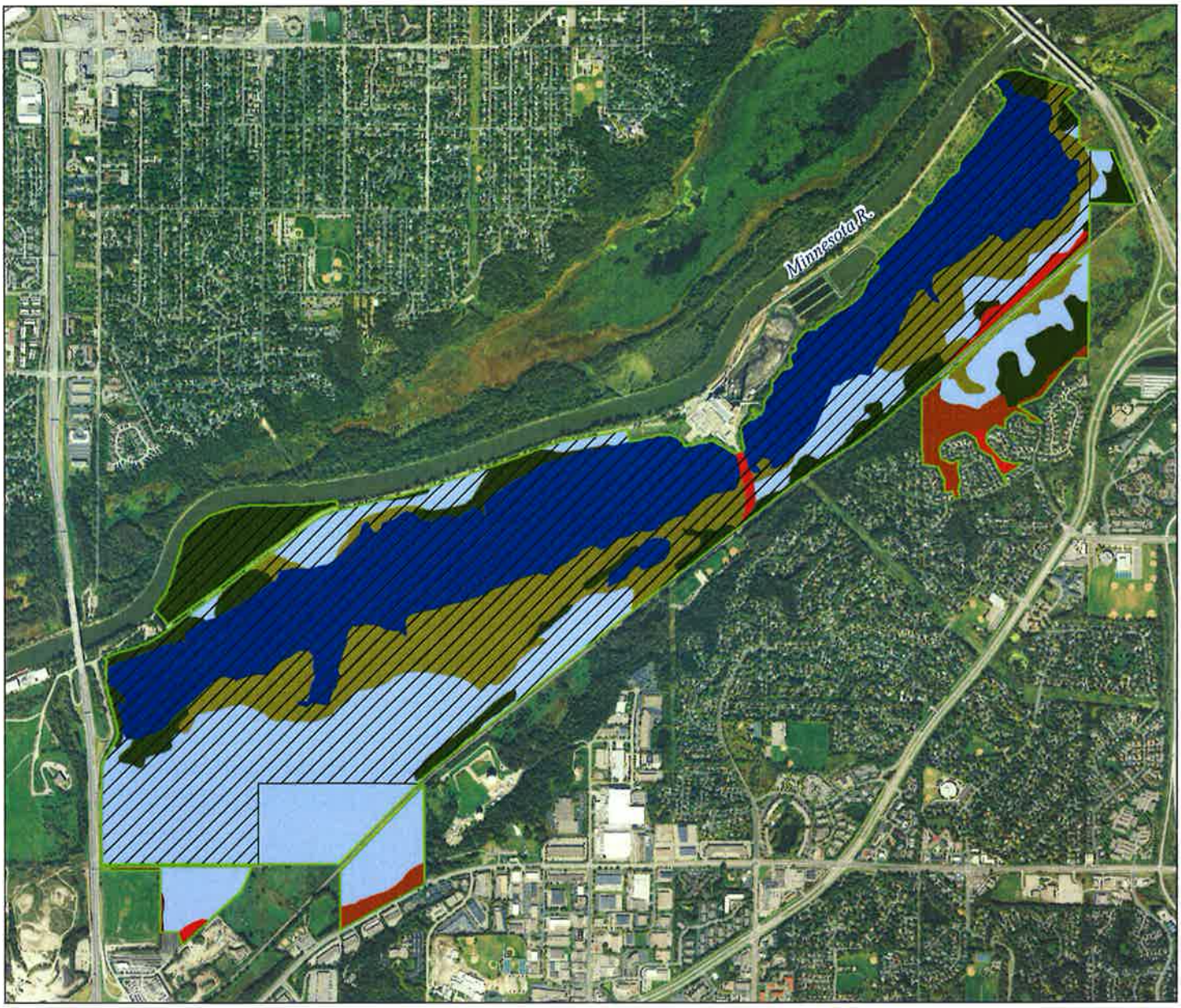
U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Black Dog Lake Unit



- Unit Boundary
- MOU Land
- Developed
- Oak Savanna
- Small River
- Remnant Wet/Mesic Prairie
- Planted Wet/Mesic Grassland
- Permanent/Semi-Permanent Wetland
- Floodplain Forest
- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

0 0.25 0.5 Miles

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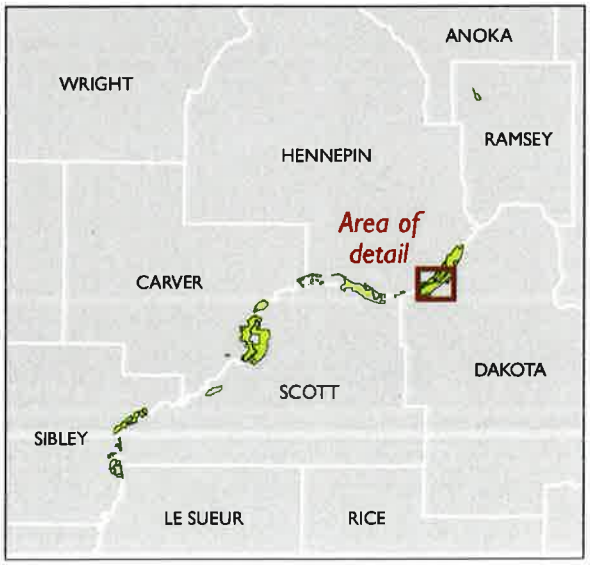
N S

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

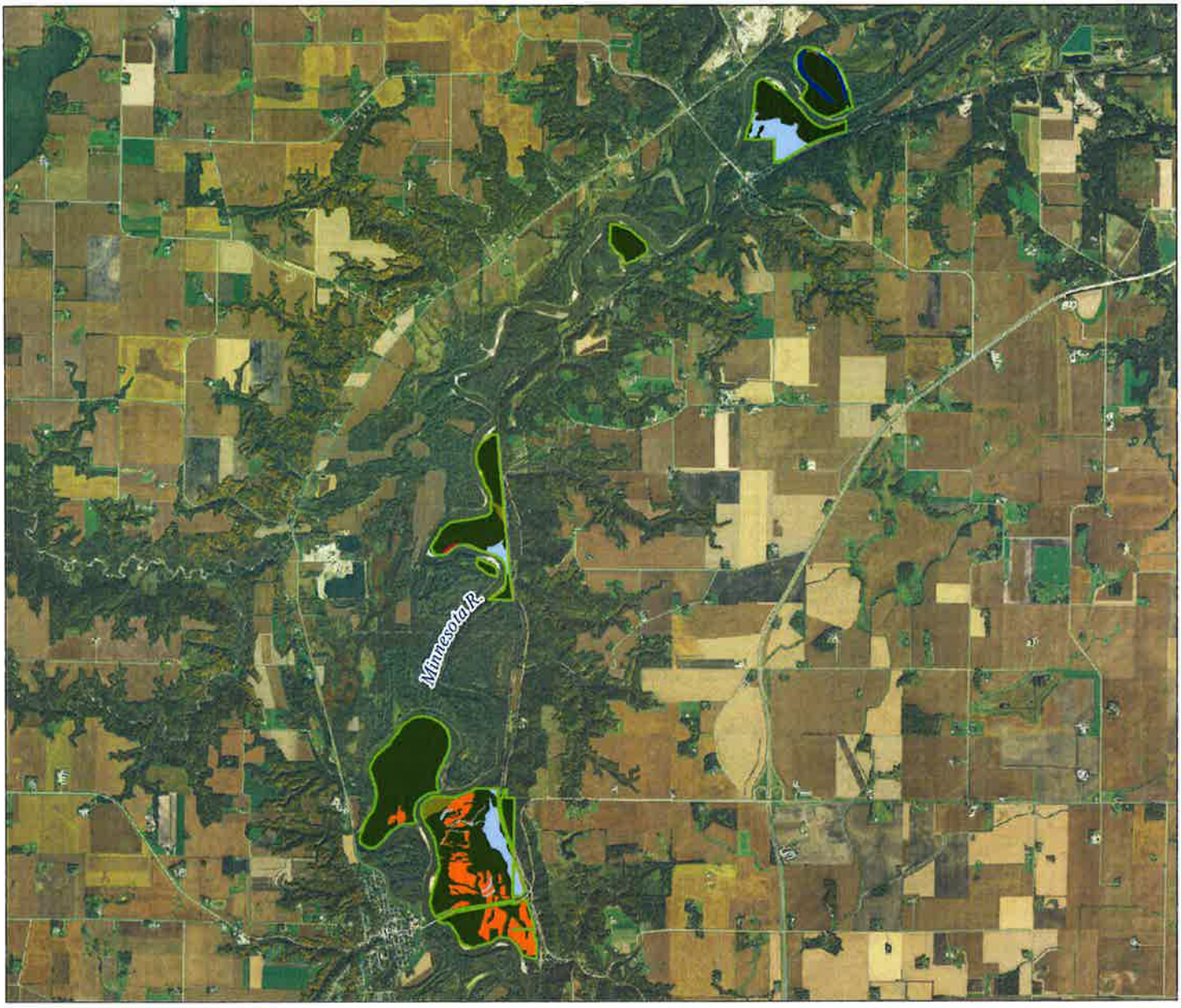


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Blakeley Unit



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- Planted Dry Grassland
- Deepwater Wetland

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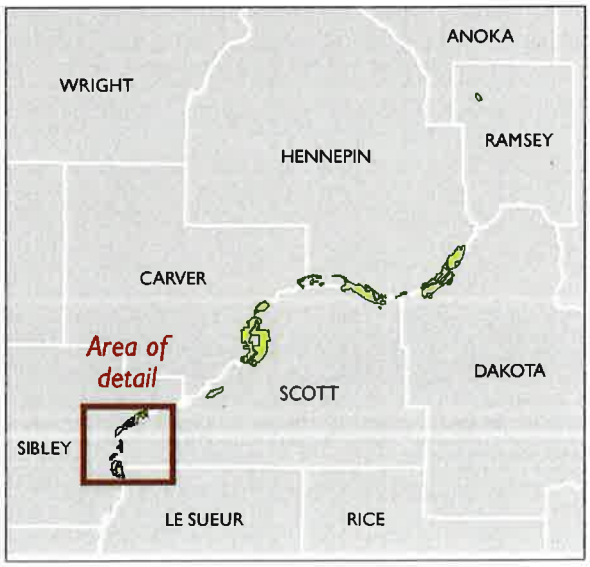
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

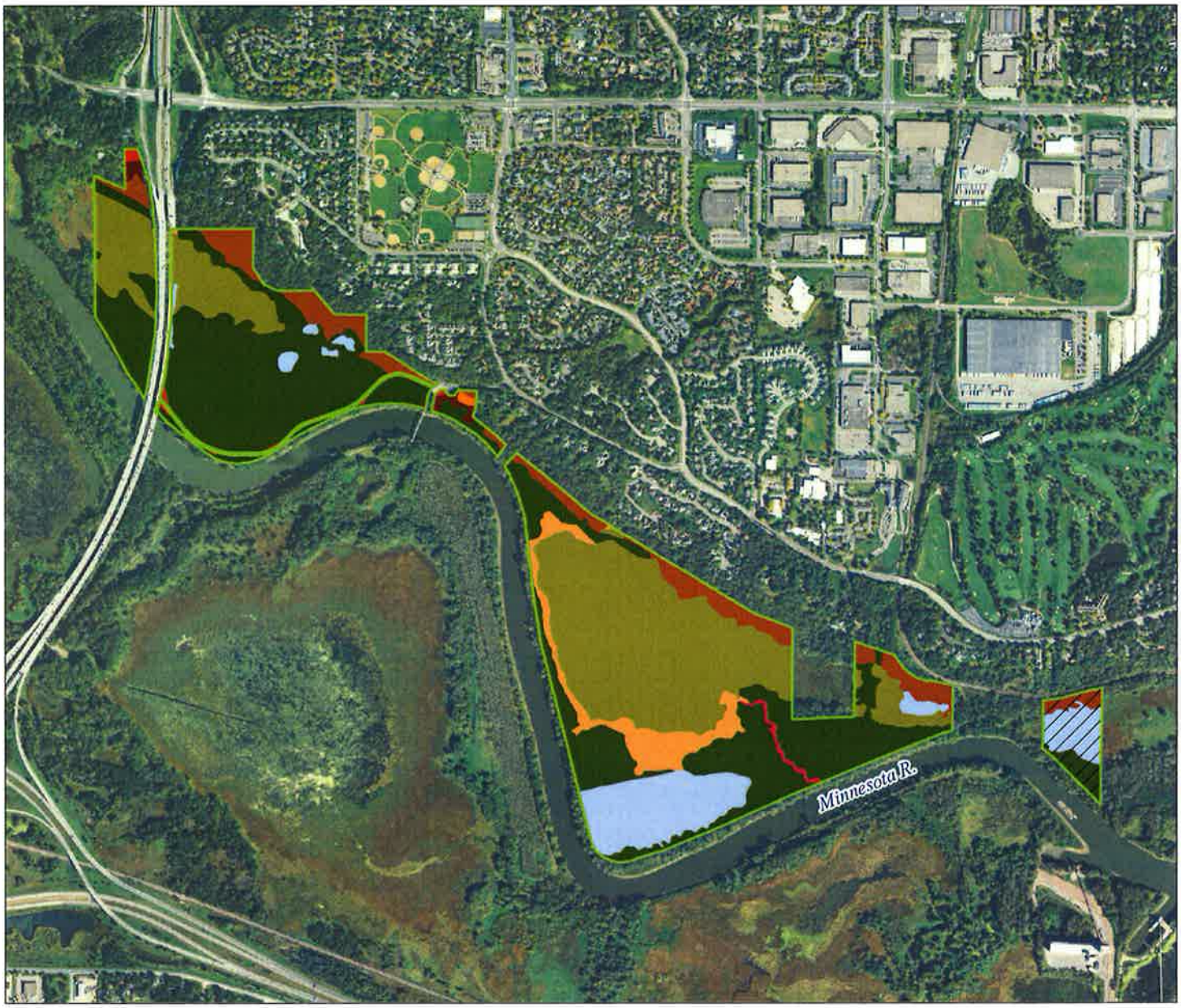


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Bloomington Ferry Unit



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- Wet Meadow
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- Planted Dry Grassland
- Deepwater Wetland

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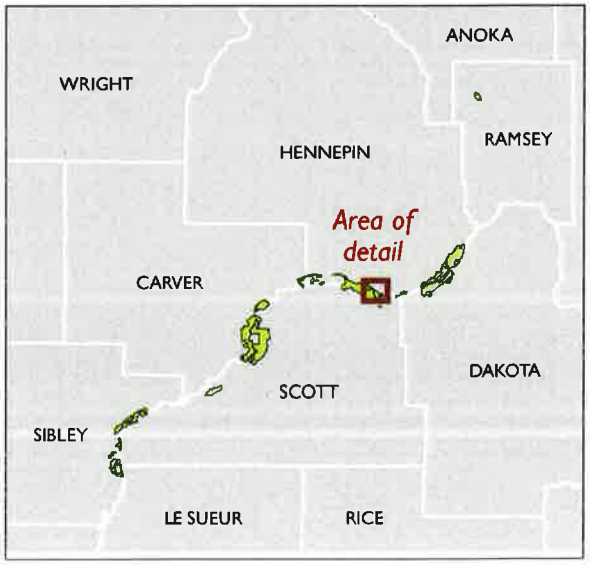
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

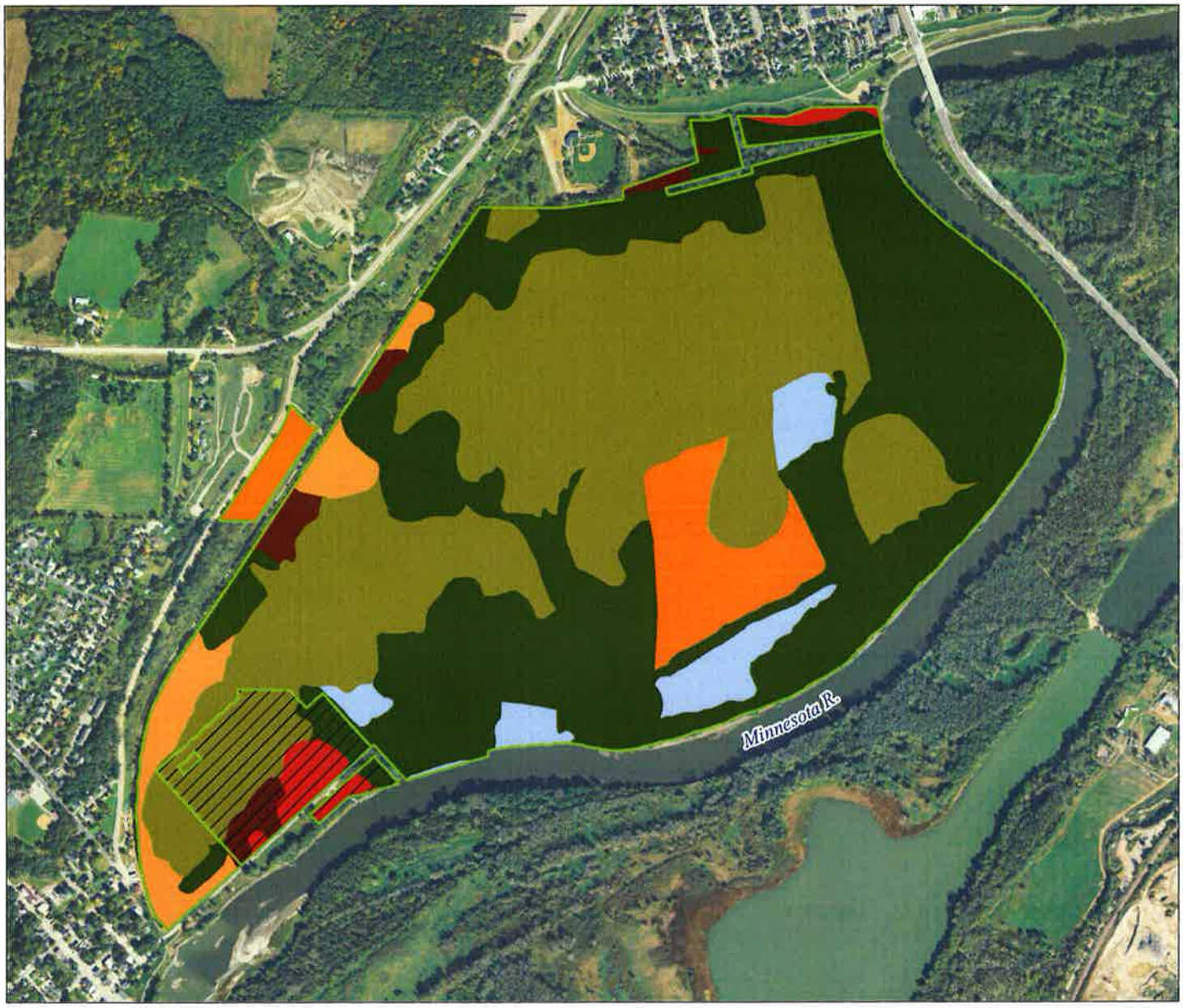


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Chaska Unit



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- Floodplain Forest
- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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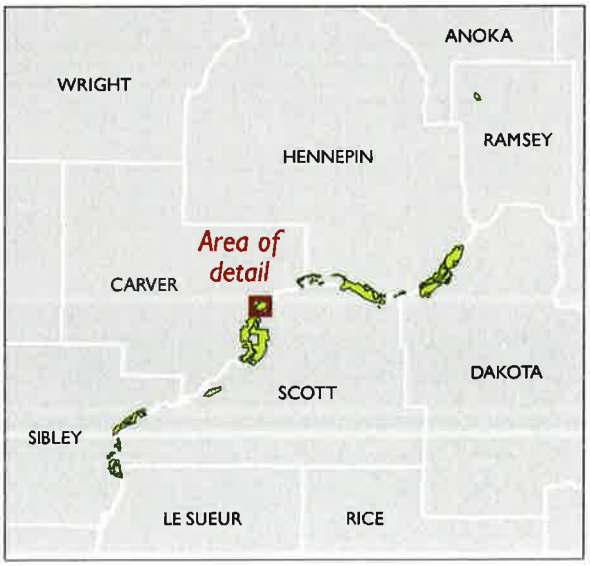
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

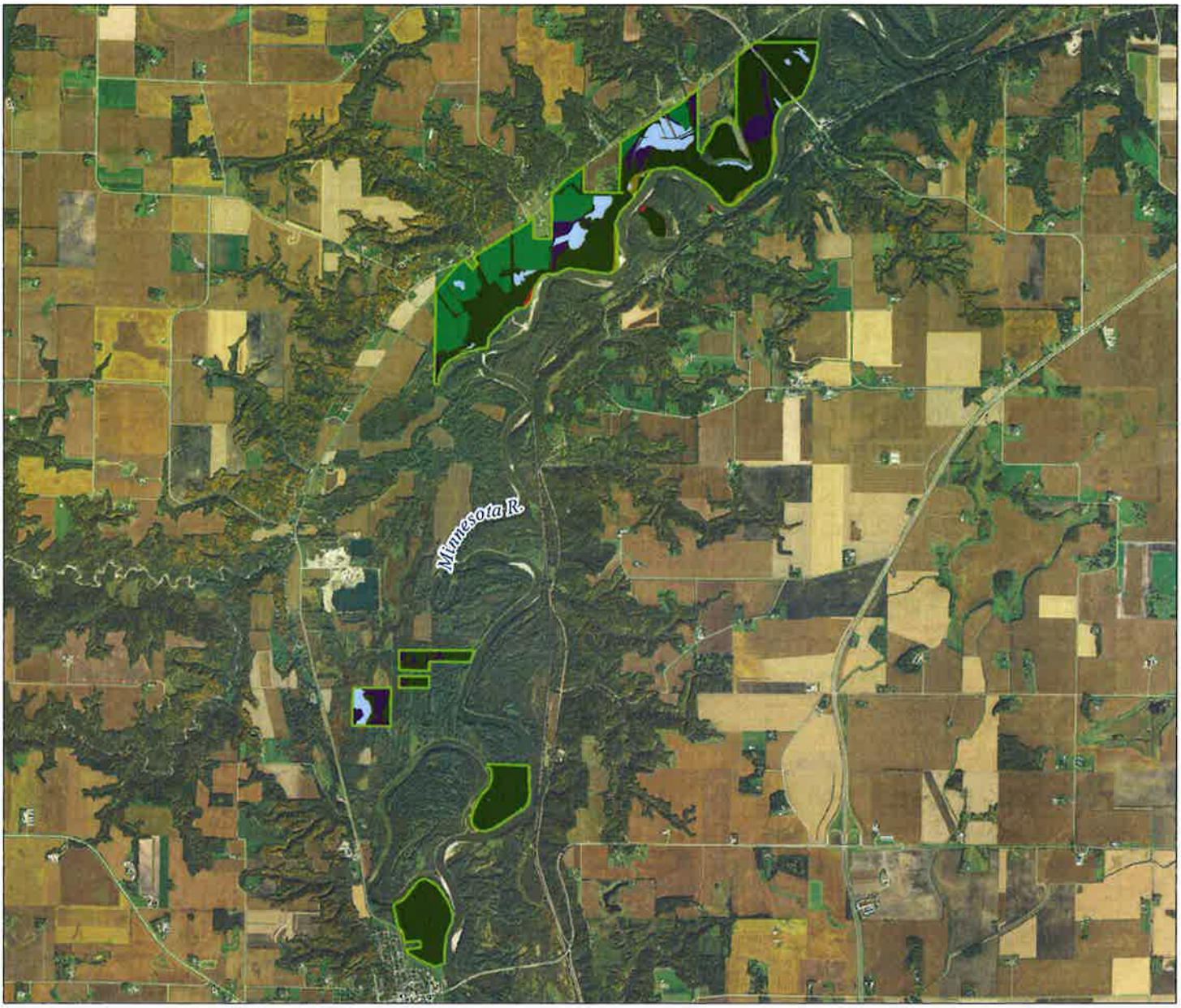


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Jessenland Unit



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- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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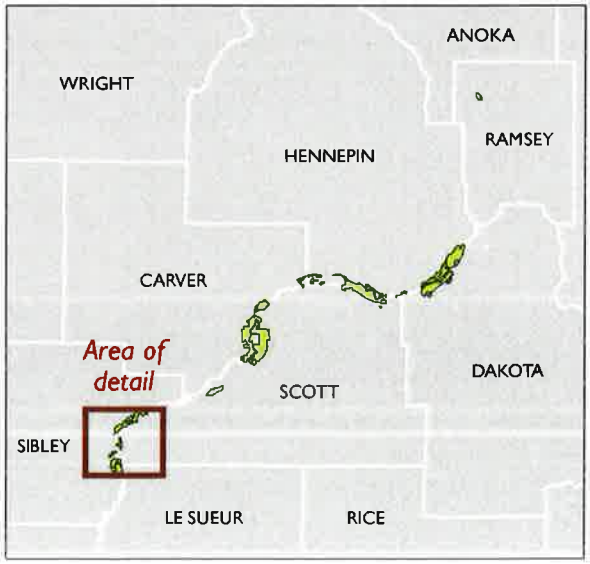
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

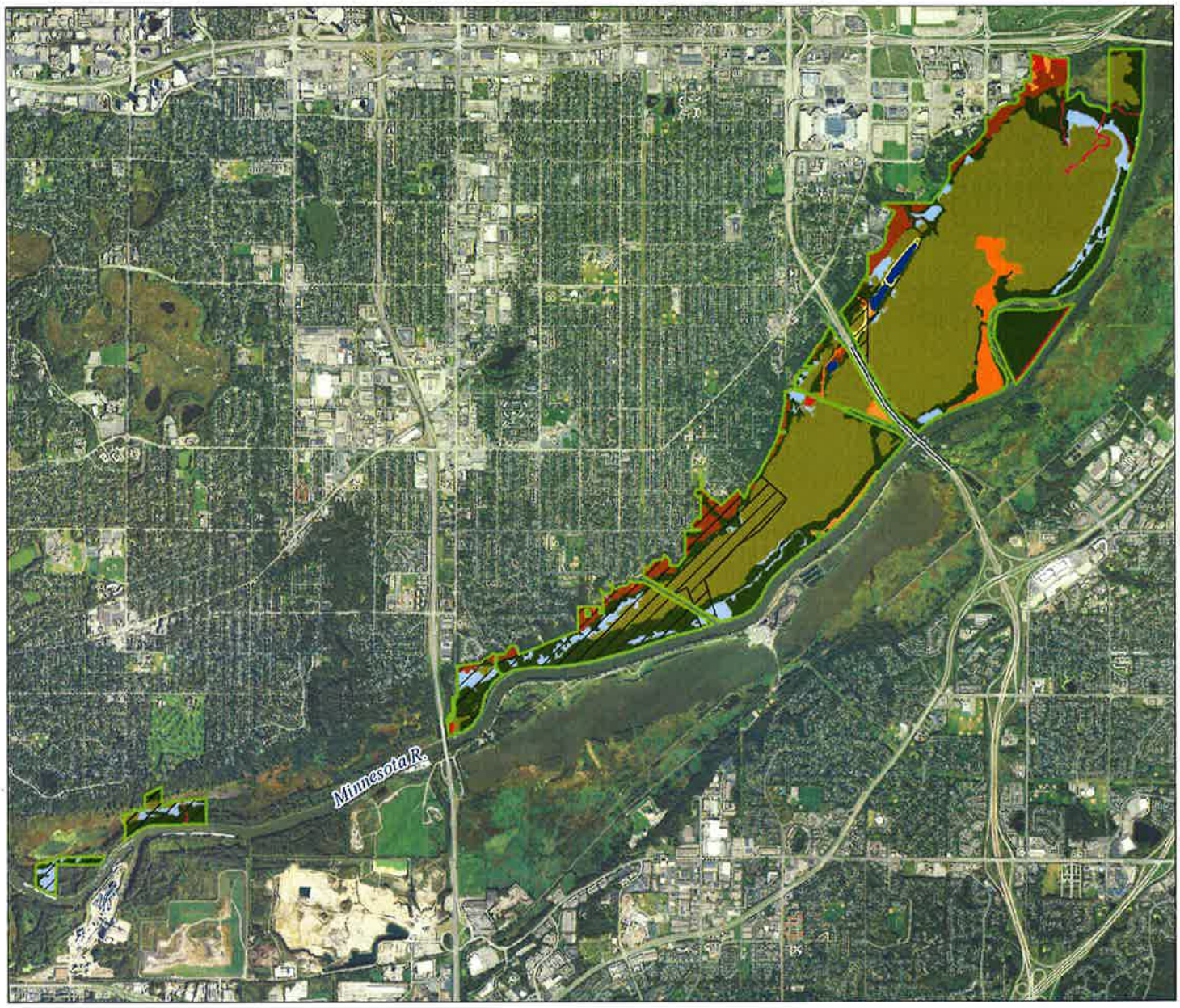


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Long Meadow Lake Unit



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- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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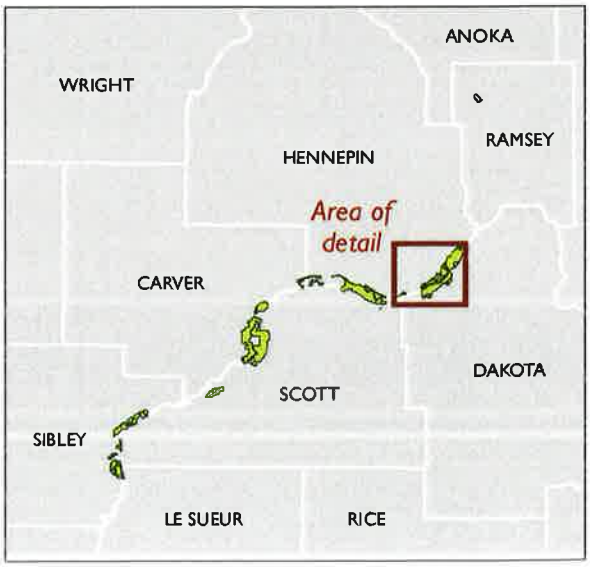
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

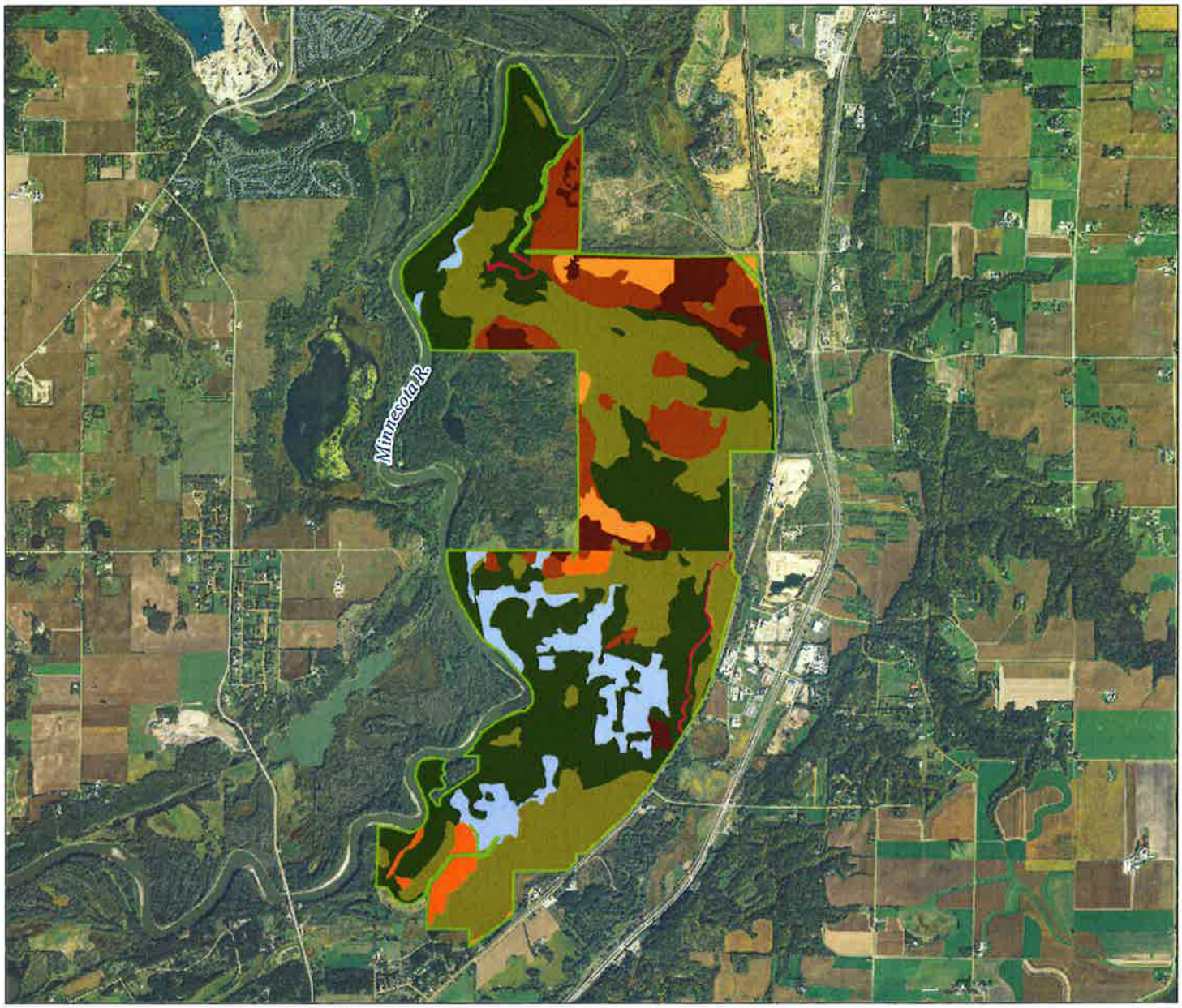


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Louisville Swamp Unit



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- Floodplain Forest
- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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UTM ZONE 15N
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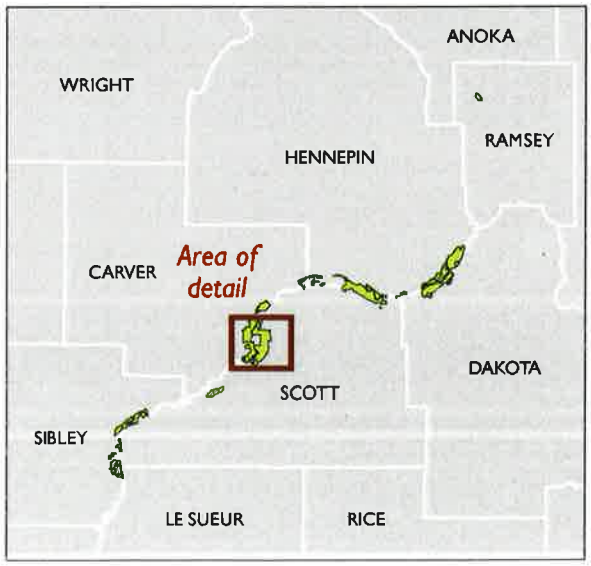
MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

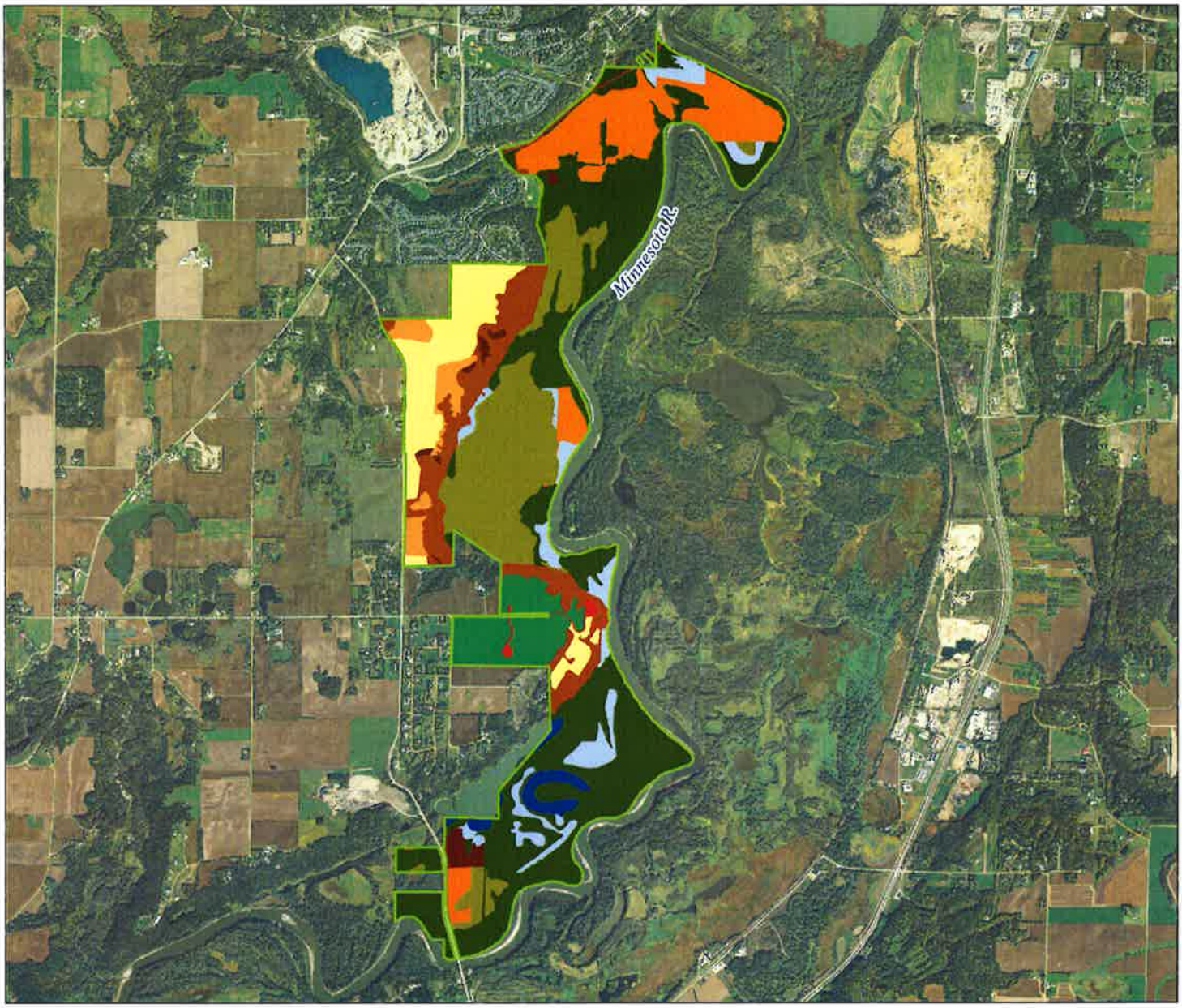


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Rapids Lake and San Francisco Units



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- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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UTM ZONE 15N
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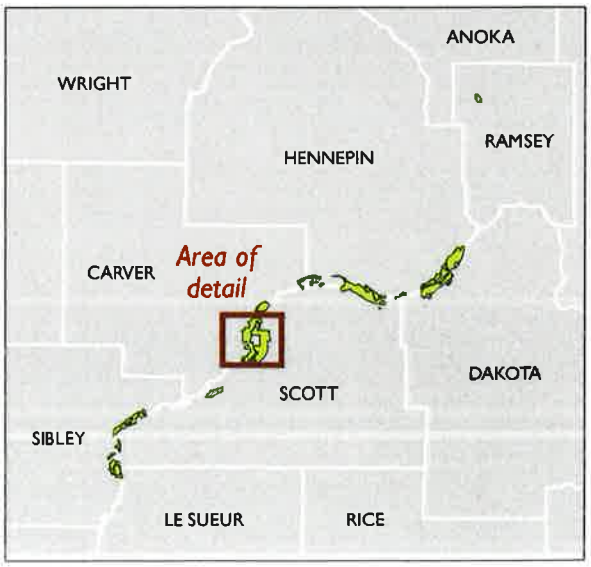
MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Round Lake Unit

- Unit Boundary
- MOU Land
- Developed
- Oak Savanna
- Small River
- Remnant Wet/Mesic Prairie
- Planted Wet/Mesic Grassland
- Permanent/Semi-Permanent Wetland
- Floodplain Forest
- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

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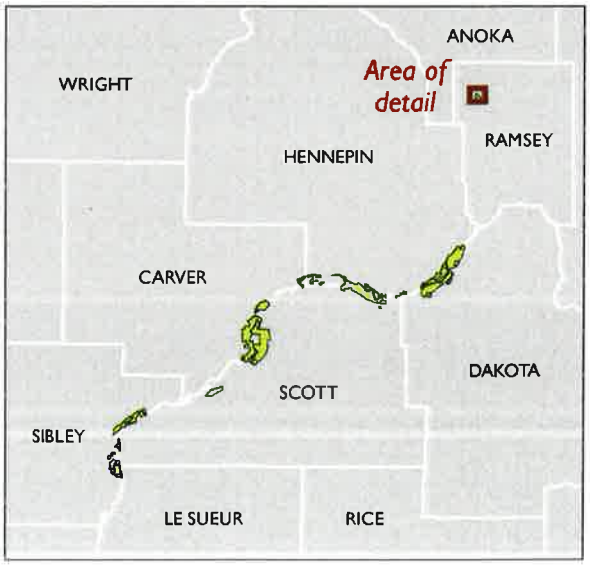
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

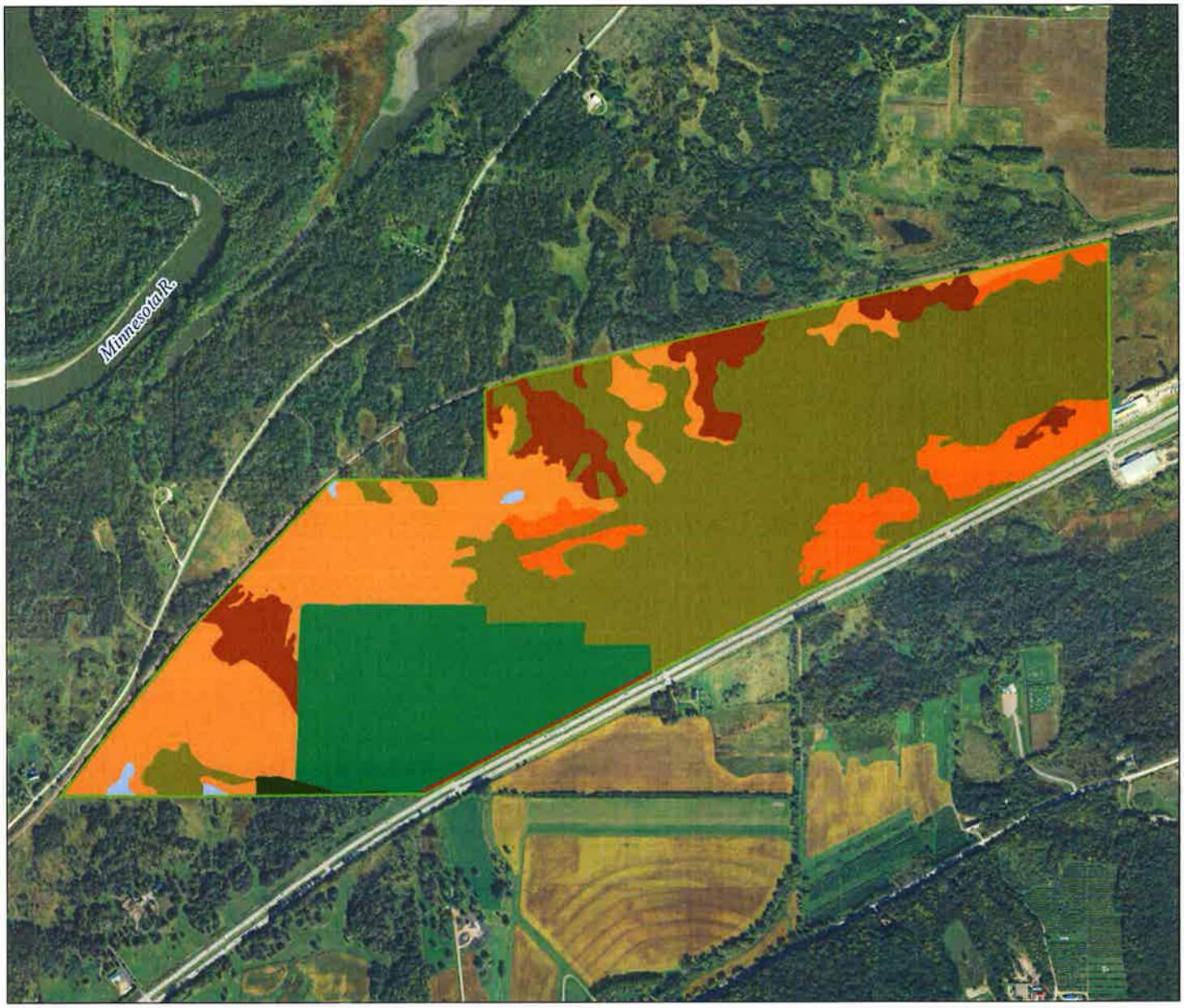


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

St. Lawrence Unit



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- Planted Dry Grassland
- Deepwater Wetland

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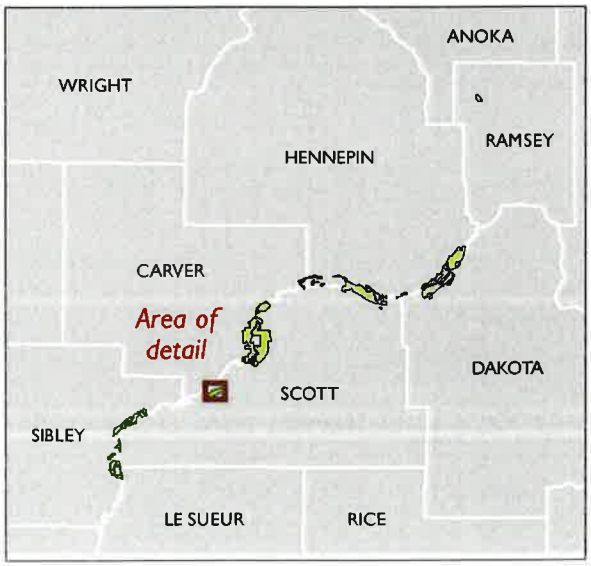
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

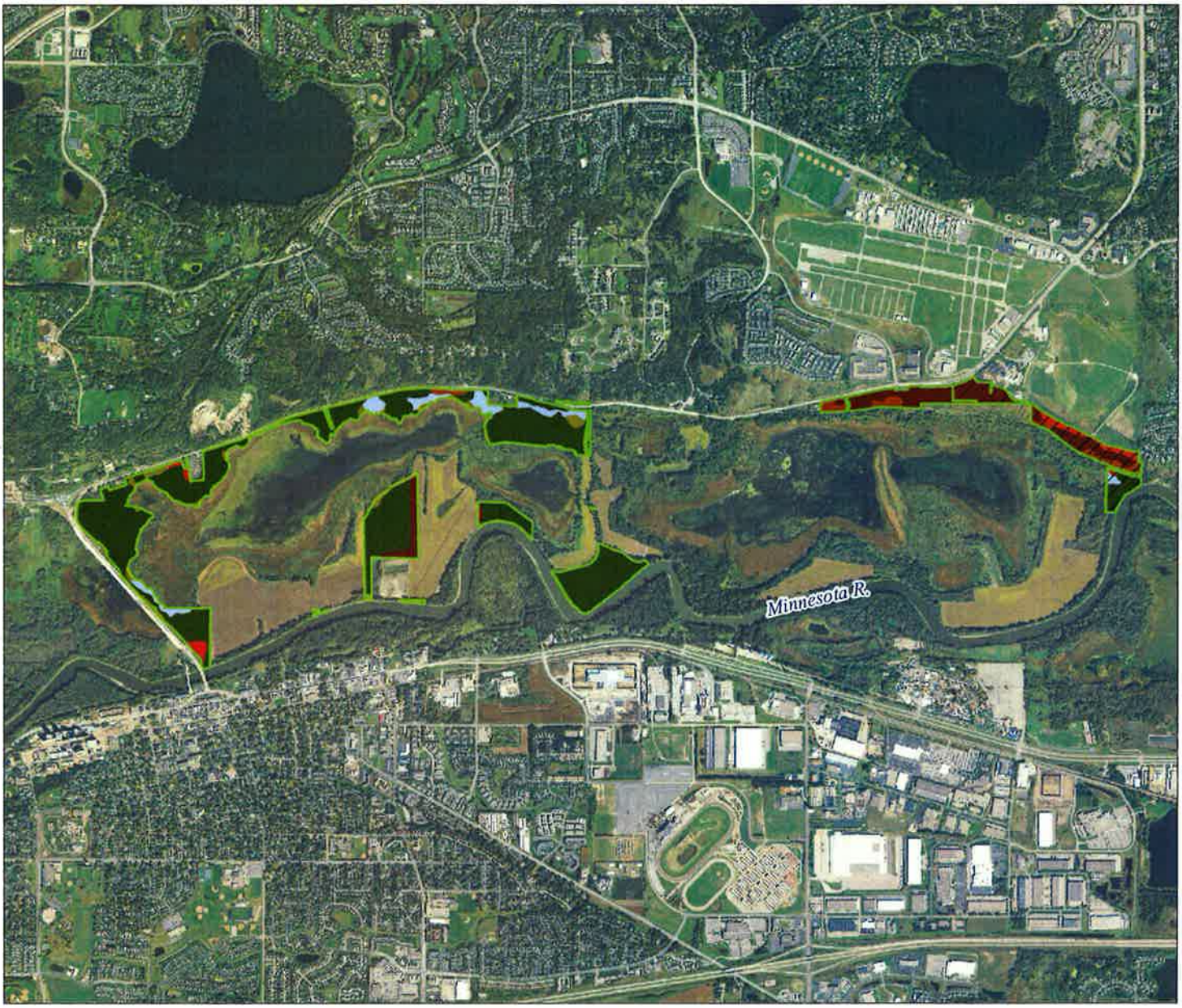


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Upgrala Unit



- Unit Boundary
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- Permanent/Semi-Permanent Wetland
- Floodplain Forest
- Upland Forest
- Wet Meadow
- Remnant Dry Prairie
- Planted Dry Grassland
- Deepwater Wetland

0 0.5 1 Miles

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UTM ZONE 15N
NAD83

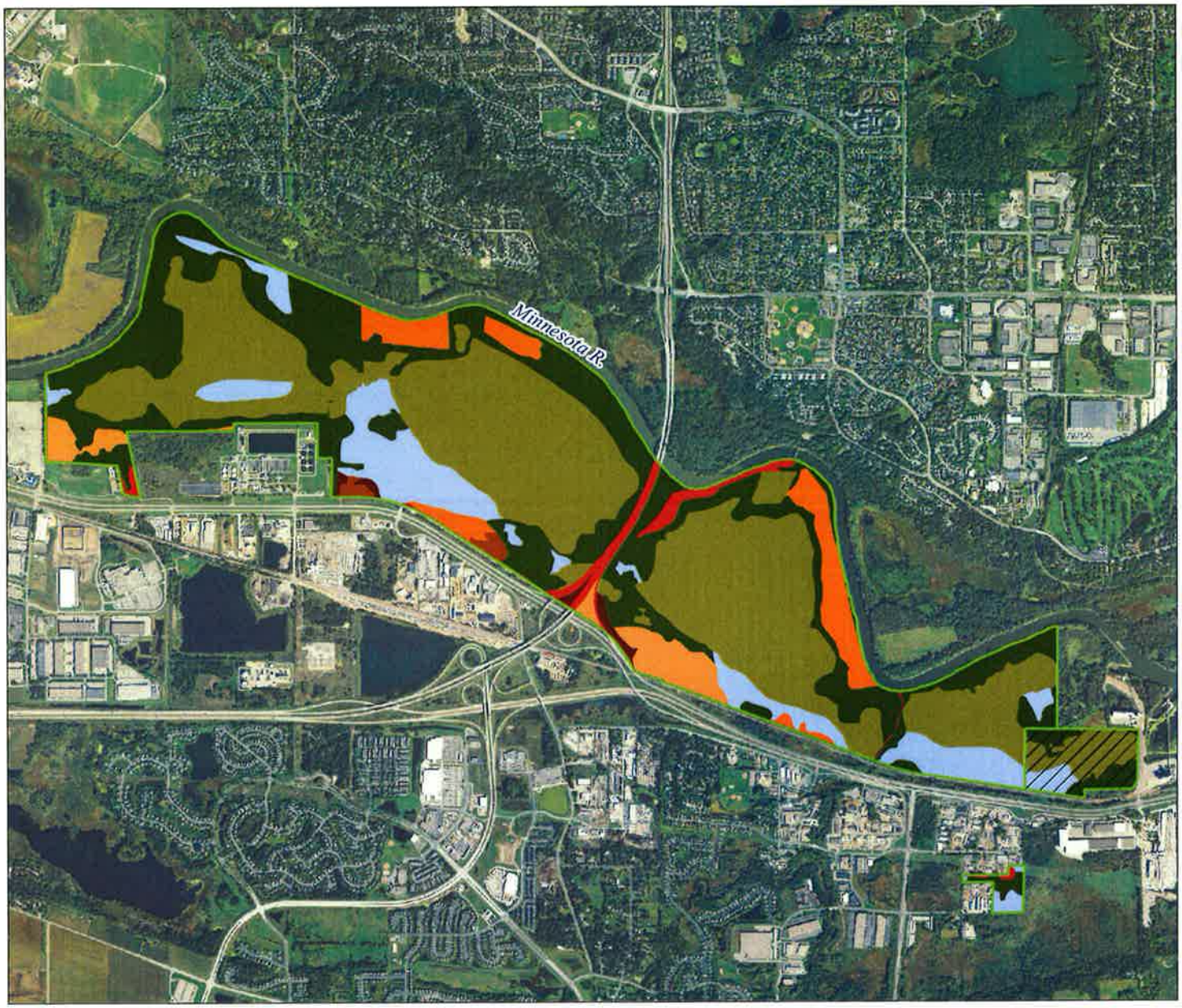
MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Existing Habitat Conditions

Wilkie Unit



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- Planted Dry Grassland
- Deepwater Wetland

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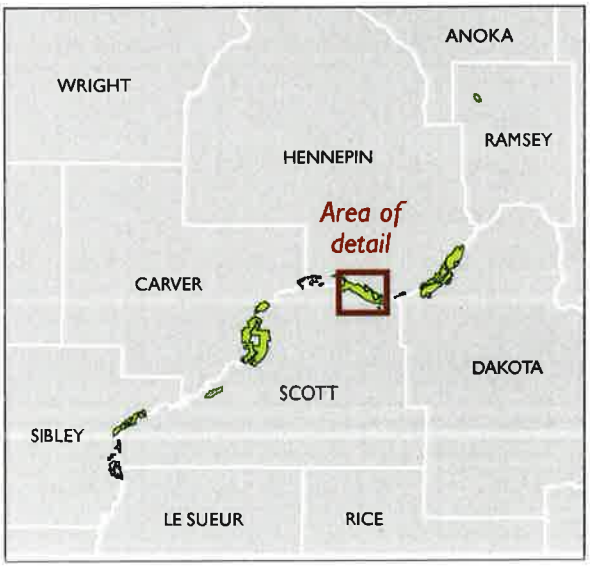
UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



APPENDIX D
PRIORITY HABITAT MAPS AND INFORMATION

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Table 1. Priority One Habitat Restoration Focus Areas

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
Black Dog Lake Mesic Prairie #4	-93.276 44.795	Remnant Prairie Fen/Wet Meadow/Carr UPs23, with pockets of WMs83, WPs54, and fen OPp93c	253	Rare remnant mesic prairie or wet meadow community. One of largest remnants in metro area. Microhabitats of mesic prairie, wet prairie, calcareous fen, and southern seepage meadow carr.	Delineate habitat types and determine hydrology. Mosaic of southern mesic prairie, southern wet prairie, southern seepage meadow carr, and calcareous fen. Develop management plan. Protect from invasive species encroachment.
Black Dog Lake Open Water #26	-93.269 44.803	Deepwater Wetland	336	Deepwater (open water) zone of basin important for fish and fish eating birds.	Balance providing northern bulrush community on edges, with open water for fish and fish eating birds, as well as wintering habitat for waterfowl and other waterbirds.
Black Dog Lake Lake Edges #27	-93.265 44.801	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	174	Northern Bulrush Marsh on edges of Black Dog Lake identified as rare community by MN DNR.	Balance providing northern bulrush community on edges, with open water for fish and fish eating birds, as well as wintering habitat for waterfowl and other waterbirds.
Bloomington Ferry Floodplain Forest #15	-93.395 44.800	Floodplain Forest FFs68a	76	Important mature FF noted as rare community by MN DNR.	Protect important mature habitat from development and degradation.
Blakeley/Jessenland Floodplain Forest #12	-93.885 44.574	Floodplain Forest FFs68a	1488	One of largest blocks of FF on the Refuge that is important to resources of concern. Designated as rare community by MN DNR.	Protect these large blocks of habitat from development and degradation.
Chaska Former Moist Soil Unit and along River #11	-93.603 44.773	Floodplain Forest FFs68a	124	Large blocks of FF are needed for several resources of concern. Letting these areas revert back to FF will help increase block size.	Protect existing FF adjacent to these areas and let these project areas revert back to FF to add to block size of FF habitat.

Table 1. Priority One Habitat Restoration Focus Areas (cont).

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
Chaska Chaska Lake #16	-93.609 44.776	Permanent/Semi-permanent Wetland Cattail Marsh MRn83	105	Important basin for migratory waterbirds where we have the ability to manage water levels.	Manipulate water levels for waterfowl, shorebirds, and other waterbirds.
Jessenland Wet Meadow #5	-93.893 44.597	Fen/Wet Meadow/Carr Remnant Prairie WMs83	4	A remnant Southern Seepage Meadow Carr area exists between the planted mesic grassland and floodplain forest.	Delineate area of wet meadow and prevent encroachment of non-desirable woody vegetation.
Long Meadow Lake LML Basin #17	-93.230 44.837	Permanent/Semi-permanent Wetland Northern Bulrush Spikerush Marsh MRn93	1227	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels.	Manipulate water levels for waterfowl, shorebirds, and other waterbirds.
Long Meadow Lake Orchard Springs #18	-93.246 44.830	Permanent/Semi-permanent Wetland	.69	Important smaller basin for waterfowl.	Limit beaver activity and keep water levels for waterfowl.
Long Meadow Lake Hogback Pond #29	-93.234 44.842	Deepwater Wetland	8	Important area for recreational fishing and fish eating birds. Managed in fishing in the neighborhood program by MN DNR.	Managed to provide recreational fishing and habitat for fish eating birds and other wildlife.
Long Meadow Lake Youth Fishing Pond #30	-93.236 44.840	Deepwater Wetland	5	Important area for recreational fishing and fish eating birds. Managed in fishing in the neighborhood program by MN DNR.	Managed to provide recreational fishing and habitat for fish eating birds and other wildlife.
Long Meadow Lake Cedar Pond #31	-93.242 44.834	Deepwater Wetland	2.5	Important area for recreational fishing and fish eating birds. Managed in fishing in the neighborhood program by MN DNR.	Managed to provide recreational fishing and habitat for fish eating birds and other wildlife.

Table 1. Priority One Habitat Restoration Focus Areas (cont).

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
Long Meadow Lake Kidder Marsh #33	-93.245 44.832	Permanent/Semi-permanent Wetland	3	Important basin for migratory waterbirds, where we have the ability to manage water levels.	Manipulate water levels for waterfowl, shorebirds, and other waterbirds.
Long Meadow Lake Hogback Marsh #34	-93.235 44.843	Permanent/Semi-permanent Wetland Cattail Marsh	19	Important smaller basin out of the floodplain for waterfowl and other waterbirds.	Manipulate water levels for waterfowl and waterbirds. Manage cattail encroachment.
Louisville Swamp Oak Savanna #7	-93.606 44.738	Remnant savanna UPs14-Dry	142	Largest remnant dry savanna on the Refuge. Degraded but initial efforts show native seed bank, including kittentails.	Remove invasive species and excess woody vegetation shading out natives. Efforts to remove woody species have been initiated and need to be continued to keep area from being dominated by undesirable woody species.
Louisville Swamp Jabs #19	-93.623 44.739	Permanent/Semi-permanent Wetland Moist Soil Plants	97	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels if the structure is rehabilitated. Great bird use in the past.	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds. Structure needs to be rehabilitated.
Louisville Swamp ARRA Frog Pond #20	-93.600 44.736	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	1.5	Important shallow bulrush marsh important to a diverse number of species of reptiles, amphibians and birds. Identified as rare community by MN DNR	Although there is no water control structure on this basin, the wetland should be protected.
Louisville Swamp Jailhouse Marsh #21	-93.617 44.696	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	236	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR.	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds. Protect and manage for northern bulrush community.

Table 1. Priority One Habitat Restoration Focus Areas (cont).

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
Rapids Lake Goat Prairies #2	-93.641 44.736	Remnant Prairie UPs13-Dry	8	Rare slope prairie with unique plant communities such as prickly pear cactus. Rare community MN DNR.	Prevent encroachment from invasive and other woody species.
Rapids Lake Oak Savanna #8	-93.644 44.735	Remnant Savanna UPs14 Dry	22	Large area of remnant dry savanna just across the river from the Louisville Swamp savanna.	Remove invasives and excess woody vegetation shading out natives, such as cedar trees.
Rapids Lake Early successional floodplain forest #14	-93.618 44.755	Floodplain Forest FFs68a	154	Areas adjacent to Hartung property may be important areas for woodcock and could be managed as early successional habitat. Other areas along Rapids Lake could add to mature FF block size.	Maintain as floodplain forest. Look to keep some areas as early successional habitat for woodcock.
Rapids Lake Rapids Lake Basin #22	-93.638 44.729	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	256	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR	Seasonally manipulate water to encourage plant growth to attract migratory shorebirds, waterfowl and other waterbirds.
Rapids Lake Horseshoe and Long Lakes #32	-93.634 44.705	Deepwater Wetland	37	Important area for recreational fishing and fish eating birds.	Managed to provide recreational fishing and habitat for fish eating birds and other wildlife.
Round Lake Round Lake Basin #28	-93.177 45.074	Deepwater Wetland	139	Important area for migratory waterbirds such as swans and diving ducks, fish and fish eating birds.	Managed to provide recreational fishing and habitat for fish eating birds and other wildlife.

Table 1. Priority One Habitat Restoration Focus Areas (cont).

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
St. Lawrence Mesic Prairie/ Wet Meadow #3	-93.697 44.651	Remnant Prairie, Wet Meadow/Carr UPs23 with mosaic of Ups54, WMs83 and scattered oak trees	95	One of largest native remnant mesic prairie/wet meadows on Refuge. Microhabitats of mesic prairie, wet prairie and southern seepage meadow carr	Delineate habitat types. Develop management plan and protect from invasive species encroachment.
St. Lawrence Klehr Tract Savanna #10	-93.711 44.649	Remnant Savanna Ups24-Mesic	97	One of largest mesic oak savanna areas on the Refuge.	Oak savanna remnants rare in Midwest and removing invasive species could help return this to quality oak savanna habitat.
Wilkie Stagecoach Road and Rex Gun Club #6	-93.401 44.788	Remnant Prairie UPs23-Mesic	10	One of a few remnant mesic prairies on the Refuge and in the metro.	Prevent encroachment from invasive species. Removal of pine plantation may reveal native seed bank.
Wilkie Oak Savanna #9	-93.414 44.791	Remnant Savanna UPs14-Dry	69	Remnant dry savanna that has been encroached by wood vegetation. Removing woody encroachment could reclaim area.	Remove undesirable woody vegetation and invasives to reclaim savanna remnant.
Wilkie Rice Lake #23	-93.391 44.790	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	283	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds.
Wilkie Blue Lake #24	-93.435 44.804	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	184	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds.

Table 1. Priority One Habitat Restoration Focus Areas (cont).

Unit Map, Location & ID #	Coordinates	Habitat Type	Acreage	Rationale	Management Action Needed
Wilkie Fisher Lake #25	-93.411 44.799	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	305	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds.
Wilkie Fisher Lake #13	-93.414 44.801	Floodplain Forest FFs68a	449	Large blocks of FF are needed for several resources of concern. Letting these areas revert back to FF will help increase block size.	Protect existing FF adjacent to these areas and let these project areas revert back to FF to add to block size of FF habitat.
Wilkie Con Grain Marsh #35	-93.70 44.783	Permanent/Semi-permanent Wetland Northern Bulrush Marsh MRn93	127	Important basin for migratory shorebirds, waterfowl and other waterbirds where we have the ability to manage water levels. Identified as rare community by MN DNR	Seasonally manipulate water to encourage moist soil plant growth to attract migratory shorebirds, waterfowl and other waterbirds. Structure needs to be rehabilitated on Con Grain Marsh.
Upgrala Hillside Prairie #1	-93.455 44.818	Remnant Prairie UPs13-Dry	50	One of largest native remnant dry prairies in metro area and largest on the Refuge.	Removal of invasive species and protection from degradation and development.

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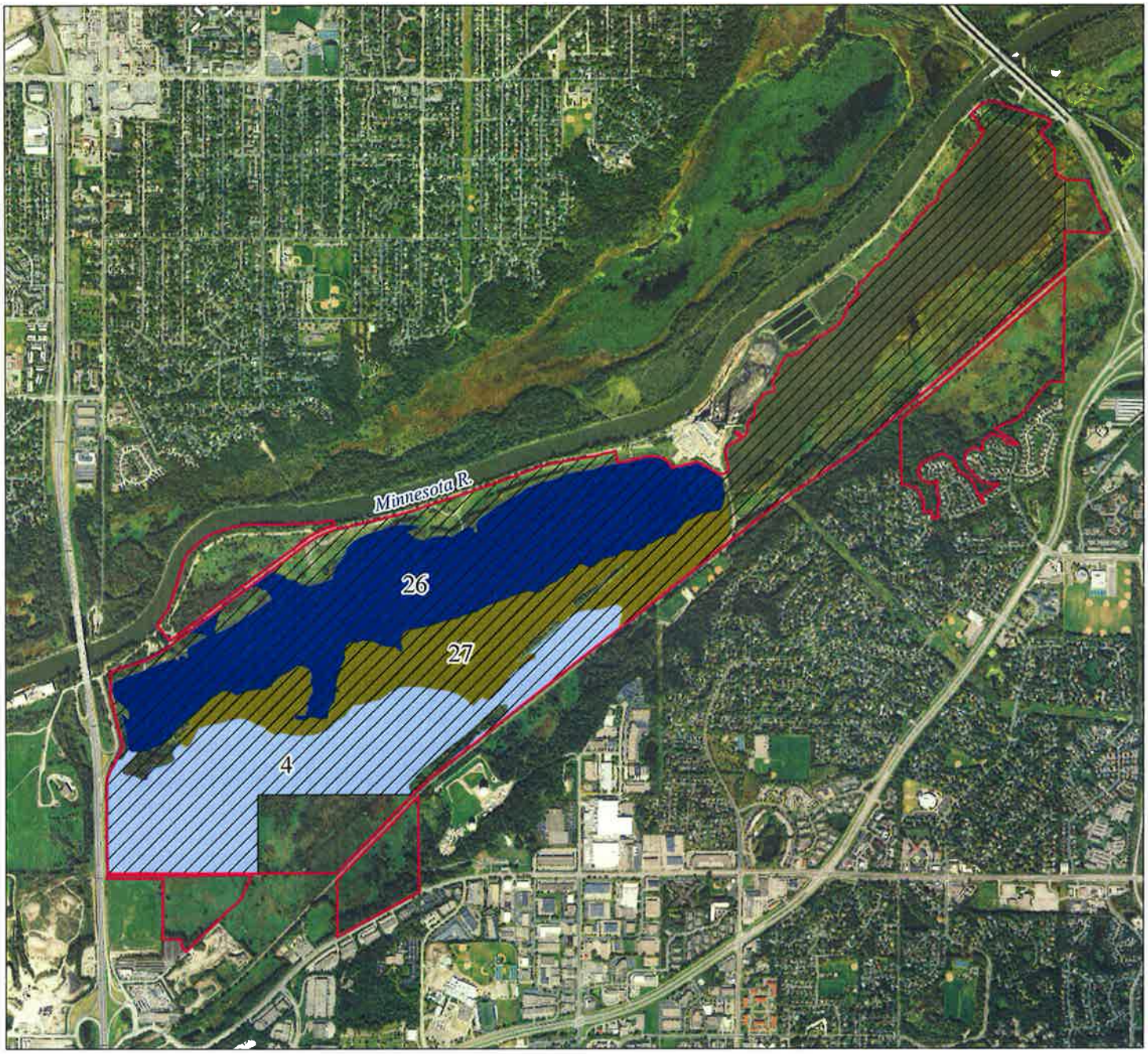
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Black Dog Lake Unit



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

Oak Savanna

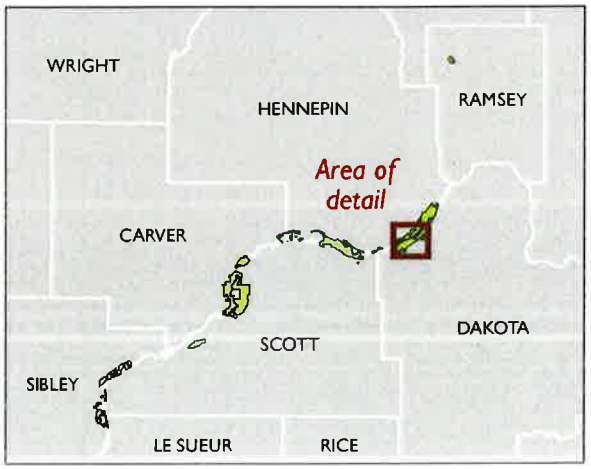
0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N S

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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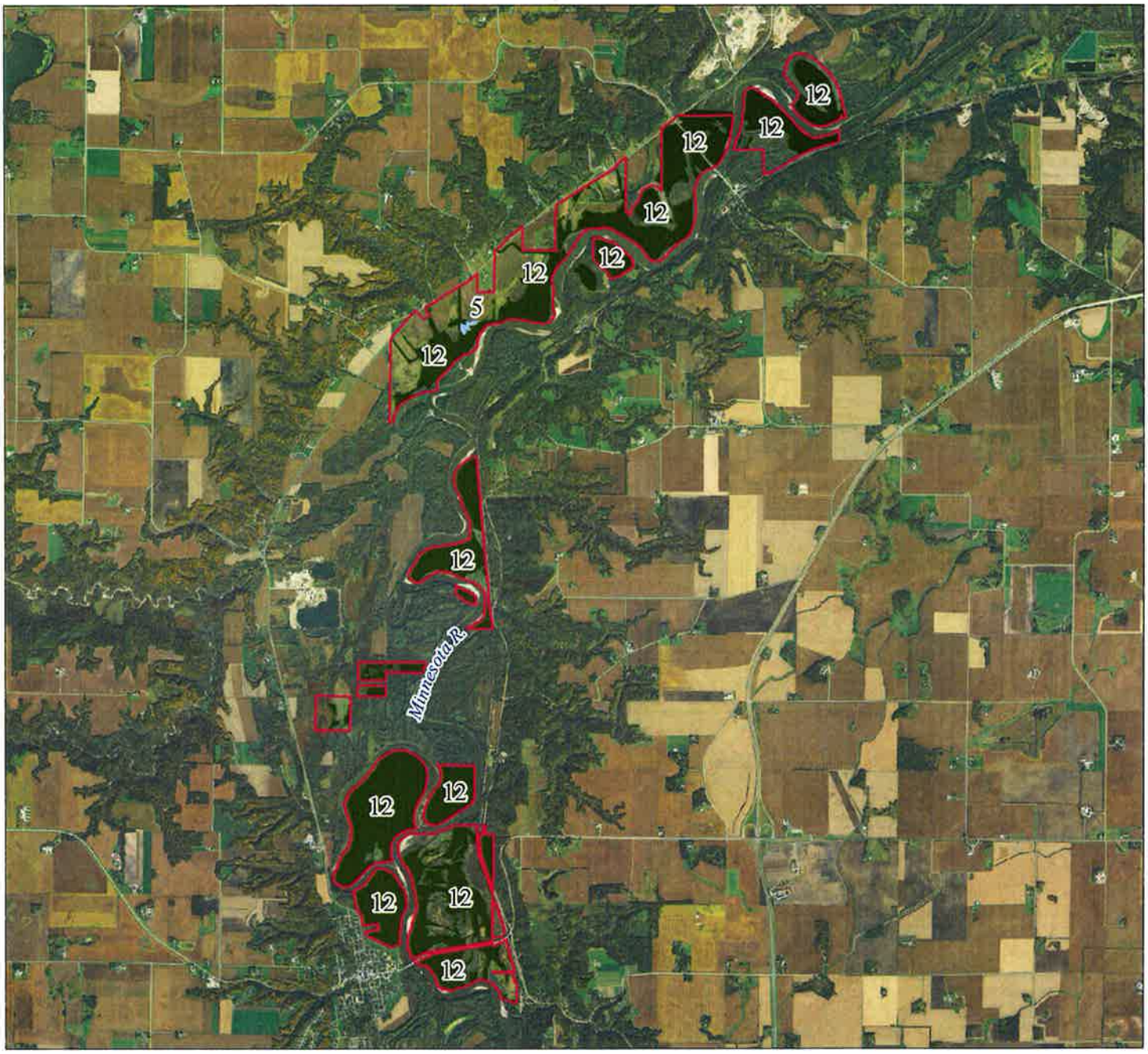
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Blakeley and Jessenland Units



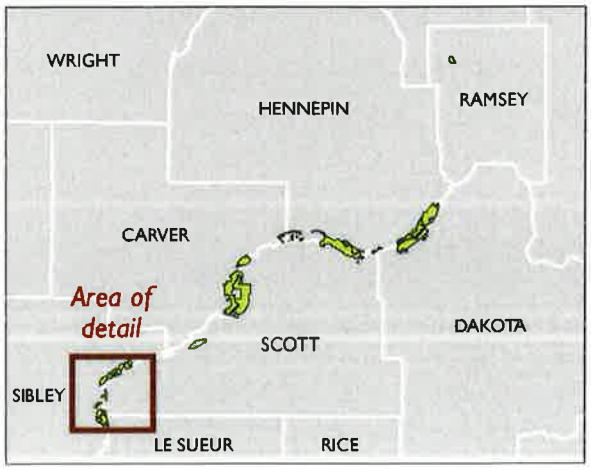
- Unit Boundary
- MOU Land
- Remnant Mesic Prairie
- Remnant Dry Prairie
- Permanent/Semi-Permanent Wetland
- Deepwater Wetland
- Fen/Wet Meadow/Carr
- Floodplain Forest
- Oak Savanna

0 0.5 1 Miles

0 0.5 1 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Bloomington Ferry Unit

- Unit Boundary
- MOU Land
- Remnant Mesic Prairie
- Remnant Dry Prairie
- Permanent/Semi-Permanent Wetland
- Deepwater Wetland
- Fen/Wet Meadow/Carr
- Floodplain Forest
- Oak Savanna

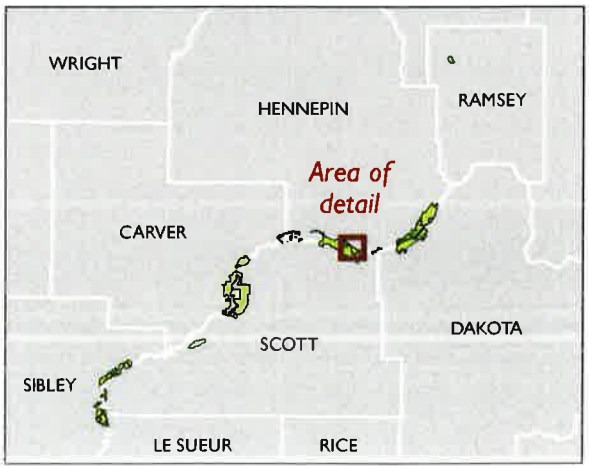
0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N S

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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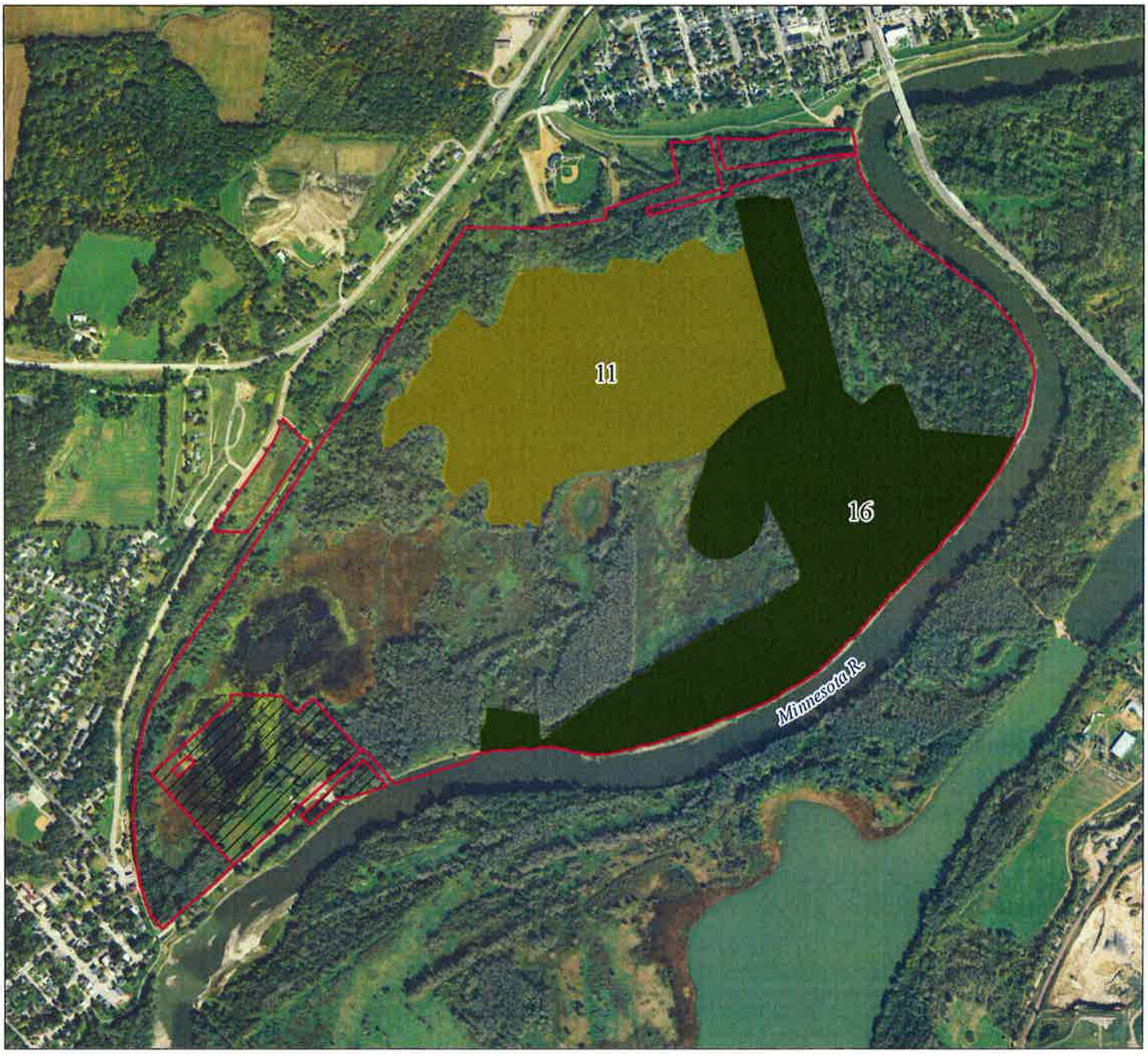
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Chaska Unit



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

Oak Savanna

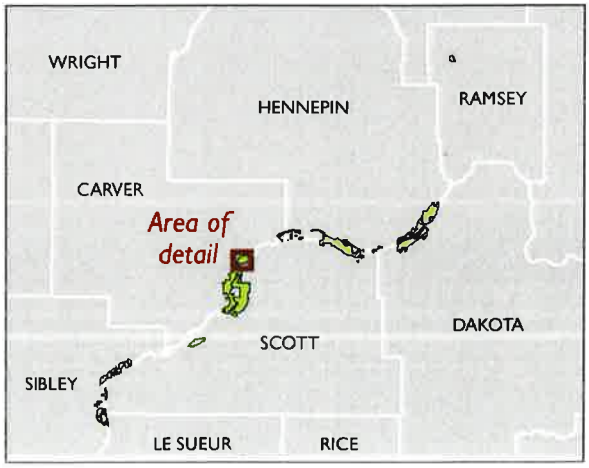
0 0.2 0.4 Miles

0 0.2 0.4 Kilometers

N S

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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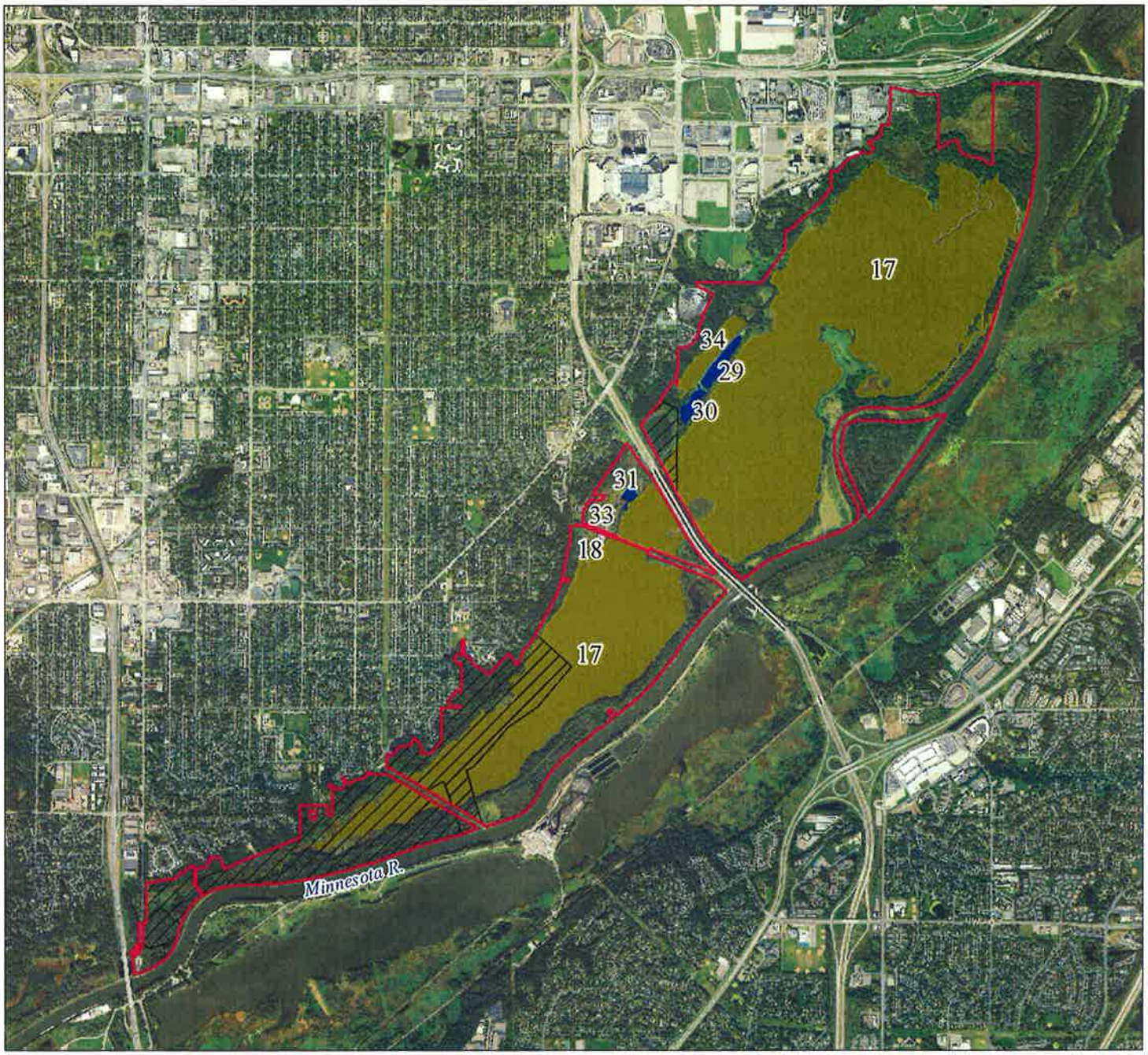
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Long Meadow Lake Unit



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

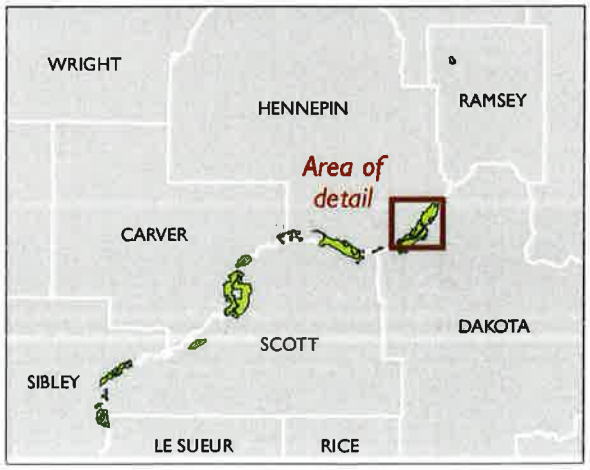
Oak Savanna

0 0.5 1 Miles

0 0.5 1 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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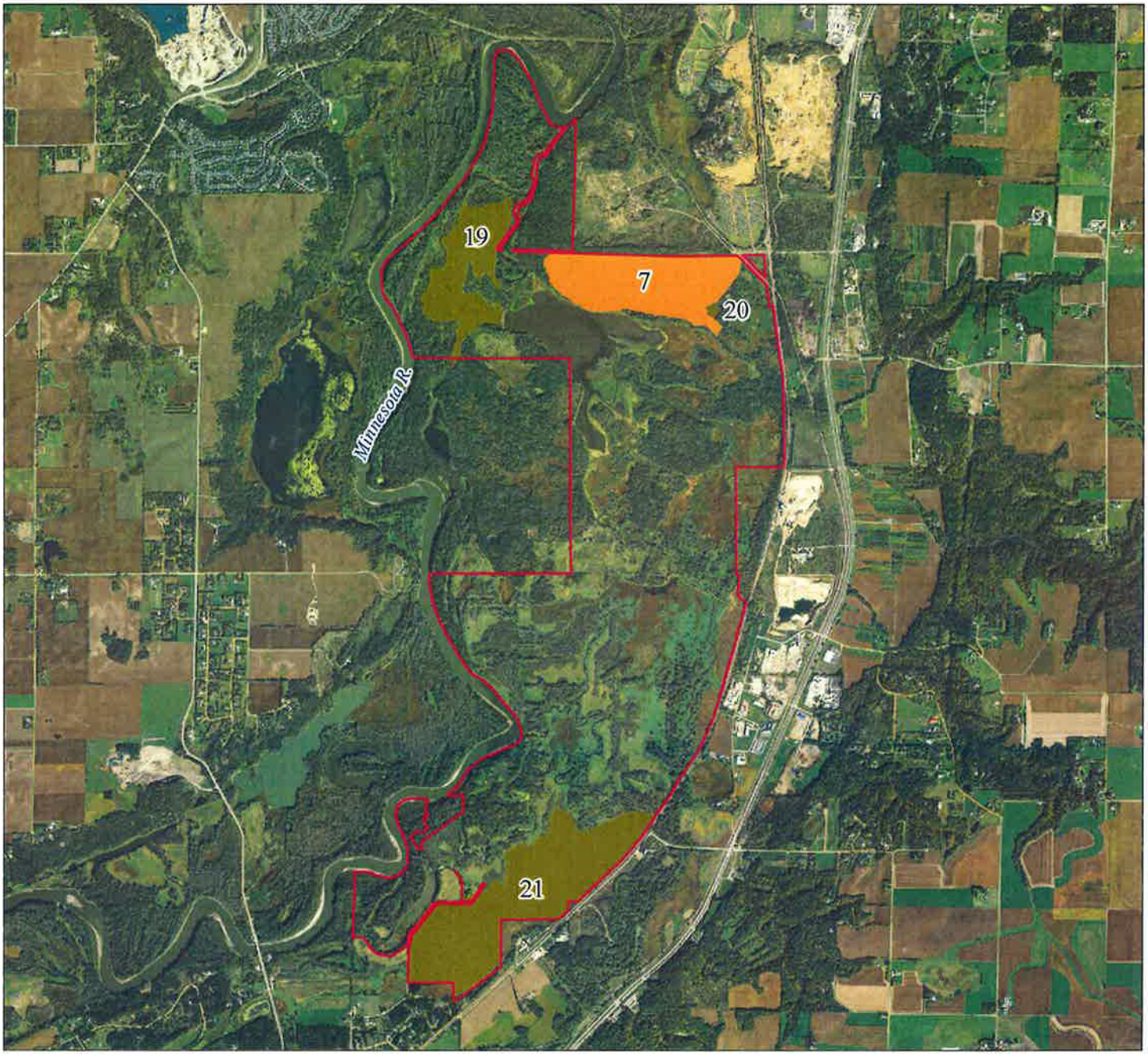
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Louisville Swamp Unit



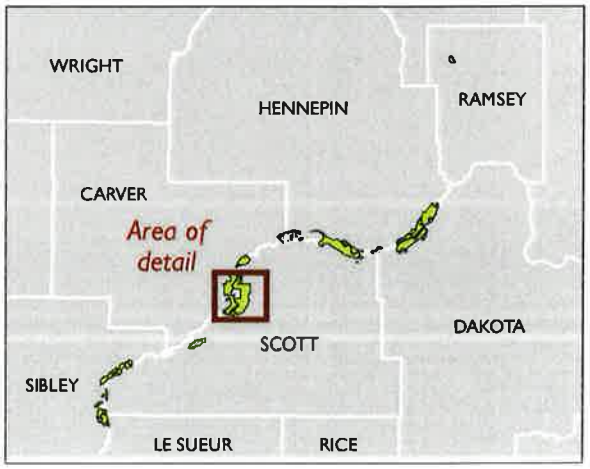
- Unit Boundary
- MOU Land
- Remnant Mesic Prairie
- Remnant Dry Prairie
- Permanent/Semi-Permanent Wetland
- Deepwater Wetland
- Fen/Wet Meadow/Carr
- Floodplain Forest
- Oak Savanna

0 0.5 1 Miles

0 0.5 1 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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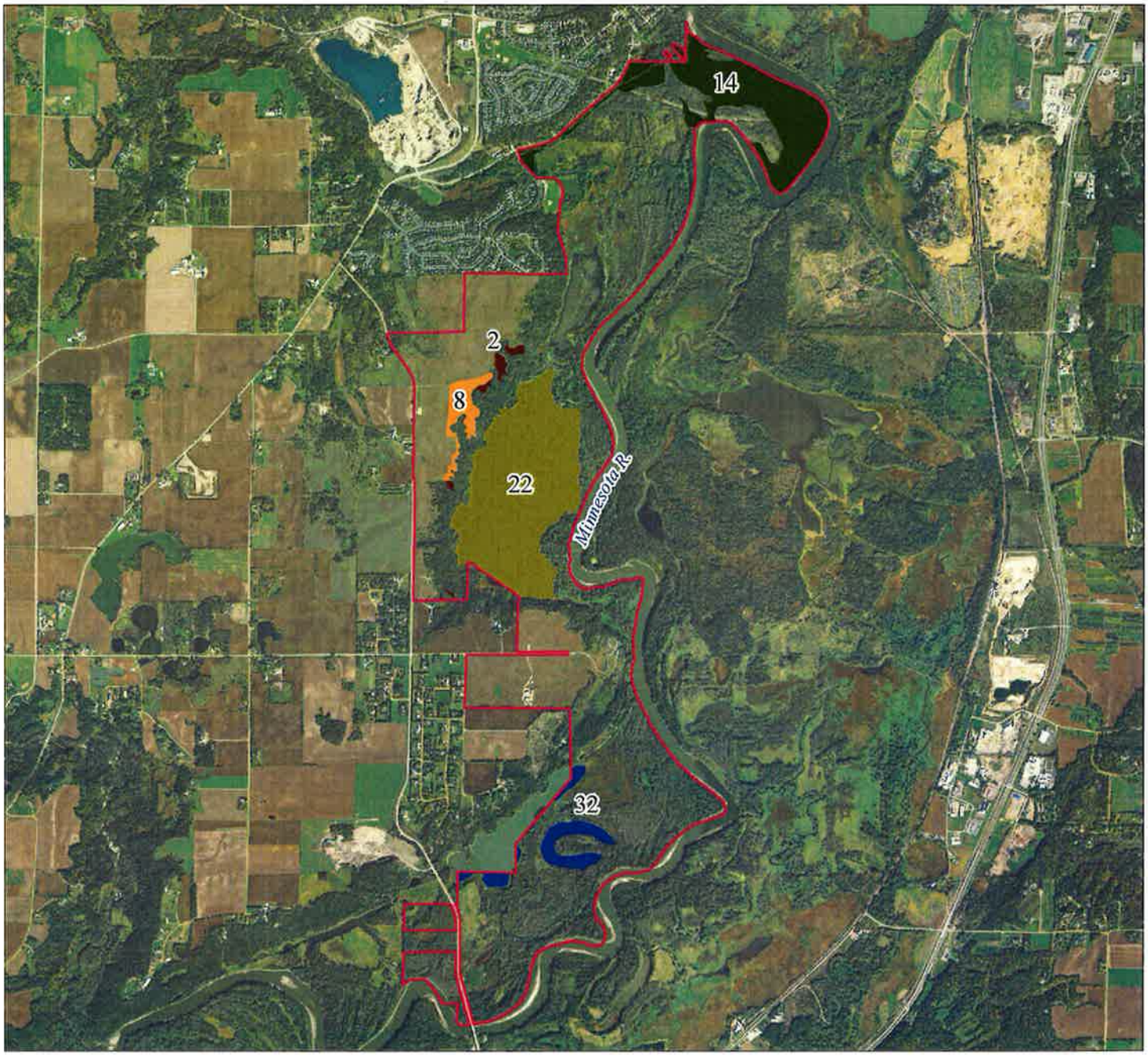
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Rapids Lake and San Francisco Units



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

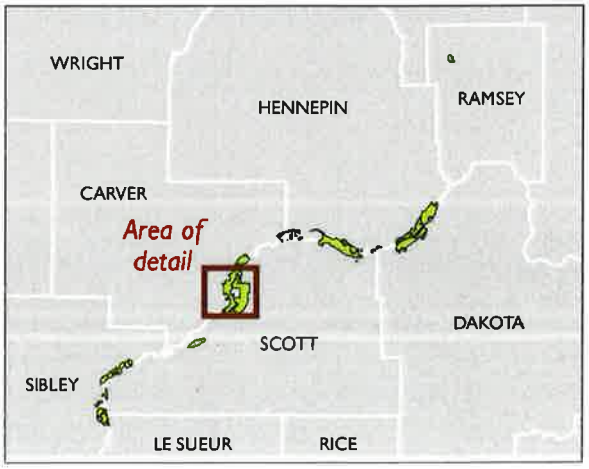
Oak Savanna

0 0.5 1 Miles

0 0.5 1 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Round Lake Unit

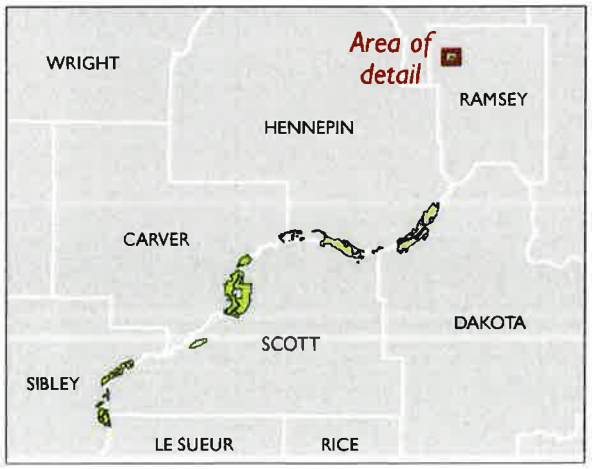
- Unit Boundary
- MOU Land
- Remnant Mesic Prairie
- Remnant Dry Prairie
- Permanent/Semi-Permanent Wetland
- Deepwater Wetland
- Fen/Wet Meadow/Carr
- Floodplain Forest
- Oak Savanna

0 0.1 0.2 Miles

0 0.1 0.2 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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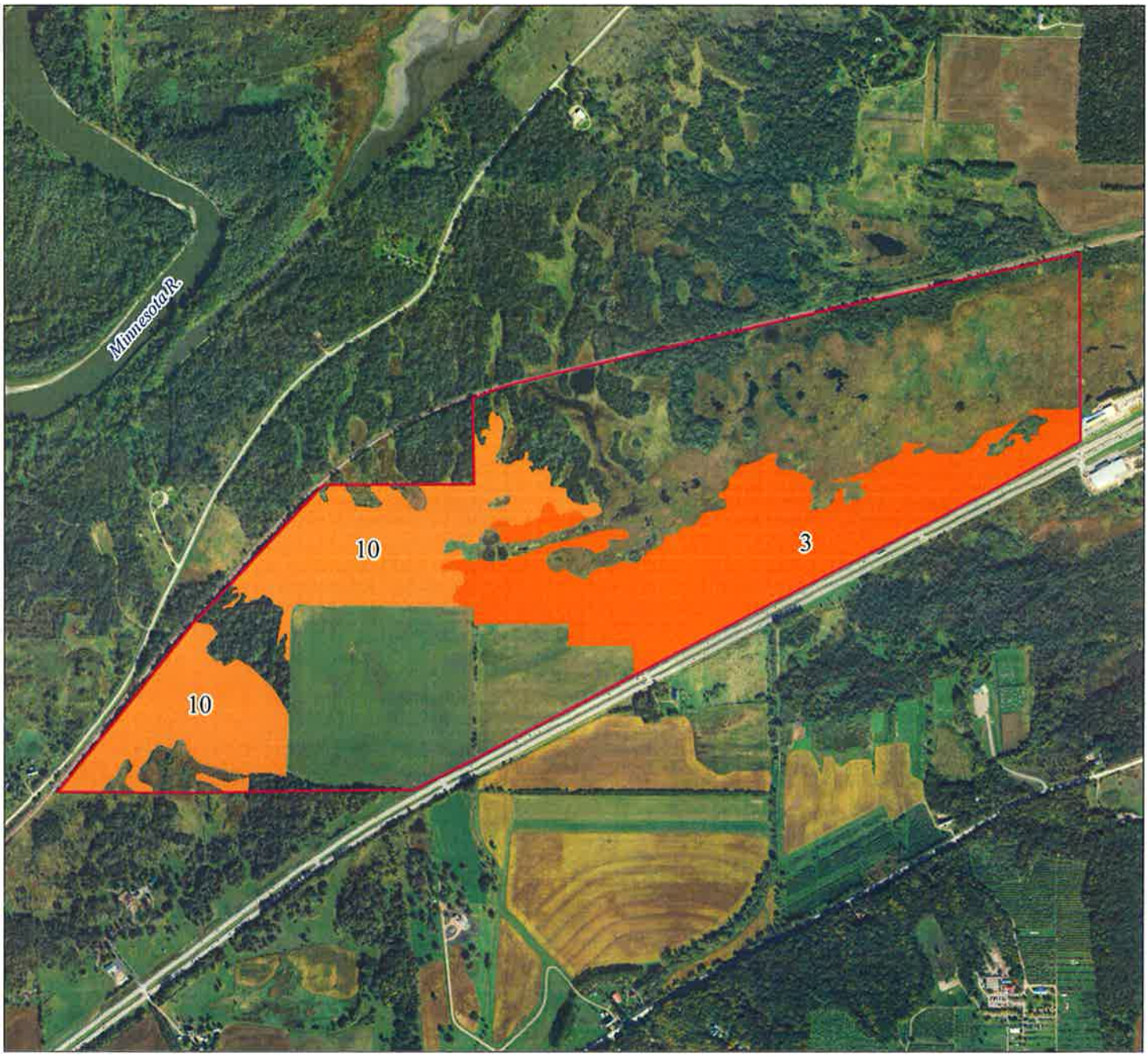
Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

St. Lawrence Unit



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

Oak Savanna

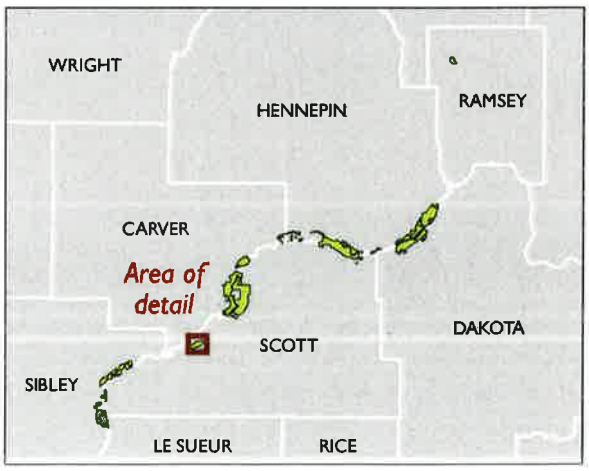
0 0.2 0.4 Miles

0 0.2 0.4 Kilometers

N S

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR



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Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Upgrala Unit

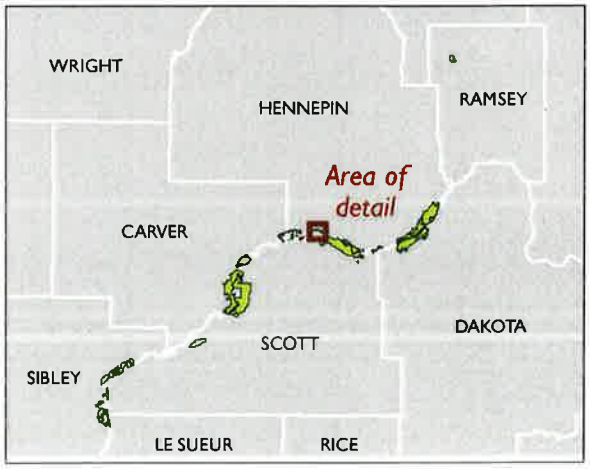
- Unit Boundary
- MOU Land
- Remnant Mesic Prairie
- Remnant Dry Prairie
- Permanent/Semi-Permanent Wetland
- Deepwater Wetland
- Fen/Wet Meadow/Carr
- Floodplain Forest
- Oak Savanna

0 0.2 0.4 Miles

0 0.2 0.4 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

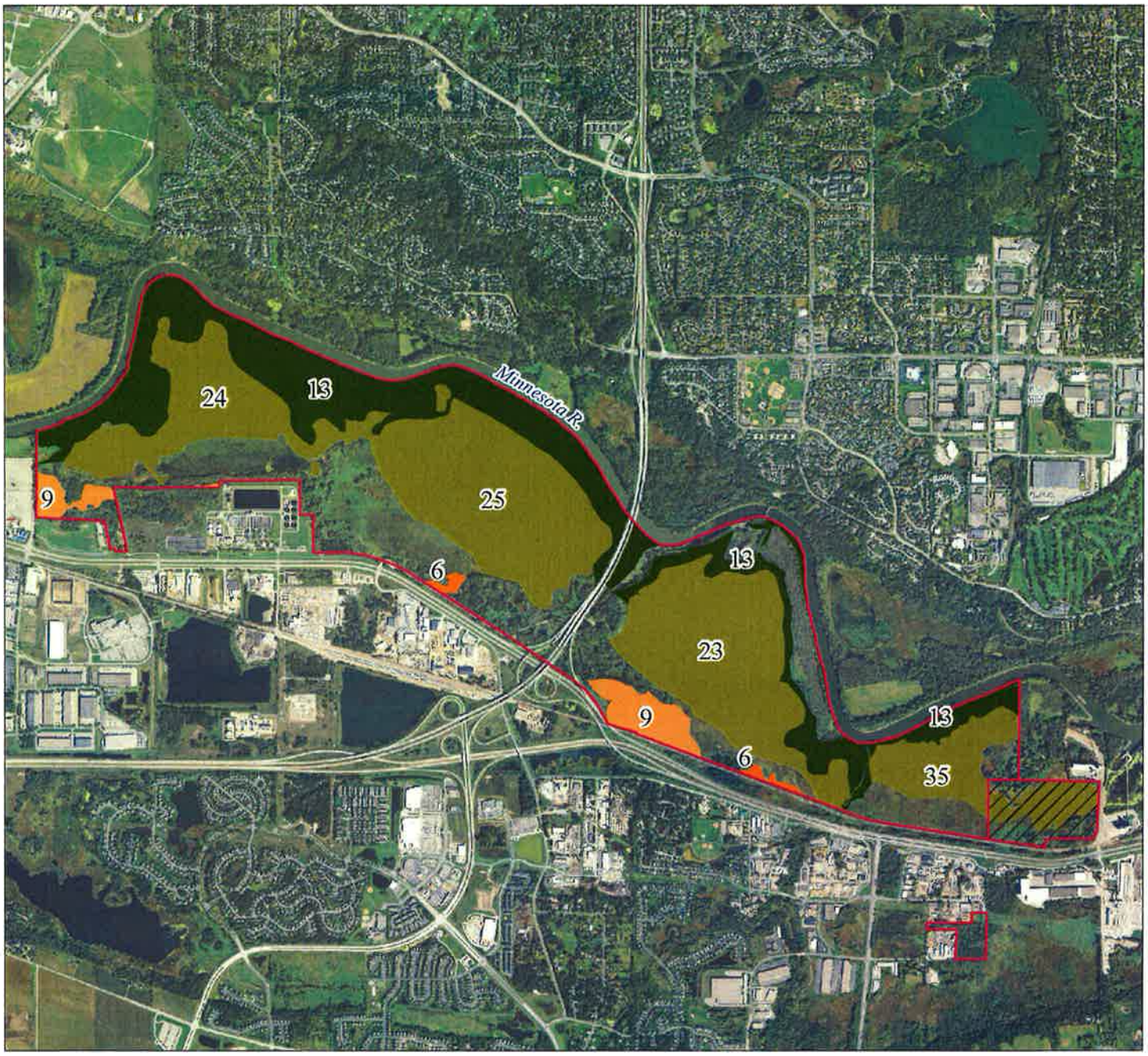


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority One Restoration Areas

Wilkie Unit



Unit Boundary

MOU Land

Remnant Mesic Prairie

Remnant Dry Prairie

Permanent/Semi-Permanent Wetland

Deepwater Wetland

Fen/Wet Meadow/Carr

Floodplain Forest

Oak Savanna

0 0.5 1 Miles

0 0.5 1 Kilometers

UTM ZONE 15N
NAD83

MATT MILLETT
1/10/2017
SOURCES: MVNWR, USDA, MN DNR

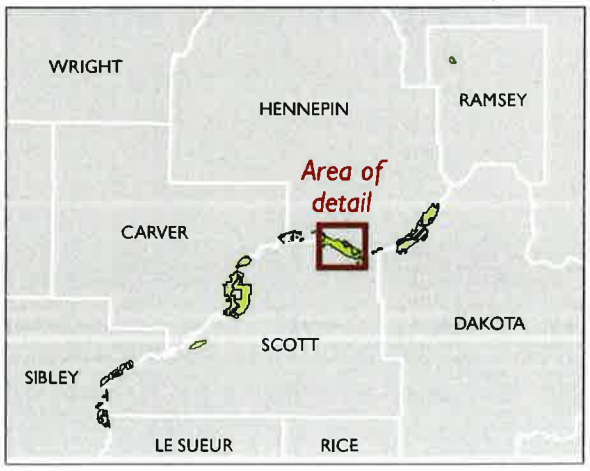


Table 2. Priority Two Suggested Habitat Restoration Areas.

Unit Map, Location & ID #	Coordinates	Habitat Type	Rationale	Management Action Needed
Black Dog Lake Upland Forest #12	-93.270 44.790	Red Oak, Sugar Maple, Basswood Forest, MHs38c	Rare plant community identified by the MN DNR. Many of these communities are being impacted by development or invasion by exotic invasive species.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.
Black Dog Lake Upland Forest #13	-93.235 44.810	Pin Oak, Burr Oak Woodland, FDs37b	Rare fire dependent community that has been encroached by nondesirable woody species due to lack of fire on the landscape.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.
Black Dog Lake Trout Stream #117	-93.280 44.794	Small Stream Trout Stream	Many of these streams are impacted by changes in water distribution and degradation of habitat. Continue work with MN DNR and partners to protect these streams.	Work with the MN DNR to protect Refuge streams from further habitat degradation. If possible, with guidance from the MN DNR, work with partners to restore habitat conditions of streams where needed.
Black Dog Lake Trout Stream #118	-93.260 44.802	Small Stream Trout Stream	Many of these streams are impacted by changes in water distribution and degradation of habitat. Continue work with MN DNR and partners to protect these streams.	Work with the MN DNR to protect Refuge streams from further habitat degradation. If possible, with guidance from the MN DNR, work with partners to restore habitat conditions of streams where needed.
Black Dog Lake Trout Stream #119	-93.241 44.812	Small Stream Trout Stream	Many of these streams are impacted by changes in water distribution and degradation of habitat. Continue work with MN DNR and partners to protect these streams.	Work with the MN DNR to protect Refuge streams from further habitat degradation. If possible, with guidance from the MN DNR, work with partners to restore habitat conditions of streams where needed.
Black Dog Lake Trout Stream (Unnamed #4) #120	-93.237 44.814	Small Stream Trout Stream	Many of these streams are impacted by changes in water distribution and degradation of habitat. Continue work with MN DNR and partners to protect these streams.	Work with the MN DNR to protect Refuge streams from further habitat degradation. If possible, with guidance from the MN DNR, work with partners to restore habitat conditions of streams where needed.
Black Dog Lake Trout Stream (Black Dog Creek) #121	-93.229 44.821	Small Stream Trout Stream	Many of these streams are impacted by changes in water distribution and degradation of habitat. Continue work with MN DNR and partners to protect these streams.	Work with the MN DNR to protect Refuge streams from further habitat degradation. If possible, with guidance from the MN DNR, work with partners to restore habitat conditions of streams where needed.
Blakeley Upland Forest #15	-93.889 44.542	Red Oak, Sugar Maple, Basswood Forest, MHs38c	Rare plant community identified by the MN DNR. Impacted by invasive exotic species.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.

Table 2. Priority Two Suggested Habitat Restoration Areas.

Unit Map, Location & ID #	Coordinates	Habitat Type	Rationale	Management Action Needed
Jessenland Mesic Grassland Planted #24	-93.886 44.603	Planted Mesic Grassland	Converted farm field planted to native grassland habitat. Restoring these areas to native grass and forbs will provide habitat to many Resources of Concern.	Maintain native grassland habitat by keeping out invasive species and undesirable tree species, and encouraging growth of native grassland species for Resources of Concern.
Long Meadow Lake Upland Forest #37	-93.246 44.829	Red Oak, White Oak, Sugar Maple Forest, MHs39	Rare plant community identified by the MN DNR. Many of these communities are being impacted by development or invasion by exotic invasive species.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.
Long Meadow Lake Upland Forest #38	-93.232 44.847	Red Oak, White Oak, Sugar Maple Forest, MHs39	Rare plant community identified by the MN DNR. Many of these communities are being impacted by development or invasion by exotic invasive species.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.
Long Meadow Lake Bloomington VC Oak Savanna-Planted #39	-93.216 44.860	Southern Dry Savanna, UPs14	Demonstration oak savanna habitat around the Bloomington VC. Need to maintain as an example oak savanna restoration.	Maintain area by prescribed fire and cutting of undesirable woody species.
Long Meadow Lake Ike's Creek #114	-93.230 44.846	Small Stream Trout Stream	High quality cold water stream with self-sustaining brook trout. Only brook trout stream in metro area. Brook trout are sensitive to water temperature and oxygen levels and indicator of good water quality.	Protect stream from impacts from development and work with MN DNR and other partners on trout stream designation to give the stream added protection. Work on solving erosion issue along the stream.
Louisville Swamp Upland Forest-ARRA Area #41	-93.600 44.736	Pin Oak, Burr Oak Woodland, FDs37b	Rare fire dependent community that has been encroached by nondesirable woody species due to lack of fire on the landscape.	Area previously managed as savanna, but should be a more open woodland community. Let revert back to woodland, while preventing encroachment from exotic invasive species.
Louisville Swamp Dry Prairie-Outcrop #54	-93.612 44.730	Crystalline Bedrock Outcrop-MN River Subtype, ROs12a1	Very rare fragile habitat. Need to protect this habitat and the fragile species that are present such as cactus species.	Protect habitat and fragile species. Include this habitat in fire management plan since caution needs to be taken around fragile cactus community.

Table 2. Priority Two Suggested Habitat Restoration Areas.

Unit Map, Location & ID #	Coordinates	Habitat Type	Rationale	Management Action Needed
Louisville Swamp Middle Road #60	-93.612 44.717	Temporary/Seasonal Wetlands	Many of these non-permanent wetlands scattered throughout the mesic prairie are dominated by reed canary grass or filled in with sediment. Important to provide this habitat for Resources of Concern.	Look for areas to restore temporary basins. Scraping of areas to decrease invasive species and provide temporary wetlands for species may take minimum effort.
Louisville Swamp Upland Forest #65	-93.603 44.732	Pin Oak, Burr Oak Woodland, FDs37b	Rare fire dependent community that has been encroached by nondesirable woody species due to lack of fire on the landscape.	Protect area from invasion by exotic invasive species.
Louisville Swamp Upland Forest #66	-93.612 44.726	Pin Oak, Burr Oak Woodland, FDs37b	Rare fire dependent community that has been encroached by nondesirable woody species due to lack of fire on the landscape.	Protect area from invasion by exotic invasive species.
Louisville Swamp Sand Creek #116	-93.601 44.711	Mid-size stream Warmwater stream	Sand Creek water quality is impacted by agriculture. Many partners working on water quality issues of this stream.	Protect stream from further degradation. Gather information from partners and work together to improve water quality throughout the watershed.
Rapids Lake Upland Forest #77	-93.645 44.728	Pin Oak, Burr Oak Woodland, FDs37b	Rare fire dependent community that has been encroached by nondesirable woody species due to lack of fire on the landscape.	Protect area from invasion by exotic invasive species.
Rapids Lake Upland Forest #79	-93.634 44.721	Sugar Maple, Basswood, Bitternut Hickory Forest, MHs39	Rare plant community identified by the MN DNR. Many of these communities are being impacted by development or invasion by exotic invasive species.	Check quality of community type and protect if intact. Minimize invasion by exotic invasive species.
Rapids Lake Planted Grassland #80	-93.647 44.739	Planted Dry Grasslands	Converted farm fields planted to native habitat.	Remove invasive species and manage to preserve grassland habitat. Allow savanna habitat to feather in to soften fire breaks.
Rapids Lake Planted Grassland #81	-93.635 44.716	Planted Dry Grasslands	Converted farm fields planted to native habitat.	Remove invasive species and manage to preserve grassland habitat. Allow savanna habitat to feather in to soften fire breaks.

Table 2. Priority Two Suggested Habitat Restoration Areas.

Unit Map, Location & ID #	Coordinates	Habitat Type	Rationale	Management Action Needed
Rapids Lake Planted Grassland #82	-93.635 44.720	Planted Dry Grasslands	Converted farm fields planted to native habitat.	Remove invasive species and manage to preserve grassland habitat. Allow savanna habitat to feather in to soften fire breaks.
Rapids Lake By Rapids Maintenance Shop #83	-93.640 44.716	Mesic Grassland and Temporary/Seasonal Wetlands	Converted farm field to planted native grassland habitat. Restoring these areas to native grass and forbs will provide habitat to many Resources of Concern. Non-permanent (temporary/seasonal) wetlands are also scattered throughout area.	Maintain native grassland habitat by keeping out invasive species and undesirable tree species, and encouraging growth of native grassland species for use by grassland Resources of Concern. Determine locations of wetlands to see if restoration is warranted.
Rapids Lake By Rapids Maintenance Shop #84	-93.639 44.716	Mesic Grassland and Temporary/Seasonal Wetlands	Converted farm field to planted native grassland habitat. Restoring these areas to native grass and forbs will provide habitat to many Resources of Concern. Non-permanent (temporary/seasonal) wetlands are also scattered throughout area.	Maintain native grassland habitat by keeping out invasive species and undesirable tree species, and encouraging growth of native grassland species for use by grassland Resources of Concern. Determine locations of wetlands to see if restoration is warranted.
Rapids Lake By Rapids Maintenance Shop #85	-93.642 44.716	Mesic Grassland and Temporary/Seasonal Wetlands	Converted farm field to planted native grassland habitat. Restoring these areas to native grass and forbs will provide habitat to many Resources of Concern. Non-permanent (temporary/seasonal) wetlands are also scattered throughout area.	Maintain native grassland habitat by keeping out invasive species and undesirable tree species, and encouraging growth of native grassland species for use by grassland Resources of Concern. Determine locations of wetlands to see if restoration is warranted.
Rapids Lake Carver Creek #86	-93.632 44.754	Mid-size stream Warmwater stream	A metro area stream with very high fish species diversity that is being impacted by bank erosion and road development. Also has water quality impairments.	Protect against development. Work with road developer to minimize impacts to this creek and work with partners to improve water quality.

Table 2. Priority Two Suggested Habitat Restoration Areas.

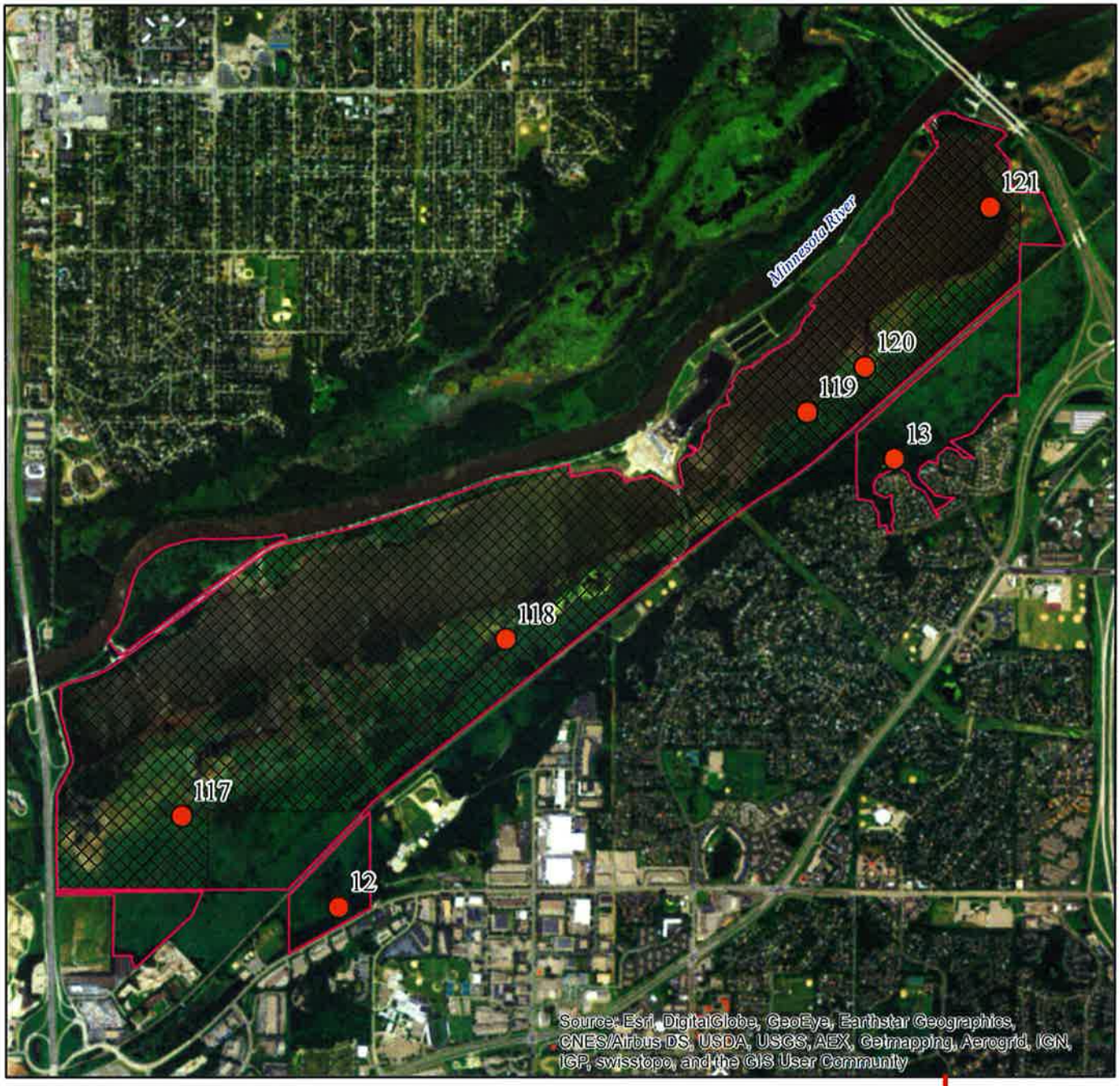
Unit Map, Location & ID #	Coordinates	Habitat Type	Rationale	Management Action Needed
St. Lawrence Planted Grassland #98	-93.709 44.647	Planted Mesic Grassland	Converted farm field planted to native grassland habitat. Restoring these areas to native grass and forbs will provide habitat to many Resources of Concern.	Maintain native grassland habitat by keeping out invasive species and undesirable tree species, and encouraging growth of native grassland species for use by grassland Resources of Concern
Wilkie Eagle Creek #113	-93.380 44.784	Small/Mid-size Stream. Brown Trout Stream	A metro area brown trout stream managed by the MN DNR as a designated trout stream. Brown trout can tolerate higher temperatures and more fluctuations than the more sensitive brook trout.	Protect this stream from degradation and continue working with the MN DNR to protect and manage the stream.

U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Black Dog Lake Unit



Unit Boundary

MOU Lands

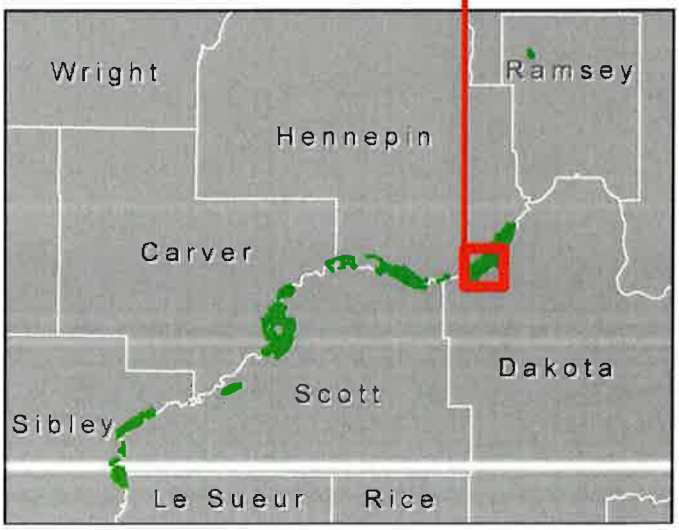
Restoration Areas

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

N S

UTM ZONE 15
NAD 83

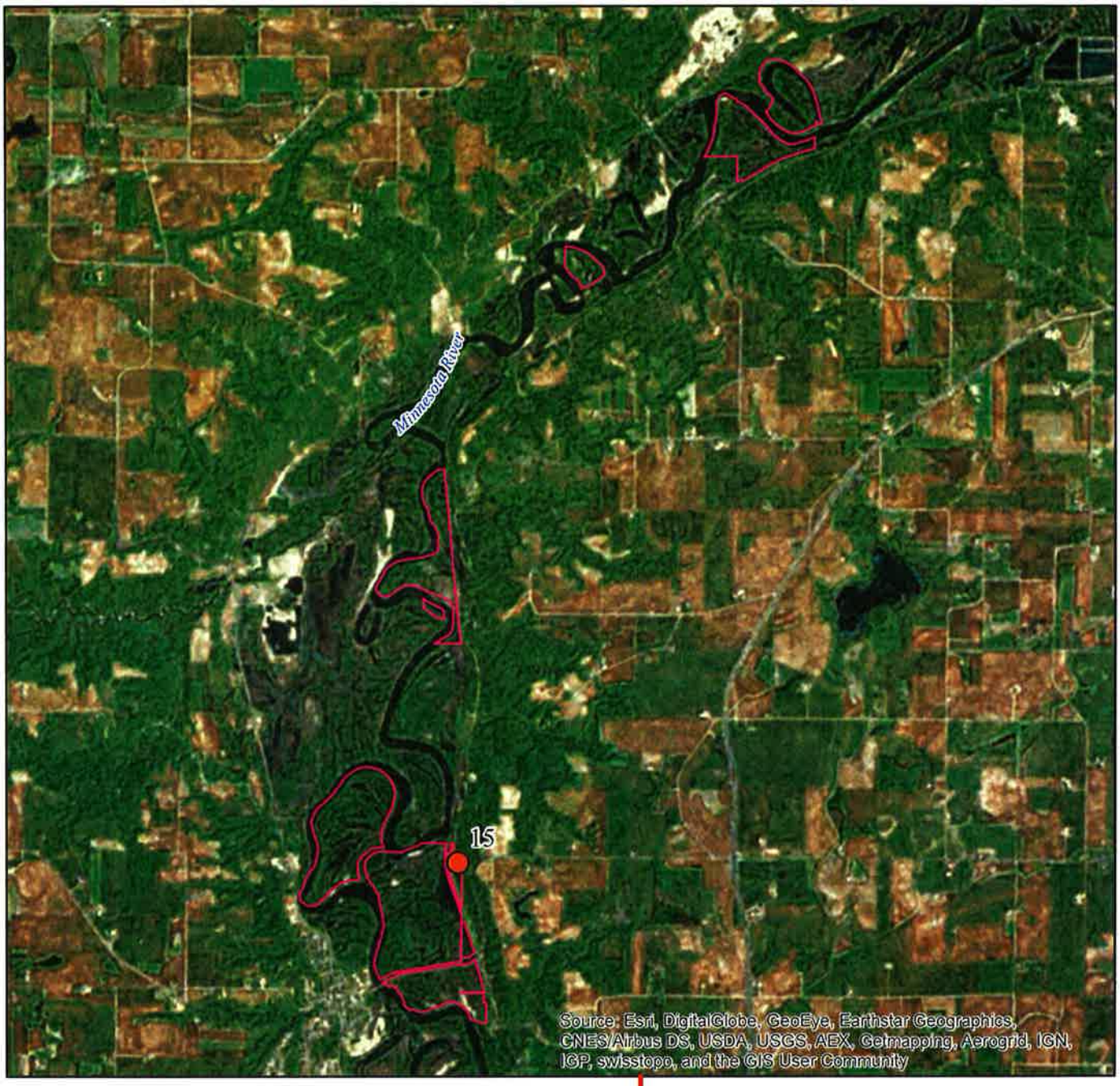


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Blakeley Unit



Unit Boundary

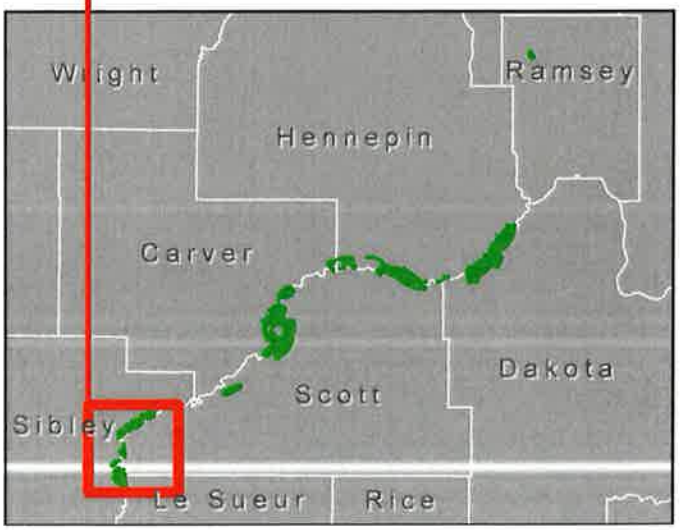
MOU Lands

Restoration Areas

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

UTM ZONE 15
NAD 83

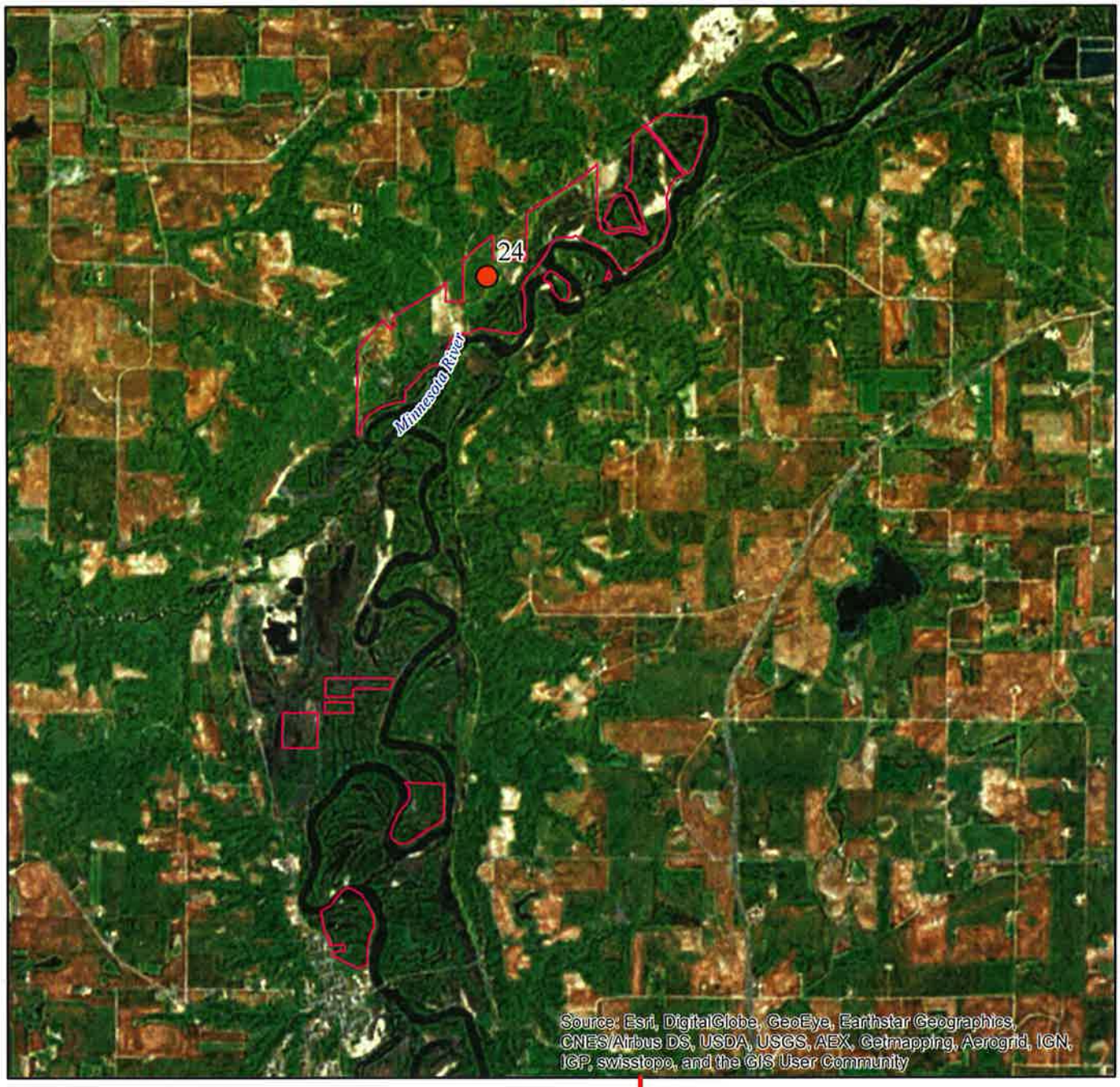


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Jessenland Unit



Unit Boundary

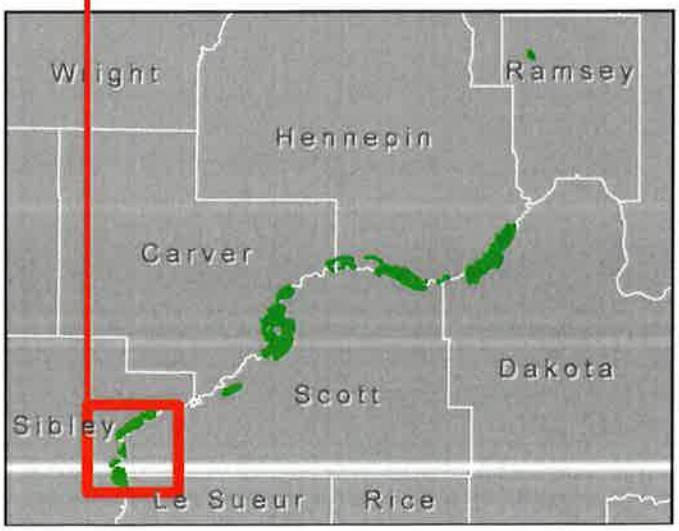
MOU Lands

Restoration Areas

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

UTM ZONE 15
NAD 83



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Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Long Meadow Lake Unit

Unit Boundary

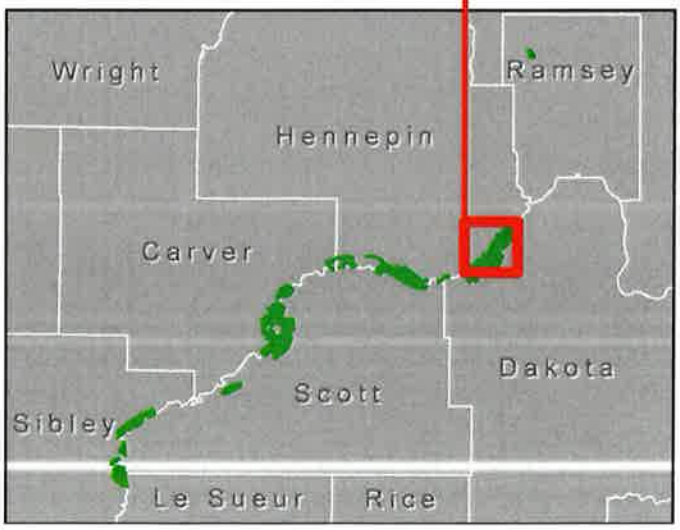
MOU Lands

Restoration Areas

0 0.35 0.7 1.4 Miles

0 0.35 0.7 1.4 Kilometers

UTM ZONE 15
NAD 83



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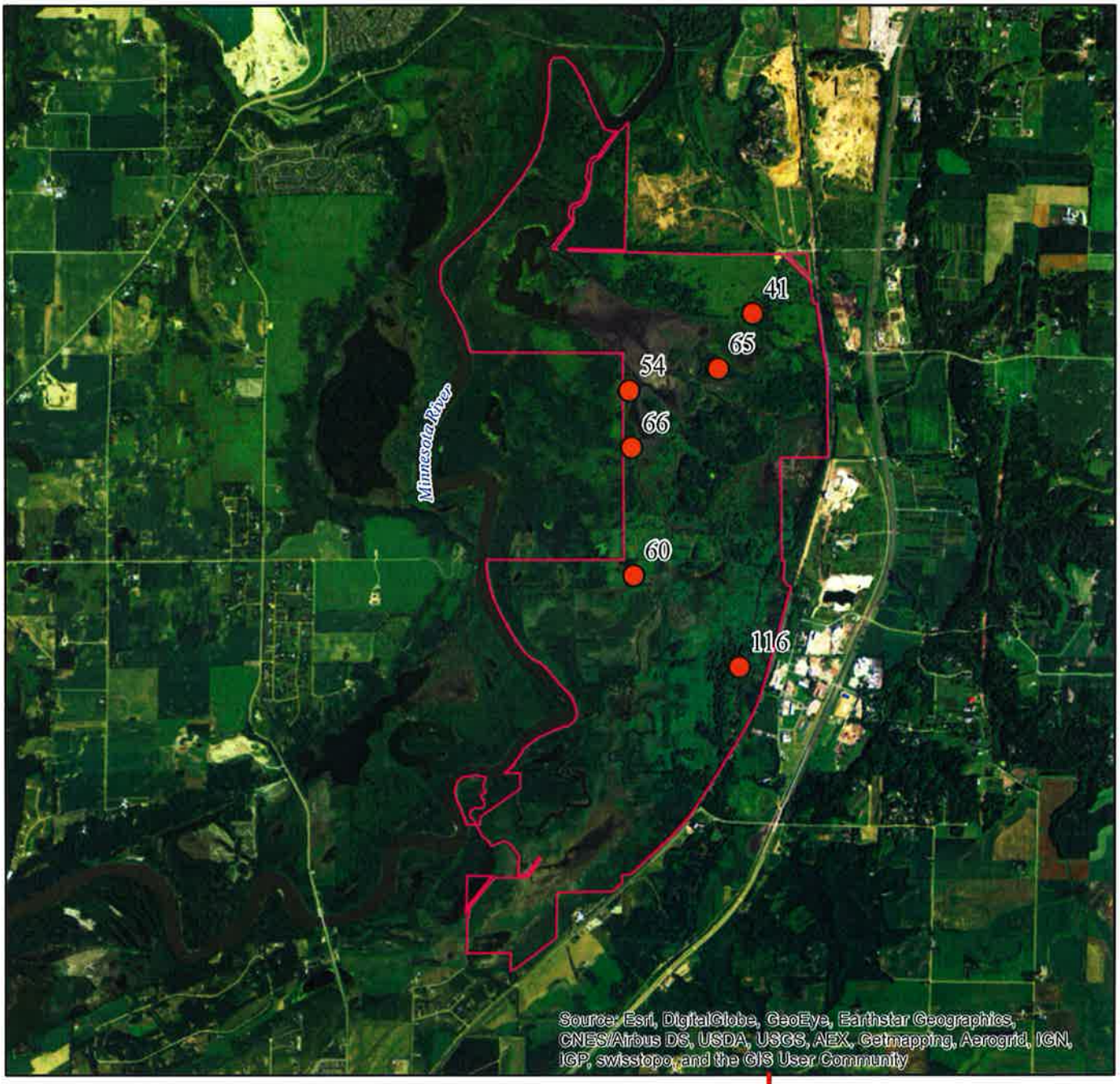
Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Louisville Swamp Unit



Unit Boundary

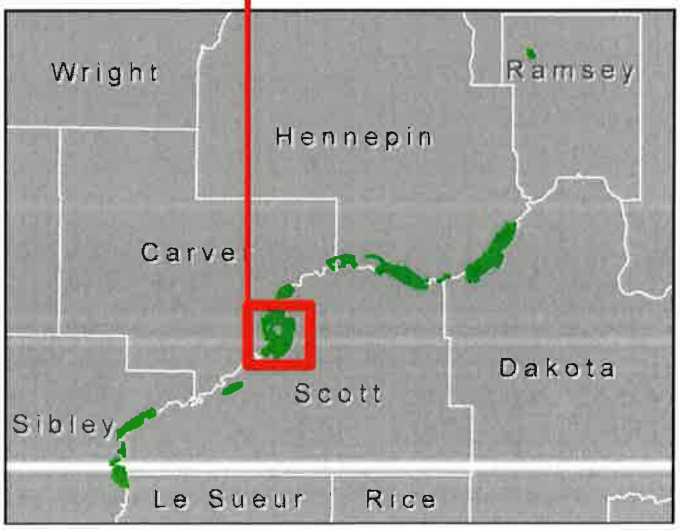
MOU Lands

Restoration Areas

0 0.4 0.8 1.6 Miles

0 0.425 0.85 1.7 Kilometers

UTM ZONE 15
NAD 83



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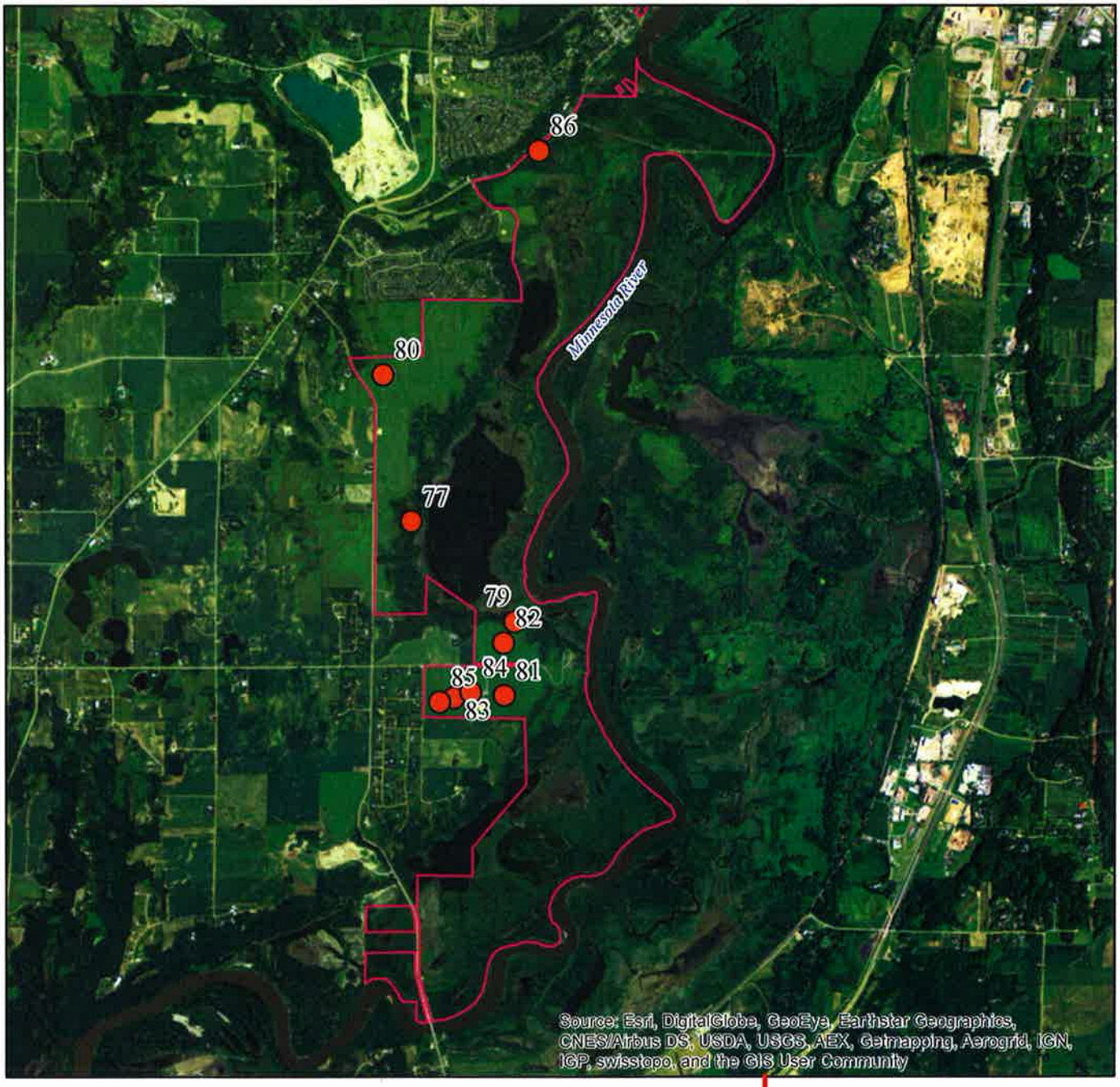
Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Rapids Lake Unit



Unit Boundary

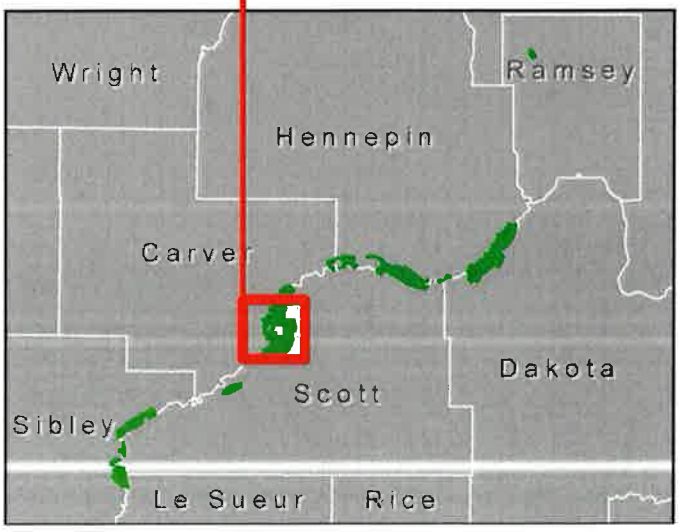
MOU Lands

Restoration Areas

0 0.4 0.8 1.6 Miles

0 0.425 0.85 1.7 Kilometers

UTM ZONE 15
NAD 83



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Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

St. Lawrence Unit

Unit Boundary

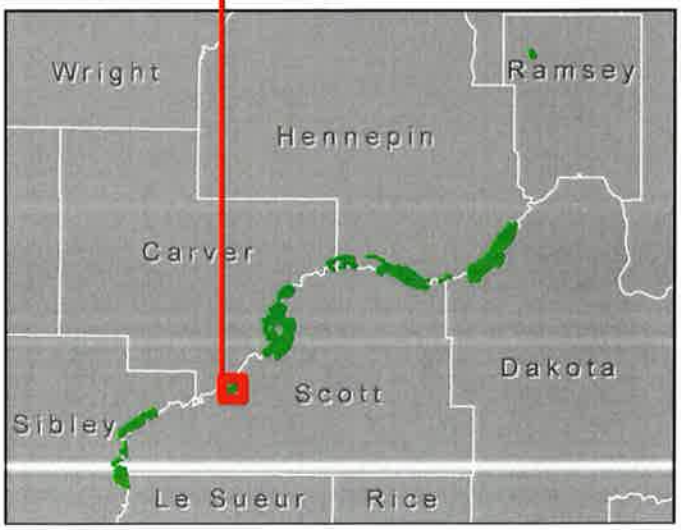
MOU Lands

Restoration Areas

0 0.125 0.25 0.5 Miles

0 0.125 0.25 0.5 Kilometers

UTM ZONE 15
NAD 83

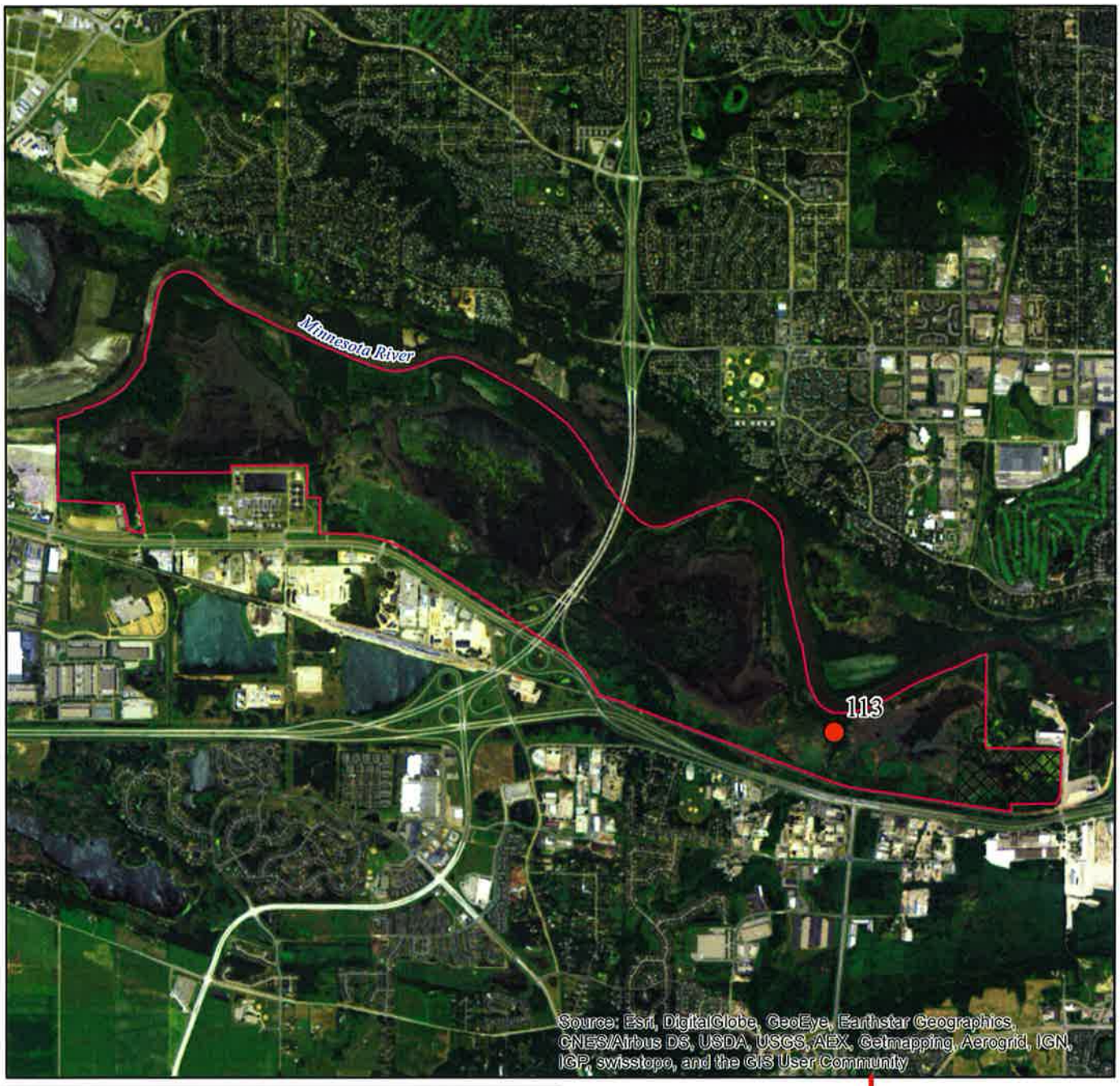


U.S. Fish & Wildlife Service

Minnesota Valley National Wildlife Refuge

Priority Two Restoration Areas

Wilkie Unit



Unit Boundary

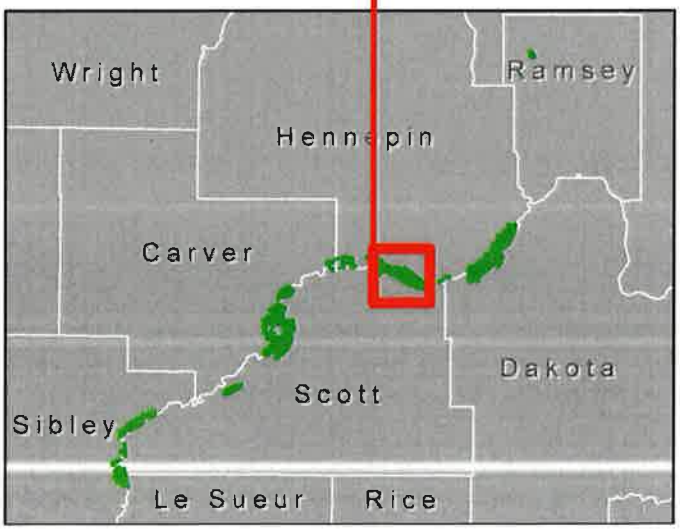
MOU Lands

Restoration Areas

0 0.375 0.75 1.5 Miles

0 0.375 0.75 1.5 Kilometers

UTM ZONE 15
NAD 83



APPENDIX E
SELECTION OF RESOURCES OF CONCERN AND ROCSTAR RESULTS

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ROCSTAR: Resources of Concern Selection Tool for Americas Refuges

Steps 1 through 3: From the Handbook: This section reviews the primary legal mandates and FWS polices that direct priorities for wildlife and habitat management on refuges.

Step 1. Identify Refuge Purpose

1. Find the refuge and purpose at the refuge purpose database:
HERE

b. Paste here:

Station Name	Type	Purposes
Minnesota Valley	NWR	The Secretary shall develop and administer ... the refuge, in accordance with the National Wildlife Refuge System Act ... The Secretary may also exercise any other authority available to him for the conservation and management of wildlife and natural resources, the development of wildlife recreational opportunities, wildlife interpretation, and environmental education, to the extent deemed by him to be appropriate ... The Secretary shall construct, administer, and maintain, ... a wildlife interpretation and education center. ... to promote environmental education and to provide an opportunity for the study and enjoyment of wildlife in its natural habitat. 90 Stat. 1993, dated Oct. 8, 1976. "... particular value in carrying out the national migratory bird management program." 16 U.S.C. § 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes) "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956) Legislative Authority — Station Name Special Legislation — Minnesota Valley NWR GSA Transfer Authority — Minnesota Valley NWR Fish and Wildlife Act 1956 — Minnesota Valley NWR
Minnesota Valley	WMD	... as Waterfowl Production Areas subject to "... all of the provisions of such Act [Migratory Bird Conservation Act] ... except the inviolate sanctuary provisions ..." 16 U.S.C. 718(c) (Migratory Bird Hunting and Conservation Stamp) "... for any other management purpose, for migratory birds."16 U.S.C. § 715d (Migratory Bird Conservation Act) Legislative Authority — Station Name Migratory Bird Conservation Act — Minnesota Valley WMD Migratory Bird Hunting and Conservation Stamp Tax — Minnesota Valley WMD

From the Handbook: The best source for such specifics is original decision documents for refuge establishment and/or expansion. These documents include Land Protection Plans, Conceptual Management Plans, and various environmental compliance documents required by the National Environmental Policy Act of 1969 (NEPA). These documents may provide more detailed information on wildlife or habitat to be managed on the refuge. This approach is described in Policy on the Comprehensive Conservation Planning Process (602 FW 1-4).

Step 4. Compile Comprehensive List of Refuge Resources of Concern:

This list was compiled for UMRGLR LCC (16) and BCR 23, then modified for Minnesota Valley NWR and WMD.

All web sources and codes used for the various plans and lists are explained in the review comments at the head of each column.

MNV NWR and WMD					T & E Federal and		STATE	MOU	BCR BIRDS OF			FWS LISTS			PIF	UMRGLR JV BIRD PLANS					ABC	OTHER					
Common Name	Broad Habitat	Sport species	Potential Priority Spp: Y,	Documented in NWR/WMD Counties	R3 Fed T&E 2013	MN State T&E, 2013	MN SWAP MNV SGCN 2006	MOU SGCN Birds	BCR 11, Prairie Potholes, US	BCR 22, Eastern Tallgrass Prairie	BCR 23, Prairie Hardwood Transition	FWS R3 BCC 2012	FWS FY2012-FY2016 Focal Species	Regional Conservation Priority List UMR	PIF 16 Upper Great Lakes Plain, 2001	UMRGLR JV All Bird Implementation	UMRGLR JV/BCR 12, 13, 23 Priority Spp	UMRGLR JV/BCR 12, 13, 23 Priority Spp	UMRGLR JV Priority Spp Landbird 2007	UMRGLR JV/BCR 12, 13, 23 Priority Spp	ABC Watchlist 2007	INTERJURISDICTIONAL FISH, 2006	PARC	Xerces	Total Number of Plans; Does Not Include Sport	Global Rank	MOU Rational for including on SGCN List
Crimson Saltflat Tiger Beetle (fulgida	Gra					E	X																		2		
Uncas Skipper	Gra					E	X																		2		
Persius Duskywing	Gra					E	X																	I	3	G5T1T3	
Karner Blue	Gra				E	E	X							UMR GRL										CI	5	G5T2	
Uhler's Arctic	Gra					E	X																		2		
Headwaters Chilostigman Caddisfly	Lac, Riv					E	X																		2		
Rock Pocketbook	Riv			X		E	X							UMR											3	G4	
Elephant-ear	Riv			X		E	X																		2	G5	
Ebonyshell	Riv			X		E	X																		2	G4G5	
Higgins' eye pearlymussel	Riv			X	E	E	X							UMR											4	G1	
Slough sandshell	Riv					E																			1		
Yellow sandshell	Riv			X		E	X																		2	G5	
Sheepnose	Riv			X	E	E	X							UMR											4	G3	
Winged Mapleleaf	Riv			X	E	E	X																		3	G1	
Wartyback	Riv			X		E	X																		2	G4	
Iowa Pleistocene Succinea						E	X																		2		
Midwest Pleistocene Vertigo						E	X																		2	G3	
Sandy Tiger Beetle						E	X																		2		
Blackfoot Quillwort						E																			1	G5	
Snail-seed Pondweed						E																			1	G4	
Water-thread Pondweed				X		E																			1	G5	
Ball Cactus						E																			1		
purple crowberry						E																			1		
black crowberry						E																			1		
Chilean Sweet Cicely						E																			1	G5	
Sticky Locoweed						E																			1		
Narrow-leaved Milkweed						E																			1		
Sweet-smelling Indian-plantain						E																			1		
gray ragwort						E																			1		
American Fever-few						E																			1	G5	
Norwegian Whitlow-grass						E																			1		
Purple Rocket						E																			1	G5	
Bladder Pod						E																			1		
Forked Chickweed				X		E																			1		
Knotty Pearlwort						E																			1		
Narrow-leaved Pinweed				X		E																			1		
James' Polanisia				X		E																			1	G5	
Leedy's roseroot					T	E																			2		
Braun's Holly-fern						E																			1	G5	
alpine milk-vetch						E																			1		
Slender-leaved Scurf Pea						E																			1		
Virginia Bartonia						E																			1		
Minnesota dwarf trout lily				X	E	E																			2		
Small False Asphodel						E																			1		
Hairy Water Clover						E																			1		
Frenchman's bluff moonwort						E																			1		
Blunt-lobed Grapefern				X		E																			1	G4Q	
Pale Moonwort						E																			1	G3	
Auricled Twayblade						E																			1	G3G4	
Bog Adder's-mouth						E																			1		
Tubercled Rein-orchid				X		E																			1	G4T4Q	
Western prairie fringed orchid					T	E																			2		
eared false foxglove				X		E																			1	G3	
Roundstem foxglove						E																			1	G4	
Western Jacob's Ladder						E																			1	G5?T1Q	
Cross-leaved Milkwort						E																			1	G5	
Montia						E																			1		

MNV NWR and WMD					T & E Federal and		STATE	MOU	BCR BIRDS OF			FWS LISTS			PIF	UMRGLR JV BIRD PLANS					ABC	OTHER						
Common Name	Broad Habitat	Sport species	Potential Priority Spp: Y,	Documented in NWR/WMD Counties	R3 Fed T&E 2013	MN State T&E, 2013	MN SWAP MNV SGCN 2006	MOU SGCN Birds	BCR 11, Prairie Potholes, US	BCR 22, Eastern Tallgrass Prairie	BCR 23, Prairie Hardwood Transition	FWS R3 BCC 2012	FWS FY2012-FY2016 Focal Species	Regional Conservation Priority List UMR	PIF 16 Upper Great Lakes Plain, 2001	UMRGLR JV All Bird Implementation	UMRGLR JV/BCR 12, 13, 23 Priority Spp	UMRGLR JV/BCR 12, 13, 23 Priority Spp	UMRGLR JV Priority Spp Landbird 2007	UMRGLR JV/BCR 12, 13, 23 Priority Spp	ABC Watchlist 2007	INTERNJSDICT	PARC	Xerces	Total Number of Plans: Does Not Include Sport		Global Rank	MOU Rational for including on SGCN List
Prairie Fame-flower				X		E																			1		G3G4	
Prairie Shooting Star						E																			1			
sea milkwort						E																			1			
Floating Marsh-marigold						E																			1		G5	
Goldenseal				X		E																			1		G4	
Iowa Golden Saxifrage						E																			1			
Nodding Saxifrage						E																			1			
Northern Paintbrush						E																			1			
Low Spike-moss						E																			1		G5	
Twisted Yellow-eyed-grass						E																			1			
Handsome Sedge				X		E																			1		G4	
Pale Sedge						E																			1			
Plantain-leaved Sedge				X		E																			1			
Wolf Spike-rush				X		E																			1		G3G4	
Hairy Fimbristylis						E																			1		G5	
Tall Nut-rush				X		E																			1		G5	
Indian rice grass						E																			1			
Piping Plover (Great Plains pop.)	Bar				T	E	X	X				X		UMR GRL											6			Fedrally en
Piping Plover (Great Lakes pop.)	Bar				E	E	X	X				X /E		UMR GRL	X (I)	X(f)		M/B (f), 4							9			Fedrally en
Eastern Massasauga	For, Pal				C	E	X							UMR GRL									H		5		G3G4T3T4Q	
[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chestnut-collared Longspur	Gra					E	X	X	X			X									Yellow				6			MN Endang
Burrowing Owl	Gra					E	X	X					f												4			MN Endang
King Rail	Pal			X		E	X	X				X (f)	f	UMR GRL	X	X(f)	B				Yellow				10		G4	MN Endang
Blanchard's Cricket Frog	Pal			X		E																			1			
Northern Cricket Frog	Pal					E	X																MH		3		G5	
Baird's Sparrow	Gra					E	X	X	X			X									Red				6			MN Endang
Sprague's Pipit	Gra				C	E	X	X	X				f												6			MN Endang
A Jumping Araneae	Gra			X		SC	X																		2			
A Jumping Araneae	Gra			X		SC	X																		2			
A Jumping Araneae	Gra			X		SC	X																		2			
A Jumping Araneae	Gra			X		SC																			1			
A Jumping Araneae	Gra					SC	X																		2			
A Jumping Araneae	Gra			X		SC	X																		2			
A Jumping Araneae	Gra					SC	X																		2			
A Jumping Araneae	Gra					SC																			1			
Arogos (Iowa) Skipper	Gra			X		SC	X																	V	3			
Leonard's Skipper	Gra			X		SC	X																		2			
Grizzled Skipper	Gra					SC	X																		2			
Northern Blue	Gra					SC	X																		2		G5TU	
Phlox Moth	Gra					SC	X																		2		G2G4	
Regal fritillary	Gra			X	C	SC	X																	V	4		G3	
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv			X		SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
Vertrees's Ceraclean Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
A Caddisfly	Lac, Riv					SC	X																		2			
Saint Croix Snaketail	Pal			X		SC	X																		2		G2	
Spike	Riv			X		SC	X																		2			
Creek Heelsplitter	Riv			X		SC	X																		2			
Fluted-shell	Riv			X		SC	X																		2			
Black Sandshell	Riv			X		SC	X							UMR GRL											3		G5	
Hickorynut	Riv			X		SC	X																		2		G4	
Beach-dune Tiger Beetle						SC	X																		2		G5T4	

MNV NWR and WMD					T & E Federal and	STATE	MOU	BCR BIRDS OF			FWS LISTS			PIF	UMRGLR JV BIRD PLANS					ABC	OTHER					
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Sandy Stream Tiger Beetle				X		SC	X																		2	G5	
Northern Barrens Tiger Beetle				X		SC	X																		2	G3T3	
Splendid Tiger Beetle						SC	X																		2		
Red-Tailed Prairie Leafhopper				X		SC	X																		2	G2	
Purple-flowered Bladderwort						SC																			1		
lavender bladderwort						SC																			1	G4	
slender naiad				X		SC																			1	G5?	
Sea Nalad						SC																			1		
American Shore-plantain						SC																			1		
Vasey's Pondweed						SC																			1	G4	
Sheathed Pondweed						SC																			1		
spiral ditchgrass				X		SC																			1		
Widgeon-grass						SC																			1		
Plains Prickly Pear				X		SC																			1		
Creeping Juniper				X		SC																			1		
Eastern Hemlock						SC																			1		
woolly beachheather				X		SC																			1	G5	
moschatel						SC																			1	G5	
plains spring parsley						SC																			1		
Rattlesnake-master				X		SC																			1		
American Water-pennywort				X		SC																			1	G5	
Blunt-fruited Sweet Cicely						SC																			1		
Prairie Parsley						SC																			1	G5	
Beaked Snakeroot						SC																			1		
American ginseng				X		SC																			1	G3G4	
Clasping Milkweed				X		SC																			1		
Ebony Spleenwort						SC																			1		
Small-leaved Pussytoes				X		SC																			1		
Bitter Fleabane						SC																			1		
short ray fleabane						SC																			1		
Blanket-flower						SC																			1		
Nuttall's Sunflower						SC																			1		
Elegant Groundsel						SC																			1		
Nodding Rattlesnake-root						SC																			1	G4	
Three-leaved Coneflower				X		SC																			1		
Soft Goldenrod						SC																			1		
Cliff Goldenrod						SC																			1		
Cutleaf Ironplant						SC																			1		
Twinleaf						SC																			1	G5	
Scouler's popcornflower						SC																			1		
Arabian whitlow grass						SC																			1		
Sessile-flowered Cress				X		SC																			1		
Rock Sandwort				X		SC																			1		
Drummond's Campion						SC																			1		
Long-stalked Chickweed						SC																			1		
English Sundew						SC																			1	G5	
linear-leaved sundew						SC																			1		
Goldie's Fern				X		SC																			1		
Alpine Woodsia						SC																			1		
Missouri Spurge						SC																			1		
Slender Milk-vetch						SC																			1		
Missouri Milk-vetch						SC																			1		
White Wild Indigo				X		SC																			1		
Western White Prairie-clover						SC																			1		
Big Tick-trefoil				X		SC																			1		
Stemless Tick-trefoil				X		SC																			1		
goat's rue						SC																			1		
Squirrel-corn				X		SC																			1		
Northern Gentian						SC																			1		
felwort						SC																			1		
Franklin's Phacelia						SC																			1		

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Common Butterwort						SC																				1		G5	
Snow Trillium				X		SC																				1		G4	
swamp loosestrife				X		SC																				1			
Prairie Mimosa				X		SC																				1			
Rhombic-petaled Evening Primrose				X		SC																				1			
Prairie Moonwort				X		SC																				1		G3G4	
Mingan Moonwort						SC																				1		G4	
Little Goblin Moonwort						SC																				1		G3	
Small White Lady's-slipper			Y	X		SC																				1		G4	
Broad-lipped Twayblade						SC																				1		G5	
White Adder's-mouth						SC																				1			
Club-spur Orchid				X		SC																				1			
Clustered Broomrape				X		SC																				1		G4	
Louisiana Broomrape				X		SC																				1		G5	
One-flowered Broomrape				X		SC																				1		G5	
Alpine Bistort						SC																				1			
Carey's Smartweed						SC																				1			
Carolina Spring-beauty						SC																				1			
northern androsace						SC																				1			
Whorled Loosestrife						SC																				1			
Purple-stem Cliff-brake						SC																				1		G5	
Small Shinleaf						SC																				1		G5	
Lapland Buttercup						SC																				1		G5	
barren strawberry						SC																				1			
Roundleaf Water-hyssop				X		SC																				1		G5	
Hudson Bay eyebright						SC																				1			
Mudwort						SC																				1			
clustered bur-reed						SC																				1		G4?	
Narrow-leaved Vervain						SC																				1		G5	
Montane Yellow-eyed Grass						SC																				1			
Linear-leaved Sundew						SC																				1		G4	
Coralberry						SC																				1			
Yellow-fruited Sedge				X		SC																				1			
Raven's-foot sedge						SC																				1		G5	
Coast Sedge						SC																				1		G5	
Yellow Sedge						SC																				1		G5	
Hall's Sedge						SC																				1			
Michaux's Sedge						SC																				1		G5	
Blunt Sedge						SC																				1			
Prairie Sedge						SC																				1			
Northern Singlespike Sedge						SC																				1			
Weak Arctic Sedge						SC																				1			
Cattail Sedge				X		SC																				1		G5	
Wood's Sedge				X		SC																				1			
Dry Sedge						SC																				1			
Twig-rush				X		SC																				1			
dwarf spikerush						SC																				1			
Dwarf Spike-rush						SC																				1			
Few-flowered Spike-rush						SC																				1		G5	
Autumn Fimbristylis				X		SC																				1			
Brown Beak-rush						SC																				1		G4G5	
Clinton's Bulrush				X		SC																				1			
Grassleaf Rush						SC																				1		G5	
Bog Rush						SC																				1		G5	
small-flowered woodrush						SC																				1			
Red Three-awn						SC																				1			
seaside three-awn				X		SC																				1			
Oat-grass						SC																				1			
Buffalo Grass						SC																				1			
Marsh Reedgrass						SC																				1			
Plains Reedgrass						SC																				1			

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Purple Reedgrass						SC																			1		
Slender Hairgrass						SC																			1		
Beak Grass						SC																			1	G4GS	
Catchfly Grass						SC																			1		
One Flowered Muhly						SC																			1		
Wolf's Bluegrass						SC																			1	G4	
Tumblegrass						SC																			1		
Torrey's Manna-grass						SC																			1		
Purple Sand-grass				X		SC																			1		
Witch-hazel				X		SC																			1		
Butternut				X		SC																			1		
McCalla's Willow						SC																			1		
Satiny Willow						SC																			1		
Silverleaf Grape						SC																			1		
Rock Whitlow-grass						SC																			1	G4	
Five-lined Skink	Bar, For			X		SC	X																		2		
Red-shouldered Hawk	For			X, ccp		SC	X	X						UMR GRL											4	G5	MN Special
Northern Long-eared Bat	For		Y	X		SC	X																		2	G4	
Woodland Vole / Pine Vole	For					SC	X																		2	G5	
Four-toed Salamander	For, Pal					SC																	H		2		
Bald Eagle	For, Rip		Y	X, ccp	delisted	SC	X	X	X (b)	X (b)	X (b)	X (f)	f	UMR GRL											10	G5	Federally T
Acadian Flycatcher	For, Rip			X		SC	X	X		X		X		UMR GRL	X (I)										7	G5	MN Special
Least Weasel	For, Rip					SC	X																		2	G5	
Greater Prairie-Chicken	Gra	X				SC	X	X							X (I)	X(f)			X (f)		Red				7	G4	MN Special
Short-eared Owl	Gra			X, ccp		SC	X	X	X	X (nb)	X (nb)	X		UMR GRL	X (IIC)	X			X						11	G5	MN Special
Plains Hog-nosed Snake	Gra		Y	X, ccp		SC	X																H		3	G5	
Northern Bog Lemming	Gra					SC	X																		2		
Plains pocket mouse	Gra			X, ccp		SC	X																		2	G5	
Prairie Vole	Gra			X		SC	X																		2	G5	
Least Shrew	Gra Shr					SC	X																		2	G5	
Lined Snake	Gra, Shr					SC	X																		2	G5	
Gophersnake (Bullsnake)	Gra, Shr, For			X		SC	X																		2	G5	
Forster's Tern	Lac			X, ccp		SC	X	X						UMR GRL	X		B/m								6	G5	MN Special
Lake sturgeon	Lac, Riv	X		X		SC	X							UMR GRL								X			4	G3G4	
Pallid Shiner	Lac, Riv			X		SC	X															X			3	G4	
Pugnose Shiner	Lac, Riv			X		SC	X																		2	G3	
Topeka Shiner	Lac, Riv				E	SC	X																		3		
Yellow Bass	Lac, Riv					SC	X																		2		
Smooth Softshell	Lac, Riv			X, ccp		SC	X																		2	G5	
Common Snapping Turtle	Lac, Riv, Pal			ccp		SC	X																		2	G5	
Franklin's Gull	Pal			X, ccp		SC	X	X									M								4		MN Special
Yellow Rail	Pal					SC	X	X	X		X	X	f	UMR GRL		X(f)	B/m				Red				11	G4	MN Special
Common Gallinule	Pal			X		SC																			1		
Marbled Godwit	Pal					SC	X	X	X	X (nb)	X (nb)	X (f)	f	UMR GRL		X		M, 3			Yellow				12		MN Special
Nelson's Sparrow	Pal, Gra					SC	X	X	X			X									Yellow				6	G5	MN Special
North American Racer	Rip, Bar, Gra			X, ccp		SC	X																		2	G5	
Blue Sucker	Riv			X		SC	X															X			3	G3G4	
Ozark Minnow	Riv			X		SC	X															X			3	G5	
Slender Madtom	Riv					SC																			1	G5	
Crystal Darter	Riv			X		SC								UMR								X			3	G3	
Least Darter	Riv			X		SC	X																		2	G5	
Northern Brook Lamprey	Riv					SC	X																		2		
American White Pelican	Riv, Lac, Pal		Y	ccp		SC	X	X							X		w/m/w								5	G4	MN Special
Pirate perch				X		SC	X															X			3	G5	
Black Buffalo		X		X		SC	X															X			3	G5	
Skipjack herring				X		SC	X															X			3	G5	
Gilt Darter				X		SC	X															X			3	G4	
Southern Brook Lamprey				X		SC	X																		2		
Kiyi						SC	X																		2	G3	
Shortjaw cisco		X				SC	X																		2	G3	
Tricolored Bat				X		SC																			1		

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Smoky Shrew						SC	X																		2	G5	
Powesheik Skipper	Gra			X	C	SC	X							UMR GRL										I	5	G2G3	
Hill's Thistle				X		SC																			1		
Plains Wild Indigo				X		SC																			1		
Least Grape Fern				X		SC																			1	G5	
Larger Water-starwort				X		SC																			1	G5	
Cerulean Warbler	For			X, ccp		SC	X	X		X		X	f	UMR GR	X (i)	X(f)			X (f)		Yellow				11	G4	MN Special
Hooded Warbler	For			X		SC	X	X							X										4	G5	MN Special
Louisiana Waterthrush	For, Rip			X		SC	X	X				X		UMR GR	X (IIC)	(f, h)			X (f)						8	G5	MN Special
A Tiger Beetle	Gra					T	X																		2		
Little White (Ghost) Tiger Beetle	Gra			X		T	X																		2	G3G4	
Dakota Skipper	Gra				C	T	X																	I	4		
Ottoe Skipper	Gra					T	X							UMR GRL										V	4	G3G4	
Mucket	Riv			X		T	X																		2		
Elktoe	Riv			X		T	X							UMR GRL											3	G4	
Spectaclecase	Riv			X	E	T	X							UMR											4	G3	
Purple Wartyback	Riv			X	E	T	X																		3	G5	
Butterfly	Riv			X		T	X																		2	G4G5	
Snuffbox	Riv			X	E	T	X							UMR											4	G3	
Washboard	Riv			X		T	X							UMR											3	G5	
Round pigtoe	Riv			X		T	X							UMR											3	G4G5	
Monkeyface	Riv			X		T	X							UMR											3	G4	
Salamander mussel	Riv			X		T	X							UMR											3	G3	
Pistolgrip	Riv			X		T	X							UMR											3	G4G5	
Ellipse	Riv			X		T	X																		2	G4	
Minnesota Pleistocene Succinea						T	X																		2		
Variable Pleistocene Vertigo						T	X																		2		
Bluff Vertigo						T	X																		2		
Laurentian Tiger Beetle						T	X																		2		
Mud Plantain						T																			1		
Prairie Milkweed						T																			1		
Sullivant's milkweed				X		T																			1	G5	
Maidenhair Spleenwort						T																			1	G5	
Siberian Yarrow						T																			1		
Long-leaved Arnica						T																			1		
tuberous indian plantain						T																			1		
Upland Boneset						T																			1		
Annual Skeletonweed						T																			1		
Short's Aster						T																			1		
Holboell's Rock-cress						T																			1		
awlwort						T																			1		
Large-leaved Sandwort						T																			1	G5	
Canadian Forked Chickweed						T																			1		
Snowy Campion						T																			1	G4?	
Red Saltwort						T																			1		
Pigmyweed						T																			1		
narrow-leaved spleenwort						T																			1	G5	
Marginal Shield-fern						T																			1		
Christmas Fern						T																			1	G5	
Smooth Woodsia						T																			1		
Rocky Mountain woodsia						T																			1		
Prairie Bush-clover				X	T	T																			2	G3	
Ovate-leaved Skullcap				X		T																			1		
Nodding Wild Onion						T																			1		
wild chives						T																			1		
False Mermaid				X		T																			1		
Rock Clubmoss				X		T																			1	G4	
Tooth-cup				X		T																			1		
Glade Mallow						T																			1		
narrow triangle moonwort						T																			1		
Common Moonwort						T																			1	G5	

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Rugulose Grape-fern				X		T																			1		G3	
Ram's-head Lady's-slipper						T																			1		G3	
Slender Plantain						T																			1			
Encrusted Saxifrage						T																			1			
Sullivantia						T																			1		G4	
Fernleaf False Foxglove				X		T																			1			
Kitten Tails				X		T																			1		G3	
Broad Beech Fern						T																			1		G5	
Hairy Valerian				X		T																			1		G5	
Lance-leaved Violet				X		T																			1			
Yellow Prairie Violet						T																			1			
Fen indian-plantain				X		T																			1			
Small White Water-lily						T																			1			
Carey's Sedge						T																			1		G4G5	
Jointed Sedge				X		T																			1			
Field Sedge						T																			1		G5	
Davis's sedge				X		T																			1		G4	
Fescue sedge						T																			1		G5	
Garber's sedge						T																			1		G5	
James' Sedge						T																			1			
Smooth-sheath Sedge						T																			1		G5	
loose-culmed sedge						T																			1			
Sterile Sedge				X		T																			1			
Short-pointed Umbrella-sedge				X		T																			1			
Capitate Spike-rush						T																			1		G5	
Slender Spike-rush						T																			1		G4	
Beaked Spike-rush				X		T																			1		G5	
Hair-like Beak-rush						T																			1			
Whorled Nut-rush				X		T																			1		G5	
beachgrass						T																			1			
Three-flowered Melic Grass						T																			1		G5	
Bog Bluegrass				X		T																			1			
Alpine Bilberry						T																			1			
Black Hawthorn						T																			1			
Cloudberry						T																			1			
Timber Rattlesnake	For, Bar			X		T	X							UMR									H		4		G4	
Wood Turtle	For, Riv			X		T	X																H		3		G4	
Loggerhead Shrike	Gra, Shr			X		T	X	X		X		X		UMR GR	X										7		G4	MN Threat
Spotted skunk	Gra, Shr			X, ccp		T	X																		2		G5	
Wilson's Phalarope	Pal			X, ccp		T	X	X						UMR GR	X (I)	X(f)		M/b (f), 4							7		G5	MN Threat
Blanding's Turtle	Pal		Y	X, ccp		T	X																H		3		G4	
Peregrine Falcon	Rip			X, ccp	delisted	T	X	X	X (b)	X (b)	X (b)	X		UMR GR	X										10		G4	MN Threat
Paddlefish	Riv			X		T	X							UMR								X			4		G4	
Horned Grebe	Riv, Lac			ccp		T	X	X	X	X (nb)	X (nb)	X					b/M								8			MN Threat
Common Tern	Riv, Lac, Bar					T	X	X		X	X	X	f (Great	UMR GRL		X (f)	B/m								10		G5	MN Threat
Trumpeter Swan	Riv, Lac, Pal		Y	X		T	X	X						UMR GR	X (I)					B/N	Yellow				7		G4	MN Threat
fetid marigold						watch																			1			
northern croton						watch																			1			
narrow-leaved water plantain						watch																			1			
spiny coontail						watch																			1			
three-stamened waterwort						watch																			1			
broadleaf water milfoil						watch																			1			
slender water milfoil						watch																			1			
two leaf waterweed						watch																			1			
hidden-fruit bladderwort						watch																			1			
humped bladderwort						watch																			1			
small yellow water crowfoot						watch																			1			
wild petunia						watch																			1			
short-beaked arrowhead						watch																			1			
hooded arrowhead						watch																			1			
cowbane						watch																			1			

MNV NWR and WMD					T & E Federal and		STATE	MOU	BCR BIRDS OF			FWS LISTS			PIF	UMRGLR JV BIRD PLANS						ABC	OTHER						
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yellow pimpernel						watch																			1			
green dragon						watch																			1			
purple milkweed						watch																			1			
great Indian plantain						watch																			1			
field sagewort						watch																			1			
discoid beggarticks						watch																			1			
poor robin's fleabane						watch																			1			
long-bearded hawkweed						watch																			1			
Florida wild lettuce						watch																			1			
awl aster						watch																			1			
awl aster						watch																			1			
awl aster						watch																			1			
Virginia forget-me-not						watch																			1			
smooth rock cress						watch																			1			
cuckoo flower						watch																			1			
hoary whitlow grass						watch																			1			
slender-fruited Venus' looking-glass						watch																			1			
nodding chickweed						watch																			1			
povertyweed						watch																			1			
Canada frostweed						watch																			1			
Kalm's St. John's-wort						watch																			1			
southern dodder						watch																			1			
smartweed dodder						watch																			1			
hybrid bladder fern						watch																			1			
silvery spleenwort						watch																			1			
northern oak fern						watch																			1			
Oregon woodsia						watch																			1			
six-angled spurge						watch																			1			
lotus milk-vetch						watch																			1			
Cooper's milk-vetch						watch																			1			
racemose milk-vetch						watch																			1			
loose-flowered milk-vetch						watch																			1			
Allegheny vine						watch																			1			
lesser fringed gentian						watch																			1			
marsh arrowgrass						watch																			1			
yellow giant hyssop						watch																			1			
American pennyroyal						watch																			1			
Virginia bugleweed						watch																			1			
rough-fruited fairybells						watch																			1			
Bartley's clubmoss						watch																			1			
Appalachian fir moss						watch																			1			
water purslane						watch																			1			
biennial gaura						watch																			1			
cut-leaved evening primrose						watch																			1			
tailed grapefern						watch																			1			
upswept moonwort						watch																			1			
slender moonwort						watch																			1			
matricary grapefern						watch																			1			
Michigan moonwort						watch																			1			
spatulate moonwort						watch																			1			
dragon's mouth						watch																			1			
Oklahoma grass pink						watch																			1			
lily-leaved twayblade						watch																			1			
Case's ladies' tresses						watch																			1			
purple false foxglove						watch																			1			
halberd-leaved tearthumb						watch																			1			
mild waterpepper						watch																			1			
jeweled shooting star						watch																			1			
white baneberry						watch																			1			
cutleaf anemone						watch																			1			
mousetail						watch																			1			

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purple meadow-rue						watch																			1			
Nuttall's groundrose						watch																			1			
rough avens						watch																			1			
spreading cinquefoil						watch																			1			
bushy cinquefoil						watch																			1			
northern comandra						watch																			1			
large-flowered false foxglove						watch																			1			
old field toadflax						watch																			1			
foxglove beard tongue						watch																			1			
eastern green-violet						watch																			1			
hair-like sedge						watch																			1			
Gray's sedge						watch																			1			
nodding sedge						watch																			1			
Hooker's sedge						watch																			1			
sallow sedge						watch																			1			
intermediate sedge						watch																			1			
Muskingum sedge						watch																			1			
New England sedge						watch																			1			
necklace sedge						watch																			1			
Ross' sedge						watch																			1			
Robbins' spikerush						watch																			1			
Georgia bulrush						watch																			1			
stalked bulrush						watch																			1			
rufous bulrush						watch																			1			
jointed rush						watch																			1			
short-fruited rush						watch																			1			
black-grass rush						watch																			1			
slender rush						watch																			1			
winter bentgrass						watch																			1			
Carolina foxtail						watch																			1			
slimspike three-awn						watch																			1			
Walter's barnyard grass						watch																			1			
little barley						watch																			1			
Canadian ricegrass						watch																			1			
Plains bluegrass						watch																			1			
woodland bluegrass						watch																			1			
Nuttall's alkali grass						watch																			1			
alkali cordgrass						watch																			1			
Torrey's mannagrass						watch																			1			
spike trisetum						watch																			1			
honey locust						watch																			1			
Kentucky coffee tree						watch																			1			
swamp white oak						watch																			1			
chestnut oak						watch																			1			
red mulberry						watch																			1			
rough-leaved hawthorn						watch																			1			
bristle-berry						watch																			1			
Missouri dewberry						watch																			1			
swamp blackberry						watch																			1			
bristle-berry						watch																			1			
Vermont blackberry						watch																			1			
buttonbush						watch																			1			
false mountain willow						watch																			1			
wild grape						watch																			1			
Hine's emerald dragonfly	For				E									GRL											2		G2G3	
A Jumping Araneae	Gra						X																		1			
Disa Alpine	Gra						X																		1			
Pepper and Salt Skipper	Gra																							V	1			
Linda's Roadside Skipper	Gra																							V	1			
Two-spotted Skipper	Gra						X																		1			
Dukes' Skipper	Gra																							V	1		G3	

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Assiniboia Skipper	Gra						X																		1			
Pawnee skipper	Gra						X																		1		G4	
Garita Skipper	Gra						X																		1			
Byssus Skipper	Gra																							V	1		G3G4	
Frosted Elfin	Gra																							I	1		G3	
Early Hairstreak	Gra																							V	1		GU	
Blazing Star Stem Borer	Gra						X																		1		G2G3	
Tawny Crescent	Gra						X																		1		G4	
Mitchell's satyr butterfly	Gra				E									GRL										CI	3		G1G2T1T2	
Macoun's arctic	Gra						X																		1		G5	
Northern Metalmark	Gra																							V	1			
Swamp metalmark	Gra				C																				1		G3	
Bog Copper	Gra						X																		1			
Handsome Clubtail	Pal						X																		1			
Skillet Clubtail	Pal						X																		1			
Green-faced clubtail	Pal						X																		1		G3G4	
Extra-striped snaketail	Pal						X																		1		G4	
Pygmy snaketail	Pal						X																		1		G3	
Rusty crayfish	Riv													n											1			
Slippershell	Riv													UMR GRL											1		G4G5	
Threeridge	Riv													UMR											1			
Asian clam	Riv				n									n											2			
Zebra mussel	Riv				n									n											2			
Bullhead	Riv				E																				1		G3	
Fat Pocketbook	Riv				E									UMR											2			
Pimpleback	Riv													UMR											1		G5	
Mapleleaf	Riv				E									UMR											2		G5	
Fawnsfoot	Riv						X																		1		G5	
Hungerford's crawling water beetle	Riv				E									GRL											2		G1	
Illinois cave amphipod	Sub				E									UMR											2			
Cave Crayfish	Sub				E																				1			
Tumbling Creek cavesnail	Sub				E																				1			
Chittenango ovate amber snail					T																				1			
Northeastern beach tiger beetle					T																				1			
Puritan tiger beetle					T																				1			
American burying beetle					E									UMR GRL											2		G2G3	
scotch pine																									0			
prostrate pigweed																									0			
smooth pigweed																									0			
Powell's amaranth																									0			
redroot amaranth																									0			
white lamb's quarters																									0			
goutweed																									0			
fool's-parsley																									0			
dill																									0			
chervil																									0			
caraway																									0			
poison hemlock																									0			
Queen Anne's lace																									0			
burnet saxifrage																									0			
Japanese Hedge Parsley																									0			
green arrow arum																									0			
pearly yarrow																									0			
annual bursage																									0			
dog fennel																									0			
common burdock																									0			
southernwood																									0			
absinthe wormwood																									0			
biennial wormwood																									0			
common wormwood																									0			
cornflower																									0			

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brown knapweed																									0			
chicory																									0			
lance-leaved coreopsis																									0			
plains coreopsis																									0			
golden marguerite																									0			
yellow hawk's beard																									0			
yerba de tajo																									0			
rose-ring gaillardia																									0			
small-flowered galinsoga																									0			
hairy galinsoga																									0			
low cudweed																									0			
orange hawkweed																									0			
meadow hawkweed																									0			
mouse-ear hawkweed																									0			
king devil hawkweed																									0			
common hawkweed																									0			
elecampane																									0			
prickly lettuce																									0			
nipplewort																									0			
giant daisy																									0			
ox-eye daisy																									0			
tarweed																									0			
wild chamomile																									0			
pineapple weed																									0			
common groundsel																									0			
spiny sow thistle																									0			
common sow thistle																									0			
short-rayed aster																									0			
feverfew																									0			
red-seeded dandelion																									0			
common dandelion																									0			
yellow goat's beard																									0			
meadow goat's beard																									0			
scentless false mayweed																									0			
alkanet																									0			
hound's tongue																									0			
blue weed																									0			
nodding stickseed																									0			
Virginia stickseed																									0			
western stickseed																									0			
two-row stickseed																									0			
field forget-me-not																									0			
true forget-me-not																									0			
common comfrey																									0			
alyssum																									0			
horseradish																									0			
winter-cress																									0			
yellow rocket																									0			
Indian mustard																									0			
black mustard																									0			
field mustard																									0			
European false flax																									0			
small-seeded false flax																									0			
large-seeded false flax																									0			
shepherd's-purse																									0			
hare's ear mustard																									0			
herb sophia																									0			
dog mustard																									0			
wormseed mustard																									0			
dame's rocket																									0			
field peppergrass																									0			

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sweet alyssum																									0			
one-row yellowcress																									0			
small-leaved water cress																									0			
ball mustard																									0			
creeping yellow cress																									0			
wild mustard																									0			
tumble mustard																									0			
tall hedge mustard																									0			
hedge mustard																									0			
bristly bluebells																									0			
European bellflower																									0			
Japanese hops																									0			
purple cockle																									0			
thyme-leaved sandwort																									0			
field chickweed																									0			
mouse-ear chickweed																									0			
Deptford pink																									0			
low baby's-breath																									0			
common baby's-breath																									0			
giant chickweed																									0			
petrorhagia																									0			
bird's eye pearlwort																									0			
bouncing bet																									0			
knawel																									0			
sweet William catchfly																									0			
smooth catchfly																									0			
forking catchfly																									0			
red cockle																									0			
ragged robin																									0			
white campion																									0			
night-flowering campion																									0			
bladder campion																									0			
corn spurry																									0			
red sand spurrey																									0			
lesser stitchwort																									0			
common chickweed																									0			
cowherb																									0			
spearscale																									0			
Russian pigweed																									0			
hyssop-leaved bugseed																									0			
eastern bugseed																									0			
Jerusalem oak																									0			
summer cypress																									0			
salsola tumbleweed																									0			
Russian thistle																									0			
spider-flower																									0			
common St. John's-wort																									0			
orpine																									0			
orange stonewort																									0			
two-row stonecrop																									0			
mossy stonecrop																									0			
teasel																									0			
bluebuttons																									0			
painted leaf																									0			
cypress spurge																									0			
sun spurge																									0			
crownvetch																									0			
everlasting pea																									0			
tuberous vetchling																									0			
bird's-foot trefoil																									0			
large-leaved lupine																									0			

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black medick																									0			
alfalfa																									0			
alfalfa																									0			
alfalfa																									0			
white sweet clover																									0			
yellow sweet clover																									0			
rabbit's foot clover																									0			
palmate hop clover																									0			
field hop clover																									0			
alsike clover																									0			
crimson clover																									0			
red clover																									0			
white clover																									0			
narrow-leaved vetch																									0			
tufted vetch																									0			
spring vetch																									0			
hairy vetch																									0			
storksbill																									0			
Siberian cranesbill																									0			
yellow flag																									0			
Cumberland pagoda plant																									0			
hemp nettle																									0			
hemp nettle																									0			
hemp nettle																									0			
creeping charlie																									0			
henbit																									0			
common motherwort																									0			
motherwort																									0			
heartmint																									0			
spearmint																									0			
catnip																									0			
heal-all																									0			
heal-all																									0			
heal-all																									0			
lance-leaved sage																									0			
asparagus																									0			
star-of-bethlehem																									0			
Sibirican squill																									0			
blue flax																									0			
common flax																									0			
velvet leaf																									0			
flower-of-an-hour																									0			
cheeses																									0			
round-leaved mallow																									0			
carpetweed																									0			
narrow-leaved four o'clock																									0			
helleborine																									0			
common wood sorrel																									0			
celandine																									0			
common plantain																									0			
Pursh's plantain																									0			
Pursh's plantain																									0			
Pursh's plantain																									0			
leafy-stemmed plantain																									0			
corn speedwell																									0			
seaside Veronica																									0			
common speedwell																									0			
bird's eye speedwell																									0			
thyme-leaved speedwell																									0			
thyme-leaved speedwell																									0			
spring speedwell																									0			

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garden phlox																										0			
ground pink																										0			
buckwheat																										0			
bohemian knotweed																										0			
black-bindweed																										0			
Japanese knotweed																										0			
marsh waterpepper																										0			
lady's thumb																										0			
prince's feather																										0			
prostrate knotweed																										0			
common knotweed																										0			
common knotweed																										0			
common knotweed																										0			
green sorrel																										0			
common sheep sorrel																										0			
curly dock																										0			
domestic dock																										0			
bitter dock																										0			
patience dock																										0			
field dock																										0			
narrow-leaved dock																										0			
purslane																										0			
pimpernel																										0			
moneywort																										0			
tall buttercup																										0			
creeping buttercup																										0			
silvery cinquefoil																										0			
rough-fruited cinquefoil																										0			
false baby's breath																										0			
yellow bedstraw																										0			
dwarf snapdragon																										0			
yellow foxglove																										0			
tartary eyebright																										0			
dalmation toadflax																										0			
butter-and-eggs																										0			
yellow-seeded false pimpernel																										0			
moth mullein																										0			
common mullein																										0			
jimsonweed																										0			
angel's trumpet																										0			
hairy ground cherry																										0			
three-flowered nightshade																										0			
stinging nettle																										0			
garden heliotrope																										0			
large-bracted vervain																										0			
pansy																										0			
caltrop																										0			
cocoa cyperus																										0			
brown flatsedge																										0			
compressed rush																										0			
Lamarck's woodrush																										0			
many-flowered woodrush																										0			
crested wheatgrass																										0			
redtop																										0			
spreading bentgrass																										0			
water foxtail																										0			
meadow foxtail																										0			
tall oat grass																										0			
wild oats																										0			
cultivated oats																										0			
smooth brome																										0			
Japenese brome																										0			

MNV NWR and WMD					T & E Federal and		STATE	MOU	BCR BIRDS OF			FWS LISTS			PIF	UMRGLR JV BIRD PLANS					ABC	OTHER					
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rye brome																									0		
cheatgrass																									0		
orchard grass																									0		
smooth crabgrass																									0		
hairy crabgrass																									0		
cockspur barnyard grass																									0		
stink grass																									0		
little lovegrass																									0		
sand lovegrass																									0		
hairy cupgrass																									0		
red fescue																									0		
chewing fescue																									0		
red fescue																									0		
long-leaved fescue																									0		
Nepal barley																									0		
English rye grass																									0		
amur silver grass																									0		
western wheatgrass																									0		
reed canary grass																									0		
birdseed grass																									0		
timothy																									0		
annual bluegrass																									0		
bulbous bluegrass																									0		
tall bluegrass																									0		
Canada bluegrass																									0		
sylvan bluegrass																									0		
Kentucky bluegrass																									0		
rough bluegrass																									0		
European alkali grass																									0		
tall fescue																									0		
meadow fescue																									0		
foxtail millet																									0		
yellow foxtail																									0		
bristly foxtail																									0		
green foxtail																									0		
green foxtail																									0		
green foxtail																									0		
amur maple																									0		
Norway maple																									0		
Japanese barberry																									0		
common barberry																									0		
cigar tree																									0		
pretty honeysuckle																									0		
Morrow's honeysuckle																									0		
tartarian honeysuckle																									0		
European cranberrybush																									0		
Russian olive																									0		
Siberian peashrub																									0		
black locust																									0		
oak																									0		
flowering currant																									0		
white mulberry																									0		
European mountain ash																									0		
white poplar																									0		
red willow																									0		
crack willow																									0		
bay-leaved willow																									0		
matrimony vine																									0		
Siberian elm																									0		
bittersweet nightshade																									0		
Fassett's Locoweed					T																				1	G5T1T2	
Decurrent false aster					T																				1		
Pitcher's thistle					T																				1	G3	

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Houghton's goldenrod					T																				1			
Short's Goldenrod					E																				1		G1	
Lakeside Daisy					T																				1			
Missouri bladderpod					T																				1			
Virginia sneezeweed					T																				1			
Buffalo Clover					E																				1		G5T2T4Q	
Running Buffalo Clover					E																				1		G3	
Dwarf Lake Iris					T																				1		G3	
Colorado Butterfly Plant					T																				1			
Prairie Fringed Orchid					T																				1		G2G3	
Ute ladies' tresses					T																				1			
Michigan monkey-flower					E																				1			
Hayden's (Blowout) Penstemon					E																				1			
Northern Monkshood					T																				1		G3	
Price's potato-bean					T																				1			
American hart's-tongue fern					T																				1			
Leafy prairie-clover					E																				1			
Lakeside daisy					T																				1			
Small Whorled Pogonia					T																				1			
Short's bladderpod					C																				1		G2	
Pondberry					E																				1			
Appalachian Spiraea					T																				1			
Mead's Milkweed					T																				1			
Geocarpon minimum					T																				1			
Eurasian water milfoil																									0			
brittle water-nymph																									0			
wild parsnip																									0			
plumeless thistle																									0			
nodding thistle																									0			
spotted knapweed																									0			
Canada thistle																									0			
bull thistle																									0			
field sow thistle																									0			
field sow thistle																									0			
field sow thistle																									0			
tansey																									0			
garlic mustard																									0			
hoary alyssum																									0			
hoary cress																									0			
jointed charlock																									0			
pennycress																									0			
flowering rush																									0			
marijuana																									0			
field bindweed																									0			
leafy spurge																									0			
purple loosestrife																									0			
English plantain																									0			
Grecian floxglove																									0			
horse nettle																									0			
quackgrass																									0			
giant foxtail																									0			
glossy buckthorn																									0			
common buckthorn																									0			
Asian bittersweet																									0			
Brown-headed Cowbird	Dev, For, Shr			ccp																					0			
Common Grackle	Dev, For, Shr			ccp																					0			
Horned Lark	Dev, Gra			ccp																					0			
Brewer's Blackbird	Dev, Gra			ccp																					0			
American Robin	Dev, Gra, For			ccp																					0			
Barn Swallow	Dev, Gra, Rip			ccp																					0			
Northern Cardinal	Dev, Shr			ccp																					0			
Cooper's Hawk	For			ccp																					0			
Sharp-shinned Hawk	For			ccp																					0			

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Broad-winged Hawk	For			ccp																					0			
Scarlet Tanager	For			ccp																					0			
Brown Creeper	For			ccp																					0			
Red Crossbill	For			ccp																					0			
White-winged Crossbill	For			ccp																					0			
Black-and-white Warbler	For			ccp																					0			
Magnolia Warbler	For			ccp																					0			
Pine Warbler	For			ccp																					0			
Northern Parula	For			ccp																					0			
American Redstart	For			ccp																					0			
Tennessee warbler	For			ccp																					0			
Pileated Woodpecker	For			ccp																					0			
Red-bellied Woodpecker	For			ccp																					0			
Downy Woodpecker	For			ccp																					0			
Hairy Woodpecker	For			ccp																					0			
Red-breasted Nuthatch	For			ccp																					0			
White-breasted Nuthatch	For			ccp																					0			
Northern Saw-whet Owl	For			ccp																					0			
Eastern Screech Owl	For			ccp																					0			
Blue-gray Gnatcatcher	For			ccp																					0			
Hermit Thrush	For			ccp																					0			
Gray-cheeked Thrush	For			ccp																					0			
Swainson's Thrush	For			ccp																					0			
Red-eyed Vireo	For			ccp																					0			
Philadelphia Vireo	For			ccp																					0			
Blue-headed Vireo	For			ccp																					0			
Palm Warbler	For, Gra			ccp																					0			
Osprey	For, Rip			ccp																					0			
Alder Flycatcher	For, Rip			ccp																					0			
Yellow-bellied Flycatcher	For, Rip			ccp																					0			
Warbling Vireo	For, Rip			ccp																					0			
Black-capped Chickadee	For, Shr			ccp																					0			
Chestnut-sided Warbler	For, Shr			ccp																					0			
Blackpoll Warbler	For, Shr			ccp																					0			
Ruby-crowned Kinglet	For, Shr			ccp																					0			
Golden-crowned Kinglet	For, Shr			ccp																					0			
Red-tailed Hawk	Gra			ccp																					0			
Rough-legged Hawk	Gra			ccp																					0			
Common Redpoll	Gra			ccp																					0			
American Kestrel	Gra			ccp																					0			
Great-horned Owl	Gra, For			ccp																					0			
Barred Owl	Gra, For			ccp																					0			
Common Yellowthroat	Gra, Pal			ccp																					0			
Eastern Kingbird	Gra, Rip, Shr			ccp																					0			
American Goldfinch	Gra, Shr			ccp																					0			
Pine Siskin	Gra, Shr			ccp																					0			
Eastern Bluebird	Gra, Shr			ccp																					0			
Red-winged Blackbird	Pal			ccp																					0			
Yellow-headed Blackbird	Pal			ccp																					0			
Belted Kingfisher	Rip			ccp																					0			
Cliff Swallow	Rip			ccp																					0			
Purple Martin	Rip			ccp																					0			
Bank Swallow	Rip			ccp																					0			
Tree Swallow	Rip			ccp																					0			
Yellow Warbler	Rip, Shr			ccp																					0			
Cedar Waxwing	Shr			ccp																					0			
Indigo Bunting	Shr			ccp																					0			
House Finch	Shr			ccp																					0			
Purple Finch	Shr			ccp																					0			
Eastern Milksnake	Bar, For			ccp			X																		1		GS	
Mountain Plover	Bar, Gra								X																1			
Northern Prairie Skink	Bar, Rip, Gra			ccp																			MH		1		G6	
Human	Dev													n											1			

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Chimney Swift	Dev, For			ccp												(f, h)			X (f)						2			
Barn Owl	Dev, For, Gra													UMR											1		G5	
American Crow	Dev, For, Shr	X		ccp																					0			
Blue Jay	Dev, For, Shr			ccp																					0			
House Wren	Dev, For, Shr			ccp																					0			
Cattle Egret	Dev, Gra																b/m								1			
Common Nighthawk	Dev, Gra			ccp			X	X																	2		G5	Not well m
Mourning Dove	Dev, Shr	X		ccp																					0			
Northern Goshawk	For			ccp			X	X						UMR GRL											3		G5	On USFS se
Whip-poor-will	For			ccp			X	X		X		X		UMR GRL	X	(f, h)			X (f)						8			Not well m
Rose-breasted Grosbeak	For			ccp			X	X																	2			High Partn
Baltimore Oriole	For			ccp											X										1			
Boreal Chickadee	For						X	X																	2		G5	Suggested
Wilson's Warbler	For			ccp																					0			
Kentucky Warbler	For				E					X		X			X (I)	X(f)			X (f)		Red/Y				7		G5	
Worm-eating Warbler	For											X		UMR		X			X						4		G5	
Swainson's Warbler	For											X		UMR											2			
Connecticut Warbler	For			ccp			X	X						UMR GRL		(f, h)			X (f)						5		G4	Highest Pa
Ovenbird	For			ccp			X	X																	2			While does
Black-throated Blue Warbler	For			ccp			X	X						GRL		(f, h)			X (f)						5			Highest Pa
Bay-breasted Warbler	For			ccp			X	X								X			X						4			Partners in
Blackburnian Warbler	For			ccp											X										1			
Cape May Warbler	For			ccp			X	X						GRL		(f, h)			X (f)						5			Highest Pa
Black-throated Green Warbler	For			ccp																					0			
Bachman's Warbler	For				E																				1			
Nashville Warbler	For			ccp																					0			
Spruce Grouse	For	X					X	X																	2		G5	Not well m
Black-backed Woodpecker	For						X	X																	2		G5	High Partn
Yellow-bellied Sapsucker	For			ccp			X	X																	2			High Partn
Boreal Owl	For						X	X																	2			Meets seve
Winter Wren	For			ccp			X	X																	2			Highly sign
Veery	For			ccp			X	X								(f, h)			X (f)						4			Highest Pa
Wood Thrush	For		Y	ccp			X	X		X		X	f	UMR GRL	X (IIC)	X(f)			X (f)		Yellow				10			Partners in
Eastern Wood-pewee	For		Y	ccp			X	X																	2			High Partn
Yellow-throated Vireo	For			ccp											X										1			
Blue-spotted Salamander	For			ccp																			MH		1			
Spotted Salamander	For			ccp			X																		1			
Eastern Red-backed Salamander	For						X																		1			
Eastern Ratsnake	For						X																		1			
White-tailed deer	For	X		ccp																					0			
Gray wolf	For	X			E		X							UMR GRL											3		G4	
Bobcat	For	X																							0			
Puma / Cougar / Mountain Lion	For				E																				1		G5	
Canada Lynx	For				T		X							GRL											3		G5	
American Marten	For																								0			
Racoon	For	X		ccp																					0			
Black Bear	For	X																							0			
Virginia Opossum	For	X		ccp																					0			
Eastern gray squirrel	For	X		ccp																					0			
Eastern fox squirrel	For	X		ccp																					0			
Prothonotary Warbler	For, Rip		Y	ccp			X	X		X		X		UMR GRL	X (I)	X(f)			X (f)		Yellow				9		G5	Partners in
Olive-sided Flycatcher	For, Rip			ccp			X	X				X		UMR GRL		X(f)			X (f)		Yellow				7		G4	Partners in
Least Flycatcher	For, Rip			ccp			X	X																	2			High Partn
Great Crested Flycatcher	For, Rip			ccp																					0			
Western Wormsnake	For, Rip																						MH		1		G5	
Fisher	For, Rip						X																		1			
Mink	For, Rip	X		ccp																					0			
Eastern Foxsnake	For, Rip, Pal			ccp			X																		1			
Yellow-billed Cuckoo	For, Shr			ccp											X										1			
Black-billed Cuckoo	For, Shr			ccp			X	X	X	X	X	X		UMR GRL	X (I)										8			Highest Pa
Fox Sparrow	For, Shr			ccp																					0			
Gray Catbird	For, Shr			ccp																					0			
Ruffed Grouse	For, Shr	X																							0			

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Wild Turkey	For, Shr	X		ccp																					0			
Red Fox	For, Shr	X		ccp																					0			
Gray Fox	For, Shr	X		ccp																					0			
Swainson's Hawk	Gra						X	X	X			X		UMR											5			Partners in
Dickcissel	Gra			ccp			X	X	X	X	X	X		UMR GRL	X (I)	X			X						10		G5	Partners in
American Golden Plover	Gra						X	X								X(f)		M (f), 4							4			High Priori
Grasshopper Sparrow	Gra		Y	ccp			X	X	X	X		X	f	UMR GRL	X										8		G5	High Partn
McCown's Longspur	Gra								X																1			
Smith's Longspur	Gra								X (nb)	X (nb)		X									Yellow				4			
Lark Sparrow	Gra		Y	ccp																					0			
Bachman's Sparrow	Gra											X									Red				2		G3	
Vesper Sparrow	Gra			ccp																					0			
Field Sparrow	Gra			ccp			X	X		X		X		UMR GRL	X (I)										6			Highest Pa
Bobolink	Gra		Y	ccp			X	X			X	X	f	UMR GRL	X (I)										7			Highest Pa
Eastern Meadowlark	Gra			ccp			X	X						UMR GRL		(f, h)			X (f)						5			On USFWS
Western Meadowlark	Gra			ccp										UMR GRL											1		G5	
Prairie Warbler	Gra											X		UMR							Yellow				3		G5	
Ring-necked Pheasant	Gra	X		ccp																					0			
Sharp-tailed Grouse	Gra	X					X	X																	2		G4	Population
Upland Sandpiper	Gra						X	X	X	X	X	X	f	UMR GRL	X (I)	X(f)		M/b (f), 3	X (f)						12		G5	High Priori
Butler's Gartersnake	Gra																						MH		1		G4	
Ornate Box Turtle	Gra																						MH		1		G5	
American Badger	Gra	X		ccp			X																		1		G5	
Northern Grasshopper Mouse	Gra						X																		1		G5	
Heather Vole	Gra						X																		1			
Franklin's Ground Squirrel	Gra						X																		1		G5	
Richardson's Ground Squirrel	Gra			ccp			X																		1			
Northern Pocket Gopher	Gra						X																		1			
Savannah Sparrow	Gra			ccp																					0			
Six-lined Racerunner	Gra, Bar						X																		1		G5	
Northern Flicker	Gra, For		Y	ccp						X		X		UMR GRL											3			
Red-headed Woodpecker	Gra, For			ccp			X	X	X	X	X	X		UMR GRL	X (I)	X(f)			X (f)		Yellow				11			Partners in
Long-eared Owl	Gra, For			ccp										UMR GRL											1		G5	
Eastern Hog-nosed Snake	Gra, For						X																		1		G5	
Elk or Wapiti	Gra, For	X					X																		1		G5	
Coyote	Gra, For, Shr	X		ccp																					0			
Killdeer	Gra, Pal			ccp												(f, h)		M/B (f), 5							2			
Hudsonian Godwit	Gra, Pal						X	X	X (nb)	X (nb)	X (nb)	X	f	UMR GRL		X		M, 4			Yellow				11			High Priori
Smooth Greensnake	Gra, Pal			ccp			X																H		2		G5	
Western Harvest Mouse	Gra, Pal			ccp			X																		1		G5	
Northern Rough-winged Swallow	Gra, Rip			ccp			X	X							X (IIA)										3			High Partn
Turkey Vulture	Gra, Shr			ccp																					0			
Dark-eyed junco	Gra, Shr			ccp																					0			
Lincoln Sparrow	Gra, Shr			ccp																					0			
Song Sparrow	Gra, Shr			ccp																					0			
Eastern Towhee	Gra, Shr			ccp																					0			
American Tree Sparrow	Gra, Shr			ccp																					0			
Clay-colored Sparrow	Gra, Shr			ccp																					0			
Chipping Sparrow	Gra, Shr			ccp																					0			
Orchard Oriole	Gra, Shr			ccp								X		UMR GRL											2			
Northern Bobwhite	Gra, Shr														X										1		G5	
Bell's Vireo	Gra, Shr		Y	ccp			X	X		X (c)		X		UMR GRL	X (I)	X			X		Red				9		G5	Partners in
Eastern Cottontail	Gra, Shr	X		ccp																					0			
Jack Rabbit	Gra, Shr	X		ccp																					0			
Snowshoe Hare	Gra, Shr	X																							0			
Atlantic brant	Lac	X																		n					1			
Long-tailed Duck	Lac	X																		N					1			
White-winged Scoter	Lac	X																		N					1			
Black Scoter	Lac	X																		N					1			
Surf Scoter	Lac	X																		N					1			
Lake Chubsucker	Lac																					X			1		G5	
Banded Sculpin	Lac																					X			1			
Goldfish	Lac				n																				1		G5	

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Lake Chub	Lac						X																		1			
Yellow perch	Lac	X																				X			1			
Greater Scaup	Lac	X		ccp									f							N					2			
Common Eider	Lac	X																		N					1			
Parasitic Jaeger	Lac																M								1			
Northern pike	Lac	X	Y																			X			1		G5	
Rainbow smelt	Lac	X			n																				1		G5	
Long-ear sunfish	Lac,	X					X															X			2		G5	
Lesser Black-backed Gull	Lac, Dev			ccp													W								1			
Glaucous Gull	Lac, Dev			ccp													W								1			
Great Black-backed Gull	Lac, Dev																b/w								1			
Spotted Turtle	Lac, Pal																						H		1		G5	
Bluegill	Lac, Riv	X	Y																			X			1		G5	
Largemouth bass	Lac, Riv	X	Y																			X			1		G5	
White crappie	Lac, Riv	X																				X			1		G5	
Black crappie	Lac, Riv	X																				X			1		G5	
Smallmouth bass	Lac, Riv	X																				X			1			
Longnose gar	Lac, Riv	X																				X			1		G5	
Shortnose gar	Lac, Riv																					X			1		G5	
Spotted Gar	Lac, Riv																					X			1		G5	
Alligator gar	Lac, Riv																					X			1			
White bass	Lac, Riv																					X			1		G5	
Hybrid striped bass	Lac, Riv				n																	X			2		GNR	
Striped bass	Lac, Riv				n																	X			2		G5	
Common Mudpuppy	Lac, Riv			ccp			X																MH		2		G5	
Northern Pintail	Pal	X		ccp			X	X					f			X				n					5			Continenta
Green-winged Teal	Pal	X		ccp																b/n					1			
Blue-winged Teal	Pal	X	Y	ccp										UMR		X (f, s)				B/N					3			
American Black Duck	Pal	X		ccp			X	X					f	GRL	X (IIC)	X(f)				B/N					7			Continenta
Snow Goose, Greater	Pal	X		ccp																N					1			
Great Egret	Pal			ccp													b/m								1		G5	
American Bittern	Pal			ccp			X	X	X	X	X	X		UMR		X	B								9		G4	High priori
Little Blue Heron	Pal																b/m								1			
Snowy Egret	Pal																b/m								1		G5	
Least Bittern	Pal			ccp			X	X	X	X		X		UMR GRL		X									7		G5	Moderate
Yellow-crowned Night-heron	Pal															X	b/m								2		G5	
Semipalmated Plover	Pal			ccp														M, 4			Yellow				2			
Black-bellied Plover	Pal			ccp														M, 4							1			
Whooping Crane	Pal				E							X /E		UMR GRL	X (I)	X	M				Red				7			
Sandhill Crane	Pal	X		ccp													B/M								1			
Common Moorhen	Pal			ccp			X	X						UMR GRL			B/m								4		G5	MN Special
Black Rail	Pal								X	X		X	f	UMR GRL	X (I)	X	m				Red				9			
Sora	Pal	X		ccp												X	B/m								2		G5	
Virginia Rail	Pal	X		ccp			X	X									B/m/w								3			Moderate
American Avocet	Pal			ccp			X	X										M							3			High Priori
Spotted Sandpiper	Pal			ccp														M/B, 4							1			
Ruddy Turnstone	Pal						X	X								X (c)		M, 4							4			High Priori
Sanderling	Pal															X (f, c)		M (f), 4			Yellow				3			
Dunlin	Pal			ccp			X	X					f			(f, h)		M (f), 4							5			High Priori
Baird's Sandpiper	Pal																	M, 4							1			
Red Knot (roselaari ssp.)	Pal									X (nb)	X (nb)	X	f			X		M, 3			Yellow				7			
Red Knot (rufa ssp.)	Pal									X (nb, c)	X (nb, c)	X	f			X		M, 3			Yellow				7			
White-rumped Sandpiper	Pal						X	X										M, 4			Yellow				4			High Priori
Stilt Sandpiper	Pal			ccp										UMR GRL				M, 4			Yellow				3			
Western Sandpiper	Pal																	M, 3			Yellow				2			
Pectoral Sandpiper	Pal			ccp														M, 4			Red				2			
Least Sandpiper	Pal																	M, 5							1			
Semipalmated Sandpiper	Pal			ccp			X	X				X	f					M, 4							5			High Priori
Wilson's Snipe	Pal	X		ccp												(f, h)		M/B (f), 4							2			
Short-billed Dowitcher	Pal		Y	ccp			X	X	X (nb)	X (nb)	X (nb)	X		UMR GRL		X(f)		M (f), 4							9			High Priori
Long-billed Dowitcher	Pal																	M, 5							1			
Long-billed Curlew	Pal								X				f								Yellow				3			
Whimbrel	Pal						X	X		X (nb)	X (nb)	X		UMR GRL		X		M, 3							8			High Priori

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Red-necked Phalarope	Pal																	M, 3								1			
Lesser Yellowlegs	Pal		Y	ccp								X						M, 5								2			
Greater Yellowlegs	Pal		Y	ccp			X	X						UMR GRL				M, 5								4			High Priori
Willet	Pal																	M, 3								1			
Solitary Sandpiper	Pal			ccp					X (nb)	X (nb)	X (nb)	X				X (c)		M/b 4								6			
Buff-breasted Sandpiper	Pal						X	X	X (nb)	X (nb)	X (nb)	X	f	UMR GRL		X		M, 4			Red					11			High priori
Marsh Wren	Pal			ccp			X	X			X	X			X (IIC)											5		G5	High Partn
Sedge Wren	Pal		Y	ccp			X	X				X		UMR GR	X (IIC)											5			Highest Pa
Eastern Ratsnake (Carolinian pop in	Pal						X																	H		2		G5	
Northern Shoveler	Pal	X		ccp																b/n						1			
Swamp Sparrow	Pal			ccp			X	X							X (IIA)											3			High Partn
American Woodcock	Pal, For	X	Y				X	X					f	UMR GR	X, IIIB	X(f)		M/B (f), 4	X (f)							8			High Priori
Wood Duck	Pal, For, Rip	X	Y	ccp										UMR GRL		(f, h)				B/n						3			
Northern Harrier	Pal, Gra		Y	ccp			X	X						UMR GR	X (IIC)											4		G5	High Partn
Mallard	Pal, Gra	X	Y	ccp										UMR GRL		X (f, s)				B/N						3			
Gadwall	Pal, Gra	X		ccp																b/n						1			
Greater White-fronted Goose	Pal, Gra																									0			
Le Conte's Sparrow	Pal, Gra			ccp			X	X				X		UMR GRL							Yellow					5		G4	Highest Pa
Pied-billed Grebe	Pal, Lac		Y	ccp						X	X	X				X	B/w									5			
Great Blue Heron	Pal, Rip			ccp													B/w									1			
Green Heron	Pal, Rip			ccp													B									1			
Black-crowned Night-heron	Pal, Rip			ccp			X	X		X		X		UMR GRL		X(f)	b/w									7		G5	Med to hig
Rusty Blackbird	Pal, Rip			ccp			X	X		X (nb)	X (nb)	X	f	UMR		X			X		Yellow					10			Partners in
Beaver	Pal, Rip	X		ccp																						0			
Muskrat	Pal, Rip	X		ccp																						0			
Pickerel Frog	Pal, Rip, Riv						X																			1		G5	
Bluntnose Darter	Pal, Riv						X															X				2		G5	
Willow Flycatcher	Pal, Shr			ccp			X	X			X	X			X	X(f)					Yellow (SW sp)					7			Partners in
Northern Waterthrush	Rip			ccp																						0			
Rock Vole	Rip						X																			1			
Queensnake	Rip, Riv																							MH		1		G5	
Shortnose sturgeon	Riv				E																					1			
Pallid Sturgeon	Riv				E									UMR								X				3		G2	
Shovelnose Sturgeon	Riv						X							UMR								X				3		G4	
American Eel	Riv						X															X				2		G4	
Highfin carpsucker	Riv																					X				1			
River redhorse	Riv	X					X															X				2		G4	
Black Redhorse	Riv	X					X															X				2		G5	
Shorthead Redhorse	Riv	X																				X				1		G5	
Greater redhorse	Riv	X					X															X				2		G4	
Rock bass	Riv	X																				X				1			
Spotted bass	Riv																					X				1			
Largescale stoneroller	Riv						X																			1			
Plains Minnow	Riv													UMR								X				2		G4	
Sturgeon Chub	Riv				C																	X				2		G3	
Sicklefin Chub	Riv				C																	X				2		G3	
River Shiner	Riv																					X				1		G5	
Silverband shiner	Riv																					X				1		G5	
Flathead chub	Riv						X															X				2		G5	
Gravel Chub	Riv						X															X				2		G4	
Weed Shiner	Riv																					X				1		G5	
Pugnose minnow	Riv						X															X				2		G5	
Plains Topminnow	Riv						X																			1			
Neosho Madtom	Riv				T																	X				2			
Sauger	Riv	X																				X				1		G5	
Walleye	Riv	X												UMR								X				2		G5	
Western Sand Darter	Riv						X															X				2		G3	
Arkansas Darter	Riv				C																					1			
Stippled Darter	Riv																					X				1			
American Brook Lamprey	Riv						X																			1			
Brook trout, Heritage strains	Riv	X	Y											UMR GRL												1			
Least Tern, Interior	Riv, Bar				E							X /E		UMR							Red					4			
American Wigeon	Riv, Lac	X		ccp												X (s)				b/n						2			

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Lesser Scaup	Riv, Lac	X		ccp			X	X					f	UMR GRL		X(f)				b/N						6			Continenta
Redhead	Riv, Lac	X		ccp											X (IIC)	X (s)				b/n						3		G5	
Canvasback	Riv, Lac	X		ccp										UMR GRL		X(f)				b/N						3			
Bufflehead	Riv, Lac	X		ccp																b/N						1			
Common Goldeneye	Riv, Lac	X		ccp												X (s)				B/N						2		G5	
Tundra Swan	Riv, Lac	X		ccp												(f, h)				N						2			
Mute swan	Riv, Lac	X																		B/N						1			
Common Merganser	Riv, Lac	X	Y	ccp																b/N						1			
Red-breasted Merganser	Riv, Lac	X		ccp																b/N						1			
Common Loon	Riv, Lac						X	X						UMR GRL			B/M									4		G5	High priori
Red-throated Loon	Riv, Lac																M/w									1			
Iceland Gull	Riv, Lac			ccp													W									1			
Thayer's Gull	Riv, Lac			ccp													W				Yellow					2			
Bonaparte's Gull	Riv, Lac			ccp													W/m									1			
Sabine's Gull	Riv, Lac																M									1			
Double-crested Cormorant	Riv, Lac			ccp										UMR GRL			B/w									2			
Western Grebe	Riv, Lac						X	X									B/m									3			Declining N
Red-necked Grebe	Riv, Lac			ccp			X	X									B/M									3		G5	High and m
Caspian Tern	Riv, Lac, Bar			ccp													B/m									1		G5	
Canada Goose, Interior	Riv, Lac, Dev	X		ccp										UMR GRL		X				B/N						3			
Herring Gull	Riv, Lac, Dev			ccp													B/w									1			
Ring-billed Gull	Riv, Lac, Dev			ccp													B/w									1			
American Coot	Riv, Lac, Pal			ccp													B/m/w									1			
Ruddy Duck	Riv, Lac, Pal	X		ccp																B/N						1			
Black Tern	Riv, Lac, Pal			ccp			X	X		X	X	X	f	UMR GRL	X (IIC)	X(f)	B									10		G4	High priori
Eared Grebe	Riv, Lac, Pal						X	X									B									3			Moderate
Hooded Merganser	Riv, Lac, Pal, Rip	X		ccp											X					B/N						2			
Ring-necked Duck	Riv, Lac, Rip	X	Y																	B/N						1			
Northern Shrike	Shr			ccp																						0			
Brown Thrasher	Shr			ccp			X	X			X	X			X (IIA)											5			Highest Pa
Yellow-breasted Chat	Shr			ccp											X	(f, h)			X (f)							3		G5	
Kirtland's Warbler	Shr				E							X /E		GRL		X(f)			X (f)		Red					6		G1	
White-eyed Vireo	Shr														X											1			
White-throated Sparrow	Shr			ccp			X	X																		2			Suggested
White-crowned Sparrow	Shr			ccp																						0			
Harris Sparrow	Shr			ccp																						0			
Painted Bunting	Shr, For											X	f								Yellow					3			
Canada Warbler	Shr, For			ccp			X	X			X	X		UMR GRL	X	X(f)			X (f)		Yellow					9			Partners in
Golden-winged warbler	Shr, For		Y	ccp			X	X			X	X (f)	f	UMR GRL	X (I)	X(f)			X (f)		Red					10			Partners in
Blue-winged Warbler	Shr, For			ccp			X	X			X	X		UMR GRL	X (I)	X(f)			X (f)		Yellow					9			Partners in
Bewick's Wren (bewickii ssp.)	Shr, For									X		X		UMR	X											4			
Mourning Warbler	Shr, Rip			cp											X											1			
Eastern Pipistrelle	Sub, For			ccp			X																			1		G5	
River carpsucker																						X				1		G5	
White Sucker		X																				X				1		G5	
Smallmouth buffalo		X																				X				1		G5	
Bigmouth buffalo		X																				X				1		G5	
Northern hogsucker																						X				1			
Spotted Sucker																						X				1			
Silver redhorse		X																				X				1			
Golden Redhorse		X																				X				1		G5	
Warmouth							X																			1			
Redbreast sunfish		X																				X				1			
Alabama shad																						X				1		G3	
Gizzard shad																						X				1		G5	
Spoonhead sculpin							X																			1		G5	
Grotto Sculpin					C																					1			
Redside Dace							X																			1		G3G4	
Grass carp					n									n								X				3		G5	
Common carp					n																	X				2		G5	
Western Silvery Minnow														UMR								X				2		G4	
Brassy Minnow																						X				1		G5	
Central silvery minnow							X																			1		G5	

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Silver carp					n									n									X			3		G5	
Bighead carp					n									n									X			3		G5	
Redfin Shiner							X																			1		G5	
Speckled Chub							X																X			2		G3G4	
Redfin shiner							X																			1		G5	
Suckermouth minnow							X																			1		G5	
Red Shiner							X																			1			
Spotfin Shiner																							X			1			
Black carp																							X			1			
Arkansas river shiner																							X			1			
Muskellunge		X																					X			1			
Goldeye																							X			1		G5	
Black bullhead		X																					X			1		G5	
Blue catfish																							X			1		G5	
Channel catfish		X																					X			1		G5	
Tadpole Madtom																							X			1			
Flathead catfish		X																					X			1		G5	
Crystal Darter							X																			1			
Mud Darter							X																X			2		G4G5	
Greenside Darter																							X			1			
Slough Darter																							X			1			
Niangua Darter					T																					1			
Banded Darter																							X			1			
Blackside Darter																							X			1			
Leopard Darter					T																					1			
River Darter																							X			1		G5	
Chestnut Lamprey																							X			1		G4	
Mosquitofish					n																					1		G5	
Bloater							X																			1			
Nipigon cisco							X																			1			
Cutthroat trout		X																					X			1			
Rainbow trout		X																					X			1			
Brown trout		X																					X			1			
Freshwater drum																							X			1		G5	
Deepwater Sculpin							X																			1			
pygmy whitefish							X																			1			

HABITAT TYPE	Species - Common Name	Species - Scientific Name	# of priority rankings or listings in *All* plans	Guild: B-Bird, I-Ivertebrate, M-Mammal, R-Reptile, P-Plant	Ability to be supported by current or restorable refuge capabilities? (See scoring scale A) - NWR	Abundance on NWR (See scoring scale B)	Responds well to habitat management? (See scoring scale C) - NWR	Ability to represent a larger guild or group of species? (See scoring scale D)	Ability to represent on-refuge ecological processes, or broader ecosystem processes? (See scoring scale E)	NWR Scoring
open grassland	Grasshopper Sparrow	*Ammodramus savannarum*	*8*	*B*	10	10	10	10	10	**9.8**
open grassland (some scattered shrubs)	Bobolink	*Bartramia longicauda*	*7*	B	10	10	10	10	10	**9.7**
open grassland	Henslow's Sparrow	*Ammodramus henslowii*	*13*	*B*	10	5	10	10	10	**9.55**
open ground including cities	Bell's Vireo	*Dolichonyx orizivorus*	*9*	*B*	10	10	7	10	10	**9.3**
open, brushy woodlands, overgrown fields	Dickcissel	*Spiza americana*	10	B	10	7	10	10	7	**9.1**
Seasonal wetlands near uplands	Bald Eagle	*Haliaeetus leucocephalus*	*10*	B	10	7	7	10	7	**8.5**
floodplain forest	Bald Eagle	*Haliaeetus leucocephalus*	*10*	B	10	7	7	10	7	**8.5**
Seasonal wetlands	Sedge Wren	*Cistothorus platensis*	*5*	B	10	10	7	7	10	**8.45**
	Kitten Tails	*Besseya bullii*	*2*	P	10	5	10	10	10	**8.45**
	Mallard	*Anas platyrhynchos*	*3*	B	10	10	10	7	7	**8.4**
migratory, temp wetlands in PPR	Wood Duck	*Aix sponsa*	*3*	B	10	10	10	7	7	**8.4**
floodplain forest	Wood Duck	*Aix sponsa*	*3*	B	10	10	10	7	7	**8.4**
dense low brush near the water	Mallard	*Colaptes auratus*	*3*	*B*	10	10	10	7	7	**8.4**
Seasonal wetlands near uplands	Greater Yellowlegs	*Tringa melanoleuca*	*4*	B	10	10	7	7	10	**8.35**
	Lesser Yellowlegs	*Tringa flavipes*	*2*	B	10	10	7	7	10	**8.15**
shallow marshes prairie sloughs	Prothonotary Warbler	*Protonotaria citrea*	*9*	B	10	5	7	10	7	**8.1**
Floodplain forest	Prothonotary Warbler	*Protonotaria citrea*	*9*	B	10	5	7	10	7	**8.1**
open habitats with woodland edges	Field Sparrow	*Spizella pusilla*	*6*	*B*	10	10	10	5	5	**8.1**
tallgrass prairies	Vesper Sparrow	*Pooecetes gramineus*	0	B	10	7	10	10	7	**8.1**
open grassland and wetland edges	Semipalmated Sandpiper	*Calidris pusilla*	*5*	B	10	7	7	7	10	**8**
Seasonal wetlands	Marsh Wren	*Cistothorus palustris*	*5*	B	10	7	7	7	10	**8**
tallgrass prairie	Pied-billed Grebe	*Podilymbus podiceps*	*5*	B	10	10	7	7	7	**8**
	Red-headed Woodpecker	*Melanerpes erythrocephalus*	*11*	B	7	5	7	10	10	**8**
open grassland wetland margins	Red-headed Woodpecker	*Melanerpes erythrocephalus*	*11*	*B*	7	5	7	10	10	**8**
floodplains	Northern Prairie Skink	*Plestiodon septentrionalis septentrionali*	*1*	R	10	10	10	5	7	**7.9**
	Northern Prairie Skink	*Plestiodon septentrionalis septentrionali*	1	R	10	10	10	5	7	**7.9**
migratory, variety of wetland types	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	*3*	B	10	10	10	5	5	**7.8**
	Beaver	*Castor canadensis*	*0*	M	10	10	10	5	7	**7.8**
Winter, migratory	Muskrat	*Ondatra zibethicus*	*0*	M	10	10	10	5	7	**7.8**
open grasslands	Northern Flicker	*Charadrius vociferus*	0	B	10	10	10	7	5	**7.8**
migratory	Northern Rough-winged Swallow	*Anas platyrhynchos*	3	B	10	10	10	5	5	**7.8**
open and brushy grasslands and woodland ed	Clay-colored Sparrow	*Stelgidopteryx serripennis*	*0*	*B*	10	10	10	5	7	**7.8**
shallow wetlands and uplands	Black Tern	*Chlidonias niger*	*10*	B	10	5	7	7	7	**7.75**
	Killdeer	*Charadrius vociferus*	*2*	*B*	10	10	10	5	5	**7.7**

HABITAT TYPE	Species - Common Name	Species - Scientific Name	# of priority rankings or listings in *All* plans	Guild: B-Bird, I-Ivertebrate, M-Mammal, R-Reptile, P-Plant	Ability to be supported by current or restorable refuge capabilities? (See scoring scale A) - NWR	Abundance on NWR (See scoring scale B)	Responds well to habitat management? (See scoring scale C) - NWR	Ability to represent a larger guild or group of species? (See scoring scale D)	Ability to represent on-refuge ecological processes, or broader ecosystem processes? (See scoring scale E)	NWR Scoring
open grasslands	Killdeer	*Asio flammeus*	2	B	10	10	10	5	5	7.7
	American Woodcock	*Scolopax minor*	8	B	7	7	10	7	7	7.7
Young successional forest	American Woodcock	*Scolopax minor*	8	B	7	7	10	7	7	7.7
open and riparian woodlands	Savannah Sparrow	*Sturnella magna*	0	B	10	7	10	7	7	7.65
	Plains Hog-nosed Snake (Western)	*Heterodon nasicus*	3	R	7	7	10	10	7	7.65
	Northern Shoveler	*Anas clypeata*	1	B	10	10	7	7	7	7.6
migratory, flooded ag fields, mudflats	Ring-necked Duck	*Aythya collaris*	1	B	10	10	7	7	7	7.6
Floodplain forest	Cerulean Warbler	*Setophaga cerulea*	11	B	10	3	5	10	7	7.6
grasslands and seasonal wetlands	Eastern Meadowlark	*Geothlypis trichas*	5	B	10	7	10	5	5	7.55
	Gacwall	*Anas strepera*	1	B	10	5	10	7	7	7.45
open grassland	Gacwall	*Anas strepera*	1	B	10	5	10	7	7	7.45
grasslands and seasonal wetlands	Pectoral Sandpiper	*Calidris melanotos*	2	B	10	5	7	7	10	7.4
temporary wetlands, uplands	Common Yellowthroat	*Geothlypis trichas*	0	B	7	7	10	10	7	7.35
	American Bittern	*Botaurus lentiginosus*	9	B	10	3	7	7	7	7.35
	Lesser Scaup	*Aythya affinis*	6	B	10	5	7	7	7	7.35
open grassland	Common Yellowthroat	*Spizella pallida*	0	B	7	7	10	10	7	7.35
migratory, flooded grasslands	Least Sandpiper	*Calidris minutilla*	1	B	10	5	7	7	10	7.3
northern peatlands	Common Snapping Turtle	*Chelydra serpentina*	2	R	10	10	5	7	7	7.3
	Hooded Merganser	*Lophodytes cucullatus*	2	B	10	7	7	7	7	7.25
forest edge and clearings	Gray Catbird	*Dumetella carolinensis*	0	B	10	10	7	7	5	7.2
	Northern Harrier	*Circus cyaneus*	4	B	10	7	7	5	7	7.15
grasslands, wetlands open water in winter	Least Bittern	*Ixobrychus exilis*	7	B	10	3	7	7	7	7.15
muddy margins of lakes, ponds, ditches, etc.	Trumpeter Swan	*Cygnus buccinator*	7	B	10	5	7	7	5	7.15
grasslands and old field habitats	Northern Harrier	*Vireo bellii*	4	B	10	7	7	5	7	7.15
	Gophersnake (Bullsnake)	*Pituophis catenifer*	2	R	7	7	10	7	7	7.1
	Leonard's Skipper	*Lycaeides melissa samuelis*	2	I	7	1	10	10	10	7.1
open grassland with shrubs	Gophersnake (Bullsnake)	*Pituophis catenifer*	2	R	7	7	10	7	7	7.1
	Blue-winged Teal	*Anas discors*	3	B	10	7	7	7	5	7.05
grasslands and seasonal wetlands	Short-eared Owl	*Passerculus sandwichensis*	11	B	7	3	5	10	7	6.85
open areas, forest edge, savannas	Northern Flicker	*Colaptes auratus*	3	B	10	10	5	5	5	6.8
mature forest	Downy Woodpecker	*Picoides pubescens*	0	B	10	10	5	7	5	6.8
mature forest	Hairy Woodpecker	*Picoides villosus*	0	B	10	10	5	7	5	6.8
mature forest	White-breasted Nuthatch	*Sitta carolinensis*	0	B	10	10	5	7	5	6.8
grasslands and wetland margins	Smooth Greensnake	*Opheodrys vernalis*	2	R	7	7	10	5	7	6.8

HABITAT TYPE	Species - Common Name	Species - Scientific Name	# of priority rankings or listings in *All* plans	Guild: B-Bird, I-Ivertebrate, M-Mammal, R-Reptile, P-Plant	Ability to be supported by current or restorable refuge capabilities? (See scoring scale A) - NWR	Abundance on NWR (See scoring scale B)	Responds well to habitat management? (See scoring scale C) - NWR	Ability to represent a larger guild or group of species? (See scoring scale D)	Ability to represent on-refuge ecological processes, or broader ecosystem processes? (See scoring scale E)	NWR Scoring
damp deciduous forest,, disturbed forest, ea	Veery	*Catharus fuscescens*	*4*	B	10	5	5	7	7	**6.75**
open grasslands	Red-tailed Hawk	*Icterus spurius*	*0*	*B*	7	10	7	7	7	**6.75**
shrubby leafy understory	Wood Thrush	*Hylocichla mustelina*	*10*	B	7	5	7	7	5	**6.7**
open brushy fields and edges of woods	Western Meadowlark	*Chordeiles minor*	*1*	*B*	7	7	10	5	7	**6.7**
	Eastern Hog-nosed Snake	*Heterodon platirhinos*	*1*	R	7	5	10	7	7	**6.7**
	Eastern Hog-nosed Snake	*Heterodon platirhinos*	1	R	7	5	10	7	7	**6.7**
nests near water, savanna species	Orchard Oriole	*Sialisa sialis*	2	B	7	10	7	5	7	**6.65**
mature forest	Red-bellied Woodpecker	*Melanerpes carolinus*	*0*	B	10	7	5	7	7	**6.65**
moist upland tallgrass prairies	Ring-necked Pheasant	*Phasianus colchicus*	0	B	10	10	7	3	5	**6.6**
forest edge and clearings	Baltimore Oriole	*Icterus galbula*	*1*	B	10	7	7	3	7	**6.55**
closed canopy forest near clear stream	Louisiana Waterthrush	*Parkesia motacilla*	*8*	B	7	3	7	7	7	**6.5**
open grasslands and cities	Song Sparrow	*Melospiza melodia*	0	B	10	10	5	5	5	**6.5**
mature forest	Pileated Woodpecker	*Dryocopus pileatus*	*0*	B	10	5	5	7	7	**6.35**
small forest near water	Red-shouldered Hawk	*Buteo lineatus*	*4*	B	10	5	5	5	5	**6.15**
mature forest	Red-breasted Nuthatch	*Sitta canadensis*	*0*	B	10	5	5	7	5	**6.05**
migratory	Golden-winged warbler	*Vermivora chrysoptera*	*10*	B	3	1	7	10	7	**5.85**
floodplain forest, near rivers and streams	Eastern Foxsnake	*Elaphe vulpina*	*1*	R	10	5	5	5	5	**5.85**
dry mixed forest no understory	Whip-poor-will	*Caprimulgus vociferus*	*8*	B	7	3	5	7	5	**5.8**
forest edges and thickets, clearings	Black-billed Cuckoo	*Coccyzus erythropthalmus*	*8*	B	7	5	5	5	5	**5.8**
Brushy 2nd growth and open woods	Blue-winged Warbler	*Vermivora cyanoptera*	*9*	B	3	1	7	10	7	**5.75**
young forest	Yellow-bellied Sapsucker	*Sphyrapicus varius*	*2*	B	7	5	5	7	5	**5.5**
forest clearings and edges, mature hardwood	Least Flycatcher	*Empidonax minimus*	*2*	B	7	7	5	5	5	**5.5**
mature oak dominate forest	Scarlet Tanager	*Piranga olivacea*	*0*	B	7	3	7	7	5	**5.4**
Floodplain forest, ash	Blue-gray Gnatcatcher	*Polioptila caerulea*	*0*	B	10	5	3	7	3	**5.35**
wet forest	Great Crested Flycatcher	*Myiarchus citrinus*	*0*	B	10	7	3	5	3	**5.35**

APPENDIX F
RARE COMMUNITIES MAPS

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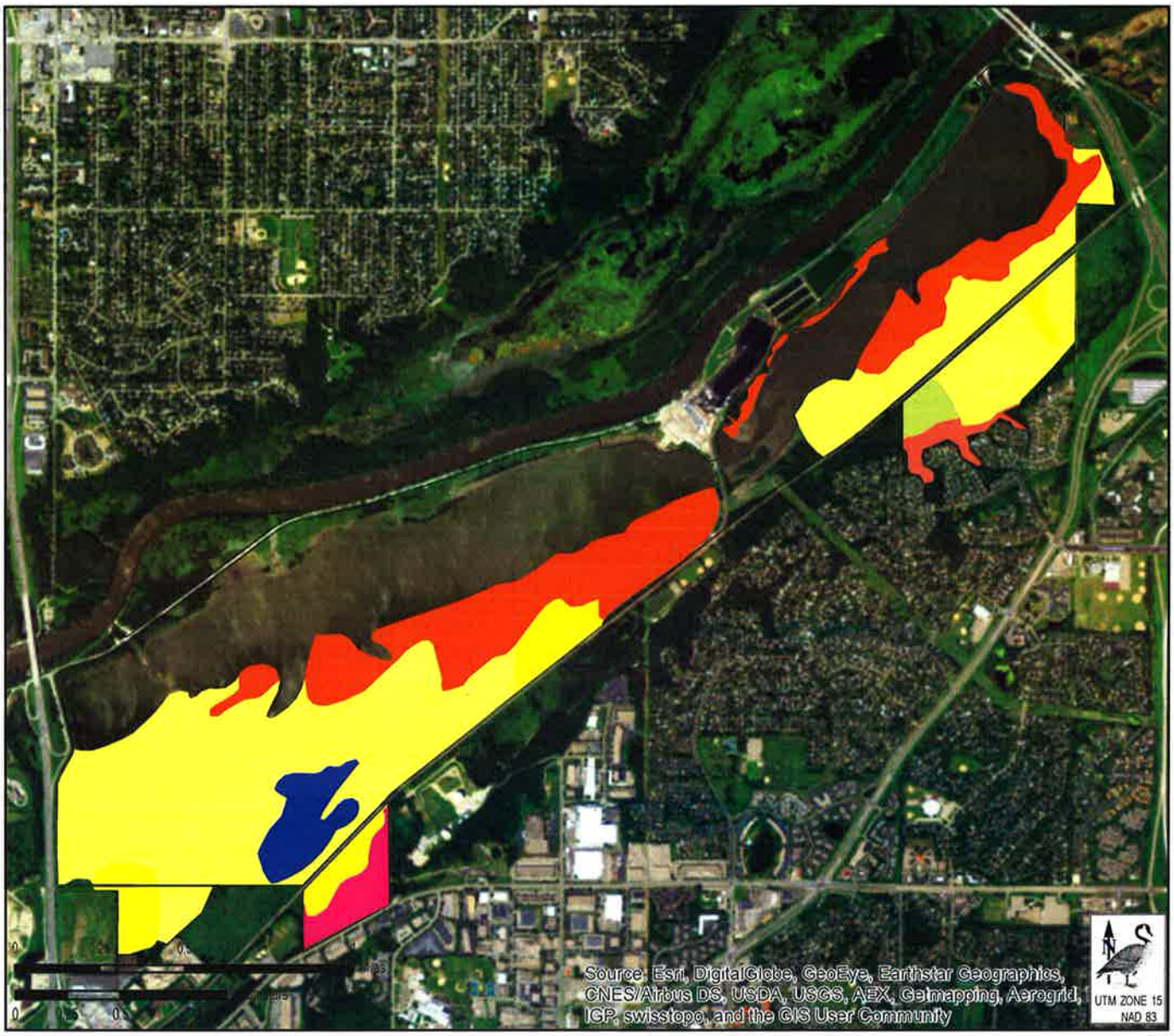
Minnesota Valley National Wildlife Refuge

Rare Habitat

Black Dog Lake Unit



Black Ash - (Red Maple) Seepage Swamp	Red Oak - Sugar Maple - Basswood - (Bitternut Hickory)
Bulrush Marsh (Northern)	Red Oak - White Oak - (Sugar Maple) Forest
Calcareous Fen (Southeastern)	Sedge Meadow
Crystalline Bedrock Outcrop (Prairie): Minnesota River Subtype	Seepage Meadow/Carr
Dry Barrens Oak Savanna (Southern): Oak Subtype	Silver Maple - (Virginia Creeper) Floodplain Forest
Dry Sand - Gravel Oak Savanna (Southern)	Spikerush - Bur Reed Marsh (Northern)
Dry Sand - Gravel Prairie (Southern)	Sugar Maple - Basswood - (Bitternut Hickory) Forest
Mesic Prairie (Southern)	Wet Prairie (Southern)
Other Water Body	Wet Seepage Prairie (Southern)
Pin Oak - Bur Oak Woodland	Unit Boundary

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Rare Habitat

Blakeley Unit

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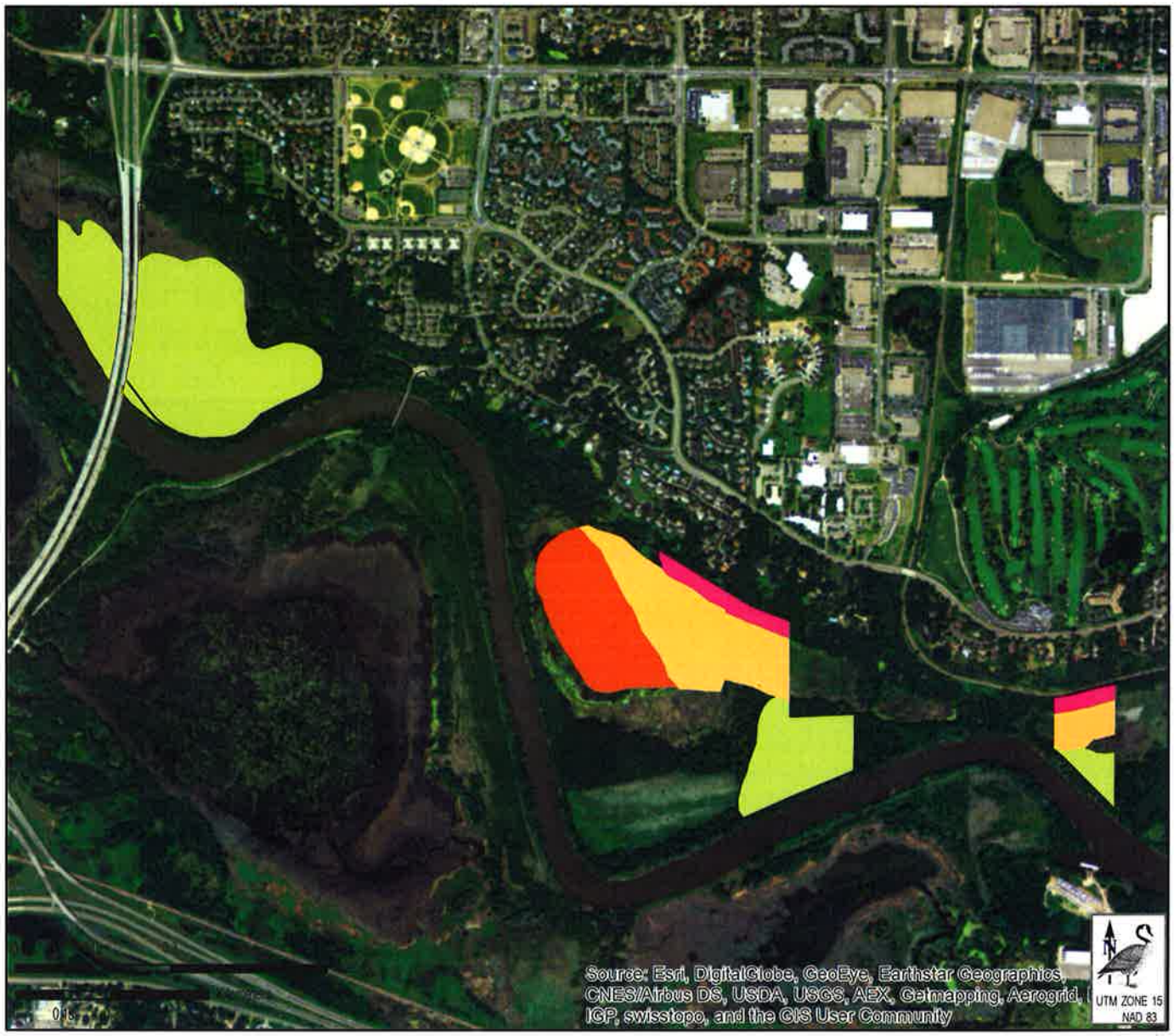
Rare Habitat

Bloomington Ferry Unit



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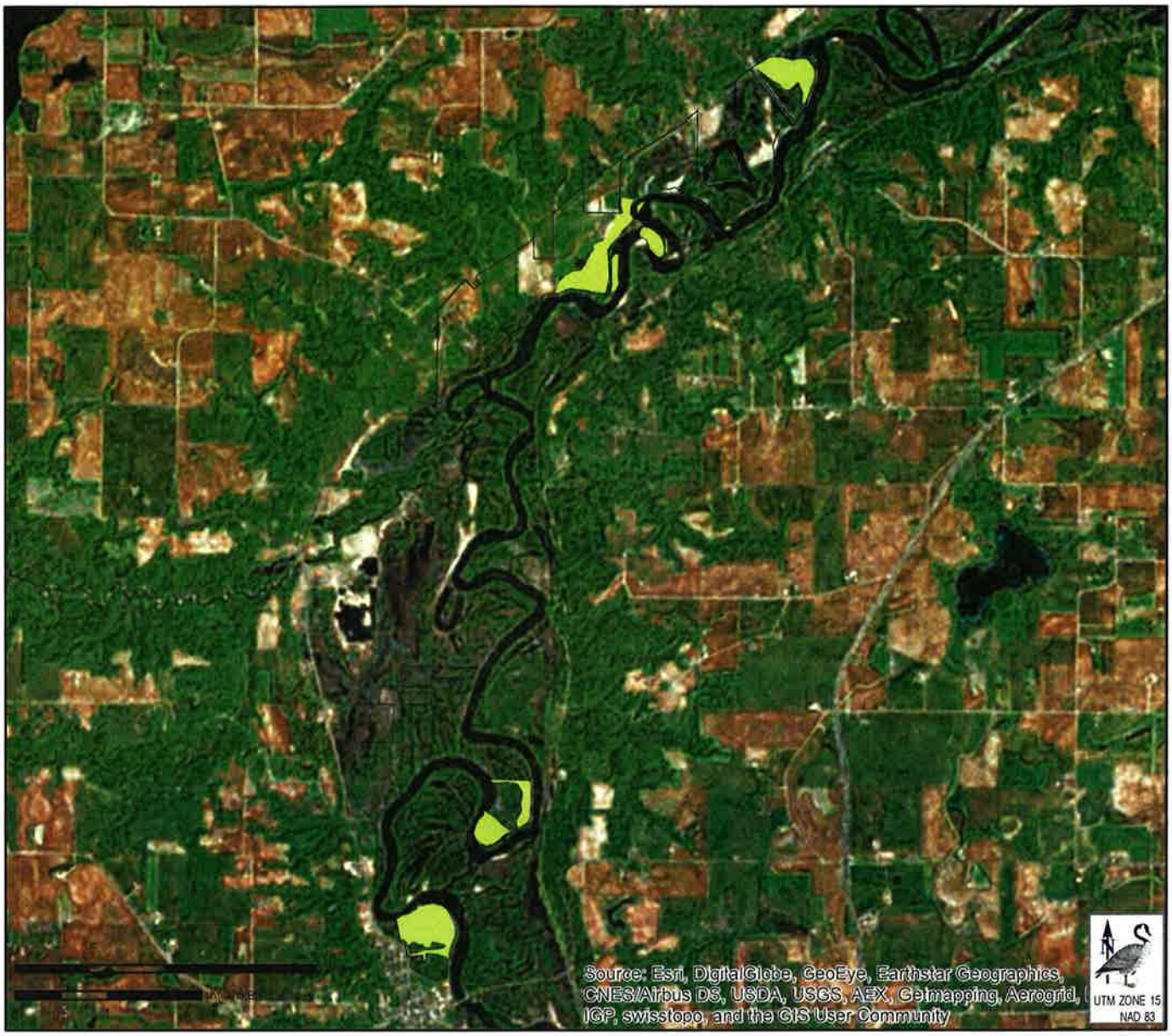
Jessenland Unit



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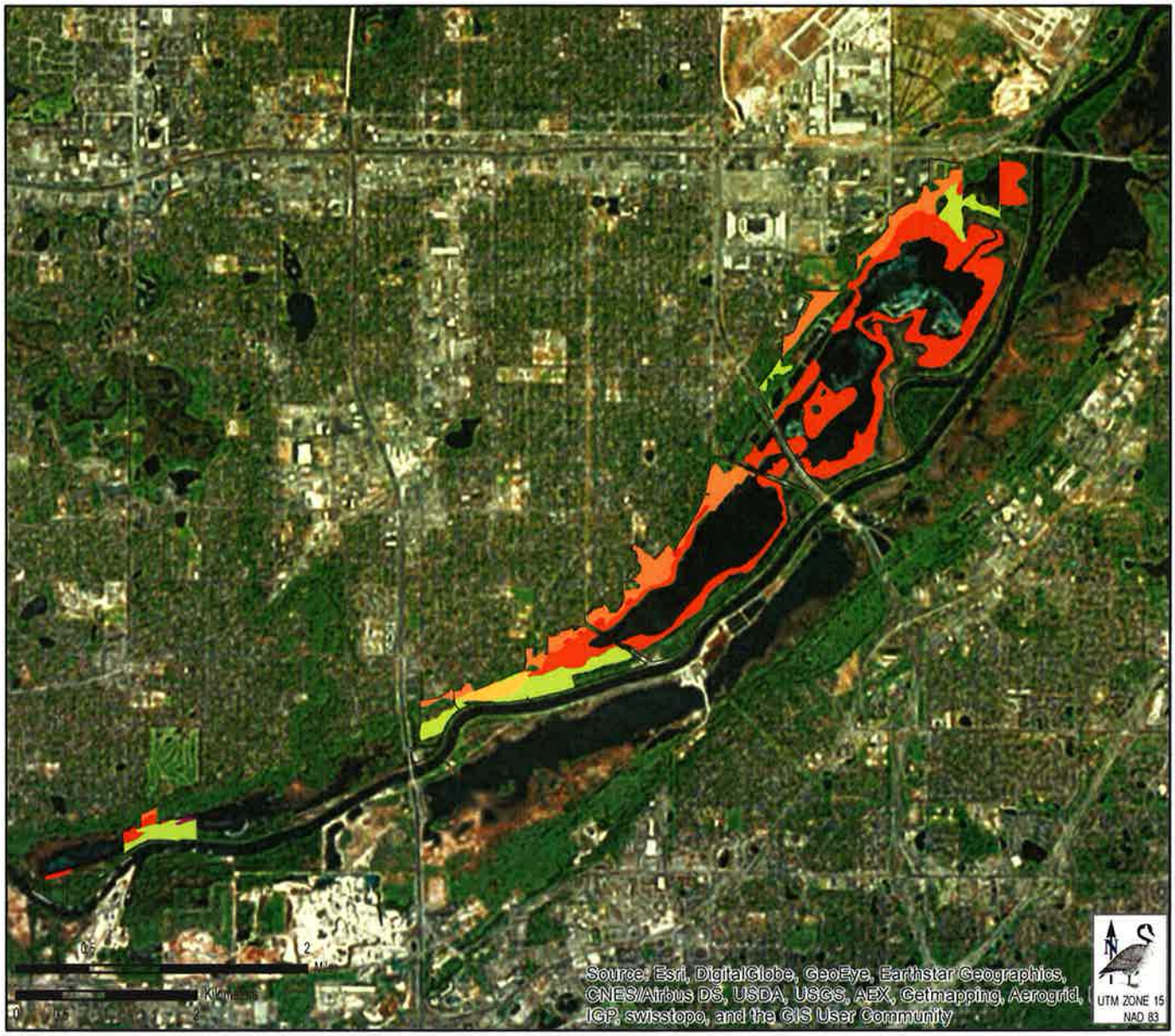
Long Meadow Lake Unit



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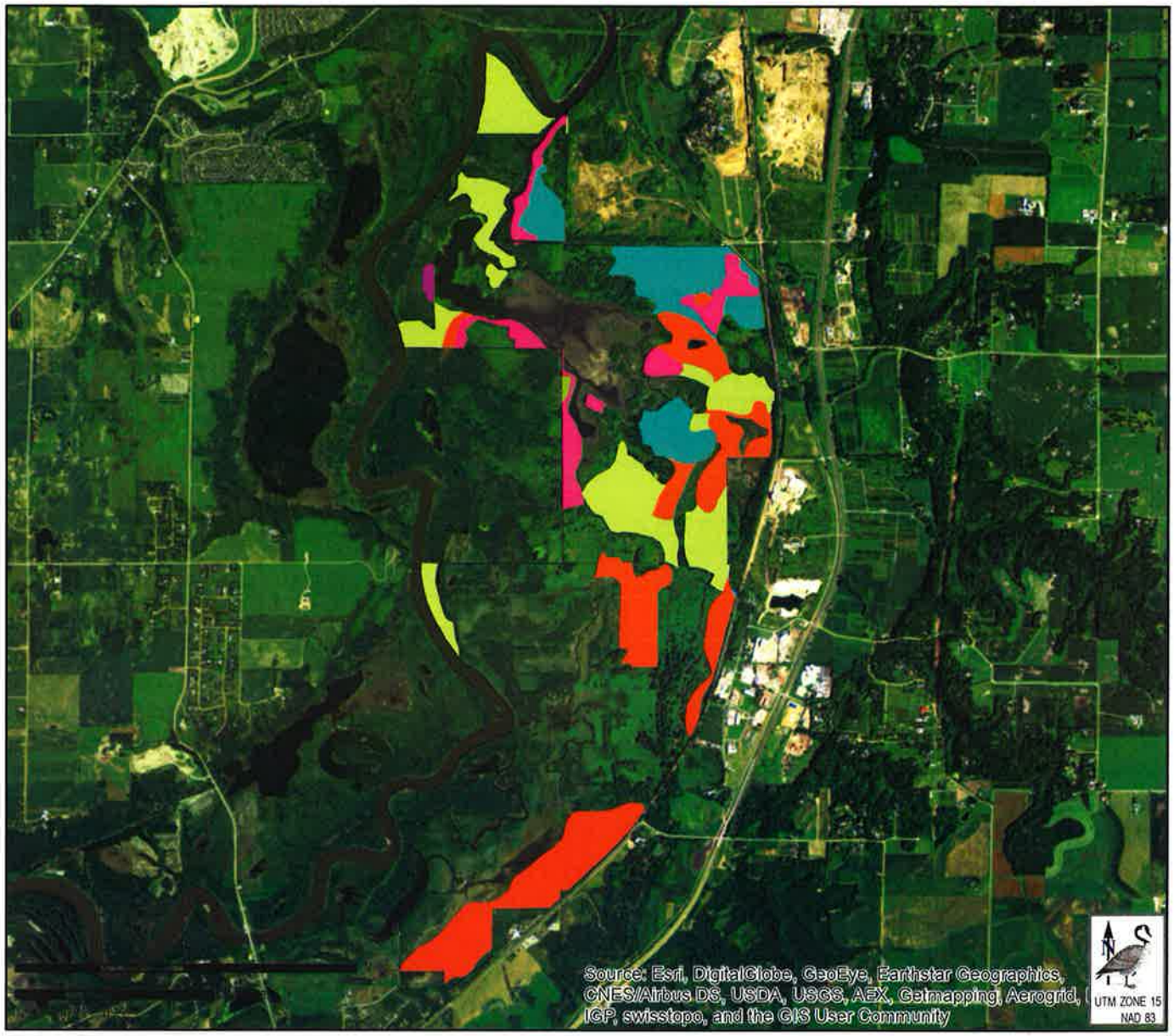
Louisville Swamp Unit



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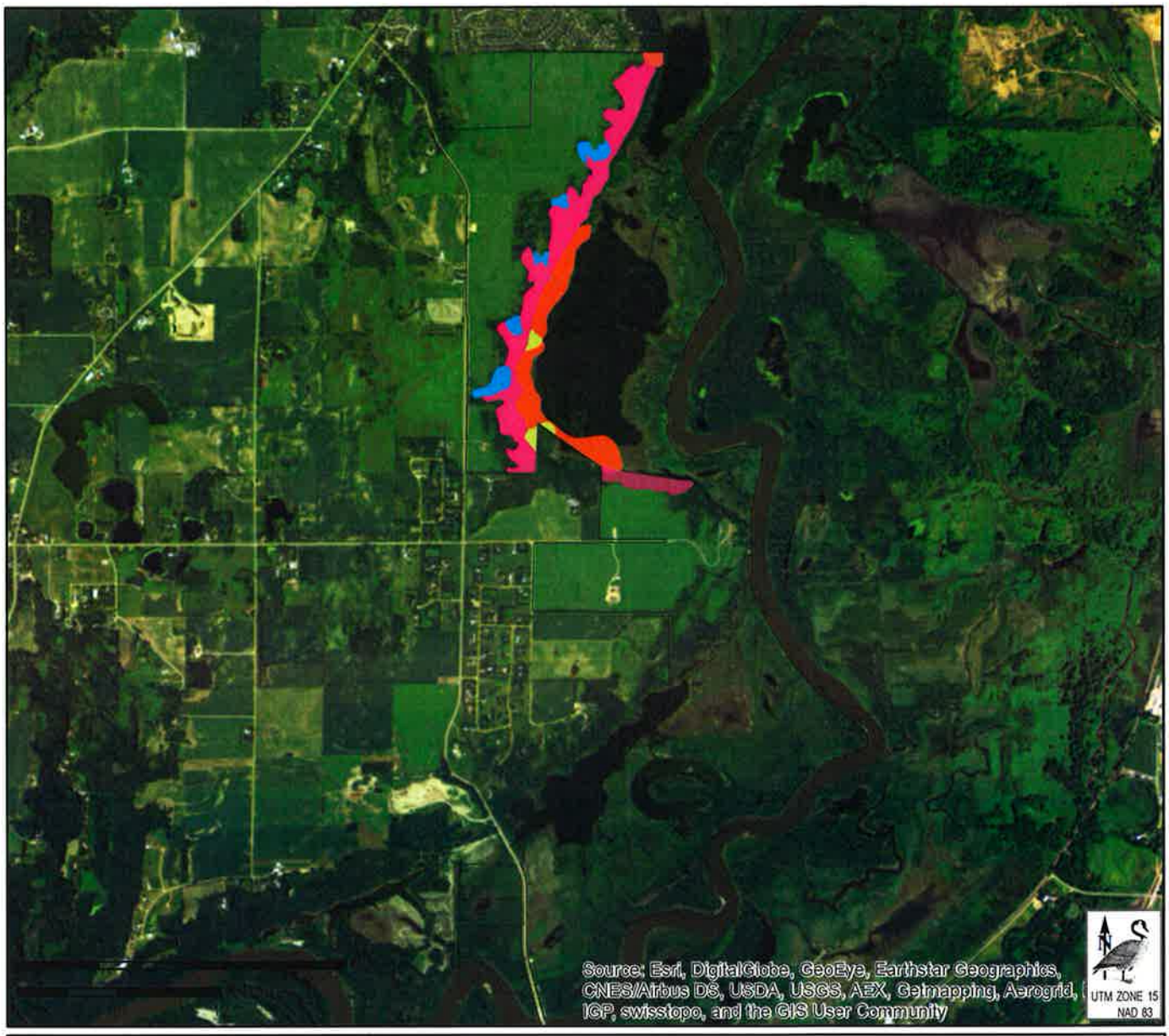
Rare Habitat

Rapids Lake Unit



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Rare Habitat

St. Lawrence Unit

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Rare Habitat

Upgrala Unit

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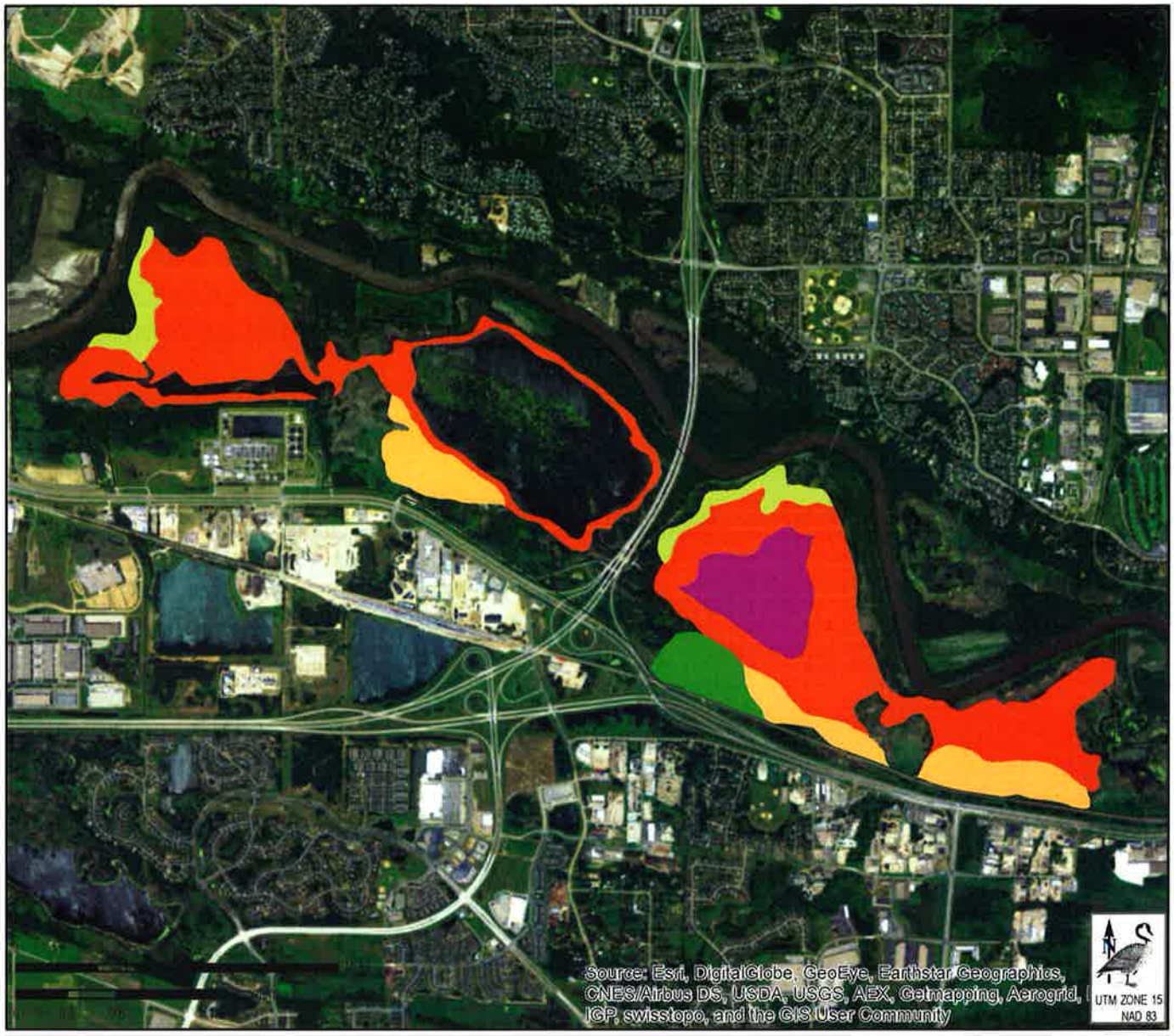
Rare Habitat

Wilkie Unit



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Minnesota Valley NWR
Bloomington, MN
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J. Miller

APPENDIX G
LIST OF SPECIES

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SPECIES COMMON AND SCIENTIFIC NAME

American elm	Ulmus americana
American White Pelican	*Pelecanus erythrorhynchos*
American Woodcock	*Scolopax minor*
arrowhead	Sagittaria spp.
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
beaver	*Castor canadensis*
Bell's Vireo	*Vireo bellii*
bidens	Bidens spp.
big bluestem	*Andropogon gerardii*
black raspberries	*Rubus occidentalis*
Black Tern	*Chlidonias niger*
Blanding's turtle	*Emydoidea blandingii*
blue sucker	*Cycleptus elongatus*
bluegill	*Lepomis macrochirus*
Blue-gray Gnatcatcher	*Polioptila caerulea*
blue grama	*Bouteloua gracilis*
bluejoint grass	*Calamagrostis canadensis*
Blue-winged Teal	*Anas discors*
Bobolink	*Dolichonyx oryzivorus*
box elder	*Acer negundo*
brittle prickly pear	*Opuntia fragilis (Nutt.) Haw.*
broadleaf arrowhead	*Sagittaria latifolia*
brook trout	*Salvelinus fontinalis*
Bulrush	Scirpus spp.
bur-reed	Sparganium spp.
Canada thistle	*Cirsium arvense*
Canada wild rye	*Elymus canadensis*
Canvasback	*Aythya valisineria*
Caspian Tern	*Sterna caspia*
cattail	Typha spp.
Cerulean Warbler	*Setophaga cerulea*
channel catfish	*Ictalurus punctatus*
common buckthorn	*Rhamnus cathartica*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
common mudpuppy	*Necturus maculosus maculosus*
common reed	*Phragmites australis*
common snapping turtle	*Chelydra serpentina*
Common Yellowthroat	*Geothlypis trichas*
Dickcissel	*Spiza americana*
Downy Woodpecker	*Picoides pubescens*
duckweed	Lemna spp.
eastern foxsnake	*Elaphe vulpina*
eastern hog-nosed snake	*Heterodon platirhinos*
Eastern Wood-pewee	*Contopus virens*
Field Sparrow	*Spizella pusilla*
Forster's Tern	*Sterna forsteri*
fowl manna grass	*Glyceria striata*
Golden-winged Warbler	*Vermivora chrysoptera*
gophersnake	*Pituophis catenifer*
Grasshopper Sparrow	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Great Crested Flycatcher	*Myiarchus citrinus*
Greater Yellowlegs	*Tringa melanoleuca*
green ash	*Fraxinus pennsylvanica*

Green-winged Teal	*Anas crecca*
Hairy Woodpecker	*Picoides villosus*
harebell	*Campanula rotundifolia*
heath aster	*Aster ericoides*
Henslow's Sparrow	*Ammodramus henslowii*
Hooded Merganser	*Lophodytes cucullatus*
Kentucky bluegrass	*Poa pratensis subsp. pratensis*
Killdeer	*Charadrius vociferus*
kittentails	*Besseya bullii*
lake sedge	*Carex lacustris*
lake sturgeon	*Acipenser fulvescens*
largemouth bass	*Micropterus salmoides*
Lark Sparrow	*Chondestes grammacus*
leafy spurge	*Euphorbia esula*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Least Sandpiper	*Calidris minutilla*
Lesser Scaup	*Aythya affinis*
Lesser Yellowlegs	*Tringa flavipes*
little bluestem	*Schizachyrium scoparium*
mallard	*Anas platyrhynchos*
maple	*Acer saccharum*
mat muhly grass	*Muhlengergia richardsoni*
monarch butterfly	*Danaus plexippus*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
northern long-eared bat	*Myotis septentrionalis*
northern pike	*Esox lucius*
northern prairie skink	*Plestiodon septentrionalis*
Northern Shoveler	*Anas clypeata*
Osprey	*Pandion haliaetus*
paddlefish	*Polyodon spathula*
Peregrine Falcons	*Falco peregrinus*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
plains hog-nosed snake	*Heterodon nasicus*
plains pocket mouse	*Perognathus flavescens*
plains prickly pear	*Opuntia macrorhiza*
poison ivy	*Toxicodendron radicans var. negundo*
prairie skink	*Plestiodon septentrionalis*
prairie vole	*Microtus ochrogaster*
prairie wild onion	*Allium stellatum*
Prothonotary Warbler	*Protonotaria citrea*
purple loosestrife	*Lythrum salicaria*
purple prairie clover	*Dalea purpurea*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
red-osier dogwood	*Cornus sericea*
Red-shouldered Hawk	*Buteo lineatus*
reed canary grass	*Phalaris arundinacea*
regal fritillary	*Speyeria idalia*
Ring-necked Ducks	*Aythya collaris*
river otter	*Lontra canadensis*
rough-seeded fame flower	*Phemeranthus rugospermus*
rusty patched bumble bee	*Bombus affinis*
Savanna Sparrow	*Passerculus sandwichensis*
Sedge Wren	*Cistothorus platensis*
Semipalmated Sandpiper	*Calidris pusilla*
Short-billed Dowitcher	*Limnodromus griseus*

Short-eared Owl	*Asio flammeus*
sideoats grama	*Bouteloua curtipendula*
small-flowered fameflower	*Talinum parviflorisum*small
small white lady's-slipper	*Cypripedium candidum*
smooth brome	*Bromus inermis*
smooth greensnake	*Opheodrys vernalis*
smooth softshell turtle	*Apalone mutica*
Solitary Sandpiper	*Tringa solitaria*
spikemoss	*Selaginella rupestris*
sterile sedge	*Carex sterilis*
Swamp Sparrow	*Melospiza georgiana*
switchgrass	*Catharus fuscescens*
Trumpeter Swan	*Cygnus buccinator*
tussock sedge	*Carex stricta*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
Virginia Rail	*Rallus limicola*
walleye	*Stizostedion vitreum*
Western Meadowlark	*Sturnella neglecta*
Whip-poor-will	*Caprimulgus vociferus*
wild celery	*Vallisneria americana*
wild grape	*Vitis riparia*
Willow Flycatcher	*Empidonax traillii*
willows	Salix spp.
Wilson's Phalarope	*Phalaropus tricolor*
Wood Duck	*Aix sponsa*
wood nettle	*Laportea canadensis*
Wood Thrush	*Hylocichla mustelina*

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