Town of St. Joseph, Wisconsin
Natural Areas Inventory/
Land Cover Mapping Draft
September 2016

Prepared for:
Town of St. Joseph, Wisconsin

Prepared by:
Stantec Consulting Services Inc.

Sign-off Sheet

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Prepared by _____
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Reviewed by _____
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Executive Summary

The Town of St. Joseph is a vibrant semi-rural town located on the eastern border of the greater Twin Cities Metropolitan area. The Town borders the scenic St. Croix River in St. Croix County, Wisconsin. The Town has enjoyed a relatively low but steady pace of growth for many years and its residents enjoy the pastoral beauty of the area landscape and small town lifestyle. The pending completion of the new St. Croix River crossing bridge in 2017 will bring new development pressure to the Town. In an effort to plan effectively for natural resources, the town requires accurate information about the type and quality of open space and natural areas within the town.

National Park Service (NPS) staff completed Minnesota Land Cover Classification System (MLCCS) mapping of the area between top of bluff and the St. Croix River, using aerial photos and a very limited field review. In 2015 the Town retained Stantec to conduct land cover mapping and natural resources inventory for portions of the Town that fall within previously identified natural resource corridor areas and have potential for development. Owners of parcels in the MLCCS/NRI area thought to support natural areas were contacted by the Town in late summer 2015 with field natural areas inventory work occurring in October/November 2015.

The field inventory documented a variety of distinct natural community types including forest, woodland, shrubland, herbaceous wetlands, and grasslands, as well as areas of open water (lakes and ponds). The most common upland cover type is oak woodland/brushland, while the most common lowland cover type is cattail marsh. The most unique plant communities identified during the NRI include several rich fens site and two oak savannas (an ecosystem type that is considered imperiled).

A total of 174 natural areas received quality ranks. Of these, 13 (7.5%) were considered to be Exceptional (highest quality rank possible). A total of 24 (13.8%) sites were given a High quality rank. Moderate quality sites totaled 113 (64.9%) – the majority of these were Oak Woodland-brushland sites. A total of 24 (13.8%) were mapped as Low quality – these areas typically exhibited significant signs of human disturbance and/or invasive plants.

Natural areas tend to be concentrated in the previously mapped natural resources corridors. Other natural areas can be found around the lakes, along the rivers, and in scattered locations. The NRI provides some general guidelines and information for management of natural areas.

Quality Rank	**Number of Sites***
Exceptional (341)	13
High (342)	24
Moderate (343)	113
Low (344)	24

1.0 INTRODUCTION

The Town of St. Joseph is a vibrant semi-rural community located along the scenic St. Croix River Valley, just 20 minutes east of downtown St. Paul. The Town and surrounding area host a range of desirable natural features, including the St. Croix River, Willow River State Park, and Bass Lake as well as, quality natural communities, and unique natural features on public and private land in the community. Natural features are a significant part of the quality of life for residents for their inherent beauty, the sense of place they provide and the contribution to the rural character St. Joseph currently has.

The Town of St. Joseph has been experiencing some development in past decades. The pace of development is anticipated to increase substantially after completion of the new St. Croix River crossing bridge and easier commuting to the Twin Cities. The expected increase in development will place pressure on natural resources and impact the overall feel and aesthetic of the community.

This Natural Resources Inventory (NRI) has been undertaken as part of the Comprehensive Plan update project in progress to proactively understand existing resources and conduct planning that will reflect the communities will with regard to balancing future growth with impacts to natural resources and the rural character residents find desirable.

1.1 GOALS AND OBJECTIVES OF THE NRI

The Goals and Objectives for this project were to:

- Identify and inventory significant natural areas in natural resource corridors and areas deemed to have high potential for development
- Gather on-the-ground data, where access was granted by landowners.
- Use a proven natural community classification and qualitative ranking methodology to evaluate natural communities.
- Field verify the existing land cover mapping of natural areas based on the US National Vegetation Classification System (USNVCS)
- Locate and complete a field evaluation of Natural areas
- Identify:
    - Open space with public value
    - Natural areas with restoration potential
    - Potential/suitable greenway corridors
    - Rank and prioritize sites for possible public acquisition, conservation easements, land banking, or similar measures.
- Guide policy development
- Enable protection, connection and restoration of important natural areas
- Provide information for parks, open space, trails, and greenway planning

Introduction

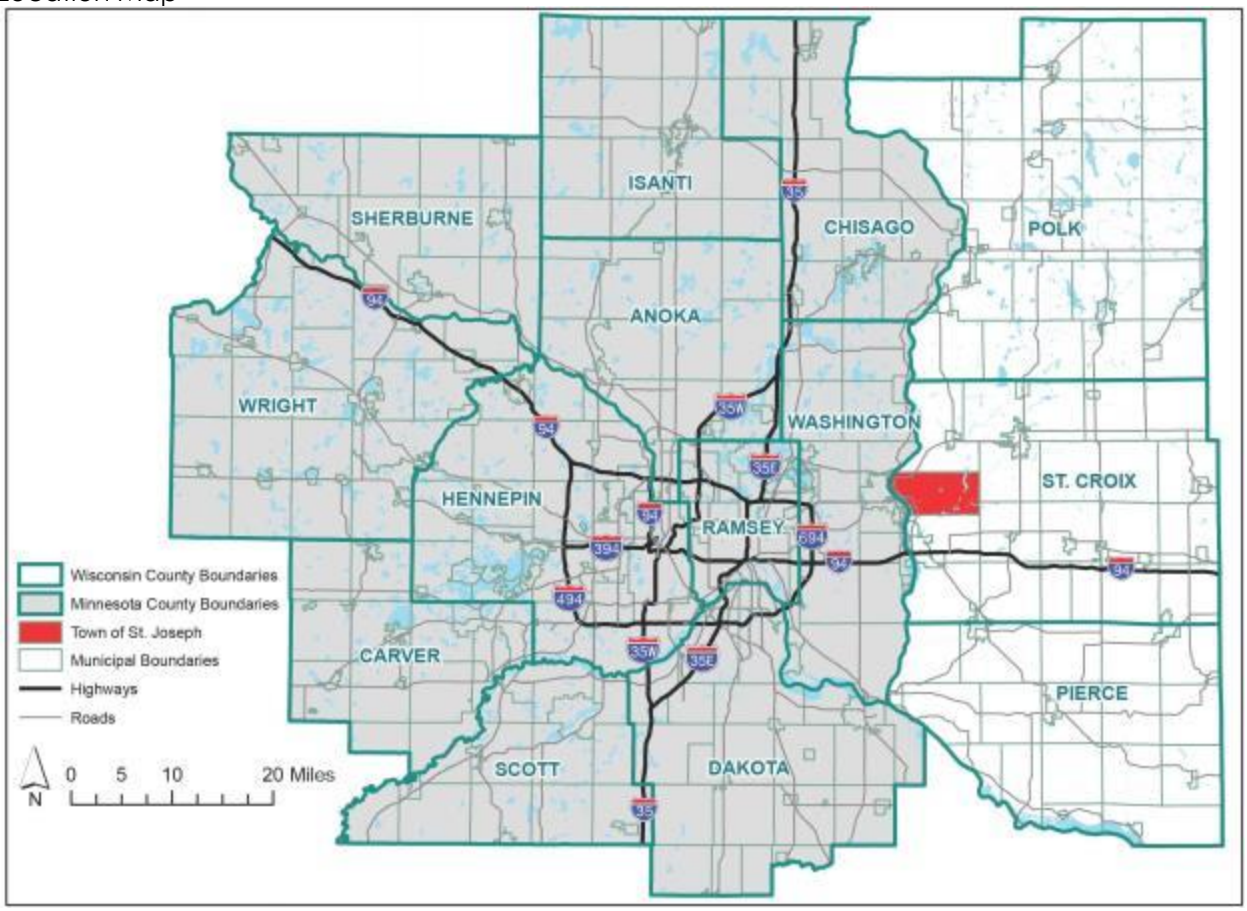
Within most communities there is a strong interest on the part of citizens to maintain a high quality of life. The preservation of natural communities and open spaces is an important component of this goal. Such areas provide opportunities for active and passive recreation, wildlife habitat, scenic vistas and buffers between developed areas, and can serve as landmarks or distinguishing features for the local community. In a community like St. Joseph, rooted in agriculture, having farms that practice viable working lands conservation can be a critical component for retaining the desirable rural character of a community. When practiced wisely, working lands conservation is compatible and indeed often necessary for sustaining quality natural areas.

Conservation of natural areas is also important for property values which are shown to increase in the closer a particular parcel is to natural open spaces.

Growth is important to the well-being of many communities. However, where growth occurs in environmentally sensitive areas, the potential to negatively impact wildlife, forest, soils and water resources is high. This NRI is available for the community to utilize as a tool to effectively manage and protect natural resources while allowing growth to occur, and will help the Town prioritize where to make investments in parks, trails and open spaces. This NRI also has the ability to help the Town if they pursue grants and other funds for management and protection of natural resources –grants look favorably on projects that have been based on community-wide inventory and prioritization of natural areas.

Introduction

Location Map



2.0 A BRIEF LOOK AT THE NATURAL HISTORY OF THE STUDY AREA

The particular resource elements present in any area and their patterns in the landscape are the result of historical processes, including climate, hydrology, plant and animal migrations and interactions, and human decisions and activities. This section very briefly describes the role these interactions have played in determining the present day composition of natural communities and landscapes in the area.

2.1 BEDROCK GEOLOGY AND GLACIAL LANDSCAPES

The majority of the region is mantled by debris left by glaciers and glacial rivers; beneath this, the bedrock that is closest to the surface in Study area is of the Cambrian System, which is some 500-600 million years old. The topography of the area was most heavily influenced by the last period of glaciation (the "Wisconsin Stage"), which ended in the area about 10,000 years ago. During this event, glaciers sculpted the landscape and left behind a variety of deposits, including drift/till and outwash composed of sand and gravel, and windblown deposits of very fine sands.

During the last glaciation, the Superior Lobe ice sheet advanced into the region from the north, and finally retreated about 20,000 years ago. Deposits from the Superior Lobe were later covered by those of the Grantsburg sublobe of the Des Moines Lobe glacier. The Des Moines Lobe entered the area from the northwest, giving rise to the Grantsburg Sublobe that moved to the northeast, through the Twin Cities and into western Wisconsin. The Grantsburg Sublobe left a variety of deposits, including rugged terrain from till, outwash, and more subtle terrain from lake deposited sands. (See map on the following page)

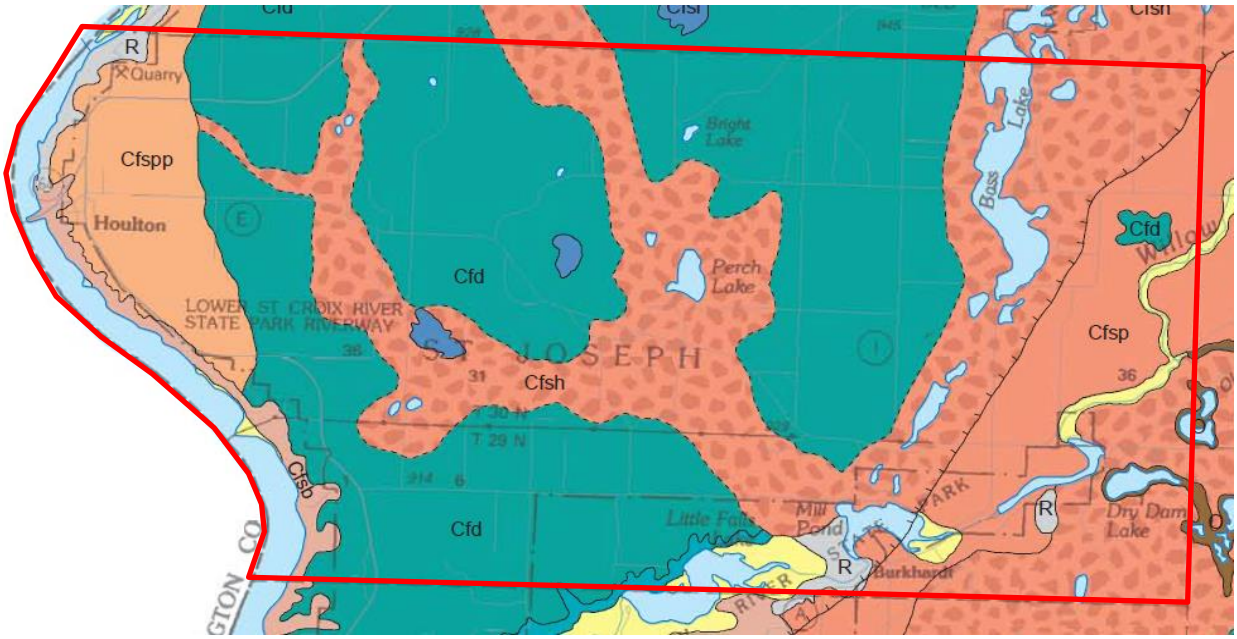
With each advance and retreat, the melting ice sheet deposited immense piles of sand and gravel along its margins, and massive rivers of glacial meltwater carried additional sand and sediment across the area. These riverine, or fluvial, deposits cover much of the area.

2.2 AFTER THE GLACIERS

After the glaciers melted, spruce trees and tundra colonized the periglacial environment. This was later followed by pine barrens and mixed boreal forests with a bracken fern-dominated ground layer. As the climate of the region warmed dramatically about 9,000 years ago, pines began to decline, and prairie expanded into the region, along with elm and oak forests. The climate remained in this warm period until about 7,000 years ago, when mid-grass prairie reached its maximum extent in the upper Midwest, including the area that is now St. Joseph.

A Brief Look at the Natural History of the Study Area

Surficial geology of the Town of St. Joseph (glacial landforms) *Adapted from: Preliminary Quaternary Geologic Map of St. Croix County, Wisconsin. S.J. Kostka, H.J. Hinke, D.M. Mickelson, and R.W. Baker. 2004*.



A Brief Look at the Natural History of the Study Area

EXPLANATION

O — **Postglacial organic sediment** Peat and muck generally found in low areas of the landscape, near lakes, rivers and other depressions; underlain by deposits of streams, glaciers, or lakes.

R — **Rock** Bedrock or very shallow (generally less than 1.5 meters) bedrock, commonly exposed on steep slopes.

A — **Postglacial sand and silt** Commonly a mixture of sand, silt and clay with various amounts of organic matter; found mostly along edges of modern streams and rivers as flood plain and low fluvial terraces; boundaries between this unit and postglacial organic sediment have been drawn arbitrarily in many places.

COPPER FALLS FORMATION

Cfd, Cfdb — **Copper Falls diamicton** Reddish-brown, unsorted or poorly sorted, non-stratified, slightly-cohesive, variable in grain-size distribution, lacks significant amounts of silt and clay; commonly contains areas of bedded sand and gravel; interpreted as melt-out and flow till, often overlain by less than one meter of loess, commonly displays high relief hummocky topography in some areas, dominant lithologies are red-brown sandstones and mafic rocks derived from the Lake Superior basin. Unit **Cfdb**: steep hill slopes in areas of deeply dissected drainage.

Cfsp, Cfspp, Cfsh, Cfsb — **Copper Falls sand and gravel in outwash deposits** Sorted and bedded deposits of sand and gravel; often overlain by less than one meter of loess; dominant lithologies are red-brown sandstones and mafic rocks derived from the Lake Superior basin, includes river terraces of Pleistocene age. **Cfsp**: less than 20 percent of original stream bed interrupted by depressions formed by melting ice blocks, (kettles). Unit **Cfspp**: more than 20 but less than 50 percent collapsed surface. Unit **Cfsh**: more than 50 percent collapsed surface. Unit **Cfsb**: steep hill slopes in areas of deeply dissected drainage.

Cfsl — **Copper Falls silt and sand** Found in glacial lake deposits; most is in former ice walled lake plains.

RIVER FALLS FORMATION

Rfd — **River Falls diamicton** Reddish-brown, unsorted or poorly sorted, non-stratified, slightly-cohesive, variable in grain-size distribution, lacks significant amount of silt and clay; commonly contains areas of bedded sand and gravel; often overlain by less than one meter of loess, same appearance and grain-size distribution as Copper Falls Formation but lacks glacial landforms and hummocky topography, has a generally rolling surface topography with few kettles, deposits of variable thickness on hill tops, local shallow bedrock exists.

Rfs — **River Falls sand and gravel in outwash deposits** Sorted and bedded deposits of sand and gravel; often overlain by less than one meter of loess; dominant lithologies are red-brown sandstones and mafic rocks derived from the Lake Superior basin.

PIERCE FORMATION

He — **Hersey diamicton** Gray-dark gray clayey, compact, cohesive, interpreted as basal till or as colluvium in valleys, massive and structure-less, commonly contains limestone and organic matter, may be locally overlain by varved lake sediments of the Kinnickinic Member.

SYMBOLS

Geologic contact. Dashed where uncertain; solid where position shown on map is judged to be generally within 0.1 km of actual position; dashed where the position shown may be more than 0.1 km from actual position.

Ice-margin position. Interpreted position of maximum extent of readvance of ice or position of ice margin stabililty where ice-contact face or end moraine is missing.

Indefinite ice-margin position. Interpreted position of ice margin must exist, but is obscured by erosion or buried by more recent deposits.

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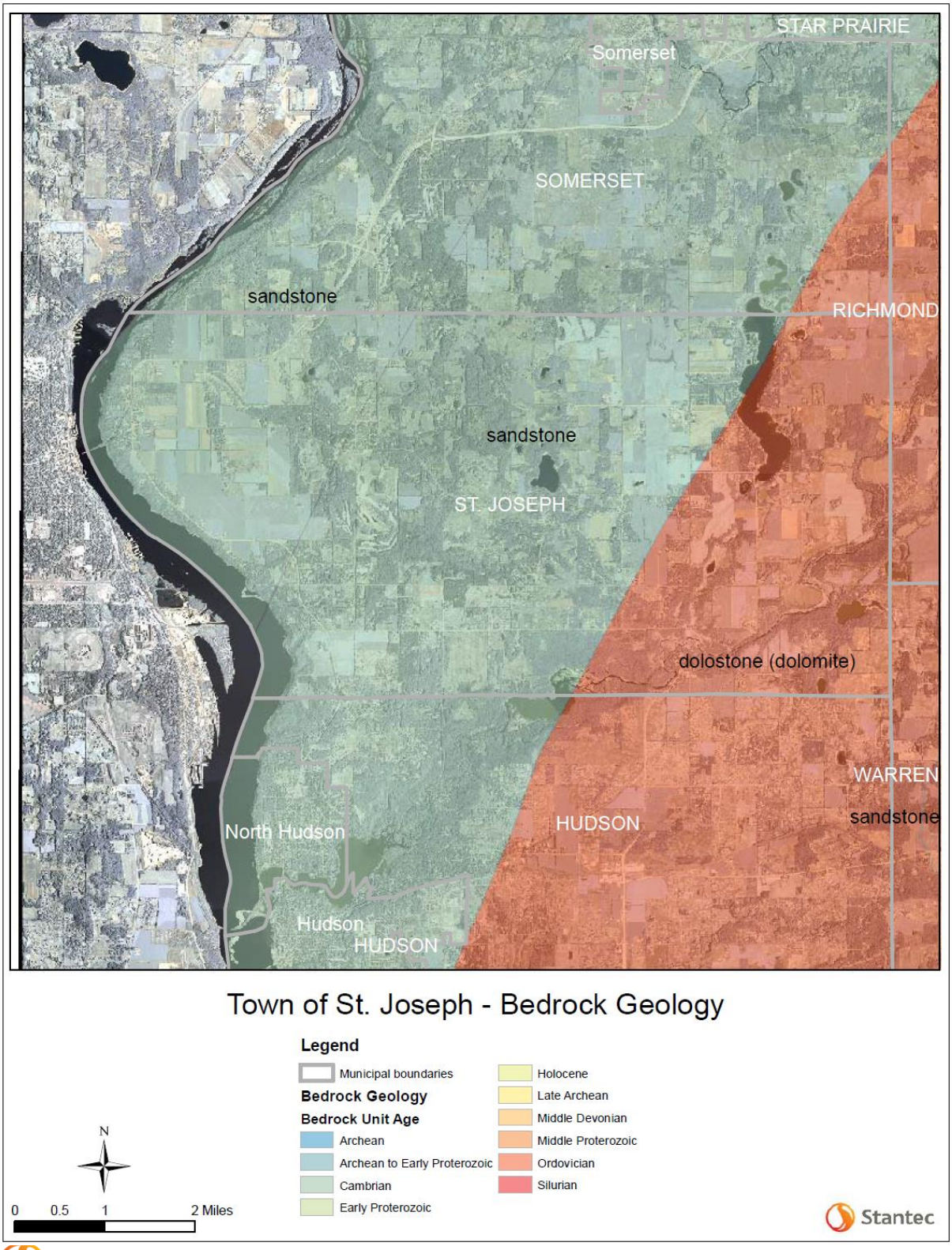
A Brief Look at the Natural History of the Study Area



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A Brief Look at the Natural History of the Study Area

Prairie, oak woodlands and brushlands, and oak savanna-- consisting of scattered trees with a prairie-like ground cover--dominated the region until about 4,000 years ago, when the climate gradually became cooler and moister. Oak thickets spread, and oak woodlands came to dominate some upland areas, interspersed with tall grass and wet prairies. White pines also migrated to the area as the climate cooled.

About 300 years ago, the climate became especially moist and cool, and fires became less frequent. As a result, extensive forests of elm, sugar maple, and basswood developed. With this, the major patterns of vegetation in the area at the time of European settlement were in place.

2.3 INFLUENCE OF LANDFORM AND CLIMATE ON VEGETATION TYPES

Plant communities that exist in any given area are the result of numerous biological and physical factors. These work in concert to influence plant communities in subtle ways, and sometimes in dramatic and immediate ways such as drought, or a tornado. Biological factors include such varied things as the presence or absence of pollinators, burrowing activities, herbivory, or over utilization of an area by a single species or number of species.

Of the physical factors, two have a consistently strong influence in the shaping of plant communities. These are climate and landform. The climate in the area is considered to be continental and subhumid, with long, cold winters and relatively brief, warm summers. Wide fluctuations in temperature and precipitation strongly influence the plant communities present in the region and cause plants to be adapted to extremes, rather than averages.

Landforms also have a profound impact on the type of plant communities found in an area. As discussed, the landforms of the area are primarily glacial in origin. Direct glacial modification of the landscape, such as the deposition of till and moraine, and the influence of periglacial processes such as outwash, have formed the vast majority of the landforms in the area. Most of the deposited materials associated directly with glaciers (e.g. till and moraine) are unsorted. These consist of mixed materials which range in size from clay and fine sand to large boulders. Overall, the materials deposited in the area tend to form well-drained to very well-drained landscapes with sands and gravels common.

In addition to the influences of climate and landform, landscape position also has a profound impact on the type of plant communities supported. Slope steepness, position, and aspect (direction a slope faces) all strongly influence the plant species that can occur in an area. Slope and aspect plays a significant role since it can exaggerate the influence of the sun; the amount of water plants lose through their leaves on south- and southwest-facing slopes makes these areas more hospitable to prairie or dry oak communities. North-facing slopes tend to be moister and have a tendency to be occupied by woodlands/forests.

2.4 PRE-HISTORIC INFLUENCE OF HUMANS ON THE LANDSCAPE

Ideas about the history of Native Americans and their influence on the local landscape are still evolving. Native Americans have probably inhabited and hunted in the area for close to 10,000 years. While their impacts were not as great as those of European settlers, Native Americans used a wide variety of plants and animals for food, and altered vegetation patterns for cultivation and by setting fire to broad expanses of landscape. Native Americans (and European fur traders) used fire to hunt game; create desired habitat; clear the landscape for travel, communication and defense; and obtain firewood. While some fires in the region would have occurred naturally, the activities of Native Americans undoubtedly accounted for the vast majority of fires. Prairies, savannas, and oak forests are fire-dependent plant communities, and would most likely not have been present in the area at the time of European settlement without these fires.

2.5 VEGETATION AT THE TIME OF LAND SURVEY

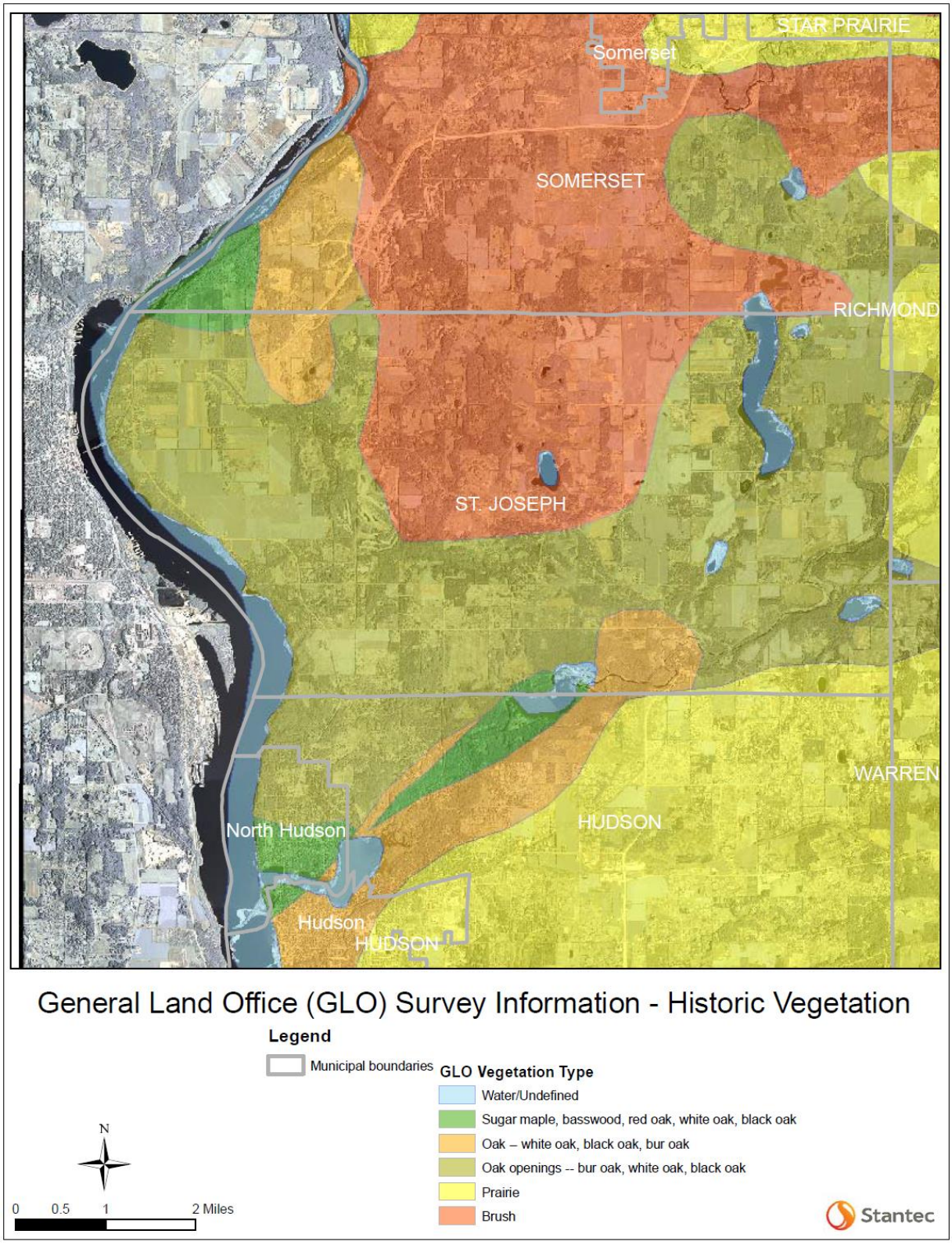
According to the original land survey notes (compiled close to or before the time an area was opened for settlement), the vegetation around the time of settlement in St. Joseph was comprised of oak savanna and oak woodland (brushland), and a small portion of forest in the northeast corner of the Town. There were areas of floodplain forest along the St. Croix and Willow Rivers, but savanna and open woodland would have been dominant in most of the upland areas. Scattered areas of wet prairie and open wet meadows/wetlands were also occasionally encountered in the area. A map illustrating the vegetation at the time of European settlement is shown on the following page.

2.6 POST-SETTLEMENT INFLUENCES ON THE LANDSCAPE

As the development occurs, increasingly intense human activities change the landscape and natural communities. In St. Joseph today, approximately a significant majority of the original natural areas have been substantially impacted by or lost to human activities. Examples of changes since Euro-American settlement include:

- Roads and the railroads began to fragment forests and other communities.
- Agriculture affected hydrology by draining wetlands and altering creeks.
- Vegetation was altered through clearing, plowing, cessation of regular fires, and grazing. These effects are evident in the reduction of native vegetation diversity in meadow and forest understory and planting of low diversity vegetation dominated (non-native plants.
- Soil erosion increased where native cover is removed, adding sediments to creeks, wetlands and lakes.

A Brief Look at the Natural History of the Study Area



3.0 PROJECT METHODOLOGY

This Land Cover Classification and Natural Resources Inventory project was conducted for all natural and semi-natural areas within select areas of the Town of St. Joseph deemed by officials to have likelihood of development. These included parcels greater than 10 acres in size that occurred inside or whose parcel boundaries intersected with the previously mapped natural resource corridors. A brief summary of the methodology is provided below.

3.1 GATHER AND REVIEW BACKGROUND INFORMATION

To provide a more detailed understanding of the study area, ecologists working on the project collected and reviewed available information on natural resources. This included information about vegetation at the time of Euro-American settlement, prairie remnant maps from WI DNR, National Wetlands Inventory (NWI), St. Croix County Soil Survey and others.

3.1.1 Previously mapped natural resource areas and ecological landscapes

Natural heritage data surrounding previously documented remnant prairies, as well as records for rare/state-listed plants and animals was reviewed for the Town of St. Joseph and the immediately surrounding area. While the reviewable data did not provide the exact location to ecologists for previous records, it did provide a broader understanding of the types of unique resources present within and immediately surrounding the Town. The Town of St. Joe occurs on the "Western Prairie" ecological landscape, as mapped by the WI DNR. A full download of the Western Prairie landscape description can be found at: http://dnr.wi.gov/topic/Landscapes/documents/1805Ch23.pdf#view=Fit

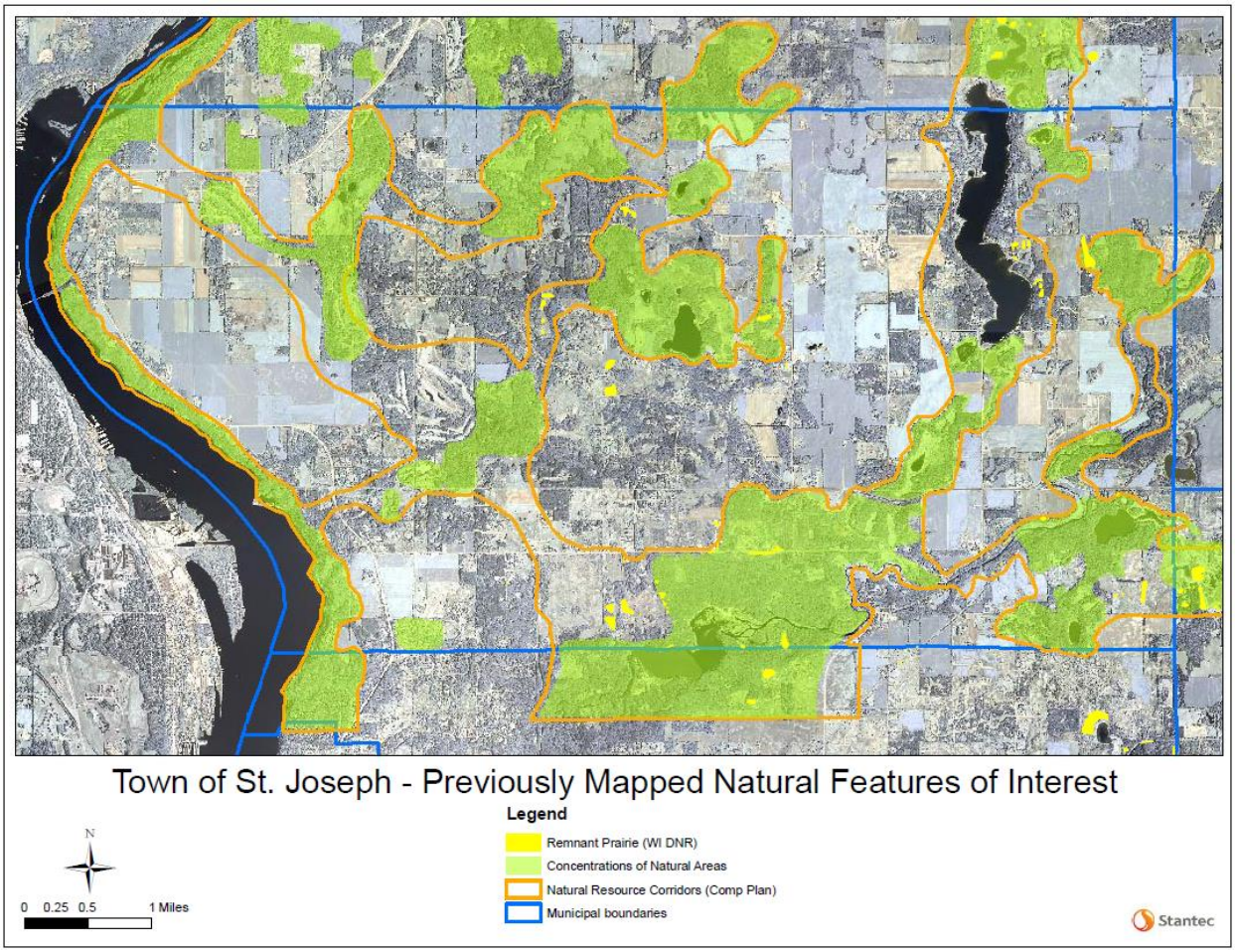
3.1.2 Minnesota Land Cover Classification System (MLCCS) Data

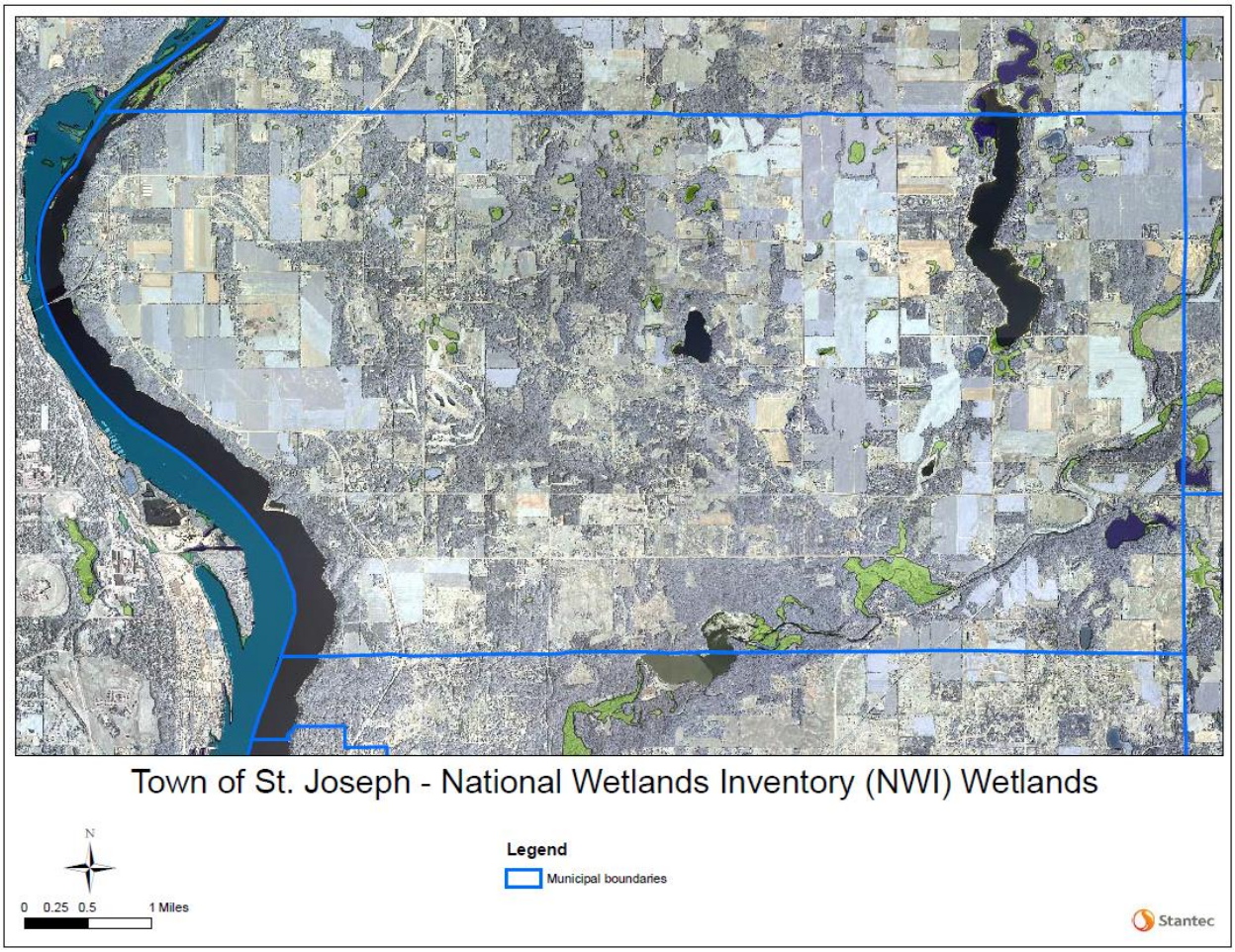
Ecologists reviewed the existing MLCCS data completed by National Park Service along the St. Croix River (extending up to and in some cases a little east of the river bluff top. The purpose of this review was to evaluate the detail and quality of the data to determine whether some of these previously mapped areas needed reevaluation or whether existing data would be adequate for Town planning. Natural and semi-natural areas within the MLCCS layer were compared to aerial photos for a preliminary verification of cover type, and were then plotted on the base maps for field inventory.

3.1.2.1 National Wetlands Inventory

Information from the National Wetland Inventory (NWI) was also reviewed and compared to the MLCCS information. In general, wetlands below the minimum mapping standard (1.25 acres for natural communities and 2.5 acres for semi-natural communities) were not mapped separately.

However, unique and/or Exceptional quality wetlands were mapped separately if they were encountered during the field inventory portion or the project.




Town of St. Joseph - National Wetlands Inventory (NWI) Wetlands
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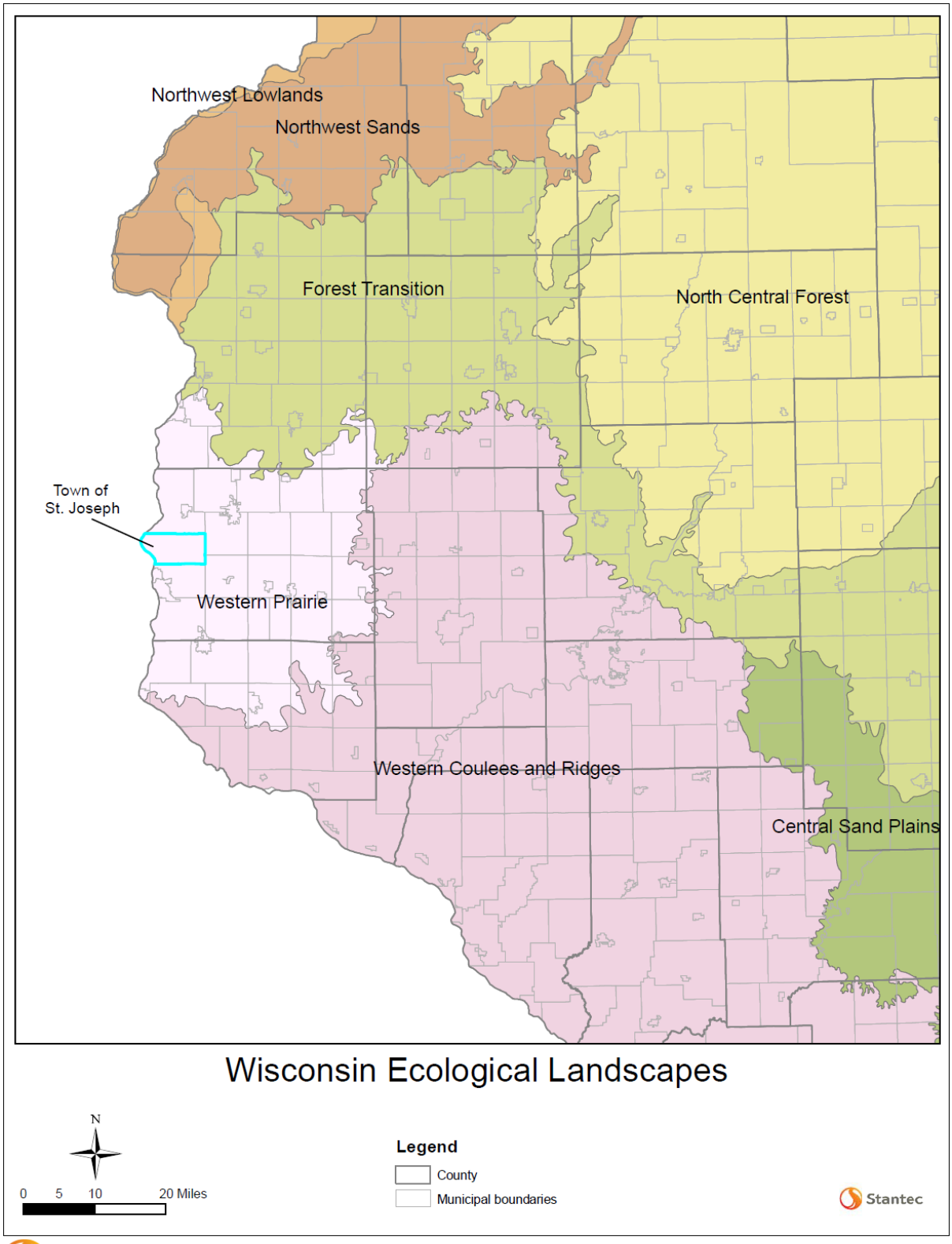
Northwest Lowlands
Northwest Sands
Forest Transition
North Central Forest
Town of
St. Joseph
Western Prairie
Western Coulees and Ridges
Central Sand Plains
Wisconsin Ecological Landscapes
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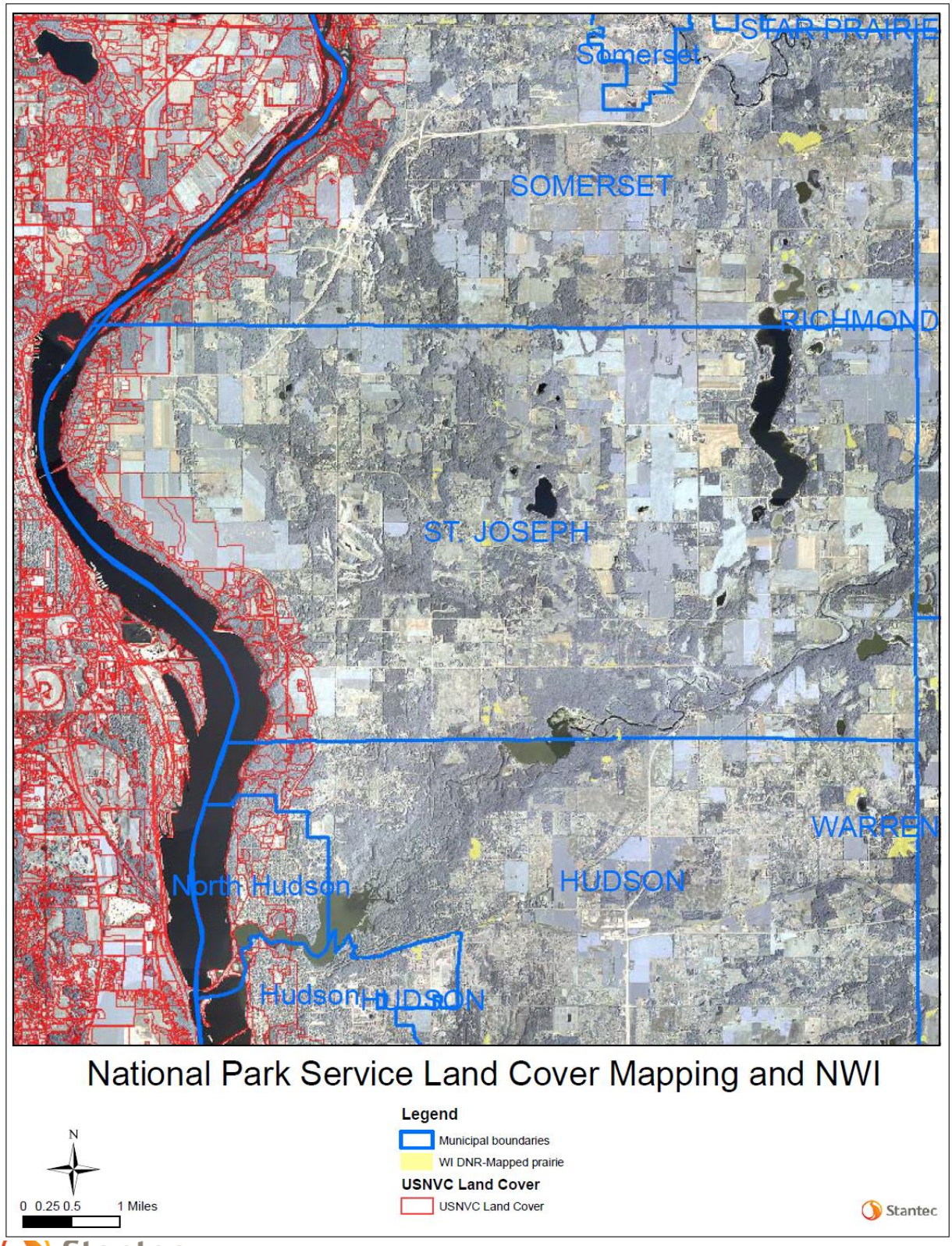
project methodology



3.2 PREPARATION OF FIELD BASE MAPS

After review of the MLCCS and NWI information, project ecologists plotted 2005 Farm Services Administration (FSA) true-color low altitude aerial photographs for each section (square mile). These were printed at a scale of 1"= 200'. Available electronic data layers such as the National Wetlands Inventory, the St. Croix County Soil Survey, geopolitical boundaries, parcel boundaries, transportation information, and DNR Natural Heritage (MCBS) data were also printed on these plotted photos to assist in the field review. MLCCS data for natural and semi-natural areas, as well as information from the wetland inventory, was also included on the base maps.

3.3 NRI PARCEL IDENTIFICATION & LANDOWNER NOTIFICATION

Information about the location of natural areas was used to identify parcels where field review by a plant ecologist was appropriate. These included parcels greater than 10 acres in size that occurred inside or whose parcel boundaries intersected with the previously mapped greenway corridors (please refer to figure on the following page).

Town staff sent each of these landowners a letter in the summer 2015 to provide information about the NRI project. Landowners were informed that they should contact the Town if they did not want their parcel to be visited by an ecologist for the purposes of gathering basic data about vegetation/land cover on their property.

3.4 FIELD INVENTORY

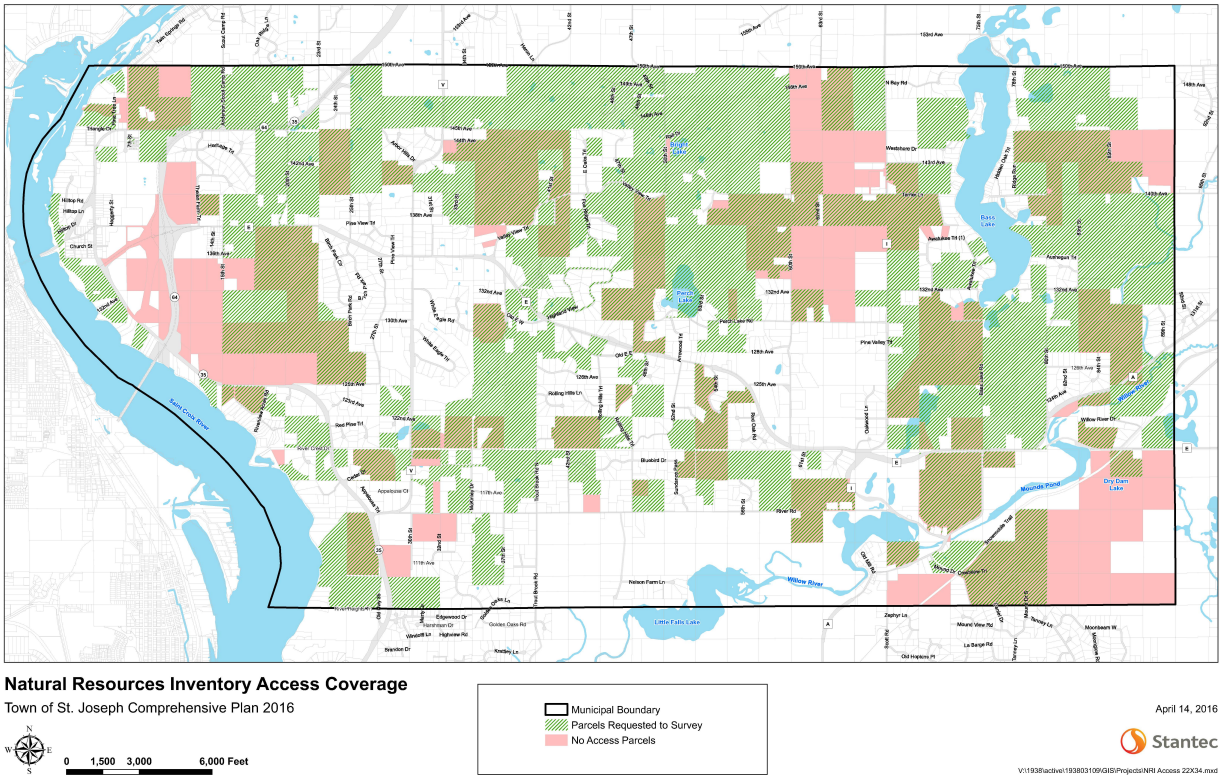
Town officials approved initiation of NRI field work in September 2015 and on-the-ground field inventory land cover classification took place in October/November 2015. Where property access was not available, sites were viewed from nearby roads or adjacent properties where access was permitted. In many cases, natural communities crossed multiple properties and partial access to a site could still be obtained. In others, no access was available, and terrain or other factors prevented viewing the site – those areas were mapped from aerial photos and the appropriate field visit code assigned to polygons in the GIS shapefile attribute table.

During the field review, a 5-digit MLCCS code was assigned to the natural and semi-natural areas. Other pertinent data was also recorded including notations using MLCCS Modifiers and Field Check Levels (see below).

The field survey also included identification of dominant plant species in quality natural communities. Field inventory level of effort for any particular site was related to its overall quality. In general, good quality natural communities were more thoroughly inventoried and more

information gathered. The field inventory emphasized gathering data on the composition, structure and function of natural communities, including disturbance indicators such as exotic species and erosion. This information provides a solid starting point for assessing the current condition of the community and can be used to develop management recommendations.

Parcels included in NRI (green shaded) and those where access was denied (red shading)



3.5 LAND COVER CLASSIFICATION

3.5.1 MLCCS Background

The Minnesota Land Cover Classification System Version 5.4 was used to classify land cover within the Town. This methodology is a local adaptation of the US National Vegetation Classification System (USNVCS) and widely utilized across the United States. Pre-existing MLCCS data from the National Park Service gave additional weight for the idea of utilizing MLCCS as the methodology for the St. Joseph NRI.

A brief explanation of the method and its application to this project is provided below. The complete 273 page MLCCS Manual can be viewed and/or downloaded on the MN DNR web site at the following address: http://www.dnr.state.mn.us/mlccs/index.html .

MLCCS has a five-level hierarchical system of land cover codes to describe natural, semi-natural, and cultural land cover types. Natural land cover types include areas such as forests, prairies, wetlands, shrublands, and other similar areas. Semi-natural areas are those dominated by nonnative plant species, but are not actively planted/maintained by humans through activities such as mowing/cutting. Cultural land cover types are areas that can be thought of as developed or substantially impacted by humans. These typically include paved (impervious) areas, agricultural fields, pastures and frequently manipulated grasslands, quarries, and others. The St. Joseph NRI focused on natural and semi-natural areas for land cover mapping.

Progression through each of the five levels of the system represents an increased level of detail in land cover classification. In this framework, Level 1 is the least detailed and Level 5 is the most detailed. For the purposes of this project, all natural and semi-natural areas within the Town were classified to the greatest level of detail practical (typically, Level 4 or Level 5).

3.5.1.1 MLCCS Modifier Codes

Several 'classes' of MLCCS modifiers were assessed in the field while conducting the land cover classification of the project area. These modifiers were assessed based on the methodology and definitions provided in the MLCCS training manual. Once assessed, the modifier values were entered into the GIS database for each land cover polygon. Below is a brief summary of the most commonly used MLCCS modifiers for this project.

3.5.1.1.1 Natural Community Quality Modifier (M_34x)

The M_34x modifier was developed as part of MLCCS methodology as a cursory method to assess the general natural quality of natural community and semi-natural land cover types. This modifier has four general categories. The assessment method is based on general ecological

variables, and is applied in the same manner for all natural community types. The following is the description of the M_34x modifier from the MLCCS training manual:

34X - Modifiers for natural community quality ranking
The natural plant community sites can be given a natural quality ranking, based on the DNR's Natural Heritage's Element Occurrence Ranking Guidelines* (EOR). See "Natural Community Modifiers" for a discussion of the Element Occurrence Ranking Guidelines.

Refer to the EOR Guidelines to evaluate the specific natural communities. Non-native, altered and disturbed communities should only be given a non-native ranking (NN or NA). Valid codes and general definitions for modifier m_34X are:

- ***A = highest quality natural community***, no disturbances and natural processes intact. Site must be visited entirely or partially to accurately assess its natural quality at this level (field check_level = 3 or 4). Modifier code = 341
- ***B = good quality natural community***. Has its natural processes intact, but shows signs of past human impacts. Low levels of exotics. Site must be visited entirely or partially to accurately assess its natural quality at this level (fld_level = 3 or 4). Modifier code = 342
- ***C = moderate condition natural community*** with obvious past disturbance but is still clearly recognizable as a native community. Not dominated by weedy species in any layer. Minimally, the site must be visited from the edge to accurately assess its natural quality at this level (fld_level = 2, 3 or 4). Modifier code = 343
- ***D = poor condition of a natural community***. Includes some natives, but is dominated by non-natives and/or is widely disturbed and altered. Herbaceous communities may be assessed with this ranking from a distance (fld_level = 1) if large masses of invasive species are present and the entire community is visible. Modifier code = 344
- ***NA = Native species present in an altered / non-native plant community***. This NA ranking can only be used if the site is field checked from the edge or to a greater degree (fld_level 2, 3, or 4), thus confirming the presence of native species within a non-native community. Modifier code = 345
- ***NN = Altered / non-native plant community***. These semi-natural communities do not qualify for natural quality ranking. Using NN signifies the site has been field checked and confirms it is a semi-natural community. Modifier code = 346

3.5.1.1.2 Invasive Species Modifiers (M_4xx)

The M_4xx modifiers represent invasive plant species occurring within land cover polygons. For the purpose of this project, the percent cover of each species of interest was estimated. These species are important to have information about due to their invasive nature and potential

* http://files.dnr.state.mn.us/ecological_services/nhnrp/eoranks2001.pdfp/eoranks2001.pdf

threats to native plant communities and biological diversity of native habitats. The cover classes used to assess invasive species aerial cover (i.e. as viewed from above) is a follows:

Cover Class/Estimated Percent Cover for Invasive Species

Cover Class	Description
0	Unknown, or if field checked, plants not observed
1	Observed, unknown quantity
2	1 – 5% Coverage
3	6 – 25% Coverage
4	26 – 50% Coverage
5	51 – 75% Coverage
6	76 – 100% Coverage

The following is a list of invasive plant species modifier numbers. Where these may have been encountered and of value for understanding any particular area, they may have been recorded for aerial coverage within land cover polygons:

402 - Purple loosestrife
403 – Eurasion watermilfoil
404 – Curly-leafed pondweed
405 – Flowering rush
406 - Narrow-leaf cattail
407 - Crown vetch
408 – Common and glossy buckthorn
409 - Leafy spurge
410 - Tartarian honeysuckle
411 - Garlic mustard
412 - Reed canary grass
413 - Smooth brome
414 - Spotted knapweed
415 – Exotic thistle
416 - Siberian elm
417 – Phragmites
418 – Grecian foxglove
419 - Amur maple
420 - Black locust
421 - Absinthe sage
422 - Dames rocket
499 - Other

3.5.1.1.3 Field-Check Level

A field-check level modifier was assigned to appropriate areas. The field-check level indicates the degree to which an individual polygon was checked in the field during the land cover assessment. Where access was permitted, most of the natural area polygons within this project were visited wholly/partially or viewed from edge. The following is a list of field check modifier values and their associated description:

- **0 = site not visited**
- **1 = viewed the site from a distance**. Unable to walk the site, but was able to discern the dominant vegetation. Masses of invasive species may be visible, and thus were recorded (buckthorn, reed canary grass, crown vetch, etc). Depending on the perceived quantity of invasive species, a natural quality ranking of D may or may not be discernable.
- **2 = visited the edge of the site**. Walked or drove to the edge of the site, and was able to inventory some invasive species and speculate on its natural quality. Depending on the perceived quantity of invasive species, a natural quality ranking of C or D may or may not be discernable.
- **3 = visited part of the site**. Walked into the site and was able to confidently inventory most invasive species present and assess its natural quality - A, B, C or D. Wetlands that are inventoried from the edges in several places should be given this field check level.
- **4 = visited the entire site**. Was able to inventory all invasive species present and assess the site's natural quality - A, B, C or D.

3.5.1.1.4 Other Modifier Codes that were applied, if appropriate:

- 247 – Trails
- 275 – Pasture
- 276 - Hayfield
- 6XX series – Forestry modifiers
- 72X series - Water modifiers, Built features
- 73X series - Water modifiers, Wetland features
- 74X series - Water modifiers, Stream features
- 75X series - Water modifiers, Spring feature

3.5.1.2 Rare Plant Species

Where natural areas occur, particularly those of better quality, there is the potential for the occurrence of rare species. Recognizing this, the plant ecologists who conducted field inventory work made an effort to search habitats estimated to have a high likelihood of supporting rare plants.

It is also important to note that although plant ecologists searched areas that appeared likely to host rare plants, limited property access, one-time visit to the natural areas, and the fact that the field inventory work could not be conducted at an ideal time/season means that rare plant populations are almost certainly present in some natural areas but not visible at the time of field

inventory work (which occurred in October/November). Therefore, this NRI cannot be considered a rare plant search.

4.0 NRI/LAND COVER CLASSIFICATION RESULTS

The NRI/Land Cover mapping effort resulted in mapping of 637 polygons, totaling 7,921 acres. This included areas previously mapped by National Park Service staff (all land cover types along the St. Croix River), as well as natural and semi-natural land cover in additional selected parcels.

- There were 528 natural and semi-natural cover type polygons mapped, totaling 6,709 acres.
- Semi-natural cover types included 290 polygons, totaling 2,651 acres.

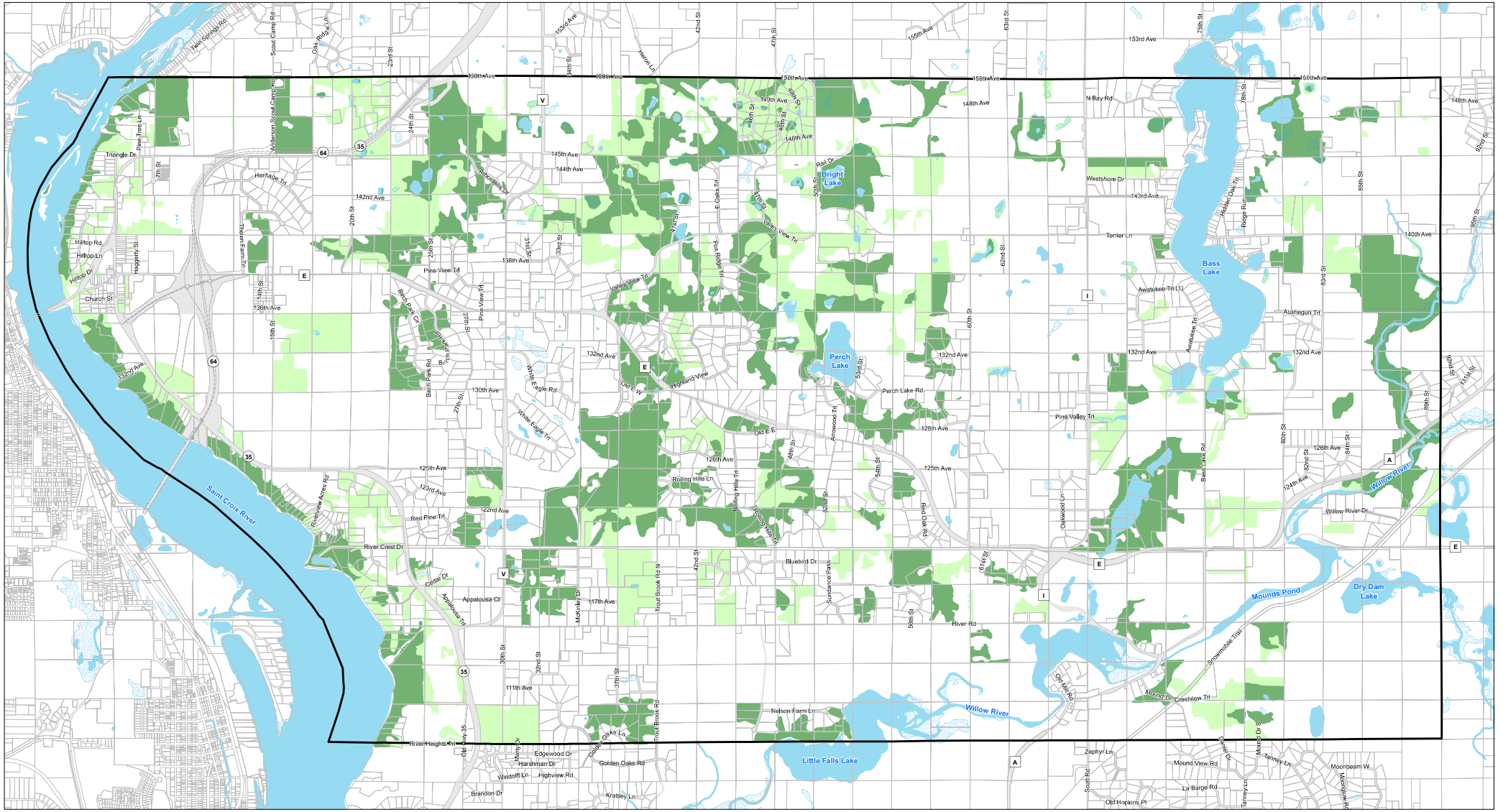
Natural areas (those most resembling native plant communities that occurred historically on the landscape in this area) included 238 polygons totaling 4,058 acres. Remnant natural area cover types represent a variety of distinct natural community types including forest, woodland, shrubland, herbaceous wetlands, and grasslands, as well as areas of open water (lakes and ponds).

The following pages include a summary of the major natural community types encountered in the Town, with general descriptions. It is important to note that there are numerous other natural community types that occur less frequently in the town. Descriptions for these community types are from the MLCCS User Manual. Note that both common and scientific names are provided for the first reference to a species. Subsequent references list only one name.

4.1 QUALITY NATURAL AREAS

The map accompanying this report illustrates the natural areas identified during the inventory, mapped according to site quality. It is important to note that due to lack of access to some areas within the town, not all high quality sites may be listed here. We recommend that appropriate field work be conducted prior to any development to determine the quality/composition of any larger natural areas not visited during this project. A figure summarizing the location of upland natural areas identified can be found on the plotted map that accompanies this report. Site-specific field descriptions of natural areas shown on the large map can be found in Appendix D. A summary of findings for site quality is provided below.

Quality Rank	Number of Sites*
Exceptional (341)	13
High (342)	24
Moderate (343)	113
Low (344)	24



Natural Resources Inventory Natural and Semi-Natural Areas

Town of St. Joseph Comprehensive Plan 2016

September 20, 2016

Stantec

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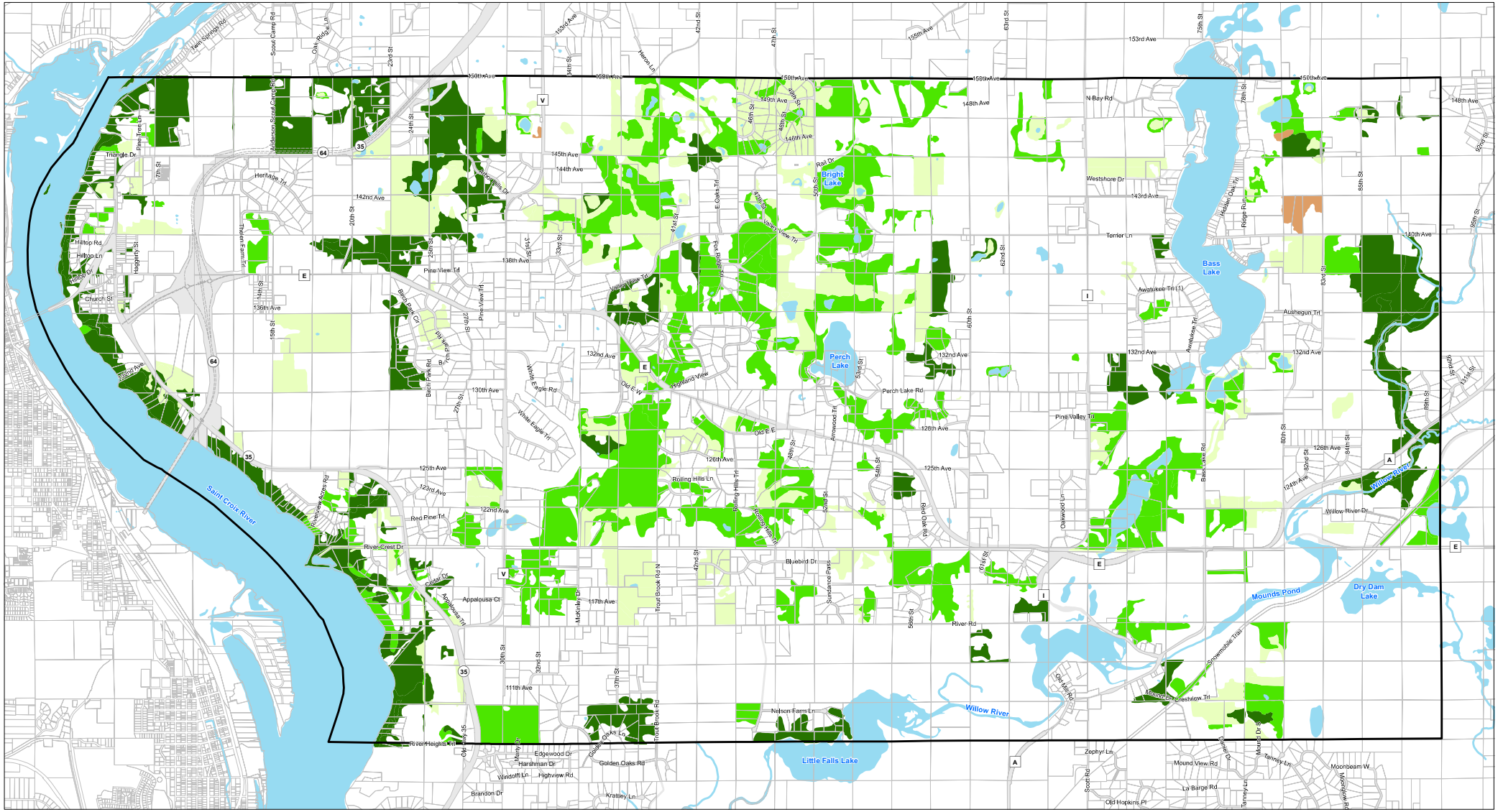

Natural Resources Inventory

Town of St. Joseph Comprehensive Plan 2016

September 20, 2016

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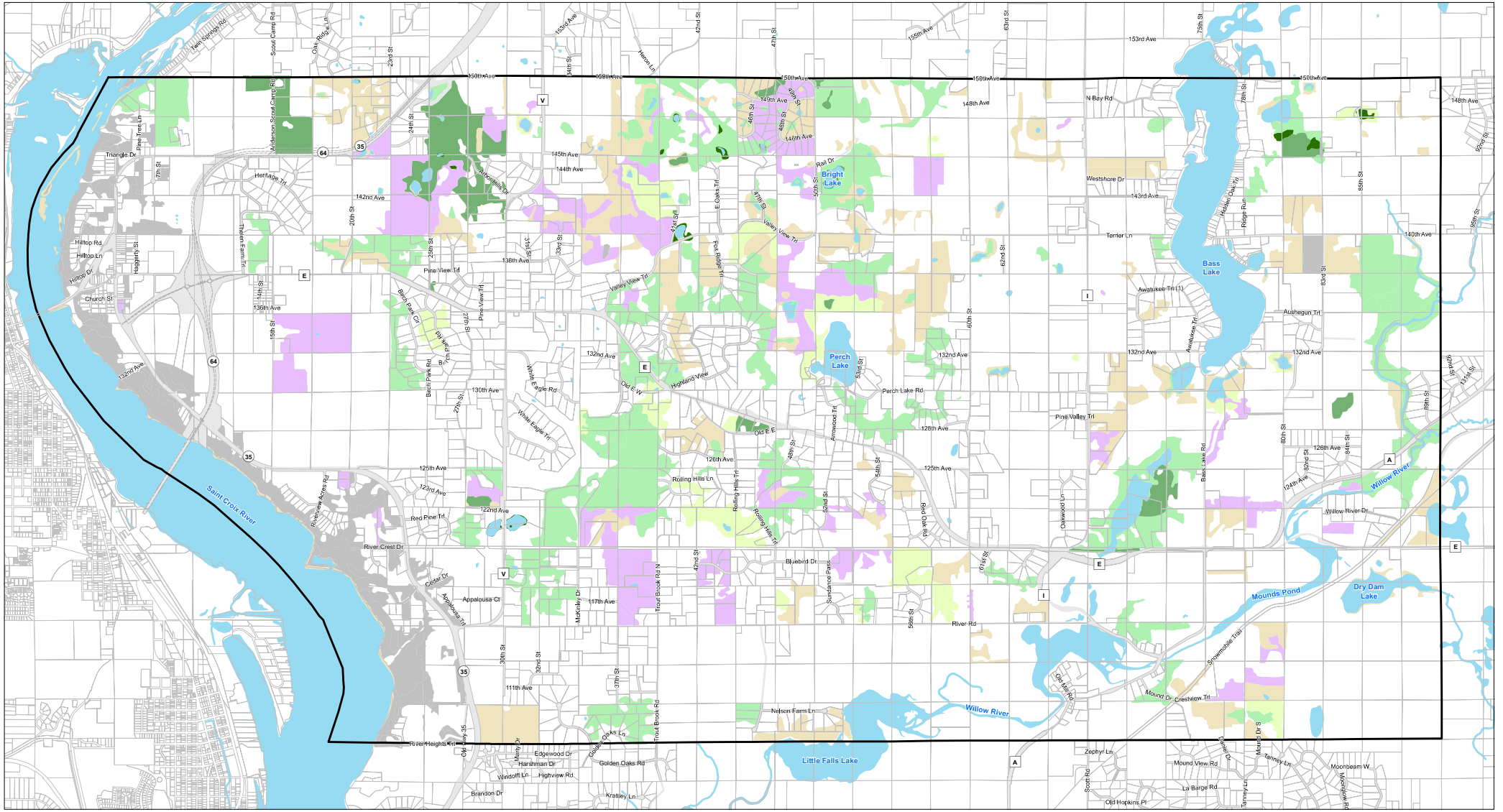

Natural Resources Inventory Community Qualities

Town of St. Joseph Comprehensive Plan 2016

September 20, 2016

Stantec

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4.2 NATURAL AREA COVER TYPES

4.2.1 Forest (Upland)

Oak Forest (All subtypes) (MLCCS Code 32110, 32111, 32112, 32113 /857 Total Acres)
36 oak forest remnants were documented totaling 857 acres. This includes oak forest of unspecified subtype, oak-red maple forest, mesic oak forest, and dry oak forest.

Northern red oaks (Quercus rubra), white oaks (Quercus alba), or bur oaks (Quercus macrocarpa) dominate mesic stands of oak forest. These stands occur on sites that had fewer severe fires before European settlement than the sites on which dry mixed oak forest occurs. Mesic stands most likely were always forest, rather than woodland or savanna. They have tall (> 20 meters), straight, single-stemmed trees that lack spreading lower branches. Commonly, mesic fire-sensitive tree species are present with the oaks in these stands, especially in the understory. These species include basswood (Tilia americana), green ash (Fraxinus americana), bitternut hickory (Carya cordiformis) big-toothed aspen (Populus grandidentata), and butternut (Juglans cinerea).

Dry oak forest tends to have pin oak (Quercus ellipsoidalis), bur oak (Q. macrocarpa), and white oak (Q. alba) more common as canopy trees. As well, the subcanopy of dry oak forests increasingly support red maple (Acer rubrum.)

Example of mesic oak forest (St. Croix Valley, Minnesota side)

The shrub layer in mesic stands is sparser than in dry stands and, correspondingly, the forb layer is denser and more diverse and there are more graminoid species. Like the drier stands, however, there is little oak regeneration, and most mesic oak forests appear to be succeeding to maple-basswood forest. Heavy selective logging of the oaks in mesic stands may accelerate this trend, producing young stands of maple-basswood forest. The mesic stands often grade into drier stands of maple-basswood forest, but differ from them by having a somewhat denser shrub layer and the herbs woodrush (Luzula acuminata) and pointed-leaved tick-trefoil (Desmodium glutinosum) in their understory.

Natural stands of mesic oak forest are rare in the St. Croix River Valley. In much of this region drier stands are more common, in part because relative to the mesic forests they occur on sites with soils less suitable for cultivation.

High quality oak forest in St. Joseph.

Maple Basswood Forest (MLCCS Code 32150 / 190 Total Acres)
Ten maple-basswood forest areas totaling 190 acres were documented. The sizes of the maple-basswood remnants ranged from 1.6 acre to 67 acres in size.

The tree canopy of Maple-basswood forests is dominated mostly by basswoods (Tilia americana), sugar maples (Acer saccharum), and (formerly) American elms (Ulmus americana). Other mesic trees, such as slippery elms (Ulmus rubra), northern red oaks (Quercus ellipsoidalis), bur oaks (Quercus macrocarpa), green ash (Fraxinus pennsylvanicum), and white ashe (Fraxinus americanum) are sometimes dominant locally. The canopy is very dense, with tall, straight, relatively narrow-crowned trees. The understory is multi-layered and patchy. It is composed of saplings and seedlings of the canopy species (especially sugar maple), along with American hornbeam, ironwood, bitternut hickory, pagoda dogwood, and leatherwood.

Maple-basswood forest in spring time, Chaska, MN

Because the tree canopy permits so little light to reach the forest floor during the summer, Maple-basswood forests have a suite of forb species that bloom, produce seeds, and die back in May and early June before tree leaves are fully developed. These species--the spring ephemerals and the winter annuals--include spring beauties (Claytonia sp.), Dutchman's breeches (Dicentra cucullaria), trout-lilies (Erythronium spp.), and

cleavers (Galium aparine). Other herbs, such as the sedge Carex pedunculata, bottlebrush grass (Hystrix patula), and bearded short-husk (Brachyelytrum erectum), are commonly present in the ground-layer but usually not abundant.

Maple-basswood forest occurs on protected sites, where catastrophic forest crown fires were rare, historically. Across most of its range, the community develops most commonly on well-drained loamy soils that lack mottling or other evidence of water-table levels within the tree-rooting zone. In north-central Minnesota, maple-basswood forests develop on soils with fine-textured subsurface layers that slow the downward movement of water and nutrients.

Maple-basswood forest is a late-successional community, tending to succeed mixed oak forest (and other forest types) on mesic sites. It is self-perpetuating in the absence of catastrophic disturbance and climate change because the dominant tree species readily reproduce by gap-phase replacement. The very shade-tolerant sugar maple seedlings and saplings, especially, may exist in a suppressed state in the understory for many years until the death of a mature tree when one or a few grow rapidly into the canopy gap. Maple-basswood forests often develop into old-growth forests, because catastrophic disturbances are rare in the community and because the dominant tree species are long-lived (> 250 years). The trend in most stands of maple-basswood forest is toward greater dominance by sugar maple.

Maple-basswood forest grades into oak forest where the frequency of fire increases in the landscape. It grades into lowland hardwood forest in low areas where elms and ashes become more abundant and where the water table is at least seasonally within the tree rooting zone. Conifers are absent or uncommon in most of the range of maple-basswood forest, but grow with sugar maple, basswood, and other mesic species.

Undisturbed stands of maple-basswood forest are rare. The soils of these forests were highly suitable for cultivation, and as a result much of these presettlement communities had been cleared for cropland. Remaining stands have often been grazed or selectively cut for lumber or fuel wood. Heavy grazing causes compaction of the soils and the almost complete destruction of the understory, resulting in even-aged woodlots with large mature trees in the canopy, little reproduction, and few native shrubs and herbs.

Selective logging of the less shade-tolerant species (northern red oak, white oak, bitternut hickory, and walnut) has been common since European settlement, and has hastened dominance by sugar maple and basswood in many stands. The composition of the community has also been altered throughout its range by Dutch elm disease, which has killed most of the mature elm trees, and in many stands by the loss of interior ground layer species following forest fragmentation. Common buckthorn (Rhamnus cathartica) and Tartarian honeysuckle (Lonicera tatarica) sometimes invade stands of maple-basswood forest, but rarely attain the high densities they may have in oak forest. Maple-sugaring is one human activity associated with maple-basswood forests that appears to have little impact on the structure and composition of the

community, as some of the best remaining tracts of maple-basswood forest have long histories of maple sugar production.

4.2.2 Forests (Lowland)

Floodplain Forests (MLCCS Codes 32210, 32211 / 77 Total Acres)
11 floodplain forests totaling 77 acres were documented within the NRI study area.

Floodplain forest is a seasonally wet forest community that occurs throughout the region on the active floodplains of major rivers and their tributary streams. The canopy of the community is dominated by deciduous tree species tolerant of inundation, abrasion, and other disturbances associated with flooding. The canopy is variable in composition, either composed of a mixture of tree species or strongly dominated by a single tree species.

The species composition of floodplain forests varies both geographically and in relation to such features as substrate type or flood cycles. In southern Minnesota, silver maples (Acer saccharinum), black willows (Salix nigra), and cottonwoods (Populus deltoides) are common canopy dominants. They occur either in nearly pure stands or in mixed stands. Scattered individuals or patches of river birch, American elm, slippery elm, green ash, and swamp white oak (Quercus bicolor) are also common in stands in southern Minnesota.

Floodplain forest example (Buffalo, WI)

The tree canopy cover is highly variable within floodplain forests. The canopy is continuous in some stands while other stands have open areas caused by repeated erosion, ice-scouring, and soil and debris deposition, all of which prevent the growth of trees and shrubs.

In recent decades, Dutch elm disease has also caused significant canopy openings in floodplain forests in which mature American elm trees were abundant in the canopy. Areas beneath tree-canopy openings in the forests are either dominated by short-lived herbaceous plants or, where erosion and disturbance from flooding tend to be repeated and severe, remain unvegetated.

Lowland Hardwood Forest (MLCCS Code 32220 / 35 Total Acres)
One 35-acre lowland hardwood forests was documented in the NRI.

Lowland hardwood forest is a wet-mesic forest that is present throughout the region. It is transitional between the terrestrial and palustrine systems, occurring on sites with seasonally high water tables (within the tree-rooting zone) but do not flood regularly and have mineral rather than peat soils. In accordance with the poorly drained sites on which the Lowland hardwood forests occur, species tolerant of periodic soil saturation dominate the tree canopy. American elms and black ashes are common canopy dominants, but most stands are mixed, with slippery elms, rock elms, basswoods, bur oaks, hackberries, yellow birches, green ashes, black ashes, quaking aspens, balsam poplars, and paper birches as important species. The tall-shrub layer is usually discontinuous and is composed of a mixture of upland and lowland shrubs. The ground layer is composed mostly of upland herbs that do not root to the water-table.

Lowland hardwood forest usually occurs in fire-protected areas, although even in unprotected areas the community burns infrequently because the woody vegetation is usually hydrated, especially in the spring. Lowland Hardwood Forest soils differ from Hardwood Swamp Forest soils by being mineral rather than peaty and from the mineral soils of other mesic upland forest types by being seasonally saturated (at depths greater than 0.5 meters).

Lowland hardwood forest is often composed of late-successional species, but few stands in Minnesota have old canopy trees, presumably because of wind throw and infrequent episodes of killing floods. Lowland hardwood forest is topographically transitional between upland forests and forested peatlands and is best developed on flat terrain where such transition zones are broad (e.g., on river terraces above normal flood levels, on loamy ground moraine, and on drumlin fields).

4.2.3 Woodlands

Oak Woodland/Brushland (MLCCS Code 42120 / 1,526 Total Acres)
Fifty-two occurrences of oak woodland/brushland totaling 349 acres were documented within the NRI area. These were generally moderate quality, with some concerns related to encroachment by brush, the absence of periodic fires, nonnative pasture grasses and other factors.

Oak woodland-brushland occurs on dry to mesic sites throughout the deciduous forest-woodland zone and locally in the prairie zone near the ecotone between the prairie zone and the deciduous forest-woodland zone. Oak woodland is floristically and

Oak Woodland-brushland in winter

structurally intermediate between oak savanna and oak forest, with a patchy tree canopy and an understory dominated by shrubs and tree saplings.

The principal species in the tree canopy are bur oak, northern pin oak, white oak, and northern red oak. Aspens may form up to 70% of the tree canopy cover. The brush layer ranges in density from sparse (with 10-30% cover), to an impenetrable thicket. It is often especially dense in openings between clumps or groves of trees. Most of the floristic diversity in the community exists in the brush layer, which most commonly is composed of blackberries and raspberries (Rubus spp.), gooseberries (Ribes spp.), dogwoods (Cornus spp.), cherries (Prunus spp.), hazelnuts (Corylus spp.), prickly ash (Zanthoxylum americanum), and sprouts of oak (Quercus spp.) and quaking aspen. Prairie vegetation, if present, occurs only in small openings in the tree or shrub canopy. Except in these scattered prairie openings, the herbaceous layer is sparse and floristically poor. It is usually composed of woodland species capable of surviving in the dense shade beneath the brush layer.

Oak woodland-brushland is a fire-maintained community. It is most common on rich sites where trees and shrubs grow well but where recurrent fires historically prevented the formation of true forest. Historically, Oak Woodland-Brushland (along with savanna) was probably one of the most extensive community types in the region, comprising much of the vegetation described as oak barrens, brushland, and thickets by the early surveyors. The fires that maintained oak woodland-brushland usually started on nearby prairies. Grazing was also important and, with the long-term decline in grazing since the mid-1900s, has resulted in accelerated brush encroachment into these former savanna areas. Following the conversion of these prairies to agricultural land, oak woodland-brushland burned less frequently and rapidly succeeded to oak forest. Oak woodland-brushland is defined broadly enough here to also include communities in which the predominant cover is oak brush or oak-aspen brush (that originated following fire or limited human disturbance) instead of a well-developed tree canopy. There are four geographic sections of oak woodland-brushland in the region. These sections may be modified in the future as more information becomes available.

In the St. Croix River Valley, oak woodland-brushland is often present on southwest-facing slopes on the blufflands and on glacial outwash terraces. It generally occurs on more gentle slopes than bluff prairie or on lower slopes below bluff prairies. Bur oaks are common canopy dominants and northern red oaks are common associates. Northern pin oaks, basswoods, and black cherries may also occur in the canopy. White oaks are rare and aspens typically are absent. Chokecherries are common in the shrub layer, with shrub cover averaging 30-50%. On droughty sites with thin soils or steep slopes these woodlands may persist even in the absence of fire.

Oak woodlands are dominated by white oak and pin oak in areas with coarse-textured soils, such as on kames or eskers, or in areas prone to occasional fires. Oak woodlands with heavier-

textured soils are often dominated by bur oak. Natural woodlands are now extremely rare i because of logging, grazing (both overgrazing and lack of grazing), and fire suppression.

Mesic Oak Savanna (MLCCS Code 62130 / 6 Total Acres)

There one 5.5-acre example of mesic savanna documented in the Town of St. Joseph. It occur as an opening in an overgrown pastures and mapped as Oak Woodland-brushland. These areas were undoubtedly quality mesic savannas as recently as two to four decades ago.

Mesic savanna was historically common and important in the study area. However, they are exceptionally rare and considered to be an imperiled ecosystem.

Oak savanna restoration at Belwin Foundation, Bayport,

The characteristic trees of mesic oak savanna are bur oaks and to a lesser extent northern pin oaks. Northward, quaking aspens were probably common in moister parts of mesic oak savannas. The stature and spacing of the oaks in the community probably varied considerably, primarily with differences in fire history, which were themselves related to differences in soils, landforms, and climate. Grubs and small, gnarly, open-grown trees were probably also common.

The distribution of trees ranged from widely spaced to strongly clumped. Shrub cover, likewise, was probably quite variable. The shrub layer included chokecherries (Prunus virginiana), low juneberries (Amelanchier humilis), gray-bark dogwoods (Cornus racemosa), wolfberries (Symphoricarpos occidentalis), and on lighter soils, prairie willows (Salix humilis), New Jersey tea (Ceanothus americanus), and American hazelnuts (Corylus americana). Leadplant (Amorpha canescens) was always present. The herbaceous vegetation was dominated by species typical of mesic prairie, but herbs typical of oak woodland and oak forest were probably present as well, especially beneath tree or shrub canopies.

Mesic oak savanna is rare throughout the region. Historically, it occurred in the prairie and deciduous forest-woodland zones. Mesic oak savanna occurred on dry-mesic to mesic, gently

undulating to moderately sloping sites. These sites were on glacial till or outwash, with soil texture ranging from clay loam to sandy loam. Mesic Oak Savanna generally occurred on sites where fire was frequent enough to prevent trees and shrubs from forming closed canopies, thereby permitting heliophilous sun-loving prairie herbs to dominate the ground layer. However, fire frequencies were lower than in prairies on similar topography and soils.

Native grazing and browsing animals may also have helped maintain the open character of mesic oak savanna. Within the deciduous forest-woodland zone, where landscape character reduced fire frequency on a large scale, mesic oak savanna often covered larger areas. With settlement and the suppression of prairie fires, savannas in the deciduous forest-woodland zone that escaped clearing and cultivation quickly succeeded to woodland unless heavily and continuously grazed. One remnant mesic savanna were documented in the study area.

Rare mesic oak savanna in Town of St. Joseph

Dry Oak Savanna – (MLCCS Codes 62120, 62122 / 9 Total Acres)
One 9-acre dry oak savanna was documented during the NRI.

Dry oak savanna occurs on the same kinds of landforms as Dry Prairie, except for bedrock bluffs. The barrens subtype of dry savanna occurs on the same kinds of sand deposits as the Barrens Subtype of Dry Prairie. On dune blankets it tends to be favored over prairie in areas of sharper relief. Bur oaks are generally the prevalent trees, but northern pin oaks are also common.

Small, gnarly, open-grown trees are most common, although in moister spots, or in heavier soils, larger trees are sometimes more common. Trees range in spacing from sparse and evenly spaced to strongly clumped. The shrub layer is usually sparse; the most common species in the shrub layer are oaks (in the form of grubs), chokecherry, American hazel, smooth sumac, prairie willow, bush juniper (Juniperus communis) and New Jersey tea (Ceanothus americanus) are usually present. The herbaceous vegetation present in open areas is similar to that of the Barrens Subtype of Dry Prairie.

Grazing and browsing animals may also have had a role in the maintenance of Dry Oak Savanna. Because Dry Oak Savanna occurs on sites that are not as suitable for cultivation as Mesic Savanna sites, and because succession in the absence of fire is not as rapid, more examples remain of Dry Oak Savanna than of Mesic Oak Savanna.

Rare dry oak savanna in Town of St. Joseph

4.2.4 Shrublands

Wet Meadow - multiple subtypes (MLCCS Code 52420, 61320, 61420, 61540, 61641 / 56 Total Acres)

Eighteen wet meadows totaling 56 acres were documented. It is important to note that there were numerous small wet meadows that occur as inclusions in other cover types (especially forest), but were below the minimum size for mapping. These wet meadow inclusions are important as wildlife habitat and very sensitive to excessive nutrient inputs that result from in-watershed land use changes such as development or conversion of natural cover types to row crop agriculture.

This wet shrub meadow type is found in the northern prairie-forest border area of Wisconsin and Minnesota. Stands may occur along stream courses or adjacent to lakes or in upland depressions. Soils are wet mineral, muck, or shallow peat (<0.5 m). Standing water is present in the spring and after heavy rains, but the water table draws down by mid-summer. Seepage areas may also occur. Shrub cover is at least 25 percent but does not become thick. Dominant species include red-osier dogwood (Cornus sericea), Bebb's willow (Salix bebbiana), pussy willow (Salix discolor), slender willows(Salix petiolaris), and meadowsweet (Spiraea alba). Herbaceous species are typical of wet herbaceous meadows, and include several species of sedges (Carex aquatilis, C. atherodes, C. haydenii, C. lacustris, C. lanuginosa, C. rostrata, and C. stricta), or grasses such as Canada blue joint (Calamagrostis canadensis) and reedgrass (Calamagrostis stricta). Forbs include swamp milkweed (Asclepias incarnata), lance-leaved aster (Aster lanceolatus), New England aster (A. novae-angliae), swamp aster (A. puniceus), turtlehead (Chelone glabra), joe-pye weed (Eupatorium maculatum), and common mint (Mentha arvensis).

Wet meadow shrub subtype is a wetland community comprised of 50-70% cover by tall shrubs where peat is <0.5m deep and gaps are not dominated by emergent species >1m tall. The leaves of typical grasses and sedges within this community are >3mm wide (such as Canada blue joint (Calamagrostis canadensis), lake sedge (Carex lacustris), and tussock sedge (C. stricta)).

Sedge-dominated wet meadow in forested rolling topography in St. Joseph.

Willow Swamp (MLCCS Code 52430 / 1.5 Acres)
One occurrences of willow swamp was documented in the NRI study area.

Willow swamp is a minerotrophic wetland with a canopy of medium to tall (>1m) shrubs dominated by willows (especially pussy willow, slender willow, and Bebb's willow) and red-osier dogwood. Other shrubs, such as speckled alder (Alnus rugosa) , bog birch, poison sumac (Rhus vernix) , and alder buckthorn (Rhamnus alnifolia) may be common in the tall shrub layer, although speckled alder is never the most abundant species present. Herbaceous species (especially graminoids) characteristic of wet meadow/fen communities are common in the more open occurrences of the community. However, in willow swamps, unlike wet meadow/fen communities, these graminoid-dominated patches are poorly separated from clumps of shrubs. The most common herbs are tussock sedge (Carex stricta), prairie sedge (Carex prairea), lake-bank sedge (Carex lacustris), broad-leaved cattail (Typha latifolia), Canada blue-joint grass, northern marsh fern (Thelypteris palustris), and jewel-weed (Impatiens capensis).

Willow swamps dominated by bog birch are closely related to the shrub subtype of rich fen but have more minerotrophic indicator species [such as speckled alder, holly (Ilex verticillata), jewel-weed, and horehound (Lycopus uniflorus)] than are present in Rich Fens. Following fire in conifer swamps or in the shrub subtype of rich fens there may be initially a dense cover of willows

(usually balsam willow and bog willow), but these stands are best classified as successional stages of conifer swamp or rich fen rather than as willow swamp. The dense groves of sand-bar willow or juvenile black willow that occur on sand bars along rivers are not considered shrub swamp communities but instead river beach communities, as they occur on mineral rather than peat or muck substrates.

Willow swamp occurs on seasonally flooded soils with <30% tree cover and >50% cover by tall shrubs (not dwarf-shrubs), where <50% of the shrubs are alders and gaps are dominated by emergent species >1m tall.

4.2.5 Herbaceous Wetlands

Cattail Marsh (MLCCS Codes 61340, 61510, 61610, 61710, 61810 / 31 Total Acres)
Thirteen cattail marshes totaling 31 acres were documented in the study area.

For the purposes of this project, cattail marshes do not include monotypic (i.e. single species) stands of the nonnative narrow-leaf cattail with very low species diversity. Wetlands within Study area comprised primarily of narrow-leaf cattail (Typha angustifolia) and reed canary grass (Phalaris arundinacea) were considered non-native dominated herbaceous wetlands (MLCCS codes 61330, 61480, 61530, and 61630). Several large cattail/reed canary grass monotypes were observed, as well as numerous medium to small disturbed basins containing a monotype or combination of invasive species.

Cattail marsh

Cattail marsh is an emergent marsh dominated by cattails including broad leaved cattail Typha latifolia and less frequently narrow leaved cattail, and very often their hybrids (T. glauca). Cattail marshes occur most commonly along lake margins and in shallow basins, although they are sometimes also present in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots do not contact the bottom but instead the plants grow suspended in a buoyant peaty mat. Associated species vary widely, but some of the most common ones are sedges of the genus Carex (Water sedge (C. aquatilis), beaked sedge (C. rostrata), and wooly sedge (C. lanuginosa), bulrushes (American bulrush (Scirpus americanus,) hardstem bulrush (S. acutus), and slender bulrush (S. heterochaetus)), and broad-leaved herbs such as northern marsh fern (Thelypteris palustris), swamp milkweed, jewel-weed, broad-leaved

arrowhead (Sagittaria latifolia), mad-dog skullcap (Scutellaria lateriflora), marsh skullcap (Scutellaria galericulata), and blue vervain (Verbena hastata).

Birch bog, spiraea shrubland – seasonally flooded (MLCCS Code 52450)
One high quality Birch bog, Spiraea shrubland – seasonally flooded (3.4-acre) was also observed.

This vegetation grows on seasonally flooded soils with <30% tree cover and >50% shrub cover, dominated by bog birch (*Betula pumila*), meadowsweet (*Spiraea alba*), or steeplebush (*Spiraea tomentosa*). This type has not yet been completely described.

Poor fen (MLCCS Codes 61450 & others)
Poor fen plant communities were observed in St. Joseph as inclusions in floating mat rich fens. For the purposes of community and stormwater planning, it should be noted that poor fens are highly sensitive to excess nutrients (typically associated with watershed disturbances including development, poor logging practices, conversion of natural vegetation to row crop agriculture.

Poor fen

Poor Fen is most common in the conifer-hardwood forest zone, with scattered occurrences in the deciduous forest-woodland zone. The ground cover of the community is typically dominated by wiregrass sedge (Carex lasiocarpa) or few-seeded sedge (C. oligosperma). Mud sedge (C. limosa), creeping sedge (C. chordorrhiza), beaked-sedge (Rhynchospora alba), tufted club-rush (Scirpus cespitosus), scheuchzeria (Scheuchzeria palustris), and ericaceous shrubs are present in most Poor Fens as associates of the dominant sedges. Poor Fens have at least 50% cover by sphagnum mosses, and up to 70% cover by shrubs and small trees, most commonly bog birches and stunted tamaracks.

Poor Fen occurs on deep peat (>1.0m) that receives minimal nutrient-rich run-off from surrounding uplands. In our region, Poor Fen often occurs in the interiors of small basins that are relatively isolated from runoff. The surface water of Poor Fen is slightly acidic (pH 4.1 - 5.9) and nutrient poor ([Ca2+] <13 mg/l). Poor Fen is transitional between Rich Fen and Open Bog and commonly grades into these communities on the landscape.

There are four subtypes of Poor Fen, a Sedge Subtype, a Shrub Subtype, a Scrub Tamarack Subtype, and a Patterned Subtype.

Key-based definition: A saturated wetland on peat >0.5m deep where grasses and sedges, such as Carex lasiocarpa and C. chordorrhiza, are mostly <3mm wide and there is <50% cover by shrubs, including dwarf-shrubs. The community does not occur on the floating mat at the edge of a shallow lake and lacks the complex patterned topography of strings and flarks. The following species are NOT common: livid sedge (Carex livida), Buxbaum's sedge (C. buxbaumii), swamp lousewort (Pedicularis lanceolata), flat stem spikerush (Eleocharis compressa), spiked muhly grass (Muhlenbergia glomerata), and Kalm's lobelia (Lobelia kalmii.)

The National Vegetation Classification System description of a more narrowly defined community is given here as well: This graminoid poor fen community is found in the Great Lakes region of the United States and Canada, as well as elsewhere in central Canada, ranging from Ontario to Manitoba, south to Iowa, and east to Illinois. Stands are found in peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding and larger peatlands. Water hydrology is saturated, and surface water is slightly acidic and nutrient poor. The vegetation is dominated by graminoids, with up to 25 percent shrub cover, and scattered trees. The dominant graminoid is Carex lasiocarpa, and typical associates include Carex chordorrhiza, Carex limosa (mud sedge), Carex oligosperma (few-seeded sedge), Rhynchospora alba, Scirpus cespitosus, and Scheuchzeria palustris. Forbs include Dragon-mouth (Arethusa bulbosa), northern bog aster (Aster borealis), grass pink (Calopogon tuberosus), rose pogonia (Pogonia ophioglossoides), pitcher plant (Sarracenia purpurea), and bog goldenrod (Solidago uliginosa). The low-shrub layer contains bog rosemary (Andromeda polifolia), bog birch (Betula pumila), leatherleaf (Chamaedaphne calyculata), Larix laricina, Salix discolor, Salix pedicellaris, and dwarf cranberry (Vaccinium oxycoccos). The moss layer is virtually continuous, and is dominated by species of sphagnum mosses including Sphagnum capillifolium, Sphagnum fuscum, and Sphagnum magellanicum. Diagnostic features include the dominance of graminoids, particularly Carex lasiocarpa, the almost continuous layer of Sphagnum peat, and few minerotrophic indicators.

Rich Fen (MLCCS Code 61460, 61461, and 61462 / 23 Total Acres documented during the NRI)

Six rich fens were documented during the NRI, totaling 23 acres.

The ground layer of rich fens is dominated by wiregrass sedge (Carex lasiocarpa), brown sedge (Carex buxbaumii), livid sedge (Carex livida), bluejoint grass (Calamagrostis neglecta), or bog reed-grass (Calamagrostis inexpansa). Although generally open communities, rich fens may have up to 70% cover of woody shrubs, especially bog birches, sage-leaved willows, and shrubby cinquefoils. Mosses range from scarce to abundant in the community. Where mosses are abundant, the dominant species are species other than sphagnum mosses (Sphagnum spp.).

Surface waters within the community are slightly acidic to circumneutral (pH 5.8 - 7.8) with moderate nutrient levels. Rich fen may grade into poor fen but is distinguishable from poor fen by its higher species diversity and by the more frequent occurrence and greater abundance of minerotrophic indicator species, including livid sedge (Carex livida), brown sedge (C. buxbaumii), swamp lousewort (Pedicularis lanceolata), spike-rush (Eleocharis compressa), marsh muhly (Muhlenbergia glomerata), and Kalm's lobelia (Lobelia kalmii).

Rich fen occurs in the conifer-hardwood forest and deciduous forest-woodland zones. There are two geographic sections of rich fen, a Transition Section and a Boreal Section. In the Boreal Section areas of northern Wisconsin and Minnesota, rich fen usually occurs on deep peat and contains characteristically northern species such as bog-rosemary (Andromeda glaucophylla) and other ericaceous shrubs, the bulrush Scirpus hudsonianus, and pitcher-plant (Sarracenia purpurea).

The sedge subtype rich fen does not occur on the floating mat at the edge of a shallow lake and lacks the complex patterned topography of strings and flarks. Rich fen – floating-mat subtype occurs on the floating mat at the edge of a shallow lake, In both community types there is no discharge of calcareous groundwater, and the following species are often common: Carex livida, C. buxbaumii, Pedicularis lanceolata, Eleocharis compressa, Muhlenbergia glomerata, and Lobelia kalmii.

Mixed Emergent Marsh (MLCCS Code 61520, 61620 / 10 Total Acres)
Eight mixed emergent marshes totaling 10 acres were documented within the study area.

Within most of the mixed emergent marsh remnants in the study area, the nonnative, invasive reed canary grass (Phalaris arundinacea) was at least present or in some cases common. This is especially true adjacent to agricultural lands that have high sediment and nutrient load in their runoff.

Mixed emergent marsh is a broad community type, encompassing all marshes dominated by species other than cattails. Bulrushes are the most common dominants, especially hard-stemmed bulrush (Scirpus acutus), river bulrush (Scirpus fluviatilis), softstem bulrush (Scirpus validus), Scirpus americanus, and Scirpus heterochaetus. Common reed grass (Phragmites australis), spike rushes (Eleocharis spp.), and (in some river backwaters) prairie cord grass (Spartina pectinata) are less common dominants.

In general, mixed emergent marsh tends to occur on harder pond, lake, or river bottoms than cattail marsh and is less likely to contain the forbs that grow on the floating peat mats present in many cattail marshes. Broad-leaved arrowhead (Sagittaria latifolia) and aquatic macrophytes are the most common non-graminoid associates. Many mixed emergent marsh species are sensitive to fertilizer run-off and other artificial disturbances, and disturbed mixed emergent marshes (especially in the Prairie Zone) tend to convert to cattail marshes or become strongly

dominated by reed canary grass (Phalaris arundinacea) or common reed grass (Phragmites australis), species that increase in abundance with disturbance.

4.2.6 Upland Grasslands

Upland Prairie
Upland prairie occurs primarily in the prairie zone, with scattered occurrences in the deciduous forest-woodland zone. It is dominated by grasses. The tall grasses, big bluestem (Andropogon gerardii) and Indiangrass (Sorghastrum nutans), are the major dominants on moist sites. Prairie dropseed (Sporobolus heterolepis) is common on both dry and moist sites. Forbs typically are abundant (but subdominant to the grasses) and may have high local diversity. Forb species composition varies with site moisture, although some forb species occur on almost all sites, moist or dry. Several low shrub or sub-shrub species are common on Upland prairie; the most characteristic is leadplant (Amorpha canescens). Taller brush and trees are absent or scattered, however brush or woodland areas may be interspersed with prairie, usually in association with topographic and aquatic features that provide protection from fire.

The most important cause of variation in species composition in prairie communities is variation in soil moisture. The local soil moisture regime is determined by slope, aspect, proximity to the water table, and soil texture. On a regional scale, variation in species composition is primarily caused by climatic variation (i.e., the westward decline in precipitation and northward decline in temperature).

Upland prairies occur on a range of landforms in the prairie zone, from nearly flat glacial lake plains to steep morainic slopes. In the deciduous forest-woodland zone, prairies occur on droughty, level outwash areas and steep south- and west-facing slopes. The pre-European settlement distribution of prairie was related to the interaction of local fire frequency with growth rates of woody species: where conditions were favorable for rapid growth, more frequent fires were necessary to maintain prairie over savanna, woodland, or forest. Fragmentation of upland prairie since European settlement has reduced fire frequency throughout the prairie and deciduous forest-woodland zones, and most prairie remnants have more brush and trees than were present in the past.

It is important to note that plantings of prairie species, typically referred to as "prairie restorations" are invariably less species rich than native prairie remnants, mimic only a small fraction of the function of a remnant prairie, and are often fraught with exotic weed species such as smooth brome (Bromus inermis) and Kentucky blue grass (Poa pratensis) among others. These prairie plantings are typically dominated by a handful of native grasses, including big bluestem (Andropogon gerardii), switchgrass (Panicum virgatum), and Indian grass (Sorghastrum nutans), with little blue stem (Schizachyrium scoparium) seldom used.

Mesic Prairie (MLCCS Code 61110 / 101 Total acres)

Nine mesic prairies and/or prairie plantings totaling 101 acres were documented.

Mesic Prairie planting (not remnant)

Mesic prairie is a dry-mesic to wet-mesic grassland that occurs mainly in the prairie zone in southern and western Wisconsin and sporadically in the deciduous forest-woodland zone. Mesic prairie is dominated by grasses. Big bluestem (Andropogon gerardii), Indiangrass (Sorghastrum nutans), and prairie dropseed (Sporobolus heterolepis) are the major native species on most sites, with little bluestem (Schizachyrium scoparium) and porcupine grass (Stipa spartea) important on drier sites, and switchgrass (Panicum virgatum) and prairie cordgrass (Spartina pectinata) common on wetter sites. The introduced grass Kentucky bluegrass (Poa pratensis) is present at most sites; it is a function of the site's disturbance history.

Forbs are abundant (but usually subdominant to grasses) and have high local diversity. Forb species-composition also varies locally with soil moisture. There is greater regional variation among forbs than among grasses. Common forb species include purple prairie-clover (Petalostemon purpureum), white prairie-clover (P. candidum), ground-plum (Astragalus crassicarpus), prairie-turnip (Psoralea esculenta), rough blazing-star (Liatris aspera), Canada goldenrod (Solidago canadensis), stiff goldenrod (S. rigida), Missouri goldenrod (S. missouriensis), prairie thistle (Cirsium flodmani), smooth aster (Aster laevis), stiff sunflower (Helianthus rigidus), Maximilian sunflower (H. maximiliani), smooth rattlesnake-root (Prenanthes racemosa), white sage (Artemisia ludoviciana), wood lily (Lilium philadelphicum), white camas (Zigadenus elegans), heart-leaved alexanders (Zizia aptera), prairie larkspur (Delphinium virescens), downy phlox (Phlox pilosa), hoary puccoon (Lithospermum canescens), tall cinquefoil (Potentilla arguta), alum-root (Heuchera richardsonii), wood-betony (Pedicularis canadensis), northern bedstraw (Galium boreale), prairie bird-foot violet (Viola pedatifida), oval-leaved milkweed (Asclepias ovalifolia), and showy milkweed (A. speciosa). Purple coneflower (Echinacea angustifolia) is common on drier sites in the western part of the community's range. Leadplant, prairie rose, sand cherry, wolfberry, and prairie willow are common low-shrub or sub-shrub species. Fragrant false indigo is common on moister sites. Trees and taller brush often occur along the margins of wetlands adjacent to mesic prairies.

Mesic prairie is a fire-dependent community. In the absence of fire, mesic prairies are often susceptible to invasion by brush and trees. In the prairie zone, mesic prairie occurs on nearly

level glacio-lacustrine and glacio-fluvial deposits, and on flat or gently rolling morainic landforms. In southeastern and, to a lesser extent, southwestern Minnesota, the glacial deposits are overlain by loess. Bedrock subtypes of mesic prairie exist in a few areas where bedrock is within about one-and-one-quarter meters of the ground surface and there are numerous small patches of exposed rock. Within the deciduous forest-woodland zone, mesic prairie usually occurs on level outwash areas or on broad, sandy river terraces.

The soils in mesic prairie are predominantly mollisols with thick, dark mineral surface layers that have high base saturation and dominantly bivalent cations. They range in texture and drainage from silty and somewhat poorly drained to sandy and somewhat excessively drained, with moderately well-drained to well-drained, loamy soils being most common. Mesic prairie grades into wet prairie on moister sites and into the hill and sand-gravel subtypes of dry prairie on drier sites. Separation of mesic prairie from other prairie types is based primarily on landform or substrate characteristics rather than on species composition, as floristic boundaries between mesic prairie and other prairie types are not well defined.

Dry Prairie – (MLCCS Code 61210, 61211, 61213 / 48 Total Acres)
Thirteen dry prairies totaling 48 acres documented.

Dry Prairie is a type of Upland Prairie, which occurs primarily in the prairie zone, with scattered occurrences in the deciduous forest-woodland zone. They are dominated by grasses. The tall grasses, big bluestem (Andropogon gerardii) and Indian grass (Sorghastrum nutans), are the major dominants on moist sites. Prairie dropseed (Sporobolus heterolepis) is common on both dry and moist sites. Forbs typically are abundant (but subdominant to the grasses) and may have high local diversity. Forb species composition varies with site moisture, although some forb species occur on almost all sites, moist or dry. Several low shrub or sub-shrub species are common on Upland Prairie; the most characteristic is leadplant (Amorpha canescens). Taller brush and trees are absent or scattered, however brush or woodland areas may be interspersed with prairie, usually in association with topographic and aquatic features that provide protection from fire.

Dry Prairie is a dry to dry-mesic herbaceous community dominated by grasses and sedges. It occurs throughout the prairie zone and sporadically in the deciduous forest-woodland zone. Dry Prairie has considerable variation in species composition, reflecting interactions among geography (namely climate), soils, and topography. In general, Dry Prairies have a greater component of Great Plains species than Mesic Prairies, especially the driest examples. Big bluestem (Andropogon gerardii) is always present in the community and usually important, but it does not achieve the dominance it typically has in Mesic Prairie. Indian grass (Sorghastrum nutans) is more limited in occurrence, generally appearing only where conditions approach mesic. Mid-height and short grasses and sedges are usually dominant in Dry Prairie. Among the more common are porcupine grass (Stipa spartea), little bluestem (Schizachyrium scoparium),

sideoats grama (Bouteloua curtipendula), prairie June-grass (Koeleria macrantha), and sun-loving sedge (Carex heliophila).

Dry prairie remnant in the Town of St. Joseph

Forb variation within the community is more pronounced. Some widespread, characteristic species are dotted blazing star (Liatris punctata), pasque flower (Pulsatilla nuttalliana), prairie golden-aster (Heterotheca villosa), stiff sunflower (Helianthus rigidus), silky aster (Aster sericeus), green milkweed (Asclepias viridiflora), stiff goldenrod (Solidago rigida), gray goldenrod (Solidago nemoralis), Missouri goldenrod (Solidago missouriensis), and narrow-leaved puccoon (Lithospermum incisum). Dry Prairies share many forb species with Mesic Prairies, including rough blazing star (Liatris aspera), buffalo-bean (Astragalus crassicarpus), tooth-leaved evening primrose (Calylophus serrulatus), silverleaf scurfpea (Psoralea argophylla), thimbleweed (Anemone cylindrica), Louisiana sagewort (Artemisia ludoviciana), prairie larkspur (Delphinium virescens), heart-leaved alexanders (Zizia aptera), purple prairie-clover (Petalostemon purpureum), hoary puccoon (Lithospermum canescens), prairie smoke (Geum triflorum), and wood lily (Lilium philadelphicum).

Three sub-shrubs--leadplant (Amorpha canescens), prairie rose (Rosa arkansana), and wolfberry (Symphoricarpos occidentalis)--typical in Mesic Prairies are also generally present in Dry Prairie. Soil-encrusting lichens and the fern-ally rock-spikemoss (Selaginella rupestris) are often common in Dry Prairie. Brush, and sometimes trees, may be present in hollows and draws. Bur oak (Quercus macrocarpa), chokecherry (Prunus virginiana), wild plum (Prunus americana), and smooth sumac (Rhus glabra) are the most widespread woody species. Other woody species more limited in distribution in the community are northern pin oak (Quercus ellipsoidalis), black oak (Quercus velutina), and hazel (Corylus americana).

Dry Prairies are maintained by fire but require less frequent fires than mesic and wet prairies because the droughty conditions within Dry Prairies slow or prevent the growth of woody species. Dry Prairie occurs on a variety of landforms, including sand dune blankets of mid-Holocene origin, glacial lake beach ridges, outwash deposits, ice-contact features (kames, eskers), morainic hills, erosional slopes in glacial drift, and bedrock-cored bluffs. Soils range from nearly pure sand with little profile development, to mollisols, although the latter have a much thinner organic-rich surface horizon than the soils of Mesic Prairie. All overlie deep glacial drift except for those of the bedrock-cored bluffs, which are formed in a thin layer of loess or residuum. Soils are well drained to excessively drained. Depending upon the degree of slope, the slope aspect, and the soil composition, Dry Prairie intergrades with Mesic Prairie.

4.2.7 Open water wetlands

Water Lily Open Marsh – (MLCCS Codes: 64111, 64113 / 15 acres)

A total of five water lily open marsh areas were documented in the inventory area.

This rooted aquatic or open marsh community occupies shallow water depressions, oxbow ponds, backwater sloughs of river floodplains, slow moving streams, ponds, and small lakes throughout the central and eastern United States, extending from Maine to Ontario and Minnesota, south to Oklahoma and east to Georgia.. It is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar lutea ssp. advena* and *Nymphaea odorata* are dominants. Other species present may include *Brasenia schreberi*, various *Potamogeton spp.*, *Polygonum amphibium*, and *Polygonum coccineum*. Submerged aquatics that are more common in the southern part of the range include *Cabomba caroliniana*, *Ceratophyllum demersum*, and *Heteranthera dubia*.

Water lily-dominated wetland in St. Joseph.

Midwest pondweed submerged aquatic wetland – (MLCCS Code 64120 / 18 acres)

There was one occurrence of Midwest pondweed/submerged aquatic wetland in the study area.

This broadly defined submerged aquatic or open marsh type is found throughout the midwestern region of the United States and adjacent Canada. Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima, Eriocaulon aquaticum, Gratiola aurea, Isoetes echinospora, Isoetes macrospora, Juncus pelocarpus*, and *Lobelia dortmanna*. Subgroup B is a shallow (<50 cm) open water marsh with emergent cover <25 percent and floating-leaved aquatics >25 percent. Substrate is a mineral soil (often sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis, Myriophyllum spp., Potamogeton amplifolius,*

Potamogeton gramineus, Potamogeton praelongus, Potamogeton robbinsii, Sparganium fluctuans, and *Utricularia vulgaris*. Subgroup C includes open water marsh with emergent cover <25 percent and floating leaved aquatics >25 percent. Substrate is sedimentary peat and stands are often found in sheltered bays of lakes and streams which do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum, Lemna spp. Myriophyllum sibiricum, Myriophyllum verticillatum, Potamogeton natans, Potamogeton pectinatus, Potamogeton richardsonii, Potamogeton zosteriformis, Ranunculus aquatilis, Utricularia vulgaris*, and *Vallisneria americana*.

4.2.8 Other Plant Assemblages (MLCCS Semi-natural Community Types)

There are a number of plant assemblages in the study area that do not have sufficient species composition, three-dimensional structure, or overall function to be considered natural communities as described in Minnesota's Native Vegetation: A Key to Natural Communities (MN DNR 1993). These communities were assigned community names according to the protocols of the Minnesota Land Cover Classification System. These were included in the inventory as a way of creating a more complete picture for the permanent habitats within the study area. Although they are not natural areas by definition, they possess one or several characteristics that contribute to overall function of natural areas at a landscape-level due to proximity to other natural areas, good restoration potential back to natural area, or they may represent the only large block of habitat in the area, or others.

The names assigned to these MLCCS communities are standardized, descriptive in nature, and give an indication of the structure of an area, as well as the hydrologic regime. Some examples of common semi-natural MLCCS community type names included in this report are:

Altered/Nonnative Deciduous Forest (MLCCS Code 32170/ 275 Total Acres)

There are 46 non-native forests totaling 275 acres in study area.

This upland deciduous forest classification is reserved for sites which do not meet the definition of other, native community types. In other words, oaks, aspens, balsam poplars (Populus balsamifera), paper birches, yellow birches (Betula allegheniensis), sugar maples, or basswoods are not dominant, and, if present, are only minor components of the community. Instead, boxelder (Acer negundo), green ash, and cottonwood (Populus deltoides) are typical canopy dominants, sometimes together and sometimes singly. Elms are common associates. Hackberries, aspens, oaks, and basswoods may also be present. The shrub layer is often dominated by buckthorn and Tartarian honeysuckle (Lonicera tatarica), but gooseberries (Ribes spp.) and elderberries (Sambucus spp.) can also be common. The ground layer is also

dominated by species tolerant of disturbances, including white snakeroot (Eupatorium rugosum), motherwort (Leonuris cardiaca) and garlic mustard (Alliaria petiolata). Occasionally, when higher quality forests are nearby, the understory can be more diverse.

Disturbed Deciduous Woodland (MLCCS Code 42130 and 43110 / 581 Total Acres)

There are 79 disturbed/altered woodlands totalling 581 acres in study area.

These upland areas have 10-70% tree cover. Aspens comprise <70% of tree cover, and oaks comprise <30%. Herbaceous species comprise <30% of the non-tree cover. Boxelder, green ash, and cottonwood are typical canopy dominants, sometimes together and sometimes singly. Elms are common associates. Hackberries, aspens, oaks, and basswoods may also be present. The shrub layer is often dominated by buckthorn and Tartarian honeysuckle, but sumacs, gooseberries and elderberries can also be common. The ground layer is also dominated by species tolerant of disturbances, including white snakeroot, motherwort, and garlic mustard. Occasionally, when higher quality forests are nearby, the understory can be more diverse.

Tall or Medium tall non-native grassland, with or without sparse trees (MLCCS Codes 61120, 61220, 62140, and 62220 / 411 total Acres)

There were 34 non-native grasslands totaling 411 acres documented in study area.

These are often plantings of smooth brome grass like those planted for the Conservation Reserve Program in the 1980's, or some other nonnative pasture grass. This upland grassland is generally <1m tall, with <25% tree cover and <50% shrub cover, and is dominated by non-native species, such as brome, Kentucky bluegrass, reed canary grass (Phalaris arundinacea), and spotted knapweed (Centaurea maculosa).

Saturated to Seasonally flooded nonnative dominated wetland vegetation (MLCCS Codes 32240, 52220, 52330, 52440, 61330, 61480, 61530, 61630 / 43 Acres)

There are 19 areas of non-native dominated wetland totaling 43 acres in study area.

These wetland areas are typically disturbed by one of several human activities such as draining and/or planting of nonnative grasses, as well as grazing. These areas typically occur in the same settings that native wetland communities occur (see descriptions, above) and tend to be dominated by non-natives including reed canary grass, giant reed grass, European buckthorn, narrow leaved cattail, and/or purple loosestrife, or the native, disturbance adapted species such as boxelder.

Grassland with sparse deciduous trees – nonnative dominated (MLCCS Codes 62140 / 776 Acres)

There are 57 areas of non-native dominated grassland with sparse deciduous trees totaling 776 acres.

These areas may occur in former oak savannas where the ground cover was planted to nonnative pasture grasses, be former agricultural fields planted to perennial nonnative grasses and later colonized by pioneer tree species, or dormant pasture/hay ground with scattered trees.

This upland vegetation has 10-70% cover by trees (of which <25% is conifer), where >30% of non-tree cover is herbaceous and dominated by non-native species. The ground layer is often dominated by brome or Kentucky bluegrass. Common shrubs include sumac and Tartarian honeysuckle. Almost any tree species can be found here, but elms, cottonwoods, green ashes, boxelders, and bur oaks are common.

It is important to note that while these plant assemblages do not meet the criteria to commonly be classified as remnant natural communities, however, they can still provide valuable habitat for wildlife. They can also be important in the landscape, providing buffers from developed and intensively farmed areas. In some cases, such as in some "Grassland with sparse deciduous trees" areas (which may be oaks over non-native grasslands), there may be opportunity to easily restore a natural community such as Mesic Oak Savanna that is exceptionally rare in the upper Midwest. Additional information about these and other communities is available in the MLCCS Manual.

5.0 RECOMMENDATIONS

Many of the following recommendations in this natural resource inventory report are designed to maintain or improve ecological function in the landscape; several important, inter-related ecological concepts help to guide these recommendations. To help provide a context for the recommendations, these concepts are defined below.

"Connectivity" refers to the physical proximity between natural or semi-natural area and other natural or semi-natural areas-- the degree to which natural and semi-natural areas are connected to each other, versus isolated on the landscape. The connections between areas provide often critical opportunities for wildlife movement, allowing wildlife access to and movement through sites for foraging, hunting, nesting, and shelter. Wildlife are important for dispersing seed and pollinating plants, and thus connectivity also can improve the stability of native plant species populations as well. Corridor plans, for example, are an attempt to improve connectivity.

"Fragmentation" describes the degree to which a particular natural land cover type is broken into smaller patches interspersed with other land cover types. For example, a forest can be broken in numerous smaller units by the presence of natural features such as prairie, or by built features such as driveways, lawns, or parking lots. As the distance between areas of similar habitat increase, these intervening areas can become barriers to animal movement and can also serve to isolate native plant and animal populations. These isolated populations can be more vulnerable to local extinction, and may suffer from genetic isolation if populations are too far apart to facilitate movement or, in the case of plants, cross pollination. This can be of significant concern on prairie remnants, which are often isolated by great distances from each other. Fragmentation is also important to consider for those wildlife species which require larger expanses of habitat, and which will not use small areas. As natural areas are fragmented into smaller units, these species also become vulnerable to loss and/or extinction.

"Edge effect" refers to the differences in habitat quality and environmental conditions that occur around the perimeter of a natural area versus the interior of the site. Edge habitat is much more susceptible to invasion by exotic species, and, in forest habitats, is typically both warmer and drier than the interior of the site. When natural areas become fragmented (such as by development), the amount of edge habitat increases and the amount of interior habitat decreases. As the amount of fragmentation increases, this creates more habitat for wildlife and plant species that prefer the edge conditions, and decreases the amount of habitat available for species that require interior conditions. Conservation development/cluster development and natural resource overlay districts are examples of strategies that attempt to minimize the impacts of fragmentation and the edge effect.

5.1 STRATEGIES FOR CONSERVATION

5.1.1 Conceptual Greenways/Open Space Corridors

For the purpose of this report, a greenway is defined as privately or publicly owned corridors of open space which often follow natural land or water features and which are identified by ecologists as having characteristics that can maintain or enhance the function of natural resources. However, greenways can, and often do, incorporate active or passive recreational trails, active recreational spaces (such as athletic fields or golf courses), and other public open spaces that may provide rudimentary ecological functions and values.

As a part of this project, ecologists at Stantec reviewed the 2006 Town of St. Joseph Greenways Corridors map and refined it within the context of the data from the Natural Resources Inventory. This updated conceptual greenway corridor map was developed with the following guiding elements, in rough order of priority:

- High and Moderate quality natural areas
- Semi-natural areas that occur immediately adjacent to natural areas
- Bodies of water and large wetland complexes
- Natural corridors with natural/semi-natural areas (e.g. streams, drainageways, ridges)
- Areas that would serve as logical links between natural and semi-natural areas, particularly those that have potential to be restored to native vegetation
- Existing development areas were eliminated from the existing corridor

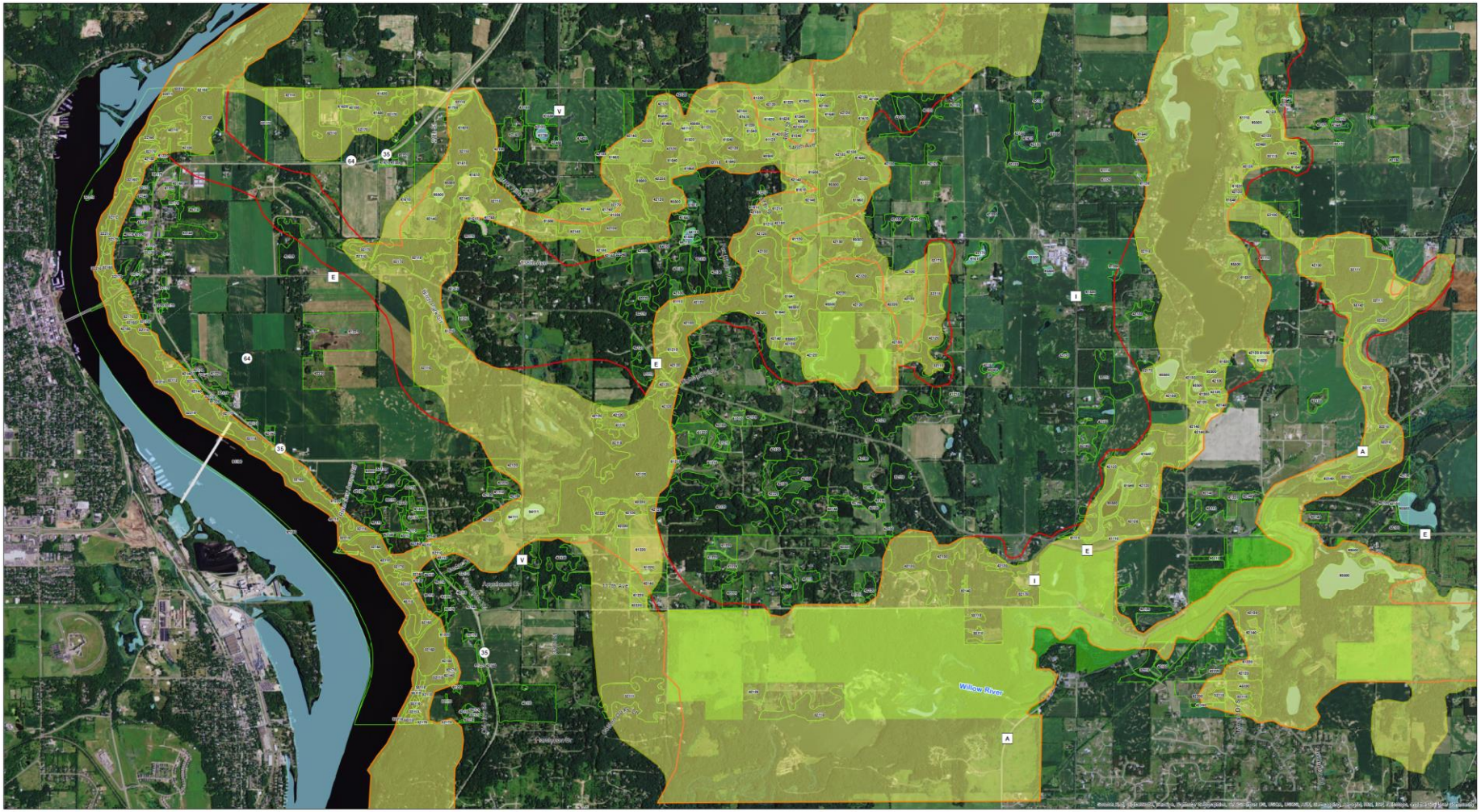
The greenways/corridors shown on the accompanying map are conceptual and broad stroke in nature. Therefore, we encourage the Town staff, along with its citizen committees and other important stakeholders to undertake a more comprehensive process of defining and locating potential greenways/corridors. Such a process will allow for public input, along with technical guidance from experienced staff in the natural resources field, ensuring long-term acceptance of a final product. During a greenway/corridor planning process, we suggest that the Town consider at a minimum the following elements:

- Public ownership – where possible, use corridors to connect large publicly owned open spaces
- Remnant natural areas – provide connectivity between natural areas, especially those of high quality and/or potential for hosting rare species.
- Incorporate semi-natural communities --into the greenway system as corridors to connect and/or buffer the highest quality remaining natural areas within the study area.
- Restore/reconstruct natural areas --to provide connectivity between natural or semi-natural areas (especially good quality sites) suitable for inclusion with greenways.

- Incorporate water resources and large permanent wetland systems within the corridor (directly or indirectly). Wetlands, lakes, and streams provide beneficial wildlife habitat and are not likely suitable for development.
- Consider opportunities for recreation and pedestrian movement through the greenway system. Co-aligning natural and recreation features should be done in a manner that minimizes negative impacts to sensitive natural areas.
- Consider educational and interpretive opportunities—High quality natural areas, unique features, and other amenities can provide an excellent resource for teaching and research, and can provide a forum for the public to develop an understanding of the local resources.

There are many opportunities to develop a viable greenways system as the Town grows over the next few decades. Water features provide significant wildlife habitat and opportunities for recreation including the St. Croix River, the Willow River, area lakes, and other features. These represent another opportunity to connect and buffer higher quality natural resources and wildlife habitat corridors within the town.

Recommendations



Natural Resources Corridors

Town of St. Joseph Comprehensive Plan 2016

0 1,500 3,000 6,000 Feet

2016 NRI Corridors
2006 Corridor
Municipal Boundary
Land Parcel Outline
Survey Included Parcels
Open Water
NWI Wetland
Parks

April 14, 2016

Draft

Stantec

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Stantec

5.1.2 Zoning and Subdivision Ordinance Review

NOTE: this section of the report will be updated based on discussion with stakeholders and review of potential options/tools.

5.1.2.1 Overview

The Natural Resources Inventory provides the Town with extensive data related to the location and quality of natural resources in the town. The Town can use this information as a basis for updating its current environmental ordinances, or for developing new approaches for protecting and enhancing its natural resources. The Town's current subdivision ordinance in the Fall of 2016 has no requirements for preserving natural resources – this is a topic for future discussion.

Future growth, changes in land use, and development of infrastructure can impact the health and function of natural communities and natural systems. The Town could use its subdivision controls to avoid or minimize these impacts, and provide incentives for developers and landowners to protect or restore natural resources.

Some potential recommendations may include topics such as the following:

5.1.2.2 Include Natural Resource Data in Preliminary Plat

5.1.2.3 Include Dedication of Natural Resources Areas as Parkland

5.1.2.4 Environmental Protection Overlay Zone

5.1.2.5 Ordinances

5.1.2.6 Use Low Impact Development Strategies

5.2 GENERAL MANAGEMENT CONCEPTS FOR ALL NATURAL AREAS

5.2.1 Maintain and Link Together Larger Tracts of Significant Natural Areas

Connectivity and size are both important factors affecting the function of natural areas. As a general rule, the larger an area is, the greater the diversity of plants and animals present. Larger natural areas are also more stable and able to withstand the impacts of naturally occurring events such as drought, insects and disease, and windstorms. For these reasons, the largest high quality natural areas should be given the highest priority for protection and management. Smaller patches of natural communities and sites with good restoration potential should then be

used to link larger areas together. Linkages should consider corridors and natural areas outside the Town as well as features within the Town.

5.2.2 Maintain Undisturbed Vegetative Buffers Around Natural Areas

A buffer of undisturbed vegetation can provide a variety of benefits. The buffer should consist of a mixture of trees, shrubs, grasses and forbs, with the mixture dependent on the specific site. Buffers reduce the impacts of surrounding land uses by stabilizing soil to prevent erosion, filtering pollutants, providing habitat areas and cover for animals, and reduce problems related to human activities by blocking noise, glare from lights and reducing disturbance. Even relatively narrow buffers of undisturbed vegetation can provide some benefits, but wider buffers will provide additional screening, water quality, and habitat benefits. Buffers will be most effective if most or all of the landowners around a natural area cooperate to make a continuous buffer. Landowners should avoid cutting vegetation, dumping grass clippings or other debris, and trampling vegetation within buffers. If a path is desired through the buffer, it should be mown or cut only as wide as is necessary for walking, and located so that it does not encourage erosion. Likewise, Town trail systems should not be located where they defeat the purpose of natural buffers.

5.2.3 Encourage the Use of Plant Species Native to the Area.

Native trees, shrubs, grasses and forbs can be planted in buffer areas or in degraded portions of natural areas. Species planted should be indigenous to the region (species lists are available from the Minnesota DNR). Plant species should be chosen based on the specific characteristics of the site including soils, slope, aspect and adjacent natural community types and quality. If possible, restore the site to the original natural community type that existed before conversion (i.e., prairie, oak forest).

5.2.4 Control Invasive Exotic Species

A number of nonnative species (sometimes called "exotics") are either currently a problem or have potential to be a problem. These include European buckthorn (Rhamnus cathartica), Tartarian honeysuckle (Lonicera tartarica), Siberian elm (Ulmus pumila), reed canary grass (Phalaris arundinacea), smooth brome (Bromus inermis), leafy spurge (Euphorbia esula), giant reed grass (Phragmites australis), Absinthe sage (Artemesia absinthium) and purple loosestrife (Lythrum salicaria), among others. For a complete list of species considered invasive by the Mn DNR, see http://www.dnr.state.mn.us/invasives/index.html

These plants invade native plant communities and can take over rapidly, eliminating native plants and leading to a loss of plant diversity and wildlife habitat. Often, disturbances from new road or home site construction serve as a pathway for introduction of these species to a natural community not yet invaded by exotic species. To control invasion by exotics, minimize

disturbance to natural areas and surrounding buffer areas as much as possible, and avoid planting or providing openings for exotics to invade. Small populations of exotics may be controlled by hand removal or through direct application of appropriate herbicides.

5.2.5 Maintain and Place Habitat Structures, Where Appropriate

Natural areas provide important habitat for many species of wildlife. Adding wood duck nest boxes and other types of nesting structures can augment habitat. Retaining or adding stones, logs, and dead trees in natural areas and buffers provides habitat for many species of reptiles, amphibians, birds and mammals. While some tree removal may be necessary for safety or for disease control (e.g., Dutch Elm disease or Oak Wilt), dead trees, both standing and down provide habitat for many animals. The books *Lakescaping for Wildlife and Water Quality* and *Landscaping for Wildlife* by Carroll Henderson are useful guides for improving habitat with plantings and structures.

5.2.6 Management Recommendations, by Community Type

Following are general management strategies for prairie, savanna, wetland and forest communities. These management strategies are intended to be generic; therefore more specific management recommendations may be necessary for individual natural communities and sites.

5.2.6.1 Prairie and Savanna Management

Prior to European settlement the health of prairie and savanna plant communities were maintained by grazing and fires, both of which probably occurred annually to every few years on most sites. Some fires occurred naturally, while most were set by Native Americans. Fires maintained the open structure of prairies by controlling the growth and spread of trees and shrubs, removing accumulated plant litter, warming the soil in spring, and returning nutrients to the soil. With the spread of agriculture and urban development, fires have been suppressed, leading to the spread of shrubs, trees, and exotic plants in prairie and savanna communities, and loss of diversity of native grasses and forbs. The activities of large and small mammals and insects also helped to maintain prairie communities by spreading seeds, burrowing to loosen soils, and pollinating prairie grasses and forbs.

In addition to the suppression of fires, prairies and savannas have been degraded by inappropriate levels of grazing, which reduces forb diversity and encourages the dominance of clonal plants (such as Canada golden rod) that are unpalatable to livestock. Other factors responsible for the decline of prairie and savanna communities include development, ill-advised tree planting, plowing, and mowing too frequently.

Less than one percent of the prairie and savanna landscapes that once existed in the Western Prairie (Star Prairie) landscape of western Wisconsin remain. The goal for managing the remaining remnants should be to maintain or restore as much of the original diversity as possible,

through re-establishing or mimicking the processes that helped to maintain these plant communities.

Prairie and savanna management should consider the following actions, as appropriate for each site:

- Remove exotic species with appropriate methods. Cutting and herbicide treatment are often most appropriate for tree and shrub species such as black locust, sumac, and buckthorn. Repeated herbicide treatments or biological controls may be needed for other exotic species such as leafy spurge and reed canary grass.

- Remedy excessive disturbance issues such as erosion or overgrazing.

- Use prescribed burns to control cool season grasses and other exotics, remove accumulated plant litter, encourage recruitment of prairie plants from the seed bed, and to maintain the health of the prairie for the long term. Burns may be scheduled annually at first, and reduced to every 3-4 years, depending on amount of litter available to successfully support a burn. Vary the burn regime over the long-term to include both fall and spring burns, and manage the timing of the burns to minimize negative impacts to ground-nesting birds. Burn only a portion of a prairie at any one time to conserve insect diversity.

- If elimination of exotics and prescribed burns over several seasons fails to restore desired diversity, consider plant community restoration through supplemental seeding of cut and burned area. Reconstructed prairies and savannas will require maintenance through infrequent mowing or prescribed burn regimes (burning is preferred over mowing when possible). Plantings should use native seed from local sources.

- Average burn frequency for the dry prairies and savannas in Study area is approximately 2-5 years, with a range of 1-10+ years. In addition, burn frequency should be greater during the first couple of years of management to control nonnative species brush.

Seasonal timing can have a profound effect on species composition. Current research information indicates that spring fires, conducted prior to April 15, tend to favor cool season grasses and summer-blooming forbs. Late spring fires (April 15 – June 1) tend to favor warm season (usually native) grasses and usually negatively affect forbs and tree/shrub species. Summer burns would mimic lightning set fires, and although these did occur, they appear to have been less of an influence on the presettlement landscape than human-set fires. Current information indicates that fall fires (after September 15) are most effective at maintaining a balance between grass and forb species and for controlling brush. There is also reason to believe, based on historical records that frequent fall burns most closely mimic the presettlement burning pattern used by Native Americans in the tallgrass prairie region of the Upper Midwest.

Mowing can also be used on sites with adequate accessibility and low risk for site disturbance. Mowing somewhat mimics the effect of grazing and can give many of the effects that prescribed burning can. Proper timing and techniques in mowing can be used to maintain a healthy balance between grasses and forbs.

Management of native communities, especially prairie, must also consider effects on the animal populations that are dependent on the community. The influence of management activities (i.e. burning) are not completely understood on animals such as butterflies and other invertebrates. To minimize the potential for devastating impacts on community obligate species and/or fire sensitive species, management should be carried out so as not to influence the entire area upon which these species depend on. An example would be not burning an entire prairie at once; this would leave refugia for the species of concern and allow for potential recolonization of burned areas.

Monitor the effectiveness of management activities, and any changes in plant and animal species in managed areas. Adjust activities as-needed based on monitoring results. This is a very important part of sound natural resource management.

5.2.6.2 Wetland Management

Wetland plant communities are frequently altered or degraded by changes in hydrologic regimes associated with agricultural or development. Farming and urban development increase the quantity and reduce the quality of runoff water entering wetlands by increasing sediments and nutrients, and by draining, filling and ditching wetlands. Agriculture and urban development also alter groundwater flows, typically diminishing flows through withdrawals for drinking water or increasing impervious surface areas. Excessive groundwater removal has been proved to de-water and alter seepage communities and fens.

Goals for wetland plant communities should include maintaining or restoring native plant communities and diversity by re-establishing or approximating original hydrology and natural processes. Some plant community types with variable hydrology, such as cattail marshes and wet meadows, may be relatively easy to restore or enhance, while more specialized communities like fens and seepage swamps can be remarkably difficult to restore if hydrologic conditions have been excessively altered.

Some strategies for maintaining or restoring quality wetlands include the following:

- When possible, maintain or restore the natural hydrologic regime, limiting “bounce” from storm events and maintaining ground water flows. Use infiltration and vegetation filtering strategies to reduce runoff from the watershed area that drains to the wetland, or use ponding or other best management practices to moderate storm flows, and remove sediments and nutrients from stormwater before it enters the wetland.

- Remove or control invasive exotic species. Repeated herbicide treatments may be necessary to control reed canary grass and purple loosestrife. Biological controls, such as weevils, have also shown promise recently in managing purple loosestrife. Hand removal of exotics by digging may be effective in areas where invasions are limited. In forested wetlands, buckthorn removal may be required, using cutting and herbicide treatments. Use herbicides that are licensed for use in wetland areas.
- Establish a vegetative buffer around wetland areas, to filter runoff, slow stormwater flows, and provide essential upland habitat needed by many species that use both wetlands and uplands as habitat during their lifecycles. Prohibit cutting, dumping or other alteration of buffers.
- Plant native wetland and upland plants in constructed wetlands and buffers. Plantings should use locally native species, and may include aquatic plants, grasses, forbs, shrubs and trees to provide structural diversity and improve habitat.
- Maintain dead and fallen trees or add nesting structures if desired to improve wildlife habitat.
- Monitor management efforts and revise strategies as needed to meet goals.

5.2.6.3 Forest Management

Most of the forest areas in the area have been grazed at varying levels, and in some cases were logged. Forest communities are often associated with ravines and steep slopes and are therefore sensitive to the impacts of erosion and sedimentation. In addition, roads and trails frequently fragment forest communities. All of these activities encourage invasion by aggressive exotic species-particularly buckthorn and Tatarian honeysuckle. Fragmentation also reduces the value of the forest community for wildlife species such as migratory songbirds that require "interior" forest areas that are well buffered from human disturbances.

Following are management strategies for maintaining and restoring the diversity and health of forest communities:

- Avoid cutting trees in areas containing exotic shrub species. Where cutting trees is necessary, cut exotic shrubs and treat with a basal application of an appropriate herbicide. Where developments are proposed within or adjacent to forest areas, removal and treatment of exotic shrubs could be incorporated into the overall site preparation process.
- Slow growing and mast-bearing trees such as oak and hickory should be given particular protection due to their high value to wildlife. Other trees through their seeds or buds also serve as important food sources for wildlife; these include maples, elms, aspens, basswood and birch.

- Large trees, particularly those containing cavities, should not be removed unless absolutely necessary. Dead standing and down trees should likewise not be removed unless they present a safety hazard. While humans perceive a forest with dead trees as messy, dead trees are important because they harbor a high diversity of plants and animals throughout their decomposition cycle. (Note that sanitation cuts may be necessary where oak wilt or Dutch elm disease is present)
- Encourage removal of weedy and/or exotic tree species such as Siberian elm, Norway maple, Russian olive, black locust and similar. Plant higher value native trees and shrubs back into forests following removal.
- Oak forest communities are adapted to fires and can often be improved through prescribed burns. Prescribed burns will generally increase diversity of grasses and forbs, encourage oak seedling germination and kill back exotic or invasive shrub species. Where oak forest communities occur adjacent to prairie and savanna communities, fires from prescribed burns should be allowed to burn into the oak forest. Burn more frequently in early years and less frequently as exotic species are controlled. Include both spring and fall burns in the management regime.
- Maple-basswood and lowland hardwood forest communities are generally not adapted to fires and should not be burned, or burned very infrequently (every 20+ years).

Oak wilt is of particular concern in the region. It is spread by construction activity or other root/top damage during the growing season. Canopy openings created by oak wilt can augment invasion by exotic species if not replanted or managed to restore oak woodlands. Oak trees should not be cut, pruned or injured between April 15 and July 1 of each year. Exposed roots injured by construction activities facilitate the spread oak wilt infection. A vibratory plow can be used to sever roots along the edge of any construction area prior to beginning work. This can reduce the potential for transfer of the oak wilt fungus between individual trees through grafted roots and allow for regeneration at the point of cutting. If vibratory plowing is used, the disturbed ground should be restored to pre-plow contours and planted with an appropriate native seed mix to prevent invasion by nonnative shrubs and weeds. Tree protection zones should be fenced to prevent entry or compaction by construction equipment. Soil and construction materials should not be stored within the tree protection zone, as this can result in contamination.

APPENDIX

Appendix A – GLOSSARY OF TECHNICAL TERMS

Acre-Foot: Volume of water that would cover an acre of land to a depth of one foot (43,560 cubic feet).
Alluvium Material:, such as sand and gravel, deposited by running water. River terraces and outwash plains are examples of landforms composed of alluvium.
Barrens: Usually refers to an area with sparse vegetation or stunted plants, caused by harsh growing conditions such as infertile, droughty, or thin soils; also, a plant community that has very sparse cover or is composed of stunted plants.
Bedrock: Any solid rock exposed at the earth's surface or covered by unconsolidated material such as till, gravel, or sand.
Best Management Practices: Methods, measures, or practices to prevent or reduce water pollution, including but not limited to structural and non-structural controls, operation and maintenance procedures, and scheduling of specific activities. Acronym is BMPs.
Blowout: An area, on a dune or other sand deposit, where wind has eroded a bowl-shaped hollow in the sand. Blowouts generally are sparsely vegetated.
Bluegreen algae: A type of algae whose population often increases dramatically at high nutrient concentrations in lakes. They can form objectionable surface scums, cause taste and odor problems, and secrete toxins poisonous to warm-blooded animals.
Bog: A wetland composed of a layer of acidic peat on which grows a specialized group of herbs and low shrubs. Bogs are distinguished from closely related poor fens by extremely nutrient-poor conditions and the absence of most of the minerotrophic species that occur in poor fens.
Bounce: In Hydrologic references, the rise in level in a wetland or lake resulting from a rainstorm event. The difference in elevation between the normal water elevation and the peak water elevation of a pond for a given size runoff event.
Brushland: An upland plant community composed of shrubs and tree sprouts.
Buffer strip: A band of un-maintained, preferably native, vegetation left along the edge of a stream, lake or wetland to filter runoff and/or stabilize the shoreline Calcareous Describes a soil or substrate that contains a significant amount of calcium carbonate.
Canopy: Aerial branches and leaves of terrestrial plants; generally the tallest layer of foliage in a plant community.
Chlorophyll: a The primary photosynthetic pigment in plants, a measure of the algal biomass in lakes
Colluvium: A deposit of rock and soil at the base of a cliff or slope, formed by gravitational action.
Colonial nesting birds: Species that nest in colonies (groups or aggregations), either with others of the same species or in mixed-species aggregations.
Cover: The proportion of the ground shaded when the living plant canopy is projected vertically downward; also a general term used to describe any component of the habitat that conceals animals from view.
DBH: (diameter at breast height) – a standard measure of tree trunk diameter taken approximately 4.5 feet above the ground level.
Dominant: Describes a plant species that shapes the character of a community by virtue of its size, abundance, dense shade, or effects on soils. Dominant species generally influence the presence, growth, and distribution of other plant species in the community.
Degradation: A decrease in quality.

Detention Pond: A pond designed to catch and temporarily store runoff before discharging the water downstream. The volume of the pool of standing water in the pond is important in determining how effective the pond will be in treating the incoming stormwater.
Dissolved Oxygen (D.O.): Oxygen that is dissolved in water. Fish and other water organisms need oxygen for respiration to survive. Depletion of oxygen from water can occur as a result of chemical and biological processes, including decomposition of organic matter.
Downcutting: The process by which a river or stream erodes and lowers its bed, eventually resulting in the formation of a valley or ravine.
Drift (glacial): Rock material, such as boulders, gravel, sand, silt, or clay, removed from one area and deposited in another by glaciers. Drift includes material deposited directly by glacial ice, such as till, as well as material deposited indirectly, such as outwash.
Ecosystem: The interacting group of physical elements (such as soils, water, etc.), plants, animals, and human communities that inhabit a particular place.
Emergent: Describes a plant capable of surviving indefinitely with its root system and lower stem in water and its upper stem above water (e.g., cattails).
Empirical : Based on experiment and observation; used to describe water quality models which are developed from measured data.
End moraine: A typically hilly landform composed of material deposited at the margin of a glacier.
Ephemeral habitat: A temporary habitat created by low intensity, short-lived fluctuations in environmental factors.
Epilimnion: Upper warm layer of a lake during thermal stratification.
Esker: A long, often serpentine hill or ridge composed of sand and gravel deposited by meltwater streams flowing in a channel in a decaying ice sheet.
Eutrophication: A natural process caused by the gradual accumulation of nutrients and consequent increased biological production, and resulting in the slow filling in of a basin with accumulated sediments, silt, and organic matter. Man's activities can increase the rate at which eutrophication occurs.
Eutrophic Lake: A nutrient rich lake; usually shallow, green due to excessive algae growth and with limited oxygen in the bottom layer of water.
Exotic species: A species that has been introduced to an area by humans or that is present in the area as a result of human-caused changes. (same as non native species.)
Export Coefficient: An estimate of the expected annual amount of a nutrient carried from its source to a lake.
Fen: a wetland community composed of sedges, grasses, forbs, and sometimes shrubs, that develops on peat in shallow basins.
Floating-leaved plants: Aquatic plants that root on lake, pond, or river bottoms and have leaves that float on the water surface at the end of long, flexible stems (e.g., water-lilies).
Floodplain: A flat area adjacent to a stream or river channel, created by erosion and deposition of sediment during regular flooding. Signs of 1flooding include debris caught in trees and ice scars at the bases of trees.
Flushing Rate: The number of times per year that a volume of water equal to the lake's volume flows through the lake.
Forb: A general term for broad-leaved, herbaceous plants.
Forest: A plant community with a nearly continuous to continuous canopy (70 to 100% cover) of mature trees.

Forest-grown tree: A tree that matured within a closed-canopy forest. Forest-grown trees tend to have narrow crowns and tall, straight trunks with few lower limbs.
Graminoid: An herbaceous plant with linear, "grass-like" leaves that typically are oriented vertically. Graminoids include grasses, sedges, and rushes.
Greenway or Greenway Corridor: A linear open space area, usually composed of natural vegetation, or vegetation that is more natural than surrounding land uses. May include paths or recreational trails.
Ground layer: A vegetation layer, mostly less than 3 feet tall, of grasses, forbs, and woody plants.
Ground moraine: A broad and level or gently undulating landform composed of material that was deposited underneath and sometimes at the margin of a glacier as the ice sheet melted; also referred to as a till plain.
Grove: A general term for a patch of trees less than 2 acres in area.
Grub: A tree or shrub whose aboveground shoots are repeatedly killed by fire or browsing but whose root system survives and continues to send up new shoots. The root system of a grub may be several hundred years old; the above ground shoots are generally much younger.
Habitat: The locality, site, and particular type of local environment in which plants, animals, and other organisms live.
Herb: A plant lacking a persistent above ground woody stem. Herbs include broad-leaved flowering plants, ferns, grasses, sedges, and others.
High Water Level (HWL): The peak water surface elevation in a ponding area as a result of a specific runoff event. Once the peak is reached, the pond water elevation eventually returns to its normal (standing) water level.
Hydrology: The science and study of water in nature, including its circulation, distribution, and its interaction with the environment.
Hydrophyte: A plant adapted to growing in water or on wet soils that are periodically saturated and deficient in oxygen.
Hypolimnion: Lower cooler layer of a lake during thermal stratification.
Ice block lake: A lake that occurs in a depression that was formed when a block of glacial ice was buried or surrounded by till or outwash sand, and then melted.
Ice scar: A scar on a floodplain tree caused by abrasion by ice floes during spring flooding.
Impervious Surface A surface that is impermeable to the downward seepage of water; e.g., pavement and roof tops.
Inflorescence: An arrangement of flowers on a plant, such as in a cluster or along a stalk.
Lacustrine: Refers to features (such as sediments, landforms, plant communities, or animal communities) that were formed by or are associated with a lake.
Landform: A land feature, such as plain, plateau, or valley, formed by a particular geologic process.
Life form: Characteristic structural features and growth pattern of plant species (e.g., broad-leaved deciduous shrub).
Litter layer: Relatively undecomposed organic matter and debris on top of soil layer.
Loading: The amount of a pollutant or other substance delivered to a lake, usually expressed as a weight per unit time (i.e. pounds per year). The loading of a given constituent to a receiving water is a function of the volume of incoming water and the concentration of the constituent in the incoming water.
Loess: Fine material consisting predominantly of silt with fine sand and clay. Loess is often deposited by wind.
Macrophytes: Higher plants which grow in water, either submerged, emergent, or floating. Reeds and cattails are examples of emergent macrophytes.

Marsh: A plant community of shallow wetland basins, dominated by herbaceous, emergent aquatic plants such as cattails and bulrushes. Marshes usually have standing water throughout the growing season.
Meltwater: Water released by melting glacial ice.
Mesic: A general term describing upland habitats that are intermediate between wet and dry; also used to describe plants and plant communities that occur in mesic habitats.
Mesotrophic Lake: Midway in nutrient levels between eutrophic and oligotrophiclakes.
Microhabitat : A small, specialized habitat.
Mineral soil: A soil composed mostly of inorganic matter, including clay, silt, sand, and gravel. Mineral soils usually have less than 20% organic matter but may have organic surface layers up to 12 inches thick.
Minerotrophic: A general term describing wetlands with nutrient levels that fall between very low (such as in bogs) and very high (such as in seepage meadows).
Mitigation: Actions taken to reduce an impact. Water quality mitigation measures can be non-structural (such as street sweeping, regulation of fertilizer use, and creation/protection of natural buffers to filter runoff) or structural (such as installation of detention basins). Properly designed detention basins are among the most effective and reliable measures for mitigating the water quality impacts of urban developments.
Model: A mathematical representation of an event or process.
Moraine: Rock and mineral debris deposited directly by glacial ice. Moraines most often consist of unsorted rock and mineral particles.
Muck: A dark-colored organic soil of highly decomposed plant material in which the original plant parts are not recognizable.
MUSA (Metropolitan Urban Service Area): The area designated by the Metropolitan Council of the twin cities area to receive urban services such as central sewer, urban streets, etc.
Native habitat A habitat formed and occupied by native plants and animals and little modified by logging, farming, ditching, flood control, and the like.
Native species: A species that occurs naturally within a given region.
Native vegetation: Vegetation composed of native plants, that has been little modified by human activities such as logging, farming, ditching, or the introduction of nonnative species.
Natural area: Geographic area in which the dominant plants and animals are native species.
Natural community: An assemblage that tends to recur over space and time of native plants and animals that interact with each other and with their abiotic habitats in ways that have been little modified by nonnative plant and animal species. Natural communities are classified and described according to their vegetation, successional status, topography, hydrologic conditions, landforms, substrates, soils, and natural disturbance regimes (such as wildfires, windstorms, normal flood cycles, and normal infestation by native insects and microorganisms).
Nonnative species: A species that has been introduced to an area by humans or that is present in the area as a result of human-caused changes.
Non-Point Source Pollution: Refers to pollution other than that caused by discharge of pollutants through a pipe from a closed system to a receiving water. Pollution caused by runoff from farm fields or paved streets are examples of this non-point pollution.
Normal Water Level (NWL): The elevation of the surface of the standing water pool within a pond or wetland. Generally, the NWL is the elevation of the bottom of the primary outlet pipe or overland flow channel. Nutrient Budget: An itemized estimate of nutrient inputs and outputs (usually for a period of one year), taking into account all sources and losses.
Nutrient Loading: The input of nutrients to a lake
Nutrient Trap: A type of pond or wetland that is effective at removing nutrients from water.

Nutrients Elements such as phosphorus and nitrogen that are required for plant growth. When excess amounts are transported in stormwater they may encourage excessive algae or other plant growth in receiving water bodies.
Oligotrophic Lake: A relatively nutrient-poor lake, usually clear and deep with bottom waters high in dissolved oxygen.
Open-grown tree: A tree that has matured in an open setting, such as a prairie or savanna. Open-grown trees tend to have broad crowns and thick, spreading lower limbs.
Organic soil: A soil in which the upper surface layers contain more than 25% organic matter.
Outcrop: Bedrock that projects above the soil.
Outwash plain: A plain formed of sorted and stratified material-such as layers of sand and gravel-carried from an ice sheet and deposited by glacial meltwater.
pH: A measure of the acidic or basic nature of the water; it is defined as the logarithm of the reciprocal of the hydrogen-ion concentration in moles/liter.
Parent material: The weathered rock or partly weathered soil material from which topsoil develops.
Parts per billion (ppb): a unit of concentration, sometimes expressed as micrograms per liter (ug/l).
Parts per million (ppm): a unit of concentration, sometimes expressed as milligrams per liter (mg/l).
Peat soil: A dark brown or black organic soil consisting largely of undecomposed or slightly decomposed plants. Peat soils usually form where persistent excessive moisture slows or inhibits the decay of plant material.
Persistent vegetation: Wetland vegetation formed by emergent hydrophytic plants with stems that normally remain standing until the beginning of the following growing season (e.g., cattails and bulrushes).
Phosphorus: A nutrient essential to plant growth. Phosphorus is the nutrient most commonly limiting plant growth in lakes.
Phosphorus Export: The amount of phosphorus carried off of a given area of land by stormwater.
Phytoplankton: Open water algae; it forms the base of the lake's food chain and produces oxygen.
Prairie: An upland plant community composed of grasses and forbs. Prairies generally lack trees; shrubs, if present, are not prominent.
Presettlement:A term used for convenience to denote the time period before Euro-American settlers moved into the Region. The Region was actually settled by American Indians for thousands of years before European-Americans arrived.
Range (geographic): The limits of the geographic distribution of a species or group.
Rate Control: A term that refers to controlling the rate at which water is discharged from a watershed. Rate control is often accomplished by creating ponds-either by excavation or berming - to temporarily store runoff, then discharging the stored water at a slower rate to downstream areas. Further reductions in the rate at which water is released from a pond can be accomplished by reducing the size of the outlet, such as through installation of a wall in the outlet structure with a hole (orifice) through it.
Reintroduced species: Species that had been eliminated from areas where they occurred historically and were later released back into the area by humans.
Remnant: A portion or fragment of a natural community that has survived while the rest of the community has been destroyed by logging, urban development, clearing of land for cultivation, and other human activities.

Residence Time: The amount of time it takes for water flowing into a lake to equal the lake volume. The shorter the residence time, the more incoming water the lake is receiving relative to its volume.
Rhizome: A horizontal underground plant stem.
Savanna: An upland plant community formed of prairie herbs with scattered trees or groves of trees. The canopy cover of trees in a savanna is generally between 10 and 70%.
Secchi Disc: A device measuring the depth of light penetration in water, typically a 9-inch, white circular plate attached to a rope. Used to measure water transparency.
Sedge: Any of a number of grasslike plants of the family Cyperaceae.
Sedimentation: The process by which matter (usually soil particles) settles on a substrate following transport by water, wind, or ice.
Seepage: The slow, diffuse oozing of groundwater onto the earth's surface.
Shallow Lake: Lakes with mean depth of less than 10 feet
Shrub layer: A vegetation layer, usually less that 6 feet high, of shrubs and tree seedlings.
Shrub swamp: A wetland community dominated by a nearly continuous to continuous canopy (70 to 100% cover) of shrubs, such as willows and alders.
Subcanopy: A vegetation layer, composed of patches of individuals of approximately equal height, that is lower than the canopy layer; often refers to a layer of saplings, tall shrubs, or small trees between 6 and 35 feet high.
Submergent: Describes an aquatic plant that grows entirely under water.
Substrate The surface layer of organic or mineral material-such as till, outwash, or bedrock-from which the soil is formed.
Succession: The change in vegetation over time.
Swale: A broad, shallow depression in a till plain or broad river plain.
Swamp: A wetland community with a fairly continuous to continuous canopy of shrubs or trees, such as speckled alder, black ash, or tamarack. Swamps generally occur in shallow basins or wet depressions.
Talus: Rocks and other coarse mineral debris that accumulate at the base of a cliff or steep slope.
Terrace: A sandy and gravelly alluvial plain bordering a river. Terraces represent former river floodplains, left stranded when the river level dropped because of channel downcutting or decreased flow. Terraces are ordinarily level or nearly level and are seldom flooded.
Till: Unstratified and unsorted material deposited directly by a glacier. Till consists of clay, sand , gravel, or boulders mixed in any proportion.
Till plain: A broad and level or gently undulating landform composed of material that was deposited underneath and at the margin of a glacier as the ice sheet melted; also referred to as a ground moraine.
Total Phosphorus (TP): A measure of all of the different forms of phosphorus in water. Includes phosphorus dissolved in the water, suspended or incorporated in algae or other organisms.
Total Suspended Solids (TSS): Particulate material which floats in or is carried along in water (e.g., algae, soil particles).
Transitional habitat: A habitat present between two adjacent natural communities (for example, the edge of a forest along a wet meadow). Transitional habitats often have features that set them apart from the habitats formed by either of the adjacent communities.
Trophic State: The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, or depth of light penetration.
Understory: The vegetation occurring below the canopy in a plant community.

Vine: A plant with a long, weak stem that grows along the ground or climbs on other vegetation for support.
Watershed: The area of land draining into a specific body of water.
Water Transparency: A measure of the clarity of water. The depth at which an object can be seen in water.
Wetland Habitats: where the soil is saturated or covered with water for part of the year.
Woodland: A wooded habitat characterized by an interrupted tree canopy; also used as a general term to describe any tract of land with trees growing on it.
Woodland-brushland: An upland plant community composed of a patchy canopy (10 to 70% cover) of mature trees and a dense understory of shrubs, tree shoots, and saplings. Usually the trees occur in scattered groves with dense thickets of brush between them.