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8 January, 2003

Mr. Tom Link
Community Development Director
City of Inver Grove Heights
8150 Barbara Avenue
Inver Grove Heights, MN 55077

Dear Tom,

Attached please find the Final Report for the Inver Grove Heights Northwest Area Natural Resource Inventory and Management Plan.

This report contains information that will be important for the city staff, its citizens and others as they look to plan the future in this area of the city. Planning that can include natural areas, greenway corridors, trails, and other important amenities that contribute to a healthy, livable, and efficient community.

The city and its citizens have a great many opportunities before them to positively influence natural areas in this growing part of the city and we encourage the full use of the information contained in this report.

On behalf of everyone who has worked on this project at Bonestroo Natural Resources, we would like to express our sincere appreciation for the opportunity to assist you on this important project.

Sincerely,

BONESTROO, ROSENE, ANDERLIK, & ASSOCIATES, INC.

Paul J. Bockenstedt

Paul J. Bockenstedt
Plant/Restoration Ecologist

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PREFACE

"Inver Grove Heights has evolved into a unique community, an element of pride to the City's residents. Factors that establish Inver Grove Heights as a unique community including its sense of history, its location along the Mississippi River and its natural features, will be reflected in future growth"

Inver Grove Heights' rural character is evident in the development pattern that exists today. Future development will reflect the community's rural heritage by providing open space and protecting key natural features."

- *Inver Grove Heights Comprehensive Plan*

These two guiding principles, found in the beginning of the Inver Grove Heights Comprehensive Plan are key to the City's future. The City initiated the Natural Resources Inventory to put these Guiding Principles into action.

The Natural Resources Inventory is Critical to how our future community and neighborhoods will look and how future citizens will live, work, and play. The Natural Resources Inventory is an accurate and detailed tool that proactively identifies and prioritizes natural resources. The Natural Resources Inventory is a versatile document that presents opportunities to protect and manage natural resources while providing for future development. The Natural Resources Inventory is the first step, a building block, that will lead to further environmental analysis, flexible land use planning, innovative land use and environmental regulations, and sensitive design of infrastructure and developments.

Inver Grove Heights citizens, through the work of the Local Advisory Committee and Northwest Area Task Force, urge that the Natural Resource Inventory be used frequently by the City Council, Planning Commission, Environmental Commission, City staff, developers, property owners, and the general citizenry to guide development decisions and implement the Guiding Pinciples of providing open space and protecting key natural features.

Northwest Task Force (2003)

Scott Edgerton – Property Owner

Warren Krech – Citizen

Joe Jacoby – Property Owner

Doug Knapp – Environmental Committee

Bill Nicols – Property Owner

Dan Oren – Property Owner

Herb Pilhofer – Property Owner

Pat Rettler – Planning Commiittee

Pat Simon – Property Owner

Local Advisory Committee (1999-2000)

Vance Grannis III –Planning Commission

Douglass Knapp –Environmental Commission

Alice Lesney – Environmental Commission

Dennis Madden – Planning Commission

Paul Mandel – Planning Commission

Eldon Marier - Commission

Rich Hiner - Developer

Steve Ryan – Developer

EXECUTIVE SUMMARY

This report presents the Inver Grove Heights Northwest Study Area Natural Resource Inventory and Management Plan. It represents the culmination of work that began in 1999 and was completed in the fall of 2003, following a quiescent period of approximately three years.

The field inventory work for this project was conducted in the summer of 1999. Upland natural areas were inventoried using standardized methodologies developed by the MN DNR, while wetland areas were evaluated using the Minnesota Routine Assessment Method (MnRAM) 2.0 methods. Using these standardized and widely regarded methods allowed for objective evaluation of natural areas. The rankings developed by these two methods were then converted into a Natural Resource Inventory Rank to allow for the placement of all natural areas on a single ranking scale. Select semi-natural areas (conifer plantations/old fields) encountered in the study area were also inventoried for their composition apparent function at this time.

During late 1999 a Local Advisory Committee was formed to provide local values input to the process. Information generated from the field inventory regarding natural area location/quality was shared with this group. Committee members were then engaged in discussions about their local perspective on what characteristics of natural and semi-natural areas they felt were important for future management and/or protection. A major contribution of this group was the decision making flowchart found in Section 4 of this report, where committee members added, edited, or removed decision making boxes to determine the final Management Class of individual plant communities found in the study area.

At this time, the committee also provided input on items such as the location of Conceptual Greenways within the study area and recommended Management Standards for plant communities.

Conceptual Greenways were developed with an eye toward possibilities for maintaining or linking natural and semi-natural areas, enabling the greatest ecological function. Conceptual Greenway alignments developed during this project are generally consistent with those defined during the North Dakota County Greenway project conducted by the Dakota County Soil & Water Conservation District in 2001.

Recommended Management Standards created with Local Advisory Committee input suggest that the level of protection provided to individual plant communities in the study area be based on its Management Class (derived from NRI rank + local values input). These standards outline potential approaches to proactively evaluate opportunities to avoid, minimize, or mitigate damage to natural areas.

The report also contains potential steps the city can take to manage and/or protect natural areas and their function in the study area through a variety tools. These vary from the creation/modification of policy at the city level, public-private-non-profit partnerships, and by simply sharing natural resource management-related information with citizens.

The result of this initial effort in 1999-2000, including input from the public at an Open House and the Local Advisory Committee was the production of a Natural Resource Inventory draft report in 2000. At that time, it was determined that the best course of action for the city and its residents was to delay publication of a final report until other related issues in the study area such as surface water management and land use planning could be appropriately evaluated.

The project was reinitiated in the fall of 2003. At this time the City Council referred the NRI to the Northwest Area Task Force and an updated Draft Report was published. Over the course of three meetings in as many months, the committee provided additional input on a variety of subjects within the draft report including the evaluation of natural and semi-natural areas, Local Value Criteria Flowchart for determining Management Class of plant communities, Management Standards, defining conceptual greenways, and recommended sites for proactive management/protection, and others.

The 2003 committee recognized the importance of high quality natural areas. They also voiced the importance of valuing areas referred to in the report as semi-natural areas (e.g. conifer plantations) for linking existing natural areas, providing aesthetic beauty and wildlife habitat, as well as contributing to the unique character of the study area.

The 2003 committee recognized greenways have the potential to play an important role in linking and preserving open space. They also see the value of recreational corridors and suggested that future greenway planning in the city may see recreational amenties in corridors such as trails, but recreational corridors and natural corridors may not share the same alignment in some locations. They also noted that due to major wildlife movement barriers in the study area (e.g. Highway 55, and Interstate 494), as well as the somewhat rural residential character of the area, movement of wildlife through greenway corridors may be limited at the scale of the study area and beyond.

There are a number of elements that contribute to quality of life in any community. Important among these are natural resources and open space as well as affordability, infrastructure, good schools and others. Natural areas provide important amenities to the community and contribute strongly to the *sense of place* that residents come to know.

This important resource provides solid information that the city, its citizens, and others can utilize to conserve the unique natural heritage of the Northwest Study Area. It has the potential to advise wise land use and natural resource management decisions in the northwest area of Inver Grove Heights for years to come. We therefore encourage making full use of its potential.

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1. INTRODUCTION

1.1 GENERAL

The citizens of Inver Grove Heights have a strong interest in maintaining the quality and values that drew them to the City, and that they still experience living in Inver Grove Heights. Some of these values are associated with the natural landscapes such as forest, prairies, and wetlands. These areas contribute to the quality of life in Inver Grove Heights by providing opportunities for active and passive recreation, wildlife habitat, stormwater infiltration, and management opportunities, and can serve as buffers between developing areas of the City. The aesthetic qualities and desirability of these natural areas increases the value of properties located near them.

The Northwest Expansion Area of Inver Grove Heights covers approximately 3,140 acres. The landscape that we know today was shaped by ancient geology and climate, the power of glaciers, flowing water, plant and animal migrations, and by people. Native peoples used the area for thousands of years, followed by European settlers in the mid-nineteenth century.

Despite its close proximity to St. Paul, much of the City has experienced only minimal urban development, and still contains a mixture of cropland, forests, and wetlands, with scattered remnants of oak forest and woodland, and prairie vegetation. We can still read much about the history and natural wealth of the area in the landscape, even as the City grows and changes.

Many cities in the Metropolitan Area have lost the high quality natural resources that remain in Inver Grove Heights, and are seeking to protect the remaining fragments or, in some cases, undertake restoration projects. When cities are fully developed or nearly so, such protection and restoration often comes at a high cost. Once lost, some resources cannot be restored, or can only be restored at a high cost.

The City Council of Inver Grove Heights and its commissions have acknowledged the need to inventory and plan for the significant natural areas that remain in the City, and to effectively integrate these features into the decision making process as the City develops.

One of the best ways to maintain the distinctive character and quality of life in the Northwest Expansion Area is by creating a strong natural resource management program. This ensures that the City can grow while retaining the natural features that attracted many people to the City.

For the purposes of this inventory, ”natural areas” are those dominated by plants and animals native or indigenous to the Inver Grove Heights area. Semi-natural areas are referred to in this report as those plant assemblages created largely as a result of human intervention and generally consist of plant species that are not native to the region and/or are largely disturbance-adapted native species.

The term “natural community” is also used in this report. A “natural community” is a distinctive group of plants and animals that usually occur together, and are native to the area, such as a bedrock bluff prairie or dry oak forest. Each of the “natural areas” may contain one or more “natural communities”.

While many areas of the City, including farms and residential properties, have some ecological and historic value, this inventory was designed to focus only on the most natural areas (that is, those least disturbed by human activities). Where cultural features occur in natural areas, these features are evaluated as part of the local value evaluation methodology and are referenced in the natural area site descriptions.

This inventory and its recommendations suggest that the natural areas of Inver Grove Heights be evaluated on an ecological basis. Simply put, **an ecosystem (or habitat) is where things live. An ecosystem includes the inter-acting group of physical elements (soil, water, etc.) and biological elements including plants, animals, and human communities.**

These elements and their linkages are considered in the inventory and recommendations for the natural areas in Inver Grove Heights. This holistic approach focuses on protecting and managing all parts of the ecosystem rather than focusing on a single species.

The standards and recommendations put forth in this report suggest managing an ecosystem by integrating scientific knowledge and human values toward the general goal of protecting the health of the landscape in the study area for the long-term.

Science suggests that a key measure of ecosystem health is the diversity of native plants and animals present in a given area. Healthy, diverse ecosystems are a desirable goal because they provide for the basic needs of all living things, and allow the landscape to adapt to changing conditions.

Urbanization and other large-scale human activities typically reduce the native diversity of landscapes, replacing woodlands and prairies with lawns and boulevards planted to non-native trees, shrubs, and grasses.

Landscapes dominated by non-native plants often have difficulty surviving drought and disease. In addition, the unique local plant communities, once lost, no longer serve to express the local character of the City of Inver Grove Heights.

1.2 STUDY AREA

The study area for this Natural Resource Inventory and Management Plan is referred to as the Northwest Expansion Area. It was identified in the City's Comprehensive Plan as an area of future development. The extent of the study area is defined by the proposed five year phasing for expansion of the Metropolitan Council's "Metropolitan Urban Sevice Area"(MUSA) between the years 2000 and 2020. A map of the study area, which totals approximately 3,140 acres is shown on the following page.

This portion of Inver Grove Heights is characterized by moderately to steeply rolling hills. Rural residential areas are common here and some active farming is still practiced in undeveloped areas. Areas of thin soils and steeper slopes unsuitable for rowcrops tend to be occupied by pioneer woodlands and planted pasture grasslands.

1.3 GOALS AND OBJECTIVES OF THE INVENTORY

It is the goal of the City Council of Inver Grove Heights and its commissions to plan for the management, protection, and/or enhancement of the remaining natural areas in the Northwest Expansion Area so residents may enjoy these amenities for years to come. This natural resource inventory is the first step toward attaining this goal.

1.3.1 Objectives

The specific objectives the City identified for this inventory include:

- Identify and inventory significant natural and semi-natural areas on a citywide basis.
- Utilize accepted criteria and evaluation methods to assess sites from both a scientific and local values perspective.
- Use the evaluation methodology to rank natural communities according to ecological and local values.
- Develop recommended standards for protection and/or enhancement of natural areas based on scientific and local values.
- Develop recommendations for management and protection of the natural resources based on ecological and local values.

Identify potential opportunities for connectivity of natural areas.

Refer to Study Location Figure

1.4 RATIONALE FOR MANAGING NATURAL RESOURCES

There are many reasons why it is important to manage natural resources in an urbanizing area. Some of the most important reasons are:

- **Natural areas are an important part of the quality of life that we all share.** It is in our best interest to be wise stewards of these resources that contribute so much to our lives and provide us with *sense of place*: Landscapes tell us we're *home*.
- **The natural areas of Inver Grove Heights are found nowhere else in the world**. The unique combination of plant communities and landforms can enchant visitors as well as attracting and retaining residents. Natural areas and parks are important community assets.
- **Native plant and animal species and natural communities have adapted together for a long time, and are particularly suited to this environment.** Over the long term, they will maintain a healthy landscape that can adapt to disease, weather extremes, or other natural disturbances. They generally require less management than nonnative species (e.g. lawns).
- **Natural communities of moderate to good quality are rare** in the Twin Cities Metro Area and in the state, and are worth protecting and enhancing. It is difficult, costly, and sometimes impossible to recreate these communities "from scratch". Such areas can serve also as a source of native seed for restoration of degraded areas.
- **Real estate adjacent to high-quality natural areas commands higher value than those without such amenities**. These properties also tend to hold or increase their value over time, as high quality natural areas become scarcer on a regional basis. Some corporations also look for such nearby amenities for locating headquarters or to provide a high-quality setting for their businesses.

1.5 GUIDING ECOLOGICAL PRINCIPLES

Some ecological principles that are important components of protecting or enhancing natural areas in the City of Inver Grove Heights include the following:

- **The health of natural communities depends on their size.** In general, smaller and more fragmented communities support fewer species, are more vulnerable to extinction and invasions, and are less able to maintain or recover their diversity, particularly if other sources of native populations are not available nearby. *Planning, therefore, emphasizes improving*

connectivity, avoiding fragmentation of contiguous habitats, protecting natural waterways, and identifying and protecting critical habitats. Connections among communities along natural corridors may help to maintain diversity and health by allowing plants and animals to migrate and reproduce.

- **People are part of nature.** The decisions and actions of humans has been a major force shaping the natural resources of Inver Grove Heights for a long time. Humans and their values must be an important component in shaping the future of natural areas in the City. Planning for integration of residential and commercial land uses with natural areas should consider the use of buffers, recreational uses, and educational opportunities in the natural areas.
- **Species are interdependent.** Further, our knowledge of all the interactions within natural communities is limited. Therefore, planning should be focused on maintaining healthy, natural communities and the processes that sustain them and "saving all the parts", since we don't always understand how all components function.
- **Exotic species degrade natural communities.** Introductions of exotic species (plant and animal species not native to the area) reduce native diversity, the quality of habitat, and the health of natural areas; therefore, exotics should be excluded or controlled.
- **Consider ecological boundaries and a long time frame.** Surrounding areas may influence the health of natural areas in the City. For example, the activities in the South Washington Watershed outside Inver Grove Heights will influence the future of Inver Grove Heights Ravine and water bodies within the City. The ways in which Inver Grove Heights and its residents care for the landscape can influence bird species seen in other areas of Minnesota and the continent. These connections should be understood as much as possible to assist the City in planning for its own resources.

2. PHYSICAL ENVIRONMENT

The natural resources of the Northwest Expansion Area include the soils, water, plants, animals, and people that are within the City. The particular resource elements present in the City 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 describes the role these interactions have played in determining the present day composition of natural communities and landscapes in Inver Grove Heights.

2.1 GEOLOGY

The geology of the region surrounding the Northwest Expansion Area is largely the result of two geologic processes:

- Deposition of sediment in warm, shallow seas over millions of years, forming sedimentary rock layers.
- Continental glaciers that have deposited large amounts of unconsolidated material on top of the sedimentary rock layers.

Bedrock Geology

The history of the city's landscape begins around 500 million years ago, when much of Minnesota was covered by water, and the sedimentary rock layers that lie under the City were formed. These rock layers date from the Upper Cambrian to Middle Ordovician ages, approximately 450 to 500 million years ago. Different layers of rock present in the study area include Jordan sandstone, Prairie du Chien limestone, and St. Peter sandstone.

Surface/Glacial Geology

The surface topography of Inver Grove Heights was shaped by the last period of glaciation in the Twin Cities Area, which occurred about 10,000 years ago, and was called the "Wisconsin Stage". The glaciers sculpted the landscape, and left behind a variety of deposits, commonly called "drift".

During this period glaciers up to several thousand feet thick advanced over and melted back from the study area several times. The material left behind by the glaciers included sand, gravel, silt, and boulders. Some of the deposited material would be sorted by size after having been transported by wind and/or water. However, much of the study area consists of glacial deposits known as till, where boulders, sand, gravel, and silts may occur in an unsorted arrangement.

In the most recent glacial ice advances, ice moved over the area from the northwest, extending just to the south of the study area.

2.2 LANDFORMS

Almost the entire study area is characterized by moderately to steeply rolling hills of the St. Croix Moraine Complex. The irregular arrangement of these hills creates numerous depressions with no outlet. The very southwest portion of the study area is moderately rolling, a characteristic often associated with the landform known as the Rosemount Outwash plain.

2.3 SOILS

According to the Natural Resources Conservation Service (NRCS), there are two major *soil associations* found in the study area. These include the Waukegan-Wadena-Hawich association in the southwestern most part of the study area and Kingsley-Mohtamedi association elsewhere in the study area.

The Waukegan-Wadena-Hawich association includes soils formed in silty and loamy sediments over sandy outwash. They occur on level to very steep slopes and are well-drained to excessively well-drained in character.

The Kingsley-Mohtamedi association soils are well-drained to excessively well-drained and formed in sandy glacial till in the study area.

2.4 GROUNDWATER

Within the study area, there are several aquifers. Three of these aquifers are currently being utilized, including 1. the quaternary (water table) aquifer found in Surficial glacial deposits, 2. the St. Peter aquifer in the uppermost layer of bedrock, and 3. the Prairie du Chien-Jordan aquifer that occurs respectively in dolomite and sandstone. City wells in Inver Grove Heights utilize the Prairie du Chien-Jordan aquifer, with the exception of one well that draws from the Hinckley sandstone aquifer.

The St. Peter and Quaternary aquifers are utilized primarily as domestic well sources. Quaternary aquifer well yields and water table elevations depend on local conditions.

Within the study area, groundwater flow in the Prairie du Chien-Jordan and St. Peter aquifers is generally to the east and northeast. In the Quaternary aquifer groundwater movement is influenced by local conditions, including lakes and wetlands.

Bedrock groundwater elevations within the study area range from about 780 feet above sea level in the southwest to about 750 feet above sea level in the northeast.

In addition to the known aquifers, there are likely numerous areas of locally perched groundwater in the study area. The perched groundwater occurs above deposits of low-permeability clay/silt. These clay/silt deposits are typically limited in extent and can be expressed at the surface in rolling topography as wetlands, ponds, or springs.

2.5 LANDUSE

Typical of many areas in the region, the study area is experiencing substantial commercial and residential growth. This type of growth typically results in periods of transition for commuities.

For the purpose of this part of the report, the study area is divided into four quadrants divided by Robert Trail and 70th Street. More detail is provided in the City's Comprehensive Plan.

The descriptions of land use in this report, is based on observations made by project team members and the terminology may not reflect terms used in the city's Comprehensive Plan.

The northwest quadrant is a mix of agricultural land and open space surrounding rural residences. Along Argenta Trail, just north of 70th Street, there is an area of low density residential housing. Interstate 494 traverses the northwest corner here.

The southwest quadrant is similar in character to the northwest. Trunk Highway 55 is oriented roughly east-west through the middle. There is an active pit mining operation for aggregate just northwest of the intersection of Robert Trail and TH 55.

The southeast quadrant supports some agricultural land use, but ithis is limited to an area between TH 55 and Old Courthouse Boulevard. The rest of the area south of TH 55 consists of low-density residential development, some of which surrounds the upper lakes of the Marcott chain. North of TH55, land use is dominated by Inver Wood Golf Course, with the remaining area a mix of open space and low-density residential.

The northeast quadrant is mostly open land surrounding rural residential development. Also, there is a large tract of open grassy space that is owned by the city, referred to as the Harmon Property. There is also low-density residential development around the north half of Dickman Lake and the southeast corner of this quadrant.

2.6 SENSITIVE RESOURCES

Fish and Wildlife

According to a search of the Minnesota Department of Natural Resources Natural Heritage Database in 2000, there were no known State- Endangered, Threatened, or Special Concern species; animal aggregations, or unique natural resource features within the study area.

Community Resources

Community resources typically include archaeological, historical, and cultural resources. According to a searchof the State historic Preservation Office (SHPO), there are no known records of unique/significant cultural resources in the study area.

DNR Protected Waters

Certain wetlands and water bodies are under the jurisdiction of the MN DNR, based on size/type criteria. There is a total of 21 DNR Protected Waters in the Study Area.

Steep Slope Analysis

As part of this project, a steep slope analysis was conducted. This was performed with Arcview GIS, using Dakota County soils data and Dakota County 2 foot contour data. Areas with slopes of 15-40% were initially located by associated soil type, and the results of this analysis were verified against the contour data.

The results of this analysis are illustrated on the following page.

Refer to Steep Slope Analysis Figure

3. NATURAL COMMUNITIES

3.1 DEVELOPMENT OF VEGETATION

Post Glacial Development

The topography, soils, and pattern of streams, lakes and wetlands that resulted from glacial activity greatly influenced the pattern of vegetation communities that developed later in Inver Grove Heights. Existing plant communities such as Oak Savannas and Prairies are well-adapted to the well-drained soils and rolling topography of the city's uplands, while mixed forests flourish on cooler slopes, and wetlands, lakes and streams remain in low depressions and valleys with denser, hydric soils.

Immediately after the glaciers melted, spruce trees and tundra plants developed around the margins of the glaciers, followed by pine barrens and forests with a bracken fern understory. As the climate of the region warmed about 9,000 years ago, pines began to decline, and prairie herbs increased, along with elm and oak forests. The climate continued to warm until about 7,000 years ago, when mid-grass prairie reached its maximum extent in Minnesota, and covered most of the Twin Cities region, including Inver Grove Heights.

Prairie, oak woodlands and brushlands, and oak forests dominated the Region until about 4,000 years ago, when the climate became cooler and moister, Oak thickets spread, and oak woodlands gradually dominated upland areas, interspersed with tall grass and wet prairies. White pines also migrated into the area as the climate cooled. About 300 years ago, the climate became especially moist and cool, and extensive forests of elm, sugar maple, and basswood developed in eastern Minnesota. The major patterns of vegetation in the Inver Grove Heights area at the time of European settlement were then in place.

At the time of settlement, around 1840-50, the landscape of Inver Grove Heights probably included a rich variety of plant communities including various types of wetlands in low areas and oak woodlands, brushlands and prairies on drier uplands. Within ravines and on cooler north-facing slopes, denser forests of mixed species were more common.

Native American Influence

Ideas about the history of American Indians and their influence on the local landscape are still evolving. American Indians have probably inhabited and hunted in the area for over 10,000 years. While their impacts were not as great as those of European settlers, American Indians used a wide variety of plants and animals for food and altered vegetation patterns by cultivation and by setting fire to vegetation. The Indians (and European fur traders) used fire to hunt game, create desired game habitat, to clear the landscape for travel, communication and defense, and to obtain firewood. While some fires in the region

occurred naturally, the activities of American Indians probably increased the frequency of fires-prairies near the Mississippi River may have been burned annually. Prairies and savannas are fire-dependent plant communities, and would most likely not have been present in the Twin Cities Area at the time of European settlement without these fires.

European Settlement Influence

As the City developed after the mid-1800s, more intense human activities began to change the landscape and natural communities. In Dakota County today, more than 90 percent of the native landscape has been removed by human activities; only a few percent of the land cover in the county remains in native communities. These alterations have included the following:

- Roads and railroads began to fragment forests and other communities, for example separating the Mississippi River floodplain from upland areas and habitats.
- Agriculture affected hydrology by draining wetlands and altering creeks. Farmers altered upland vegetation communities 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 areas and substitution of communities of low diversity and dominated by non-native plants, such as smooth brome. Soil erosion increased where native cover was removed, adding sediments to creeks, wetlands, and lakes.
- Urbanization continues to fragment natural communities further with the addition of more roads, streets, and utilities. Construction of all types altars and compacts soils, and changes the local hydrology. Large areas of impervious surface, coupled with the drainage of wetlands, increases the amount of stormwater runoff and pollutants carried to local waters.

Additional non-native, aggressive species like buckthorn have been added as landscape materials. Changes in habitat and the increasing presence of humans in the landscape has brought changes in animal populations, decreasing or eliminating some species bobolinks and bison, and favoring others such as the nonnative house sparrow and native white-tail deer.

Urban development will continue in Inver Grove Heights, and is a part of the city's future. It is useful, however, to understand the changes that urbanization brings to the landscape, identify areas that residents find most valuable for their natural character, and plan how the area will develop to successfully protect and integrate these values along with the expected growth.

Physical Influences

Plant communities that exist in any given area are the result of numerous biotic and abiotic factors. These work in concert to influence plant communities in often subtle ways (presence/absence of pollinators), but some of the influences can have rather dramatic and

immediate effects (drought, tornado). Biotic factors can include such varied things as the presence/absence of pollinators, burrowing activities, herbivory, or over utilization of an area by a single species or number of species. Of the abiotic factors, two have a consistently strong influence in the shaping of plant communities. These are climate and landform.

Climate

The climate of northern Dakota County is considered to be continental and sub-humid, with long, cold winters and relatively brief, warm summers. Wide fluctuations in temperature and precipitation also characterize the climate of the area. These fluctuations in temperature and moisture strongly influence the plant communities present in the region and require plants to be adapted to extremes, rather than averages.

Landforms

Landforms also have a profound impact on the type of plant communities found in any area. As was mentioned previously, the landforms of the Inver Grove Heights area are primarily glacial in origin. Direct glacial modification of the landscape, such as the deposition of till or moraine and the influence of glacial related processes, such as that of Glacial River Warren, have formed the vast majority of the landforms in Inver Grove Heights. Most of the deposited materials associated directly with glaciers, such as till and moraine, are unsorted. These consist of materials, which range in size from clay and fine sand to large boulders in a random arrangement. Overall, these materials tend to form well-drained landscapes that have the potential to exaggerate drought events, thus favoring more drought tolerant communities in upland areas.

In addition to the influences of climate and landform, landscape position also has a profound impact on the type of plant communities supported. Angle, position, and aspect of slope all strongly influence plant species that can be supported in an area. For soils and underlying materials (parent material) of similar character, some generalizations can be made. In general, steeper slopes tend to be doughtier; also, the higher the position on a slope the drier the conditions.

Slope aspect also plays a significant role since it exaggerates influences of the sun and evapotranspiration. As such, north-facing slopes tend to be moister, and south and southwest-facing slopes are drier. For these reasons, the droughty soils, and in particular south-facing slopes and higher positions on slopes tend to be occupied by prairie communities or dry bur/pin oak savannas. North-facing slopes, ravines, and other areas which better hold moisture have a tendency to be occupied by oak forests and maple-basswood forests.

3.2 DESCRIPTION OF NATURAL COMMUNITIES

The following is a brief description of the major natural community types that currently exist in the study area. The descriptions draw from field surveys in Inver Grove Heights, and from resources in *Minnesota's Native Vegetation: A Key to Natural Communities Version 2.0* (MN DNR 1993), and *Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats* (MN DNR 1995).

Most wetland community descriptions are from *Wetland Plants and Plant Communities of Minnesota & Wisconsin*, Second Edition – (Steve D. Eggers & Donald M. Reed). This resource serves as the foundation for plant communities in the MnRAM wetland assessment methodology.

Upland Communities

Dry Hill Prairies

These prairies were once extensive in Washington County on sandy, well-drained soils that formed on unconsolidated glacial drift. These communities are open grasslands with patches of forbs, and exposed soil areas that are often created by a combination of wind erosion and animal burrowing and digging activities. These communities are also strongly influenced by periodic fires and drought and tend to favor plant species dependent on fire for regeneration and are able to withstand droughty conditions.

Typical woody plants include prairie rose and leadplant. Characteristic graminoids and forbs include big and little bluestem, indian grass, side oats grama, prairie dropseed, and plains muhly. Characteristic forbs include rough blazingstar, plains paintbrush, stiff goldenrod, aromatic aster, hoary puccoon, butterfly weed, and large-leafed pussy-toes. Common animal species include mourning dove, field sparrow, western meadowlark, pocket gophers, red fox, American toad, and garter snakes. Threats include invasion by nonnative grasses such as Kentucky bluegrass and smooth brome, and invasion by woody plants.

Sand-Gravel Oak Savanna

These are relatively open communities of scattered, generally short, open-grown bur oaks above a layer of grasses and forbs. Trees may be widely scattered and found in groves with hazelnut or oak brush. Natural disturbances like gopher mounds and badger excavations are common. Common plant species include the tree species bur oak and northern pin oak; the forbs prairie rose, leadplant, butterfly milkweed, purple prairie clover, bird-foot violet, prairie sage, and various asters. Common grasses include little bluestem, big bluestem, prairie dropseed, and other short grasses.

Common animal species include mourning dove, indigo bunting, sparrows, squirrels, pocket gophers, and whitetail deer. Grazing or farming activities, which reduce grass and

forb species diversity and encourage exotics such as leafy spurge, European buckthorn, and sweet clovers, has often degraded these areas. Regular fires before settlement maintained these communities, and cessation of fires encourages the spread of woody shrubs such as sumac, prickly ash, European buckthorn, and red cedar. Many areas of Inver Grove Heights, which historically contained oak savanna, have today succeeded to oak woodland or forest. This succession has largely been brought about by the absence of fires; and differences in grazing influences among elk, bison, and domestic cattle.

Dry Oak Forest

A deciduous forest with oaks mainly under 50 feet, few subcanopy trees, a dense shrub layer, and patchy ground layer of moderate diversity. Typical canopy trees include northern pin oak, bur oak, and black oak, with black cherry, trembling aspen, and paper birch in the subcanopy. The shrub layer typically includes hazelnut, gray dogwood, gooseberry, and raspberries. The ground layer includes Virginia creeper, wild grape, bracken fern, wild geranium, Pennsylvania sedge, and a variety of spring ephemeral flowers.

Typical animal species include woodpeckers, chickadees, vireos, chipmunk, squirrels, and whitetail deer. Past logging may be indicated by absence of larger, single-stem trees and woody debris. Grazing and fragmentation by roads and trails often reduce diversity of shrub and ground species in forest communities, and encourage invasion by non-native plants. European buckthorn and tatarian honeysuckle are particular problems in dry oak communities.

Mesic Oak Forest

Canopy trees are typically taller in mesic oak forest than in dry oak forests, and northern pin oak is often replaced by red oak in the canopy. Large, single-stemmed trees more than 15 inches in diameter are common, with a variety of woody plants at all heights, and a mixed ground layer of seedlings and herbs. Common tree species include white, red, and bur oak with basswood, ironwood, butternut, bitternut hickory, black cherry, birch, and sometimes musclewood, in the subcanopy. Shrubs may include chokecherry, hazelnut, silky and pagoda dogwood, and other fruiting shrubs. The ground layer frequently includes wild grape, Virginia creeper, poison ivy, wild geranium, black snakeroot, and a variety of ferns and spring ephemerals, such as round-lobed hepatica.

Animals are typical of those found in other oak communities, including many songbirds, flycatchers, bluejays, chipmunk, squirrels, white-tail deer, a variety of frogs, and the American toad. Past logging and grazing may have removed canopy trees and reduced diversity in ground flora. Buckthorn and tatarian honeysuckle are common invaders, and oak wilt may spread in disturbed stands, particularly in areas of active construction.

Oak Woodland-Brushland

Oak woodland communities are characterized by a somewhat open canopy (intermediate between savanna and forest) dominated by open-grown bur and northern pin oaks and with

a pronounced shrub layer containing oak seedlings and sprouts. Oak brushland can have a shrub layer dominated by multiple stemmed oak “shrubs” caused by frequent top-killing of the stems, often by intense fires.

The ground layer includes herbs and other woody plants characteristic of both dry oak forests and prairie communities. Fire scars may be evident on older trees. Common plants include bur, and pin oaks, hazelnut, gray dogwood, and other fruit bearing shrubs, Virginia creeper, leadplant, hog peanut, bracken fern, pointed-leaf tick trefoil, and woodland sunflowers.

Animals include mourning dove, catbird, indigo bunting, squirrels, coyotes, and whitetail deer. Grazing, soil compaction, and suppression of fires have often degraded these communities. These activities lead to invasion by exotic species such as Kentucky bluegrass, European buckthorn, and tatarian honeysuckle. In Inver Grove Heights, the presence of these exotic species has significantly reduced species diversity of Oak Woodland - Brushland communities.

Lowland Hardwood Forest

A deciduous forest with a variable canopy, with coverage from 50 to 100 percent. Lowland hardwood forest occur on mineral soils and are often located near the margins of lakes and wetlands, in ravines, and at the base of north-facing slopes. Common tree species include, green ash, American elm, eastern cottonwood, basswood, and bur oak.

Subcanopy trees may include ironwood, red elm, and box elder. Common shrubs include red osier dogwood, pagoda dogwood, prickly ash, hazelnut, and gray dogwood. The ground layer may include Virginia creeper, ferns, sedges, woodland horsetail, green-headed coneflower, and jack-in-the-pulpit.

A wide range of common forest animals and birds use these forests as habitats. These forests have typically been degraded first by grazing or draining and later by the subsequent invasion of exotic plant species such as European buckthorn and reed canary grass. Logging and trail development also fragments these areas and spreads exotic species.

Wetland Communities

Many of the sites were comprised of more than one wetland community type. As mentioned above, except where indicated wetland community descriptions are from *Wetland Plants and Plant Communities of Minnesota & Wisconsin*, Second Edition – (Steve D. Eggers & Donald M. Reed). This resource serves as the foundation for plant communities in the MnRAM wetland assessment methodology.

Sedge Meadow

Sedge meadows are typically found in shallow depressions or on slightly sloping drainageways. The hydrology for sedge meadows is provided by groundwater, localized

surface runoff or quite often, a combination of both. As the name suggests, these wetlands are dominated by one or more sedge species. Along with sedges, there are frequently a few grasses and other grass-like plants such as rushes, bulrushes, and spikerushes. If adequate nutrients are available, a sedge meadow may have a moderately rich collection of forbs present. Depending on disturbance to the vegetation and hydrology, some woody plants may also be present.

Shrub Swamps

Shrub swamps are wetland plant communities dominated by woody vegetation less then 20 feet in height and a dbh of less than 6 inches. Shrub swamps of Minnesota and Wisconsin are categorized as shrub carrs and alder thickets depending on the dominant shrub species. Both occur on organic soils (peat/muck) as well as on the alluvial mineral soils of floodplains.

Seasonally Flooded Basins

Seasonally flooded basins are poorly drained, shallow depressions that may have standing water for a few weeks each year, but are usually dry for much of the growing season. These basins may be kettles in glacial deposits, low spots in outwash plains, or depressions in floodplains. They are frequently cultivated. However, when these basins are not cultivated, wetland vegetation can become established. Typical species include smartweeds, beggarticks, nut-grasses, and wild millet.

Wet Meadow

The MN DNR publication, *Minnesota's Native Vegetation: A Key to Natural Communities* describes Wet Meadows as follows: The ground layer is composed of a dense, closed stand of predominately wide-leaved sedge such as tussock, lakebank, and Hayden's sedges, and the grasses bluejoint, rattlesnake grass, rice cutgrass, and white grass. Common forbs include spotted joe-pye weed, boneset, mint, turtlehead, marsh milkweed and others. Shrub cover ranges from about 0 to 70 percent and is composed of several species of willows, and redosier dogwood. Wet meadows occur on wet mineral soil, muck, or peat. Standing water from several inches to one foot deep is generally present in the spring and after heavy rain, but the water table is generally at, or below the ground surface for most of the growing season. Draining, excessive water level fluctuation and nutrient influx, as well as removal of fire can all lead to a condition of lowered quality as descried by Eggers and Reed.

According to the description given by Eggers and Reed, Wet meadows are dominated by grasses, such as (the nonnatives) redtop and reed canary grass, and by native forbs such as giant goldenrod, growing on saturated soils. This description reflects a disturbed condition that is found in many wetlands today.

Shallow Marsh

Shallow marsh plant communities have soils that are saturated to inundated by standing water up to 6-inches in depth throughout most of the growing season. Herbaceous emergent vegetation such as cattails, bulrushes, arrowheads, and lake sedges characterize this community.

Deep Marsh

Deep marsh plan communities have standing water depths of between 6-inches and 3 or more feet during the growing season. Herbaceous emergent, floating, floating-leaved, and submergent vegetation compose this community, with major dominance by cattails, hard-stem bulrush, pickerelweed, giant bur-reed, *Phragmites*, wild rice, pond weeds and/or water lilies.

Shallow Open Water

Shallow open water communities are ponds and small lakes whose margin accommodates the shallow and deep marshes and usually range between three and six feet of standing water. They are rarely if ever completely drawn down. As with most wetlands, these communities rely on a combination of groundwater and runoff for hydrology and groundwater only during extended dry periods.

Emergent vegetation is practically absent, leaving a dominance of submerged, floating and/or floating-leaved vegetation as described above. Habitat is provided for limited types of wildlife, but is very important for fish and waterflowl. Due to the generally stable standing water levels these wetland types tend to host an increase in wildlife when other wetland types dry up.

Hardwood Swamp

Hardwood swamps are forested wetlands dominated by mature conifers and/or lowland hardwood trees. They are usually associated with ancient lake basins and retired riverine oxbows. The wooded swamps of Minnesota and Wisconsin are divided into two types depending on whether the dominant trees are conifers or hardwoods. Inver Grove Heights does not contain coniferous swamps and the hardwood swamps are generally the outside ring of wet meadows or shallow marshes.

Hardwood swamps are dominated by deciduous hardwood trees and have soils that are saturated during much of the growing season, and may be inundated by as much as a foot of standing water. Dominant trees include black ash, red maple, yellow birch and, south of the vegetation tension zone, silver maple. The shrub layer of hardwood swamps is often composed of shrub-sized individuals of the dominant tree species, as well as the dogwoods and alder species of shrub swamps. Ground layer species include some of the ferns, sedges, grasses and forbs of sedge meadows and wet meadows.

Seasonally Flooded Basin

These wetlands occur on poorly drained soils, typically as shallow basins that may experience surface water and/or saturated soils for perhaps only a few weeks each year. Seasonally high groundwater levels, surface water runoff or a combination of these two provide hydrology for these basins.

Due to the wide range of hydrologic conditions present within and among these basins, the vegetation they support can also vary widely. However, these basins are often best suited to support annual plants such as beggar-ticks, smartweeds, and a few perennial plants tolerant of water level fluctuations such as the nonnative reed canary grass.

These basins can provide important habitat for migratory waterfowl and shorebirds, particularly during the spring migration period.

3.3 Semi-natural Communities

There are a number of open space areas, referred to in this report as “Semi-natural Communities” that are composed of an assemblage of plants that resulted largely due to recent human activities/influence. These areas provide tend to provide habitat value for generalist species of animals. Likewise, they can be viewed as important by people as places of aesthetic appeal and pragmatic functionality, such as a conifer plantation providing the appearance of a pine forest and providing shelter to a home from winter winds.

There are a number of Semi-natural Community types within the Northwest Expansion Area. The two most frequently encountered of these are Conifer Plantations and Old Fields, which are described below.

Conifer Plantations

Large plantations of conifers were often planted in rural portions of the study area after the 1930s because they were believed to prevent erosion. Often these are single species groves of red pines planted closely together in rows, while in other cases, a mixture of species is planted. Some of the conifers that have been commonly planted in Inver Grove Heights include red pine, scotch pine, white pine, jack pine, white spruce, and Colorado blue spruce.

During the early years of a plantation, the ground cover continues as a field or prairie, as it was previously. Eventually, the shade created by the conifers and acid from needle drop eliminate most ground cover vegetation and the community’s ground layer becomes highly simplified or bare. If left to develop without management, these areas form dense

monocultures with low diversity. Management should include thinning with age to preserve the health of the stand.

Although the species richness of conifer plantations is generally low, they do provide shelter for some species of songbirds, owls, white-tail deer, and other species ecologists refer to as generalists because of their adaptability. These areas also provide buffers between developments and quality natural areas. In addition, conifer plantations have aesthetic appeal to humans, something that was pointed out by the Advisory Committee for this project as an important local value consideration. Some committee members suggested that an aesthetically appealing conifer plantation is one that has been thinned and can be easily traversed by a walker.

Old Fields

"Old field" is a term used to describe areas that were grazed or farmed, but where active cultivation has ceased. These often have a simplified vegetation community, dominated by smooth brome or other non-native grasses. A few prairie forbs such as yarrow, stiff goldenrod, showy goldenrod, asters, and sunflowers may remain. Also, aggressive clonal plants such as Canada goldenrod may form large, single-species colonies, which are characteristic identifiers for these areas.

The fields may also include stands of small trees and/or red cedar individuals or glades. Although old fields are less species rich than native prairie, they do provide habitat for some birds and other animals that only use grassland habitats such as meadowlarks, dickcissels, and bobolinks. One rare bird, Henslow's sparrow seems to have an affinity for these nonnative dominated old fields in the upper Midwest. Regular controlled burns may help to control non-native species, bring back additional native prairie plants, and keep tree and shrub growth in check. As well, these areas are often good candidates for prairie palntings.

Like conifer plantations, old fields have value as buffers for quality natural areas and can be actively managed for maintenance or improvement of ecological function and quality. The Harmon Property Park in the study area is an excellent example of how a nonnative-dominated grassland can play an important role as habitat for grassland birds and an aesthetically pleasing recreational setting for humans.

3.4 Status of Natural Communities

Loss of Natural Communities Statewide

(Portions excerpted from information compiled by Hannah Dunnevitz in August 1996 from MN DNR Natural Heritage Program information)

As of the mid-1990's, the highest documented percentage of land supporting intact natural communities in any county that had been surveyed by MCBS is 9 percent in Houston

County (close behind are Goodhue, with 7 percent, and Winona, with 8 percent). These numbers are higher than those in many counties in southern and central Minnesota because of the amount of terrain too steep or too wet to easily farm easily. In prairie counties and in highly urbanized counties, there is less than 2 percent. Following is a summary of the circa 1996 vs. presettlement status of natural communities in Minnesota:

- All Forests
    - Current forested acres in MN: 53 percent of presettlement acreage
    - (Current: 16.7 million acres; presettlement: 31.5 million acres)
- Old-Growth Forest
    - Today, less than 2 percent of the forest in MN is old growth
    - Presettlement: about 68 percent in the Lake States (MN, WI, MI) was old growth
    - Big Woods section of Maple-Basswood Forest
    - Currently less than 0.5 percent of presettlement acreage
    - (5000-10,000 acres currently; 1.9 million acres presettlement)
- Wetlands
    - About 60 percent of original wetland acreage remains
    - (7.5 million acres currently; 18.5 million acres presettlement)
- Oak Savanna
    - Less than 0.1 percent of original acreage remains
    - (4400 acres currently; 5,436,200 acres presettlement)
- Prairie
    - About 1 percent of original acreage remains
    - (<150,000 acres currently; 18 million acres presettlement)
    - In southeast MN, approximately 0.01 percent of the blacksoil tallgrass prairie remains

4. PROJECT METHODOLOGY

4.1 GENERAL DESCRIPTION OF THE PROCESS

The Natural Resource Inventory Methodology includes the following steps:

1. Landowner Contact
2. Identification, Field Inventory, and Qualitative Ranking of Natural Areas
3. Natural Resource Inventory Ranking
6. Management Classification/Advisory Committee Input

Two terms, natural communities and natural sites are used frequently in this report when discussing natural areas. For the purposes of this report, natural communities refer to a particular assemblage of plants that occur as a result of the biotic and abiotic factors discusses in Section 3. “Shallow marsh” and “dry oak forest” are examples of natural communities.

The term natural sites refers to a defined geographic location of a particular natural community. Each site was defined by a unique label and represents only that community

Landowner Contact

Natural Areas for field visitation were identified using existing data sets and aerial photo interpretation. This process is described in more detail in the upland and wetland methodology sections below.

Landowners in the study area were contacted to respectfully request permission to visit natural areas on their property. In general, landowners in the study area were gracious in allowing project staff to inventory natural communities on their property. It should be noted, however, that access was not available for all properties in the study area that support natural areas. For this reason, the information in this report for some areas is lacking or absent. On the following page is a figure that illustrates which properties chose not to allow access by an ecologist.

Identification and Field Inventory of Natural Areas

Evaluation of Upland Sites

This natural resources inventory covers an approximately 3,140 acre study area. The inventory identified 43 upland sites in this report. The locations of upland sites are shown in section 6.

Please Refer to No Access Figure

Preliminary Assessment

Boundaries of natural areas and natural communities were delineated using stereo pairs of 1:15,840 scale, infrared aerial photographs. All natural area and natural community boundaries as well as any other relevant information, such as other biological surveys, were then drawn on overlay maps. At this time, a review of all existing information on natural resource features was conducted. This existing information included such sources as National Wetland Inventory Maps, DNR County Biological Survey databases and maps, and other pertinent information.

Field Assessment and Community Type Determination

The field inventory is a qualitative assessment of natural communities. The field survey included identification of major plant species in the canopy, subcanopy, shrub and ground cover of forest, and woodland natural communities. In non-forested natural communities such as prairies, dominant grasses and forbs (other non-woody plants) were identified. The field inventory emphasized gathering data on disturbance indicators or natural communities such as exotic species and erosion. This information provides a solid starting point for developing future management objectives.

Classification of sites to determine the natural community type was done using methodology outlined in *Minnesota's Native Vegetation, A Key to Natural Communities* (Minnesota Department of Natural Resources, 1993). This key is the best available statewide guide to the classification of native plant communities. Field inspection indicated that some portions of the sites identified in Inver Grove Heights are dominated by non-native vegetation, and are, therefore, not classified in the Key. These areas were given common descriptive names to identify the plant community types, such as "old field" and "Conifer plantation". Appendix A summarizes the natural community types found for each site in Inver Grove Heights as well as dominant plants for each community.

Qualitative Ranking with DNR Methods

To provide further information to the City about the quality of natural areas that were surveyed, each natural community was assigned a qualitative rank, ranging from A to D, with "A" quality communities being the highest in ecological quality, and "D" communities being the lowest. Standard ecological criteria that are used to evaluate the health of natural communities were used to determine the quality rankings. These criteria include degree of native species diversity, age of trees, and amount of disturbance, such as invasion by non-native plant species. The rankings reflect how closely the community area being studied resembles an intact or "pristine" community of its type in the local area – "A" quality communities are most like intact natural areas, "D" quality communities have been highly altered from this standard. Due to the high level of human activity in urbanizing landscapes, "A" quality communities are rare.

The types of criteria used to develop these rankings are similar to those used by the Minnesota County Biological Survey in their statewide rankings. One of the major differences is that minimum sizes for different natural communities was not used, although size is given some consideration in the community evaluation process.

Additional factors need to be considered by the City and its residents to prioritize sites for management, such as surrounding land uses, suitability for active or passive recreational use, cost of restoration and management activities, and other criteria. This ranking is of ecological qualities only, and provides a starting point for evaluating natural areas in the Study Area.

To summarize the ecological rankings found in this report:

A	Exceptional quality – approaches pre-settlement condition
B	Good Quality – minimal disturbance
C	Fair Quality – significant disturbance - restorable
D	Poor Quality – high level of disturbance -unrestorable
NA	Ranking system does not apply

Communities with excellent to good (A to B) quality, generally exhibit little disturbance and are high in species diversity. For example, forest communities would be comprised of old growth trees and have a diverse group of shrub and ground cover species characteristic of the natural community type. Disturbances from human activities and invasion by nonnative shrubs such as buckthorn would be absent or minimal. Fair quality (C quality) natural communities have been disturbed by grazing, farming, or other activities, but with proper management techniques such as prescribed burning, could be upgraded to a higher quality.

Poor quality (D quality) natural communities are severely disturbed and can be restored to a higher quality only with considerable effort and expense. Poor quality natural communities have generally had their characteristic plant species assemblage replaced by weedy native species and/or nonnative species.

Communities assigned an NA do not meet minimum standards to be classified as a natural community or are human created environments such as conifer plantations and old fields. The ecological ranking for each site is summarized in the Appendix of this report.

It should also be noted that although the methodology for classifying and ranking natural areas generally followed the DNR Natural Heritage Programs, the minimum size criteria for a given natural community type (e.g. oak forest) was not adhered to.

Evaluation of Wetland Sites

Preliminary Assessment

Data from the National Wetlands Inventory (U.S. Fish & Wildlife Service) was used to determine preliminary wetland locations in the study area. This information was then plotted on 1997 black and white digital orthophotoquads from the U.S. Geological Survey for use in office and field review. Additionally, 1:15,840 scale, infrared aerial photographs (MN DNR) were gathered and served as an additional source of aerial data for office and field review.

Field Assessment and Community Type Determination

The field assessment is a qualitative evaluation of wetland sites. The assessment included identification of plant species and a determination of predominant hydrology for each wetland basin.

A database was developed in Microsoft Access to accommodate entry of data for the Minnesota Routine Assessment Method (MnRAM), Version 2.0. MnRAM was developed by the Minnesota Wetland Advisory Group as a field evaluation tool to assess wetland functions on a qualitative basis. Under this methodology, community type determination was accomplished according to descriptions found in Wetland Plants and Plant Communities of Minnesota and Wisconsin (Eggers & Reed, 1997).

MnRAM considers and assigns values to various aspects of a particular wetland's aspects. Wetlands were evaluated for the following criteria:

- Floristic quality
- Wildlife habitat value
- Aesthetic/recreational/educational/cultural value
- Stormwater susceptibility

Site descriptions for individual wetlands can be found in Section 6 of this report.

Wetland Ranking

After field evaluation of each wetland, a ranking was assigned to each wetland basin. This ranking was based on averaging the numerical scores derived for each of the four areas listed above. The resulting score allows a particular wetland to be scored on a numerical range from I – IV, with I being the highest quality.

Calculation of Wetland Site Ranking

Wetland Rank[4] = Floral Diversity [1] + Wildlife Habitat [2] + Stormwater Susceptibility[3]

[1] Score based on Modified MnRAM methodology: Exceptional or High=4; Medium High=3; Medium=2; Low or Medium-low=1. For multi-community basins, the value represents a score based on cumulative score weighted on a percent basis, by community.

[2] Score based on modified MnRAM methodology; Esceptional =4; High=3; Medium-high=2.5; Medium=2; Medium-low=1.5= Low=1

[3] Score based on modified Stormwater Advisory Group Susceptibility guidance; Highly =4, Moderately=3, Slightly=2, Least=1

[4] Qualitative Wetland Rank based on total score: I=10.25; II=7.25-10.20; III=4.75-7.2; IV=3-4.7

Natural Resource Inventory Ranking

Because this inventory included an upland and wetland inventory with different methodologies, an overall Natural Resource Inventory (NRI) Rank was developed to rank all upland and wetland natural areas on a single scale. This scale ranges from Exceptional to Low. A summary of this system is shown in the table below.

Table 4.2 – Natural Resource Inventory (NRI) Ranking Scale

Upland Rank (MN DNR NHP)	Wetland Rank (MnRAM)	NRI Rank
A, AB	I	Exceptional
B, BC	II	High
C, CD	III	Medium
D, NA	IV	Low

Management Classification/Local Advisory Committee Input

Management classifications are a method of classifying each natural site in the study area after considering both the NRI Rank of a site and the value of the site from a local perspective with input (Local Value Criteria) provided by the Local Local Advisory Committee. The resulting Management Classifications were divided into four categories from Manage 1 to Manage 4. Under this scenario, Manage 1 areas are considered to be of the highest priority for management and/or protection, while Manage 4 areas would be considered less so.

Local Advisory Committee Input

In the process of classifying wetland and upland sites based on the standard evaluation methodologies and local values, input was gathered from a Local Advisory Committee in 1999 and 2003. The 1999 committee was composed of five residents from Inver Grove Heights that served on either the Planning or Environmental Commissions. Additional members of the committee included two individuals invited to participate from the development community.

During the processes in 1999 and 2003, information about natural areas was presented to Advisory Committee members and they were asked to provide input on the perceived importance for subjects that include natural communities, greenways, and levels of protection that would be recommendable for the various types of natural communities. The majority of this work was conducted in 1999, with minor revisions occurring in 2003.

Local Value Criteria

Local Value Criteria incorporates comments from the Local Advisory Committee members from 1999 as they considered what types and characteristics of natural areas were

important to them from a local perspective. A brief summary of questions the committee used to define local values is below:

- Is the site uncommon in the study area or region?
- Is the site site adjacent to a higher quality site?
- Will the residents of Inver Grove Heights have access to the site for education or recreation?
- Is the site susceptible to input from urban runoff?
- Is the site along a potential greenway/open space corridor?

These questions led to the identification of five Local Value Criteria integrated as yes/no questions into a Site Management Classification Flowchart. The five Local Value Criteria included are:

- Community type occurs three or fewer times in the study area or region
- Site is adjacent to a Manage 1 or Manage 2 site
- Potential for public access?
- Site is adjacent to highly susceptible to urban runoff
- Site is along greenway/open space corridor

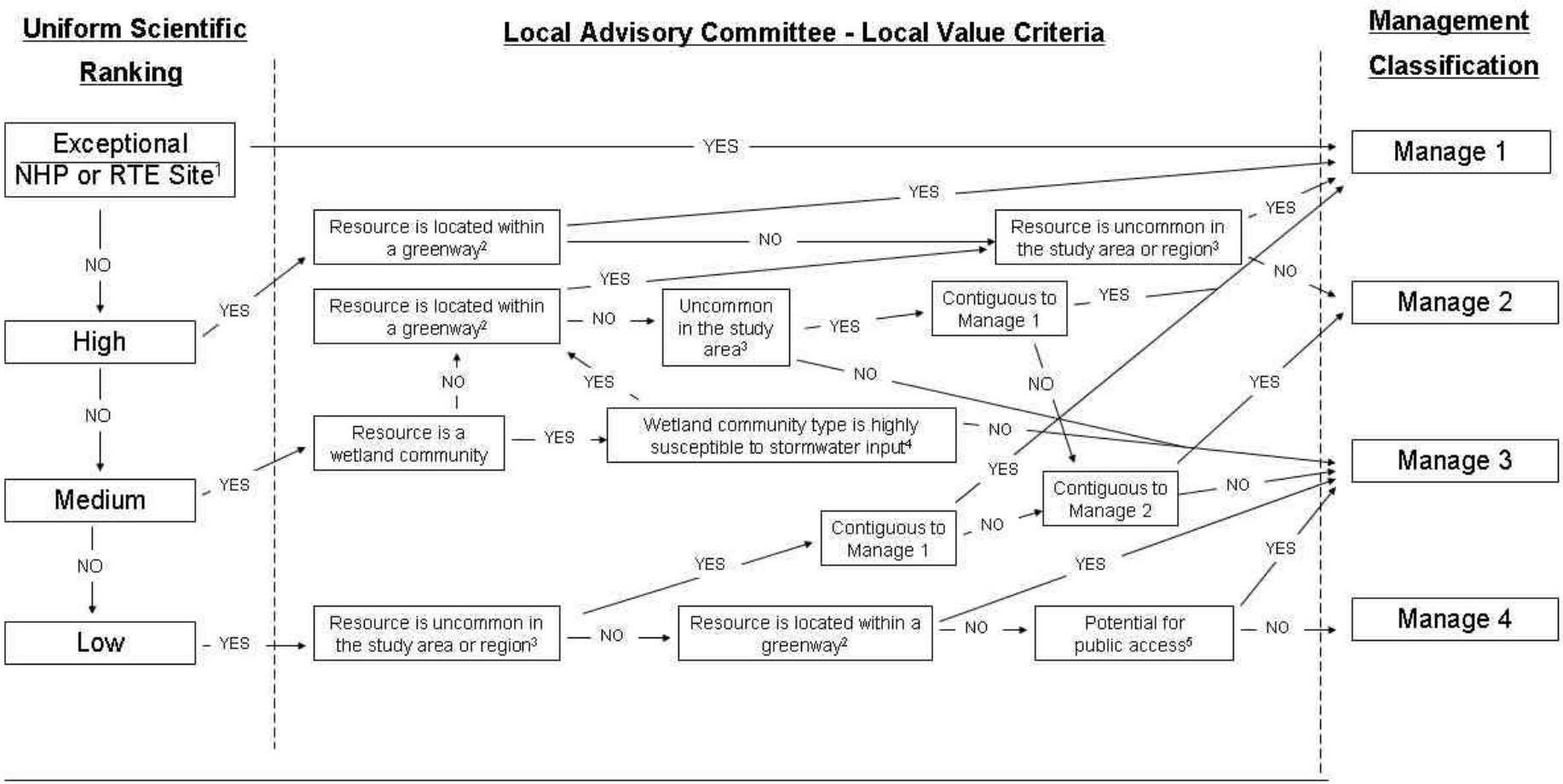
It should be noted that criteria 3 and 4, and to a lesser extent criteria 2 in the list immediately above are dynamic in nature and may change the management classification of a given site in the future. For example, if the City were to purchase a parcel of land with a wetland on it, that would change the response to the *potential for public access* criteria for that particular site. As a result, City staff may look at each of the inventoried sites as planning processes engage for any given site.

Local Value Criteria Flowchart

The following page shows the "Local Value Criteria Flow Chart" that was developed by the Local Local Advisory Committee during this project.

Input for the Site Management Classification Flowchart is any given site and its NRI Rank. The site moves from left to right through decision making boxes that may change the site management classification in the outcome boxes on the right-hand side of the flowchart (Manage 1 – Manage 4).

The Local Local Advisory Committee input process was facilitated by and City staff and Bonestroo & Associates who provided technical information regarding natural resource issues and recorded outcomes of the committee meetings. Additional information is given on the flowchart on page 4-10.



[1] Site is part of, or within 200 feet of, a site identified by the MnDNR Natural Heritage Program (NHP) to be a significant natural feature or to be the location of a known occurrence of a rare, threatened, or endangered plant or animal species

[2] Based on IGH Northwest Expansion Area ***preliminary*** "greenway" ,see Northwest Expansion Area NRI Management Classification map

[3] For the study area - 3 or fewer occurrences; for the region - based on the MnDNR NHP data

[4] Based on MN Wetland Advisory Group guidance

[5] Currently under public ownership, or adjacent to publicly owned land; or will be determined as such by the planning and development process. The management classification a resource may change as a result.

Site Management Classification Flow Chart

Greenways

Greenways are defined in the *Metro Greenprint: Planning for Natural in the Face of Urban Growth* (MN DNR 1997) as “continuous or patchy areas of vegetation that provide corridors for the movement of humans and/or wildlife. They often follow natural waterways or land features, and they may connect natural areas or other community resources such as cultural institutions”.

Greenway corridors that are composed of existing or recreated plant communities help to link natural areas, and therefore improve the functionality of each of the constituent parts.

Although current research is limited on the influence of greenways on individual species, and there are no well-defined “rules” about how wide a greenway corridor should be, current research indicates they are important in maintaining the functionality of natural areas in fragmented landscapes. In general, ecologists suggest that greenways should be a minimum of 50 to 100 feet wide, to reasonably enable wildlife and plants to move from one area to another.

In addition to providing benefits for wildlife and native plants, greenways can also serve as passive and active recreation corridors and include amenities such as trails and interpretive information.

The Local Advisory Committee identified the concept of greenways as a priority outcome of their work. As such, they identified Conceptual Primary and Secondary Greenways to facilitate linking natural areas within the Northwest Study Area. Primary Greenways are those that are thought to be most important in linking important natural areas, while Secondary Greenways are thought to facilitate more local movement of plants and animals. These conceptual greenways are shown on the maps in the Natural Community Descriptions section in Section 6 of this report.

The location of the primary and secondary greenways shown in this reporta are conceptual in nature. These were subjectively developed using information such as public ownership, slopes and ridges, waterways/wetlands, use of semi-natural areas for connecting natural areas, and other factors. In considering greenways, readers should keep in-mind the concept that greenways should extend beyond geopolitical boundaries (into adjacent cities) as a means of connecting natural areas on a regional basis.

It should be noted that the Conceptual Greenway corridors developed in 1999 during this project with input from city staff, Advisory Committee members, and Bonestroo ecologists are consistent with those developed later during the North Dakota County Greenway Planning project undertaken by the Dakota County SWCD.

Although the Advisory Committee in 2003 reviewed and provided comments on previously developed greenways, the members of this group, in general felt as though these would not be significant for the movement of wildlife in light of current and future land use plans for the Northwest Study Area. They also indicated a desire for implementation on a voluntary basis by private landowners, neighborhood associations, and developers.

4.2 Management Standards and Recommendations

Management standards represent a generalized set of techniques and practices that can be applied to groups of natural sites of similar management classification, to protect and/or enhance each of those sites.

These recommendations were developed by the Local Local Advisory Committee to reflect the values of the City and are based on current, accepted scientific understanding. Management Standards are intended to reduce impact from development and, in some cases may improve the quality of a site.

A more detailed list of management standards is listed on the following page. Some examples of standards developed for the Northwest Expansion Area, and resulting benefits include:

- Create and maintain buffer strips of appropriate width – reduces sediments entering surface waters/wetlands.
- Avoid impacts to high quality sites – preserves these areas and redirects unavoidable impacts to lowest quality areas.
- Minimize the area of grading/clearing in natural communities around a proposed building – reduces overall impact to natural communities and lends a more natural setting to the study area.
- Limit the amount of phosphorous entering a wetland – reduces growth of undesirable plants such as algae and associated problems (eg. odor, unsightliness).

As stated earlier, management classifications and their associated management standards reflect the level of protection desired and a set of techniques needed maintain its present condition.

Management standards encourage development in or adjacent to natural sites in the Northwest Expansion Area to happen in an ecologically sensible manner. The intent is to reduce development-related impact to high quality natural areas that occur here. These also allow for the types of development and densities prescribed in the City's Comprehensive Plan.

During the planning phase of development, the City will employ management standards while working with property owners and developers to create a parcel plan that benefits all parties involved, including the general constituency of Inver Grove Heights.

Should the City decide to, this information may be suitable for adaptation to a city ordinance as a tool to assist landowners with management of natural communities that occur on their property.

Upland Management Recommendations

Most upland sites have been altered to varying degrees since the time of Euro-american settlement. Some of these activities include plowing, excessive grazing, erosion, fire suppression, and others. The condition of natural communities prior to Euro-american settlement is generally considered to be the benchmark for quality comparison based on the Qualitative Ranking methodology used for this project.

The species composition, structural layers, habitat value, and connections between natural areas contribute to the quality and integrity of a particular site. Considering the factors that degrade the quality of upland natural sites and the attributes that contribute to its quality, the Management Standards seek to:

- *Avoid* impacting remaining quality natural areas
- Where impacts must occur, *minimize* their effects, and
- *Mitigate* impacts to a given site by encouraging reintroduction of appropriate locally occurring native species and the processes inherent to a community type.

Management Standards are intended to provide some general guidelines to maintain the current condition of upland natural sites in the Northwest Expansion Area. These guidelines can also foster improvement of natural areas.

Recommended Upland Management Standards

Management Classification	Management Activities
Manage 1	• Community type structure should remain intact, i.e. canopy, subcanopy, ground layer • Permanent alteration under 10,000sf and no greater than 50 feet from building pad • Buffer plantings composed of species native to Inver Grove Heights • Where impacts occur, replant with native species typical of community type in Inver Grove Heights • In areas of development, planning tools such as clustered housing should be used • Maintain current corridors, and if possible, create connectivity with other natural communities • Treat diseased trees in natural communities (i.e. oak wilt, dutch elm disease) on a case-by-case basis, taking into account the surrounding ecosystem • Manage Natural Communities and associated buffers to maintain or improve their composition, structure and function • Provide neighborhood residents with information regarding the significance of natural areas near their home
Manage 2	• Community type structure should be maintained • Avoid impacts to only poorest quality portions of a site; no permanent alteration greater than 75 feet from building pad • Where impacts occur, replant with native species typical of community type in city • In areas of development, landscape with local origin native plants • Maintain or create connectivity between natural areas • Manage natural areas to maintain or improve their composition, structure, and function
Manage 3	• Protect hardwood canopy trees, , especially trees representative of the forest type • Minimize total area of disturbance; no permanent alteration greater than 100 feet from building • Avoid impacts to better quality portions of natural areas on site • Landscape with species native to Inver Grove Heights • Maintain or create connectivity between natural areas
Manage 4	• Minimize loss of canopy trees in forest areas, especially trees representative of the forest type • Avoid impacts to better quality portions of the site with no permanent alteration greater that 150 feet from buildings • Where impacts occur, replant with native species typical of community type in city • In areas of development, landscape with local origin native plants • Maintain or create connectivity between natural areas

Wetland Management Standards and Recommendations

Generally, the factors contributing to the degradation of a wetland basin can be traced to the quality and/or quantity of runoff into the basin.

Increased amounts of sediment and nutrients are the primary attributes of the quality of runoff entering a wetland site. The amount of water delivered to a basin, along with the rate of input and duration of high water levels in a basin are the quantity attributes of runoff that can impact the quality of a site. Runoff originating from more developed areas tends to have increased amounts of sediment and nutrients. These are the primary factors that influence the current and future conditions of any particular wetland.

Wetland management standards are a tool to help manage the quality and quantity of surface water runoff that enters wetlands. Examples of widely used techniques for managing the quality/quantity of runoff include:

- Buffer strips
- Structural setbacks
- Pretreatment of runoff
- Runoff quantity/rate control

The table on the following page demonstrates the details of the four primary management techniques for maintaining the existing condition of a given wetland site. The recommendations that follow the management standards in this table are intended to establish practices that will ensure that management standards are met. Following is a brief description of how these techniques are intended to work:

- A buffer strip filters sediments and can reduce local runoff
- Structural setbacks attempt to minimize encroachment on the buffer and excessive transport of nutrients/water into a wetland
- Pretreatment manages the amount of nutrients (primarily phosphorous) that enters a basin. Inherent in the methods used for removal of phosphorous in the removal of sediment from runoff.
- Runoff quantity and rate control will keep the amount of runoff and duration of elevated water levels in a wetland within limits that will not damage the wetland type in question.

Additional Recommendations for wetlands include:

- Permanent signs/monuments should be installed to locate buffer edges
- City should monitor grading within buffer strip areas during construction
- Erosion/Sediment control inspections should be made regularly during construction
- Standards and recommendations should be reviewed with DNR Waters prior to development that occurs near a DNR Protected Water

Recommended Wetland Management Standards

Management Classification	Buffer Strip (feet)		Structural Setback from Edge of Buffer (feet)	Stormwater Phosphorous Pretreatment Requirement	Stormwater Quantity Requirement
	Slopes <15%	Slopes ≥15%			
Manage 1	60	90	10	Limit loadings to 2X predevelopment[1] loadings (0.28 lbs./ac/yr)[2]	Storm Bounce – Maintain High Water Level (HWL) at or below existing conditions for 100 year storm
Manage 2	30	45	10	Limit concentration to 150 parts per billion (ppb)[3]	Storm Bounce – Maintain HWL bounce at or below existing conditions plus 0.5 ft. for a 100 year storm
Manage 3	20	30	10	Limit concentration to predevelopment concentrations (200 ppb)	No requirement
Manage 4	15	20	10	No Requirement – Enhancement recommended[4]	No requirement

[1] A multi=cell pond configuration with the lower cell being a constructed wetland or infiltration basin is recommende to achieve these levels of removal

[2]Multi-cell pond with vegetative buffers between sells are recommended to achieve these levels of removal

[3] Enhance wildlife habitat and enhance nutrient removal efficiency to protect Mange 1, 2, or 3 downstream water bodies

[4] Existing refers to hydrologic conditions at the time this inventory was conducted (2000)

5. SUMMARY OF INVENTORY RESULTS

This section of the report includes brief summaries of the field results for the wetland and upland inventories. These are reported in narrative as well as summary tables.

A complete listing of upland and wetland natural areas, along with upland plant species lists and other information can be found in the Community Description section of the report, as well as appendices at the back of the report.

General Summary of Natural Areas and Semi-natural Areas Inventoried

Land Cover Type	Number of Areas Identified	Acres	Percent*	Percent of Land in Study Area**
Wetland Natural Areas	184[1]	267	21.1	8.5
Upland Natural Areas	43	452	35.7	14.4
Semi-natural Areas	25	547	43.2	17.4
TOTAL	252	1,266	100.0	40.3

** % of total natural and semi-natural areas*
*** Study area totals approximately 3,140 acres*
[1] An individual wetland may contain several natural community types

5.1 MANAGEMENT CLASSIFICATION SUMMARY

The table immediately below shows a summary of Management Classifications for natural communities identified. As described earlier in this report, Management Classifications take into account both the Qualitative Rank as defined by MN DNR ranking methods, and MnRAM wetland evaluation, as well as input by the Local Local Advisory Committee to arrive at an overall NRI Rank. This table illustrates that only a fraction of the total number of natural communities identified fell into the highest categories of Manage 1 and Manage 2.

Although Oak Woodland-brushland represent the vast majority of upland natural area occurrences in the study area, they are generally in moderate to poor condition as a result of past grazing and subsequent lack of management. Despite this, there is one fine example of this community type in the study area (Manage 1) that would be ideal for management.

Other natural communities that are uncommon for this region of Minnesota are Dry Prairie, Dry Oak Forest, and Mesic Oak Forest. This includes two Manage 1 Mesic Oak Forests, and one Manage 2 occurrence for each Dry Oak Forest and Dry Prairie.

The remaining natural community type identified during this study was Lowland Hardwood Forest. Although this forest type is typically associated with river and stream terraces, there were four instances of this forest type in the study area in association with low draws/wetlands.

Upland Management Classification Summary

Community Type	Management Class	No. of Occurrences
Dry Prairie (hill subtype)	3	2
Dry Prairie (sand-gravel subtype)	2	1
Dry Oak Savanna	3	1
Oak Woodland-Brushland	4	6
	3	18
	2	1
	1	1
Oak Forest, Dry	4	1
	2	1
Oak Forest, Mesic	3	2
	1	2
Lowland Hardwood Forest	4	4
	3	3
Total	-	43

The wetland community types that compose the most occurrences and land area are Wet Meadow, Shallow Marsh, Shallow Open Water, and Deep Marsh. Roughly two thirds of these community types are classified as Manage 3 or Manage 4. In a general sense, this would tend to indicate that many of these areas are of somewhat lowered quality and perhaps adversely affected by things such as runoff, invasive species, or others.

Other interesting wetland community types for the study area include Shrub Carr (also referred to as shrub swamp in Minnesota) and Alder Thicket, a community that is common to central and northeastern Minnesota, but only infrequently encountered in the Twin Cities area.

Wetland Management Classification Summary

Community Type	Management Class	No. of Occurrences
Seasonally Flooded Basin	1	1
	2	1
Sedge Meadow	1	3
	2	1
	3	2
Wet Meadow	1	7
	2	8
	3	19
	4	20
Alder Thicket	1	1
Shrub-Carr	1	1
	2	1
	3	1
Hardwood Swamp	1	4
	3	7
	4	6
Shallow Marsh	1	8
	2	7
	3	15
	4	15
Shallow Open Water	1	2
	2	2
	3	10
	4	10
Deep Marsh	1	6
	2	4
	3	10
	4	9
Other	1	1
	4	2
Total	-	184

5.2 Wetland Natural Areas Summary

The table below provides a summary of acreages and occurrences for various wetland natural community types. Since any given wetland within the study area may contain several wetland community types (e.g. shallow marsh, wet meadow, and hardwood swamp). As such, it is important to keep in-mind when reviewing the information in the table below that it is a summary of community types for all wetlands in the study area rather than a by-wetland summary.

Summary of Wetland Natural Areas

Community Type	No. of Occurrences	Acres	Percent of Wetland Natural Communities**
Seasonally Flooded Basin	2	1.1	0.4
Sedge Meadow	6	10.7	4.0
Wet Meadow	54	68.7	25.7
Alder Thicket	1	3.5	1.3
Shrub-Carr	3	6.0	2.2
Hardwood Swamp	17	14.8	5.6
Shallow Marsh	45	52.4	19.7
Shallow Open Water	24	51.5	19.3
Deep Marsh	29	49.5	18.6
Other	3	8.6	3.2
Total	184	266.8	100.0

5.3 Upland Natural Areas Summary

The upland natural areas that occur within the Northwest Area are largely dominated by Oak Woodland-brushland at 341 acres. This natural community type is characterized by scattered to somewhat closely grown oaks with moderate to dense undergrowth of shrubs and young trees.

Lowland Hardwood Forest was the second most common natural area type, by acreage, with 24.8 acres total. These occur largely as adventive communities along the margins of wetlands and lakes in the study area.

Dry and Mesic Oak Forest types comprise 11.1% and 6.3%, respectively. Although dry oak forest is still fairly common in east-central Minnesota, particularly on droughty soils of the Anoka Sandplain. Despite this, it is still uncommon in many parts of southeastern Minnesota. Mesic oak forest is becoming increasingly scarce due to conversion to different forest types. For this reason, both of these communities are important in the study area.

Dry Prairie and Dry Oak Savanna occur at 1.1% and 0.5% of the total land area in the study. Although small, these figures appear to be consistent with the remaining amount of these natural community types across southern Minnesota, illustrating why they are

considered to be imperiled ecosystems in the state according to the MN DNR (State Rarity Ranking).

Summary of Upland Natural Areas

Natural Community Type	State Rarity Rank*	Number of Occurrences	Acres	Percent of Upland Natural Communities**
Dry Prairie	2	3	5.0	1.1
Dry Oak Savanna	1	1	2.4	0.5
Oak Woodland Brushland	4	26	340.8	75.5
Dry Oak Forest	3	2	50.0	11.1
Mesic Oak Forest	2	4	28.5	6.3
Lowland Hardwood Forest	4	7	24.8	5.5
TOTAL	-	43	451.5	100.0

* State Rarity Rank, as developed by MN DNR staff reflects extent and condition of natural community types in Minnesota. Natural community types with a rank of "1" are considered critically endangered in MN, while those ranked "5" are considered secure under present conditions.
** Calculated as a percent of land area by-area

5.4 Semi-natural Areas

Semi-natural Areas typically consist of former agricultural fields referred to as "old fields" and "conifer plantations".

Old fields that have typically been planted to one or several species of nonnative grasses and may or may not have native grasses, flowers, or other native vegetation recolonizing them. Conifer plantations typically consist of large stands of pines and/or spruces planted by humans. These conifers are either not native to North America, or were not historically found in the study area in historic times.

Old fields and Conifer plantations documented during the study typically included the following characteristics:

- Old fields had native grass and/or forb species recolonizing them.
- Conifer plantations were of sufficient age that they possessed significant habitat value and some semblance of forest structure.

As previously mentioned, these created plant assemblages have some habitat value for wildlife, and can serve as important habitat buffers and links for natural areas. However, because they lack sufficient amounts of native species and/or are not plant communities

that would have been present in historic times, they are not classified or ranked under standardized criteria developed by the MN DNR.

Summary of Semi-natural Areas

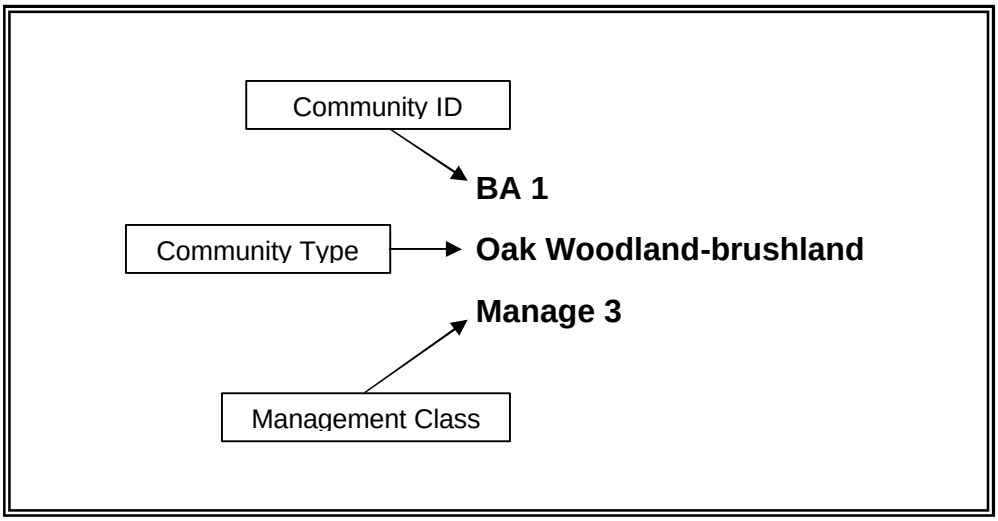
Plant Assemblage Type	Number of Occurrences	Acres	Percent of Semi-natural
Conifer Plantation	5	90	16.5
Old Field	20	457	83.5
TOTAL	25	547	100

6. Natural Community Descriptions

The following section includes descriptions for individual natural areas. These are arranged into four groups (quadrants) and based on the drainage subdistrict that they occur in. Each group of drainage subdistricts includes a map for that area, which precedes the community descriptions for upland and wetland natural areas. Descriptions for semi-natural areas for a particular quadrant are given after the wetland/upland natural area descriptions in each section.

Each natural community includes a unique alphanumeric code, community type name, management classification, and written description (see example below). Each natural area also has a description of the disturbance indicators noted, restoration potential, and management recommendations. Semi-natural communities are listed at the end of the section for each quadrant. No Management Class is given for these areas.

Example community description header:



It should be noted that there are several communities which have the term “No Description” listed under the community header. These areas were field visited and data collected that exists in the electronic database for the project. However, no written description was provided by the field investigator.

Refer to Northeast Quadrant Figure

6.1 Northeast Quadrant
Drainage District BA

BA 1

Oak Woodland-brushland

Manage 3

Large, open-grown bur and pin oak with crowns that seldom touch characterize this woodland. The bur oaks average about 26 inches in diameter, while the pin oaks average about 12. One large bur oak, 27 inches in diameter was cored and found to be approximately 143 years of age. This tree began growing at about the time of settlement by Euro-americans.

The shrub layer varies from relatively open to nearly impenetrable. The most common shrub here is the nonnative European buckthorn, with native shrubs being less common. The ground layer also varies in composition, but is generally dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. There are several small openings that are dominated by prairie forbs tolerant of disturbance, including showy goldenrod and dogbane. Although most of the community has been disturbed, the presence of better quality spots improves the overall rank.

Disturbance indicators: Fences indicate former grazing. The lack of fire and appropriate levels of grazing/mowing have allowed buckthorn to establish.

Restoration Potential: Moderate

Although much of the community would require substantial resources for restoration, the parcel just to the south of the City owned Harmon Properties is a good candidate for active management. Recommended activities include buckthorn clearing and reintroduction of appropriate native species and processes.

BA2, BB2, EA6, EF 6

Shallow Marsh

Manage 3,3,4,2

These shallow marsh sites are situated at the bottom of steep-sided depressions. The shallow standing water is mostly unvegetated, with the exception of the floating aquatic, duckweed. The wet meadow fringe includes a vriety of forbs and grasses, and only a small percentage of the nonnative reed canary grass.

The hillslopes surrounding BA2, BB@, and EA6 are wooded and appear to have had some erosion. The resulting sedimentation of the wetlands has degraded their quality.

EF6 is a relatively decent quality wetland, presumably due to the lack of significant disturbance (erosion) in the surrounding, well-vegetated uplands.

BA4, EA28, EB1, EB12, EC1, EC7, EJ6, F29, F31, Q5, W1

Wet Meadow

Manage 4, 3, 3, 4, 4, 3, 3, 1, 4, 3, 4, 4

The basins in this group of wet meadow sites are found in depressions that are, for the most part heavily wooded. Sediment transport from the surrounding slopes has resulted in dominance by the nonnative reed canary grass in most of these basins. In many of these wetlands, the deepest portions include shallow marsh type vegetation.

EJ6 has maintained a higher level of quality than the other basins in this group and also supports a fair variety of forbs, despite heavy sedimentation from Robert Trail. This may be due to its proximity to Horsehoe Lake and the Possibility that hydrology from groundwater is present for longer periods during the growing season.

BA10, EG5 EG6, F26

Hardwood swamp

Manage 4, 3, 3, 1

These wetlands are located in shallow to steep depressions. Boxelder and/or American elm are the dominant tree species here. Due to fluctuating water levels, ground cover is sparse. There are a small amount of shrubs and saplings also present.

The surrounding hillsides are wooded. Erosion on these hillsides has contributed enough sediment to these wetlands to apparently cause degradation. Hydrology is mostly from local runoff, although a neighboring landowner related that BA10 receives large amounts of water from EB15 (a storm pond for the golf course).

BA11

Dry Prairie, Sand-gravel Subtype

Manage 3

With the exception of the south end, with is a small degraded prairie remnant, this is an old field being recolonized by prairie species. It is generally dominated by nonnative cool season grasses including smooth brom and Kentucky bluegrass. However, there are several locations where prairie species have persisted or recolonized. This is particularly true on the south end of the community.

The most frequently encountered prairie species here include big bluestem, porcupine grass, heath aster, showy goldenrod, yellow coneflower, rough blazingstar, and flowering spurge.

Brush encroachment here is in the advanced stages comprising up to 75% cover in some areas. The most common shrubs include smooth sumac and dogwood.

Disturbance indicators: Appears to have been formerly cultivated.

Restoration Potential Moderately Poor

Although this community could be restored to prairie, it would require a substantial effort, including brush control, burning, and seeding.

DRAINAGE DISTRICT BC

BC1, EB22, F6

Seasonally Flooded Basin

Manage 2, 1, 3

These basins are located in shallow depressions within otherwise rolling terrain. Reed canary grass is the primary vegetation present with some amount of smartweed also present. Hydrology for these basins comes primarily form a very local watershed and is like present early in the growing season. Wetland BC1 is located on the Harmon Property.

DRAINAGE DISTRICT EA

EA1, EE6, EG7, EJ1, EJ4, EJ8, F3, F4, F10

Wet Meadow

Manage 4, 3, 4, 4, 4, 2, 3, 4, 4, 4

This group of wetlands are located in shallow depressions that are situated in moderately rolling terrain. These are dominated by reed canary grass with small areas of shallow marsh in the deepest areas. EE6 in located on the golf course. EJ4 and EJ8 are on the Harmon Property. Although wet meadow occupies the largest priton of EJ4, there are notable areas of shallow and deep marsh. The latter two wetland types are of decent quality, while the wet meadow is low quality due to reed canary grass dominance.

EA2, EA10, EA18

Oak Woodland-brushland

Manage 4

Large, widely scattered, open-grown oaks characterize this woodland. Most of the oaks found here exceed 20 inches in diameter. The remainder of the nearly closed canopy is composed of second-growth trees, especially quaking aspen. The shrub layer varies from thick to nearly impenetrable and is dominated by the nonnative European buckthorn.

The ground layer varies from moderate to poor quality. The dramatic increase in shade during recent decades has shaded out most of the ground layer species, leaving only small patches of ground cover. Overall, this community is generally low quality due to the amount of nonnative species and past disturbances.

Disturbance indicators: This site appears to have been grazed in the past, as evidenced by fences and dominance of thorny shrubs. There is also an abandoned farm road her where some dumping has occurred.

Restoration Potential: Poor

This community is restorable, but would require a heroic effort to remove European buckthorn and reintroduce appropriate native species in the shrub and ground layer.

EA3, EA5, EA26, EB19, EJ10

Deep Marsh

Manage 4, 4, 4, 4, 3

These deep marsh wetlands are situated in steep-sided depressions. They have narrow fringes dominated by a mix of the nonnative reed canary grass and pioneering trees such as American elm, willow, and boxelder. The main body of these wetlands have duckweed as the dominant plant. EA26 and EB19 have small areas of lake sedge and cattils, respectively. Otherwise, these basins are characterized by species adapted to disturbance.

EA5

Deep Marsh

Manage 4

No description

EA6

Shallow Marsh

Manage 4

No description

EA7

Oak Woodland-brushland

Manage 1

This community occurs along a largely west-facing slope. It is variable in quality and composition, from moderately good to moderately poor. Better quality areas have scattered bur oak trees with a moderately thick shrub layer dominated by native species. The ground layer in these areas tends to also be dominated by native, with prairie species common in openings. A burn oak, 14 inches in diameter was found to be approximately 95 years of age here,

The moderately poor quality areas also have scattered bur oak trees, but have greater abundance of other tree saplings. The shrub layer tends to be dominated by nonnative species, particularly European buckthorn. The ground layer is dominated by nonnative grasses in the openings, while pennsylvania sedge and bare ground are common where the canopy cover is thickest.

Disturbance indicators: This site appears to have been grazed in the past, with shrubs and trees colonizing quickly after grazing was ceased (estimated 25-30 years ago). More recent disturbance includes digging up prairie openings to create lookout areas. Some of these lookouts have caused substantial damage to the few quality prairie openings that had remained.

Restoration Potential: Moderate

The better prairie areas have been permanently impacted, but restoration opportunities still exist in the area. Removal of nonnative shrubs and the control of native species such as gray dogwood and sumac would be beneficial for the prairie remnants.

EA10

Oak Woodland-brushland

Manage 3

Please see description for EA 2 on the preceding pages

EA12

Wet Meadow

Manage 3

No description given.

EA13, EA15, EJ9, W3

Shallow Marsh

Manage 3, 2, 1, 4

With the exception of W3, these wetlands have two or three viable wetland communities in each basin. The most prevalent of these community types is shallow marsh. They also include fringes of reed canary grass and open water areas with substantial amounts of duckweed. Local runoff and groundwater and likely the hydrologic engines for these wetlands.

EJ9 is located on the Harmon Property and has small areas of hardwood swamp and shrub carr, in addition to shallow marsh.

EA 14

Sedge Meadow

Manage 1

No description given.

EA15

Shallow Marsh

Manage 2

No description given.

EA18

Oak Woodland-brushland

Manage 3

Please see community description for EA2.

EA20, EA21, EE4, EI6, EK8, EK9

Shallow Marsh

Manage 4, 4, 3, 4, 4, 3

These shallow marshes are identified by their rather uniromly shaped sides and location at the bottom of deep, steep-sided depressions. The standing wate present is almost entirely unvegetated with the exception of duckweed. There is a fringe of reed canary grass that seems to fourish in the sediments from the surrounding wooded hillsides. For the most part, these wetlands are highly degraeded. Ee4 is located on Inverwood golf course and has a fairway bordering approximately one third of its perimeter.

EA22

Shallow Marsh

Manage 4

No description given.

EA23, EB4

Oak Woodland-brushland

Manage 2

Found on a rolling landscape west of an emergent wetland, this community is characterized by large, open-grown bur and pin oaks. These average about 22 inches in diameter, with some exceeding 30 inches. One 28-inch bur oak was found to be approximately 158 years old. Between these widely spaced oaks is a dense, second growth of young aspen.

The shrub layer varies in thickness from sparse to moderate. The most common shrubs include European buckthorn, prickly ash and tatarian honeysuckle. The ground layer varies in quality from moderate to poor. Common species include enchanter's nightshade, Pennsylvania sedge, and false solomon's seal. The ground layer also has a thick blanket of buckthorn seedlings.

Disturbance indicators: dense growth of aspen indicates release from grazing, as does the dense buckthorn.

Restoration potential: Moderate

Control of the invasive/nonnative shrubs here would be the biggest job. Other potential activities include reintroduction of appropriate local origin native seed/plants.

EA26

Deep Marsh

Manage 4

No description given.

EA27

Shallow Marsh

Manage 1

No description given.

EA28

Wet Meadow

Manage 3

No description given.

EA 30

Dry Prairie, Sand-gravel Subtype

Manage 2

This prairie occurs on a knob east of a small emergent wetland and within an old field area. Although very disturbed, this is the largest prairie remnant in the study area. It is dominated by big bluestem and Indian grass. Frequently encountered native forbs include several dozen species including Virginia mountain mint, American vetch, oxeye false sunflower, and anise hyssop. Brush and tree encroachment is occurring quickly and currently comprises about 30 of the total area, including sumac, dogwood, and red cedar.

Restoration Potential: Good

Recommended management activities would include mow/cut brush and treat stumps with appropriate herbicide as well as reintroduce prescribed fire.

DRAINAGE DISTRICT EB

EB6

Lowland Hardwood Forest

Manage 4

Please see description for EB5

EB7

Wet Meadow

Manage 4

No description given.

EB10

Oak Woodland-brushland

Manage 3

Please see description for BB1

EB11

Oak Woodland-brushland

Manage 3

This community extends across several property boundaries and is characterized by scattered, open-grown bur and pin oaks that average approximately 26 inches in diameter. Composition of the shrub layer varies across property lines, being nearly impenetrable from brush growth in some areas to open, and regularly mowed to 8 inches in height in others.

Nonnative grasses with small patches of native species occur here. Some of the native species present here include Pennsylvania sedge, hear-leaved aster, wild geranium, false solomon's seal, and the rare lily-leaved twayblade orchid.

Disturbance indicators: Past grazing appears to be a common theme across all properties. Current disturbance includes mowing that is too frequent and storage of materials/equipment.

Restoration potential: moderately poor

Managing this back to oak savanna would take quite an effort, although it's certainly possible with cutting of brush and other appropriate activities.

EB 12

Wet Meadow

Manage 4

No description given.

EB 18

Shallow Marsh

Manage 4

No description given.

EB 19

Deep Marsh

Manage 4

No description given.

EB 20

Oak Woodland-Brushland

Manage 4

This community is dominated by widely spaced, open-grown oaks that average about 22 inches in diameter. One bur oak, 25 inches in diameter was cored and found to be 128 years of age. Between these large bur and pin oaks is a dense second growth of trembling aspen that average about 10 inches in diameter.

The shrub layer varies from dense to nearly impenetrable and is dominated by European buckthorn. Other, less frequent members of the shrub layer include gray dogwood, box elder, brambles, hazel, and prickly ash. Because of the relatively recent closing of the canopy, the ground layer is generally sparse and represented by only a few species. These include Virginia creeper, three-flowered bedstraw, and rough avens.

Because of the recent canopy closure, dominance of the shrub layer by non-natives, and the fragmentation by development, this community was given a low ranking of D.

Disturbance indicators: This community may have been grazed in the distant past allowing the large, open-grown oaks to persist without competition, but recent colonization of the site by many small trees and especially European buckthorn has degraded the site. Development of a home site in the center of this community has also reduced the functionality of this woodland.

Restoration potential: Poor

Although this community could be restored, a large amount of physical and financial resources would need to be called on. Removal of nonnative and invasive trees and shrubs, along with native species seeding, and potentially seeding of the site with appropriate native grasses and forbs are among the activities that could be applied to this community.

EB 22

Seasonally Flooded Basin

Manage 1

No description given.

EB 23

Oak Woodland-Brushland

Manage 3

This community is a summary description of many small fragments of Oak Woodland-Brushland on Inverwood Golf Course. Although none of these individual fragments totals more than one acre, they share similar characteristics and represent a good opportunity for restoration and management on City-owned land. This is particularly true for one parcel to the south-southeast of the clubhouse, which is actually a degraded dry oak savanna. It represents the best opportunity for savanna/oak woodland restoration on public land, and perhaps in all of the study area.

Scattered bur and pin oak with a second growth of aspen, elm and shrubs generally characterize these parcels. In some areas the canopy cover is less than 50 percent, but in most areas the gaps between the large, open grown oaks is being quickly closed in by young trees and shrubs. The age of larger oaks is somewhat variable and dependent on specific site conditions. One bur oak, 29.5 inches in diameter, was cored and found to be 143 years of age, while a 21.5-inch pin oak was cored and determined to be 56 years old.

The shrub layer is somewhat variable, but is generally thick to very thick and dominated by gray dogwood, European buckthorn, brambles, and prickly ash. In a few of the drier areas, that still have some Dry Oak Savanna Character, American hazel is more common.

Likewise, the ground layer is variable. Where canopy cover from shrubs and small trees has increased quickly, the species richness is rather poor, with most grasses and forbs present being indicators of recent disturbance. There are several locations where species typical of dry savanna and prairie are more common. This is particularly true of one parcel just to the south-southeast of the clubhouse.

Disturbance indicators: These communities have been fragmented and isolated both by previous agricultural activities, and more recently by golf course construction and maintenance activities. The lack of active native community management has allowed invasive tree and shrub species to colonized areas that were formerly more open, causing a decrease in species richness and overall quality.

Restoration potential: Moderate to good

These Oak Woodland-Brushland areas are often adjacent to what have been characterized as old fields. Managed together, these communities could both greatly benefit from ecological restoration and management activities. Restored, these areas have the potential to provide multiple benefits to both the public and wildlife.

Ecological restoration can serve to reduce long-term maintenance cost, pesticide use, runoff, and off-site migration of nutrients and chemicals associated with golf course maintenance as well as improve native diversity, and wildlife habitat. The high visibility of these areas also provides an exceptional opportunity for environmental education.

EB 24

Oak Woodland-Brushland

Manage 4

No description given.

DRAINAGE DISTRICT EJ

EJ 1

Wet Meadow

Manage 4

EJ 2

Shallow Open Water

Manage 4

No description given.

EJ 3

Dry Oak Forest

Manage 3

This oak forest varies from moderate to very poor quality. Storm damage in the spring of 1999 caused extensive damage to this community, especially near Highway 3. Approximately 50 percent of the canopy trees were lost during this event. Subsequent efforts to remove downed trees caused extensive disturbance of the shrub and ground layer. Areas that were not as heavily impacted by the storm occur along a draw and a slope facing the lake.

The most common canopy members in this community are white oak, which average about 26 inches in diameter, and pin oak which average about 20 inches in diameter. Other canopy members include black cherry, white birch, and box elder. A cored 26-inch white oak in this community was cored and found to be 74 years of age.

The shrub layer is sparse throughout the community. The ground layer in the intact portion of the community is of moderate quality, while annual weeds such as horseweed and lambsquarter dominate the wind-damaged portion of the community. Despite some of the community being of moderate quality, the prevalence of disturbance and fragmentation by development causes a much lowered ranking of D.

Disturbance indicators: Recent wind damage to canopy members, as well as “clean-up” efforts caused significant disturbance to this community. Also, the building of homes and wide driveways in this community have fragmented the forest, further reducing its ecological functionality.

Restoration potential: Poor

Although it will be possible to replace canopy trees lost to wind damage in the next 30 to 40 years, it will take much longer for the quality of the ground layer to improve without planting. Planting of local origin oak seedlings to replace canopy members lost and seeding of native woodland/savanna species in the ground layer will help in the restoration process.

Promoting the use of plants native to oak communities in landscaping, and minimal mowed yard sizes among the houses built in this community would help to partially mitigate for habitat lost during development.

EJ 5, EJ11

Oak Woodland-Brushland

Manage 3

This community includes several parcels that are separated by old field. The community is generally characterized by large bur oaks, some of which have open-grown forms. Other

members of the canopy include pin oak, which are often multiple-stemmed, as well as black cherry and white oak. One cored white oak, 25.5 inches in diameter, was found to be 188 years of age.

The shrub layer varies from moderately thick to thick and is largely dominated by native species. These commonly include gray dogwood, smooth sumac, box elder, and gooseberry. Also occurring less commonly were downy arrowwood, nannyberry, smooth juneberry, and sugar maple seedlings.

The ground layer contains a mix of species with many shade tolerant species apparently colonizing the site. Some of these include red baneberry, lady fern, wild yam, purple twayblade, and Canada mayflower. Overall, this site appears to be in transition/recovery from substantial disturbance. For this reason, it was given the lowered rank of D.

Disturbance indicators: There are numerous fences along these communities, which tends to indicate grazing. The thick brush in some areas tends to indicate transition caused by disturbance, or the removal of a management regime. Also, the northern most parcel of this community also has an old road trending north - south through it.

Restoration potential: Moderate

Although this community would benefit from active restoration, it is likely that these parcels will gradually improve in quality if further disturbance is withheld. In the absence of active management, this site will likely transition to a dry/mesic oak forest, and potentially a forest canopy co-dominated by sugar maple trees within 100 years.

EJ 4

Wet Meadow

Manage 2

No description given.

EJ 7

Shallow Marsh

Manage 4

No description given.

EJ 8

Wet Meadow

Manage 3

No description given.

EJ 9

Shallow Marsh

Manage 1

No description given.

EJ 10

Deep Marsh

Manage 3

No description given.

EJ 11

Oak Woodland-Brushland

Manage 3

No description given.

EJ 12

Shallow Marsh

Manage 3

No description given.

SEMI-NATURAL AREAS

NOTE: old fields, conifer plantations and other human- created plant assemblages provide some habitat value and can serve to link existing remnant natural communitie. However, there is no available standardized criteria for assessing their overall condition. Therefore, these sites have not received a qualitative ranking.

Old Field Sites

OF1, OF3, OF13

Comprised of scenic rolling hills, this area includes several old fields that are owned by the City of Inver Grove Heights, referred to as the Harmon Properties. Also included are

several old fields to the west and southwest of the City property. The City-owned parcels are separated by a wetland and a brushland on a generally north-facing slope.

These old fields are generally free of encroachment by trees and shrubs. They are dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. A number of native forbs are beginning to re-colonize the site including showy and stiff goldenrod, round-headed bushclover, and heath and sky blue asters.

Meadowlarks were seen in the southern City-owned old fields. This is the only place where this grassland obligate bird was seen during the study. The City-owned parcels represent an excellent opportunity for carrying out a prairie restoration. *See Restoration Potential* section below for more details.

Disturbance indicators: Formerly used for agricultural purposes.

Restoration potential: Moderate to Good

The best potential for restoration of these old fields is on the City owned Harmon Properties. Relatively free of tree and brush encroachment and with the nonnative grasses declining in vigor, this represents the best opportunity for a successful prairie reconstruction in the Northwest Expansion Study Area.

Activities to be undertaken in such an effort would potentially include treatment of the existing nonnative species, seeding of native species, regular application of prescribed fire, and monitoring. Restoration of prairie and other natural communities on the Harmon Properties would offer an opportunity not only to restore these communities, but also to provide for reduced stormwater and nutrient runoff, and environmental education for park visitors.

OF4, OF9

This old field has been abandoned for a significant period of time, perhaps decades. It is dominated by the nonnative grasses smooth brome and kentucky bluegrass. There has been a substantial amount of brush that has established in the field, comprising about half of the total cover. Common shrubs here include gray dogwood and smooth sumac.

There are several species of prairie plants that have also colonized the old field. These include heath aster, stiff and showy goldenrod, sky blue aster, and round-headed bushclover. Although these species are not typical of high quality prairie, they help to improve the overall ecological function and quality of this old field.

Disturbance indicators: This area was formerly used for agriculture. It was partially mowed during the field visit for this study and appears to be used as a recreational area by the owner.

Restoration potential: Moderately poor

Without active management, this old field will continue toward its domination by brush and small trees. Under no management it will likely develop into a forest comprised of different species of trees that happen to volunteer. Reintroduction of prairie/savanna species would enhance the site, but would require substantial physical and financial resources.

OF10

The nonnative grasses smooth brome and Kentucky bluegrass dominate this old field. Shrubs and tree saplings have become established and comprise about 50 percent of the cover. Most common among these is smooth sumac.

Some native flowers are also re-colonizing the site. Among these are showy goldenrod, black-eyed susan, flowering spurge, and showy tick trefoil. Because this is a former agricultural field, it does not meet the criteria for natural community classification.

Disturbance indicators: Formerly farmed.

Restoration potential: Poor

Because of the dominance of shrubs in this community, it would be difficult to restore to a more open area, such as a prairie. As this area progresses to a more forested one, the planting of oak seedlings would help guide this site toward establishment of an oak forest.

OF12

This old field has been abandoned for some time, perhaps 20-30 years. Scattered trees and shrubs, as well as some native prairie forbs are colonizing it. The most common trees in this area are bur oak and eastern red cedar. The community has been approximately 30 percent colonized by shrubs, especially gray dogwood and smooth sumac.

Although dominated by smooth brome and Kentucky bluegrass, there are several native grasses and forbs present. Most common among these are stiff goldenrod, round-headed bushclover, dogbane, and rough dropseed. Although this area is recovering some native character, it is insufficient to be classified as a prairie.

The scattered, young bur oak in this area give the appearance of a brush prairie or young savanna and may superficially resemble what would have been present in Inver Grove Heights at the time of Euro-American settlement.

Disturbance indicators: Formerly used for agriculture

Restoration potential: Moderately poor

Although this community could be restored to a brush prairie, it would require a substantial effort including seeding, controlled burns, and brush cutting.

OF15

Like many others in the study area, this old field has possibly been abandoned for decades. It is dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. This old field has few trees and shrubs colonizing, but there are several native species of grasses and forbs beginning to become better established. Among these are yellow coneflower, germander, Indian grass, big bluestem, and bergamot.

Disturbance indicators: Formerly used for agriculture. Some recent earthmoving in a substantial portion of the center of this area. The earthmoving may have taken place to remove the topsoil, as evidenced by the presence of scrapers and dozers.

Restoration potential: Moderate

This old field is one of the best opportunities in the study area for a prairie reconstruction. The site could be seeded with native species with little site preparation required.

OF18

This is a collection of out-of-play open areas on Inverwood Golf Course that have been planted to nonnative grasses. Smooth brome and/or Kentucky bluegrass dominate most of these. Many areas are being invaded by invasive nonnative species including spotted knapweed, leafy spurge, Canada thistle, wild parsnip, and others.

However, there are a few small areas, especially those adjacent to remnant patches of savanna, that support native species. These include species such as prairie coneflower, stiff goldenrod, and heart-leaved and heath asters.

Disturbance indicators: Either formerly used for agriculture or planted to nonnative grasses following construction of the golf course

Restoration potential: Moderately good

Along with the Oak Woodland-Brushland areas, this provides an excellent opportunity for ecological restoration on City-owned property. Restored, these areas have the potential to provide multiple benefits to both the public and to wildlife.

Ecological restoration can serve to reduce long-term maintenance cost, pesticide use, runoff, and off-site migration of chemicals and nutrients associated with golf course maintenance as well as improve native diversity and wildlife habitat. The high visibility of these areas also provides an exceptional opportunity for environmental education.

OF22

This old field has been partially colonized by small trees and shrubs. It is dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. Currently, part of this area is hayed/mowed.

Disturbance indicators: Current and past agricultural use.

Restoration potential: Poor

Because of the amount of brush and small trees in this parcel, it would be more difficult to carry out restoration activities such as planting prairie species. For this reason, it has a poor potential for ecological restoration.

Conifer Plantations

CP1, CP3

No description given

CP4, CP7

These conifer plantingsare largely composed of red and white pine that average about 12 inches in diameter. A second conifer plantation to the northeast is included in this description. It was planted to jack pine, with some hardwoods volunteering between them.

Both of these plantations, particularly the one dominated by red and white pine, are very close. Many trees are within eight feet of their neighbor. Overall, the health of the trees in these plantations appears good. However, they could benefit from thinning.

Disturbance indicators: Not applicable. This is a human-created planting.

Restoration potential: Not applicable, although thinning of pine is recommended within 5 years to maintain the health of the stands.

Refer to Southeast Quadrant Figure

6.2 SOUTHEAST QUADRANT

DRAINAGE DISTRICT BB

BB1, EB10, EB23, EE2, EE3

Oak Woodland-brushland

Manage 3

This is a summary description for several small fragments of oak woodland in Inverwood Golf Course. Although none of these individual fragments total more than one acre, they share similar characteristics and represent a good opportunity for restoration and management on city-owned land.

Scattered bur and pin oak with a second growth of aspen, elm and shrubs generally characterize these parcels. In some areas the canopy cover is less than 50%, but in most areas the gaps between the large, open-grown oaks is being quickly closed-in by young trees and shrubs. The age of the larger oaks is somewhat variable and dependent on specific site conditions. One 29.5-inch bur oak was approximately 143 years of age, while a 21.5 inche pin oak was found to be merely 56 years of age.

The shrub layer is somewhat variable, but is generally thick to very thick and dominated by gray dogwood, European buckthorn, brambles, and prickly ash. In a few of the drier areas that still have some savanna-like character, American hazel is more common.

Likewise, the ground layer is variable with some locations in moderately poor condition. Still others support species typical of dry savanna, including a parcel just to the south-southeast of the clubhouse.

Disturbance indicators: These communities have been fragmented and isolated by past agricultural activities and more recently by golf course construction. The presence of shrubs has caused a sharp decrease in quality of these areas.

Restoration Potential: Moderate to Good

These areas would be remarkably easy to manage with periodic prescribed fire and brush clearing. This would not only serve to improve the quality of the natural areas, but in most cases would be very compatible with the goals of managing the course aesthetics and playability. In addition, restoration of these areas promises to reduce other maintenance costs for fertilizer, pesticides, and mowing.

BB2

Shallow Marsh

Manage 3

No description

BB3, EB26, EJ2,

Shallow Open Water

Manage 3, 3,4

These bodies of shallow open water are situated in depressions and have steep-sided banks. There is no wetland fringe or emergent vegetation. Dominant existing vegetation is the floating species, duckweed.

BB3 and EB26 are located within the golf course. Planting native emergent aquatics would be highly beneficial here.

BB4, EE5, EJ12, F15

Deep Marsh

Manage 2, 3, 3, 4

These wetlands occupy a portion of the bottom of large depressions. They are not immediately surrounded by steep slopes. There is a narrow wet meadow fringe that is dominated by reed canary grass. Vegetation within the marsh itself is dominated by duckweed.

BB4 and EE5 are located on golf course property. Planting native emergent aquatics would be highly beneficial here.

BB5

Dry Oak Savanna, Sand-gravel Subtype

Manage 3

This remnant of dry oak savanna represents the best opportunity for oak savanna restoration on public land within the study area. The shrub layer is somewhat variable, but is genrally thick to very thicka dn dominated by American hazel with gray dogwood, European buckthorn, and brambles, with prickly ash also present.

The ground layer varies from poor to very good and is directly related to how thick shrub cover is in any given area. Where there is little shrub cover present nice quality prairie species are present including little bluestem, prairie violet, leadplant, and prairie smoke.

Disturbance indicators: Fragmentation and isolation, as well as brush encroachment have caused degradation of this area.

Restoration Potential: Moderate

This area could be managed with adjacent golf course property for the improvement of both. Activities could include brush clearing, seeding, mowing, and prescribed burning.

DRAINAGE DISTRICT EE

EE 2

Oak Woodland-Brushland

Manage 3

This community is a summary description of many small fragments of Oak Woodland-Brushland on Inverwood Golf Course. Although none of these individual fragments totals more than one acre, they share similar characteristics and represent a good opportunity for restoration and management on city-owned land. This is particularly true for one parcel to the south-southeast of the clubhouse, which is actually a degraded dry oak savanna. It represents the best opportunity for savanna/oak woodland restoration on public land, and perhaps in all of the study area.

Scattered bur and pin oak with a second growth of aspen, elm, and shrubs generally characterize these parcels. In some areas the canopy cover is less than 50 percentage, but in most areas the gaps between the large, open grown oaks is being quickly closed in by young trees and shrubs. The age of larger oaks is somewhat variable and dependent on specific site conditions. One bur oak, 29.5 inches in diameter, was cored and found to be 143 years of age, while a 21.5-inch pin oak was cored and determined to be 56 years old.

The shrub layer is somewhat variable, but is generally thick to very thick and dominated by gray dogwood, European buckthorn, brambles, and prickly ash. In a few of the drier areas, that still have some Dry Oak Savanna Character, American hazel is more common.

Likewise, the ground layer is variable. Where canopy cover from shrubs and small trees has increased quickly, the species richness is rather poor, with most grasses and forbs present being indicators of recent disturbance. There are several locations where species typical of dry savanna and prairie are more common. This is particularly true of one parcel just to the south-southeast of the clubhouse.

Disturbance indicators: These communities have been fragmented and isolated both by previous agricultural activities, and more recently by golf course construction and maintenance activities. The lack of active native community management has allowed invasive tree and shrub species to colonized areas that were formerly more open, causing a decrease in species richness and overall quality.

Restoration potential: Moderate to good

These Oak Woodland-Brushland areas are often adjacent to what have been characterized as old fields. Managed together, these communities could both greatly benefit from

ecological restoration and management activities. Restored, these areas have the potential to provide multiple benefits to both the public and wildlife.

Ecological restoration can serve to reduce long-term maintenance cost, pesticide use, runoff, and off-site migration of nutrients and chemicals associated with golf course maintenance as well as improve native diversity, and wildlife habitat. The high visibility of these areas also provides an exceptional opportunity for environmental education.

EE 5

Deep Marsh

Manage 3

No description given.

EE 3

Oak Woodland-Brushland

Manage 3

No description given.

EE 9, EE 10, EE 11, EE 12

NO ACCESS

DRAINAGE DISTRICT EF

EF 1

Deep Marsh

Manage 3

No description given.

EF 2

Deep Marsh

Manage 2

No description given.

EF 6

Shallow Marsh

Manage 2

No description given.

EF 7

NO ACCESS

DRAINAGE DISTRICT EK

EK 1

Deep Marsh

Manage 2

No description given.

EK 2

Mesic Oak Forest

Manage 1

This oak forest occurs on a generally west-facing slope above and just east of Marcott Lakes. It has a nearly closed canopy that is dominated by white and pin oak that average about 22 inches in diameter. One white oak, 24 inches in diameter, was found to be 202 years of age making it the oldest tree to be cored in the study area. Other trees that occur occasionally in the canopy and subcanopy include black cherry, white birch, and elm.

The shrub layer is sparse to moderate in thickness and dominated by native species. Some of these include red-berried elder, smooth juneberry, downy arrowwood, and chokecherry. The nonnative shrub European buckthorn is rare to occasional in this community. The ground layer demonstrates moderate species richness and is mostly represented by native species. Some of these include enchanter's nightshade, early meadow rue, wild geranium, lady fern, and hog peanut. Overall, the quality of this forest is good, justifying the quality ranking of BC.

Disturbance indicators: There is some gully erosion occurring where stormwater from the developments at the top of the slope is routed down the hill. There have been some

stopgap attempts to control the erosion with things such as concrete aprons. These have met with limited success and will likely need to be addressed in the near future.

Also, there is some encroachment into the forest by adjacent homeowners. Activities such as tree cutting, fort/tree house building, and the dumping of house and yard waste are threats to the overall quality of the forest.

Restoration potential: Good

Because of the nearly intact canopy, shrub, and ground layers, this forest has a good opportunity to maintain or improve its quality with active management. Reducing encroachment, addressing erosion problems, and management of nonnative species such as European buckthorn are all activities that would help to accomplish this task. If oak regeneration is a goal for the site, prescribed burning may also be considered as a management tool.

EK 4

Shallow Open Water

Manage 2

No description given.

EK 5

Wet Meadow

Manage 3

No description given.

EK 6

Lowland Hardwood Forest

Manage 4

Surrounding a small wetland, this forest is of recent origin and dominated by small box elder, elm, green ash, and eastern cottonwood. The shrub layer of this community varies from being sparse in areas of high tree canopy coverage to moderately thick where gaps in the tree canopy occur. The most common shrubs here are honeysuckle and European buckthorn. The ground layer is generally sparse, but dominated by nonnative cool season grasses, especially where gaps occur in the canopy cover.

Disturbance indicators: This area appears to have been more open in the past and was perhaps used for grazing.

Restoration potential: Poor

Redirecting this area from a poor quality Lowland Hardwood Forest to some other natural community type would require a great deal of resources. Without human intervention, this forest will likely transition into one dominated by green ash, elm, and to a lesser degree cottonwood and box elder.

EK 7

Shallow Open Water

Manage 3

No description given.

EK 8

Shallow Marsh

Manage 4

No description given.

EK 9

Shallow Marsh

Manage 3

No description given.

EK 10

Oak Woodland-Brushland

Manage 3

This community occurs between the separate parcels of mesic oak forest on the same west-facing slope. These areas appear to have been more open in the recent past and may have been pastured. Scattered white and pin oak trees that average about 18 inches in diameter dominate the community. Between these is a dense, even-aged stand of quaking aspen about 8 inches in diameter.

The shrub layer varies from moderate to very dense and is dominated by the natives gray dogwood and prickly ash. The ground layer is largely dominated by pennsylvania sedge, with enchanter's nightshade, heart-leaved aster, and poison ivy occurring occasionally. Because of the apparent transition of this community from open to forested in the recent past, this community is of lower quality and was given the rank of D.

Disturbance indicators: The apparently recent recruitment of many aspen trees, the thickness of the shrub layer and the species-poor ground layer all tend to indicate recent transition of this community from one that was more open. The dominance of nonnative grasses in areas that are still fairly open also indicates that the area may have been used for grazing in the past.

Restoration potential: Moderately Poor

Active restoration of this site to anything other than a stand of aspen would be difficult. Some selective cutting to release desirable hardwood tree saplings that are under the canopy would help to steer this community toward a better quality hardwood stand. This could also be established through the planting of appropriate native hardwood seedlings representative of dry/mesic oak forest. This could include white, bur, and pin oak, black cherry, hackberry, or butternut under the aspens. Tree seedling establishment could be hastened through selective cutting or girdling of aspen.

EK 12

Wet Meadow

Manage 4

No description given.

EK 13

Mesic Oak Forest

Manage 1

No description given.

EK 14

Shallow Marsh

Manage 1

No description given.

EK 16

Dry Oak Forest

Manage 2

No description given.

OF10

The nonnative grasses smooth brome and Kentucky bluegrass dominate this old field. Shrubs and tree saplings have become established and comprise about 50 percent of the cover. Most common among these is smooth sumac.

Some native flowers are also re-colonizing the site. Among these are showy goldenrod, black-eyed susan, flowering spurge, and showy tick trefoil. Because this is a former agricultural field, it does not meet the criteria for natural community classification.

Disturbance indicators: Formerly farmed.

Restoration potential: Poor

Because of the dominance of shrubs in this community, it would be difficult to restore to a more open area, such as a prairie. As this area progresses to a more forested one, the planting of oak seedlings would help guide this site toward establishment of an oak forest.

Semi-natural Areas

NOTE: old fields, conifer plantations and other human- created plant assemblages provide some habitat value and can serve to link existing remnant natural communitie. However, there is no available standardized criteria for assessing their overall condition. Therefore, these sites have not received a qualitative ranking.

Old Field Sites

OF21, OF26

This is a collection of out-of-play open areas on Inverwood Golf Course that have been planted to nonnative grasses. Smooth brome and/or Kentucky bluegrass dominate most of these. Many areas are being invaded by invasive nonnative species including spotted knapweed, leafy spurge, Canada thistle, wild parsnip, and others.

However, there are a few small areas, especially those adjacent to remnant patches of savanna, that support native species. These include species such as prairie coneflower, stiff goldenrod, and heart-leaved and heath asters.

Disturbance indicators: Either formerly used for agriculture or planted to nonnative grasses following construction of the golf course

Restoration potential: Moderately good

Along with the Oak Woodland-Brushland areas, this provides an excellent opportunity for ecological restoration on City-owned property. Restored, these areas have the potential to provide multiple benefits to both the public and to wildlife.

Ecological restoration can serve to reduce long-term maintenance cost, pesticide use, runoff, and off-site migration of chemicals and nutrients associated with golf course maintenance as well as improve native diversity and wildlife habitat. The high visibility of these areas also provides an exceptional opportunity for environmental education.

OF27, OF29, OF30 This old field includes several separate parcels of similar composition. These areas are dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. There are numerous areas that are being colonized by native forbs. Among these are stiff and showy goldenrod, heart-leaved and heath aster, and round-headed bushclover. Also, there are a few patches of big and little bluestem. The latter of these two grasses tends to re-colonize disturbed areas slower than the former.

Even though there are native species re-colonizing this area, it does not have enough native community character to be considered for classification and quality ranking.

Disturbance indicators: Formerly used for agriculture.

Restoration potential: Moderate

Since trees or shrubs have not heavily colonized this old field, it would be a good candidate for a prairie restoration planting. Seeding of native grasses and forbs, along with the reintroduction of prescribed fire and other practices would help make this area more ecologically functional and diverse.

OF33

This old field has been partially colonized by small trees and shrubs. It is dominated by the nonnatives Kentucky bluegrass, and smooth brome. Currently, part of this area is hayed/mowed.

Disturbance indicators: Current/past agricultural use.

Restoration Potential: Poor

Because of the amount of brush and small trees in this parcel, it would be more difficult to carry out restoration activities such as planting prairie species. For this reason, it has a poor potential for restoration.

OF35

This old field appears to be a retired pasture, part of which may have been an old homestead. The dominant species here are smooth brome and Kentucky bluegrass, both of which are nonnatives. Shrubs, tree saplings, and a handful of native forb species are colonizing the area. Because this area does not have sufficient native community character, it does not meet minimum standard conditions for either classification or quality

ranking. This area is surrounded by rowcrop fields to the north, east and west, and is bordered by a City road to the south.

Disturbance indicators: Past use for agriculture.

Restoration potential: Poor

Because of the encroachment by trees and shrubs, and the past disturbance, this site would require substantial input for restoration that would qualify it for classification as a natural community.

Conifer Plantations

CP12

No Description Given

REFER TO SOUTHWEST QUADRANT FIGURE

6.8 Southwest Quadrant Drainage District EG

EG 1

Lowland Hardwood Forest

Manage 4

This community is a small swale where native trees appear to have colonized. Historically, this community would not have occurred in this setting, and it apparently originated on this site in the last 30 years. Dominant trees here include elm and box elder, most of which average about 10 to 12 inches in diameter.

The shrub layer is moderately dense and composed of honeysuckle, buckthorn, gooseberry, and red raspberry. The ground layer is generally sparse, with white snakeroot, self-heal, and kentucky bluegrass most common.

Disturbance indicators: It appears that this community is of recent origin, developing after box elder and elm colonized a wet swale in an abandoned field.

Restoration potential: Poor

This community is of recent origin. If left undisturbed, eventually longer-lived trees such as green ash, cherry, and hackberry will likely replace the box elder in this community.

EG 2

Deep Marsh

Manage 1

No description given.

EG 3

Mesic Oak Forest

Manage 3

This oak forest occurs in a low-lying area just south of Highway 55. It is characterized by a nearly closed canopy with large, forest-grown trees. The most common tree species in the canopy are bur and white oak, which average about 20 inches in diameter. One 16-inch bur oak was cored and found to be 100 years of age. Other species that occur occasionally in the canopy include green ash, pin oak, black cherry, and trembling aspen. These are generally about 12-14 inches in diameter.

The shrub layer is moderately thick to thick and dominated by the nonnative European buckthorn. Other less common members of the shrub layer include gooseberry, common

elderberry, and green ash saplings. The ground layer is dominated by species that indicate previous disturbance, including white snakeroot, cleavers, Virginia stickseed, and rough avens. Because of current and past disturbances, as well as the species composition of the shrub and ground layers, the community was given the relatively low rank of CD.

Disturbance indicators: This community was possibly grazed in the past, as well as infrequently having trees cut. There is also an old, fallen building remnant and a minor amount of refuse located on the south side of this area. Currently, there is a network of ATV trails that are causing some erosion on slopes and contribute to the lowered quality and wildlife value of the forest.

Restoration potential: Moderately good

With control of the nonnative European buckthorn and rest from disturbances such as ATV traffic, this community could improve in quality rather quickly. Unlike many similar forests, this community appears to have some oak regeneration making management of this area as an oak dominated community more likely in the future.

EG 5

Lowland Hardwood Swamp

Manage 3

No description given.

EG 6

Lowland Hardwood Swamp

Manage 3

No description given.

EG 7

Wet Meadow

Manage 4

No description given.

DRAINAGE DISTRICT EI

EI 1

Dry Oak Forest

Manage 2

This community varies significantly in quality, with the eastern portions being of better quality (BC rank) and the western portion of generally poor quality (CD rank). The eastern portion of this community represents the best quality Dry Oak Forest community type in the Study Area.

The canopy closure of this forest varies from about 80 to 100 percent. Dominant canopy trees include white, pin, and bur oak that average about 27 inches in diameter, as well as trembling aspen that average 10 inches in diameter. One 25-inch white oak that was cored on the east side of the community was found to be 127 years of age. Other less common tree species include black cherry and white birch.

The shrub layer varies from sparse and dominated by native species on the east side to nearly impenetrable and dominated by the nonnative European buckthorn on the west side. Native species in the shrub layer include Missouri gooseberry, downy arrowwood, red-berried elder, and American hazel.

The ground layer is likewise variable. It is generally of good quality and dominated by natives on the east side, while it is more species poor and sparse on the west side. Common natives in the ground layer on the east side include pointed-leaf tick trefoil, hog peanut, yellow bellwort, woodland sunflower, wild sarsaparilla, and red baneberry. The most common graminoid in this community is pennsylvania sedge, which occurs occasionally.

It should be noted that there is a very small parcel of Dry Prairie (Sand-gravel Subtype) on the south side of the private lane near the end. This prairie has been disturbed by earth moving activities associated with development and is being further affected by invasion by brush and trail mowing. Although it is of relatively low quality, it does represent one of the few dry prairies remaining in the study area.

Disturbance indicators: The east portion of this community has experienced some disturbance through former and current road building, as well as possibly light grazing in the past. The western portion has been significantly disturbed through grazing, potentially logging (although no cut stumps were found), and invasion by nonnative shrubs.

The eastern portion has also been highly fragmented by development and activities of homeowners such as planting of nonnative species and disposal of yard waste in natural communities. Because of the lack of ground cover in some areas in the eastern portion, there has been an increase in sheet erosion from the site, with minor rill erosion on some steeper slopes and drainages.

Restoration potential: Moderate

The eastern portion of this community will maintain or improve its quality if left undisturbed. The western portion would require substantial amounts of effort to improve in quality. Activities to be undertaken here could include control of nonnative shrub species, promotion of oak (or other native hardwood species) regeneration, seeding of native grasses and forbs, and although more difficult, possibly the application of controlled fire to the site.

EI 2

Shallow Marsh

Manage 3

No description given.

EI 5

Shallow Marsh

Manage 1

No description given.

EI 6

Shallow Marsh

Manage 4

No description given.

EI 7

Wet Meadow

Manage 1

No description given.

EI 8

Shallow Open Water

Manage 3

No description given.

EI 12

Sedge Meadow

Manage 1

No description given.

EI 13

Shallow Marsh

Manage 1

No description given.

EI 15

Dry Oak Forest

Manage 4

This disturbed forest occurs on a generally west-facing slope and is dominated by bur oak with pin oak occurring occasionally. These trees average about 18 inches in diameter with one cored bur oak, 16.5 inches in diameter being 86 years of age. The shrub layer is moderately dense to dense with European buckthorn and elm saplings being the most common species.

The ground layer is composed of a handful of species, some of which indicate disturbance. Common species here include enchanter's nightshade, kidney-leaf buttercup, and sweet cicely. Because of the dominance of the shrub and ground layer by nonnative species and those that indicate previous disturbance, plus fragmentation by development, this community was given the low qualitative rank of D.

Disturbance indicators: The dominance of the shrub layer by thorny nonnative species and the presence of forbs in the ground layer that follow disturbance it is likely that this community was grazed prior to development for home sites. This community was also fragmented by development of three homes.

Restoration potential: Moderately poor

Although restoration of this community is possible, the presently poor species composition of the shrub and ground layer would make the process more difficult. Potential restoration activities include removal of nonnative and invasive shrub species and the reintroduction of native grasses and forbs, as well as reintroduction of prescribed burning.

EI 17

Wet Meadow

Manage 4

DRAINAGE DISTRICT W

W1

Wet Meadow

Manage 4

No description given.

W 2

Oak Woodland-Brushland

Manage 3

This disturbed mesic oak forest has approximately 70-80 percent total canopy cover. Dominant tree species in the canopy include bur, white and red oak, and to a lesser degree white birch, green ash, and cottonwood. Oak species average approximately 18 inches in diameter, while other species average approximately 10 inches. This indicates that tree species other than oak are younger growth and likely originated as a result of the removal of some activity such as grazing.

The shrub layer is moderately dense and dominated by thorny species, including the nonnative European buckthorn. The other common species in the shrub layer is gooseberry. The ground layer is generally sparse and shows signs of disturbance. Infrequent species here include jack-in-the-pulpit, false solomon's seal, and enchanters nightshade.

Disturbance indicators: The composition and structure of this community indicates past disturbance. Thorny species and the younger growth of trees under the oak canopy would tend to indicate that this site was grazed for an extended period of time. Possible overgrazing would have weakened the integrity of the native plant community and enabled thorny and unpalatable species the chance to dominate. Removal of grazing, coupled with the lack of historic processes such as fire, also allowed the generation of younger trees.

Restoration potential: Moderate

Activities that could be considered in the restoration of this site include removal of nonnative species such as buckthorn and honeysuckle, as well as invasive species. Reintroduction of some native grasses and forbs would also serve to strengthen this community. Reintroduction of controlled fire would also encourage native species,

particularly regeneration of oak species. This is a practice that should be applied only by trained crews that work in cooperation with local officials.

W 8

Oak Woodland-Brushland

Manage 4

This small oak woodland occurs on a gently west-facing slope on sandy loam soils. The dominant tree species is bur oak, and less commonly pin oak that average about 24 inches in diameter. These oaks have an open-grown form, and are being overgrown by smaller trees, killing the lower branches. Other trees occurring occasionally include elm, black cherry and trembling aspen, all of which average less than ten inches in diameter.

The shrub layer is somewhat variable but generally thick. It is dominated by the nonnative European buckthorn, with prickly ash, common elderberry, chokecherry, and gray dogwood less common. The ground layer is sparse with only a few species present. Those occurring occasionally here include enchanter's nightshade and three-flowered bedstraw.Because of the poor composition of the shrub and ground layer, this community received the relatively low rank of D.

Disturbance indicators: The species poor ground layer and presence of fences tends to indicate a past history of grazing. The thick shrub layer shows that grazing was likely ended over 20 years ago. There is currently frequent mowing of some trails to the height of a manicured lawn, which fragments the existing habitat.

Restoration potential: Moderate

This woodland would improve in quality with the control of nonnative shrubs, particularly buckthorn. Cutting of some of the invasive brush species along with seeding of native grasses and forbs and the use of periodic mowing or fire would also serve to improve dramatically the quality and overall function of this community.

SEMI-NATURAL AREAS

NOTE: old fields, conifer plantations and other human- created plant assemblages provide some habitat value and can serve to link existing remnant natural communitie. However, there is no available standardized criteria for assessing their overall condition. Therefore, these sites have not received a qualitative ranking.

OF17

This old field occurs on moderately to sharply rolling terrain. It is dominated by smooth brome, a nonnative cool season grass. Trees and shrubs are volunteering into this area and comprise about 20 percent of the total cover. Included in these are elm, cottonwood and box elder seedlings as well as gray dogwood and smooth sumac.

Other species in the ground layer include Canada goldenrod and the nonnative spotted knapweed. Because this area lacks sufficient native character, it was not given a natural community classification or quality ranking.

Disturbance indicators: Formerly used for agriculture. Currently, there are a number of dirt bike trails that are contributing to rill and gully erosion problems on the site.

Restoration potential: Poor

Because of the large amount of tree and shrub colonization in this community, it would be costly to restore it to a more open area such as prairie. Other restoration options include the planting of native hardwood tree seedlings to foster forest generation. Adjacent upland forest/woodland areas could serve as a good template for such an effort. These areas suggest that white, bur, and pin oak, as well as black cherry, butternut, hackberry, and similar species would best suit the site.

OF20

This old field is being colonized by several tree and shrub species, with canopy cover already reaching 100 percent in some areas. Tree species found here include silver maple, black cherry, and elm. Shrubs commonly occurring include gray dogwood, tatarian honeysuckle, and elm. The most common members of the ground layer are the nonnative smooth brome and the native Canada goldenrod.

Disturbance indicators: Formerly used in agriculture.

Restoration potential: Poor

Without intervention, this will likely become a poor quality forest made up of an odd collection of tree species. Planting of native hardwood tree species, particularly oaks, would help guide the long-term composition of this community, thereby improving its composition and functionality.

OF23

A few patches of large, open-grown bur and pin oak trees provide additional character to this old field area. The dominant grasses here are the nonnatives smooth brome and Kentucky bluegrass. Smaller trees and shrubs are beginning to colonize the area, including gray dogwood, smooth sumac, and American elm. There are also a number of native forbs beginning to colonize the old field as well. These include stiff and showy goldenrod, golden alexanders, and health aster. The nonnative forbs spotted knapweed and narrow-leaf vetch occur here occasionally.

Disturbance indicators: Formerly used for agriculture.

Restoration potential: Poor

Because trees and shrubs are colonizing this site, it would be difficult to restore to a native community. Two alternatives might be to cut brush and reintroduce prairie species or to plant native hardwood trees, such as oaks into the existing cover.

CP31

No description given

OF33

This old field has been partially colonized by small trees and shrubs. It is dominated by the nonnatives Kentucky bluegrass, and smooth brome. Currently, part of this area is hayed/mowed.

Disturbance indicators: Current/past agricultural use.

Restoration Potential: Poor

Because of the amount of brush and small trees in this parcel, it would be more difficult to carry out restoration activities such as planting prairie species. For this reason, it has a poor potential for restoration.

OF 34

This old field surrounds an emergent wetland and is dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. There have been a few species of native species colonizing the site, including Indian grass, and round-headed bushclover.

Native and nonnative shrubs that comprise about 60 percent of the total cover are rapidly colonizing this area. These include the natives gray dogwood and prickly ash, and the nonnatives tatarian honeysuckle and European buckthorn. Overall, this former agricultural field lacks the features necessary to be classified as a recognized natural community type.

Disturbance indicators: Former use as an agricultural field, as well as recent fragmentation of the area by construction of a road and large home.

Restoration potential: Poor

Restoration of this area to an open recognized natural community type such as a prairie would be very difficult without significant planting of native grasses and forbs and the control of brush. The potential does exist to guide future composition toward a forest by planting hardwood tree seedlings that are native to the area. The owners of the recently built home planted some areas disturbed by construction to native grass and wildflowers. This has, to some degree, helped increase the native diversity of the site.

OF36

Similar to other old fields in the area, the dominant species are the nonnative grasses smooth brome and Kentucky bluegrass. There are some native species beginning to colonize the field, including little bluestem (grass), Bicknell's sedge, hoary vervain, and yarrow. There are some white pine that have been planted on the edge and appear to be volunteering into the field along with other small trees and brush.

Disturbance indicators: Because this community was converted to agricultural use, possibly row crops at some point, it does not have sufficient native character to be classified as a recognized natural community type.

Restoration potential: Moderate

This community could be planted to prairie forbs and grasses and managed as an open area. It could also be planted to native hardwood tree seedlings. Using adjacent forest/woodland tracts as a model, the most appropriate species would likely be white, pin, and bur oak.

OF37

This old field is dominated by the nonnative grass Kentucky bluegrass, with another nonnative, smooth brome also common. It appears to have been grazed in the recent past and may be given periodic rest during the growing season. About half of the cover is made up of shrubs and small trees. These include aspen, elm, cherry, and box elder, as well as others that are less common. There is also an old road that traverses the site in an east-west alignment. It has been overgrown by pasture grasses and gives no indication of the original road surface.

Disturbance indicators: Grazing and road building are the most significant signs of human disturbance.

Restoration potential: Poor

A substantial amount of resources would be required to reconstruct a recognized natural community type on this parcel.

OF38

Smooth brome and Kentucky bluegrass, both of which are nonnative, dominate this old field. Several native species common in disturbed prairies are beginning to colonize the site. These include yarrow, black-eyed susan, and hoary vervain. Because this area has been altered significantly by human activity, it does not have sufficient native character to be classified as a recognized natural community type.

Disturbance indicators: Past agricultural use.

Restoration potential: Moderate

This area has potential to be planted to prairie grasses and forbs or to native hardwood seedlings. To mimic the tree species found in adjacent woodlands, the most appropriate hardwood seedlings would likely be bur, white, and pin oak.

Conifer Plantations

CP10

This includes three separate parcels of conifer plantation dominated by red pine. These average about 10 inches in diameter and are dominated by red pine. To maintain the overall health of the pines, thinning will likely need to be undertaken in the next 5-15 years.

Disturbance indicators: Not applicable, conifer plantations are human-created plantings.

CP14

This conifer planting is dominated by red pine, with scotch pine, spruce. and white pine also common. Most trees in the planting are about 10-12 inches in diameter. The canopy is patchy with a moderately thick brush layer. The conifers will likely need to be thinned within the next 10 years to maintain overall health. The most common species in the shrub layer is the nonnative European buckthorn. Nonnative grasses dominate the ground layer, with a few weedier native and nonnative forbs occurring occasionally.

Disturbance indicators: This site appears to be periodically grazed and is currently used for horseback riding.

Restoration potential: Poor

Restoration to a recognized natural community type that historically occurred in this area is not practical. However, planting hardwood tree seedlings native to the area under the pines would allow for increased native diversity and improve the overall value to wildlife. The nonnative European buckthorn could also be removed, further improving the functionality of the area.

CP15

This conifer planting is dominated by red pines that average about 10 inches in diameter. There is little shrub layer in the planting and a sparse ground layer that is dominated by smooth brome. Similar to other conifer plantations, this planting will likely need to be considered for thinning in the next 5-15 years to maintain the health of the stand.

REFER TO NORTHWEST QUADRANT FIGURE

6.4 Northwest Quadrant Drainage District EC

EC 1

Wet Meadow

Manage 3

No description given.

EC 2

Shallow Marsh

Manage 3

No description given.

EC 3

Oak Woodland-Brushland

Manage 3

Scattered, open-grown bur and pin oak characterize the canopy of this community. These large oaks average about 20 inches in diameter. One bur oak 28 inches in diameter was cored and found to be 169 years of age. Other occasional canopy members that occur as second growth to the oaks include trembling aspen, black cherry, white birch, and American elm.

The shrub layer is thick to nearly impenetrable and is nearly completely dominated by European buckthorn. The property owner has, in the past, cut the buckthorn in an attempt to control it. However, the buckthorn resprouted and increased in density. The ground layer is sparse to absent in many areas. European buckthorn seedlings, vines, and brambles are the most common members of the ground layer. Native species occur only where patches of light reach the ground.

This property has an interesting history as a hunting lodge and preserve in the 1920s, reportedly for residents from St. Paul who were able to afford such activities. As a result, the site would probably only have been grazed for a short portion of the growing season, which may have initially helped to conserve the native character. Subsequent removal from grazing contributed to an invasion by nonnative brush species. Because of the dominance by nonnative species and the lack of native structure and composition, this community was given a low qualitative rank of D.

EC 5

Lowland Hardwood Swamp

Manage 3

No description given.

EC 7

Wet Meadow

Manage 3

No description given.

EC 10

Dry Prairie-Sand/Gravel Subtype

Manage 3

No description given.

EC 12

Lowland Hardwood Forest

Manage 4

This Lowland Hardwood Forest is of recent origin and dominated by box elder. It is likely that this low area was more open in the recent past and was colonized by box elder seedlings. These box elder average about 10 inches in diameter. The shrub layer is generally thick and dominated by the nonnative European buckthorn. The ground layer is sparse and composed of only a few species that indicate disturbance. Because of the recent origin of this community and the overall poor composition, it was given the low qualitative rank of D.

Disturbance indicators: The recent origin of this community as well its composition tend to indicate that this community was disturbed by either grazing or farming in the past.

Restoration potential: Poor

Without active management, this community will likely remain dominated by box elder for several decades to come. It may eventually come to be dominated by hardwood species such as elm, as the box elder decline in health in several decades.

Disturbance indicators: Because of the community composition, it appears likely that grazing was conducted on many portions of this community. Recent invasion by European buckthorn and honeysuckle further reduced the quality of the community.

Restoration potential: Poor

Restoration of this community would require substantial physical and financial resources, although it could be accomplished. Activities conducted during restoration would include cutting and treatment of nonnative shrubs, temporary control of invasive species, seeding with native species, and reintroduction of prescribed fire, as well as spot mowing/spraying to control nonnative species following the initial phases of restoration.

EC 15

NO ACCESS

DRAINAGE DISTRICT F

F 3

Wet Meadow

Manage 4

No description given.

F 4

Wet Meadow

Manage 4

No description given.

F 5

Shallow Open Water

Manage 3

No description given.

F 6

Seasonally Flooded Basin

Manage 3

No description given.

F9

Shallow Open Water

Manage 1

No description given.

F10

Wet Meadow

Manage 4

No description given.

F 11

Deep Marsh

Manage 4

No description given.

F 12

Shallow Marsh

Manage 3

No description given.

F 13

Shallow Open Water

Manage 4

No description given.

F 14

Shallow Open Water

Manage 3

No description given.

F 15

Deep Marsh

Manage 4

No description given.

F 16

Oak Woodland-Brushland

Manage 3

No description given.

F 18

Shallow Open Water

Manage 3

No description given.

F 19

Shallow Open Water

Manage 4

No description given.

F 21

Deep Marsh

Manage 3

No description given.

F 22

Lowland Hardwood Forest

Manage 3

No description given.

F 23

Shallow Open Water

Manage 4

No description given.

F 24

Shallow Open Water

Manage 4

No description given.

F 25

Lowland Hardwood Forest

Manage 3

No description given.

F 27

Oak Woodland-Brushland

Manage 4

Scattered, large, open-grown bur oaks with a dense second growth of trembling aspen and brush characterize this community. Pin oak occurs rarely as large trees, and is more common in the younger, second growth. The shrub layer of this community is dense and dominated mostly by native species. These include gray dogwood, prickly ash, elm, and common elderberry.

The ground layer is species poor with the most common plants being tree and shrub seedlings. Two forbs that were noted in the ground layer include rough avens and bedstraw. Because of the dense growth and lack of species richness at the shrub and ground layer, this community was given the low rank of D.

Disturbance indicators: Dense second growth of trembling aspen and the lack of species richness in the ground layer indicate release from disturbance, potentially long-term and intense grazing.

Restoration potential: Poor

Because of the dominance of second growth trees and shrubs, this community would be difficult to restore. Potential activities for restoration of this community would include brush management, reintroduction of appropriate native grasses and forbs, and the use of periodic mowing and/or fire.

DRAINAGE DISTRICT Q

Q 1

Shallow Open Water

Manage 4

No description given.

Q 2

Deep Marsh

Manage 4

No description given.

Q 3

Oak Woodland-Brushland

Manage 4

This small oak woodland is located north of I-494 and on either side of a small lake. The composition of this community varies, but is generally characterized by scattered, open-grown white oaks that average about 24 inches in diameter. A white oak, 20 inches in diameter was cored and found to be 121 years of age. Trembling aspen is also common in this community, and dominates the second growth that has occurred between the large oaks.

The shrub layer varies from absent in some openings, to impenetrable in some areas under canopy. The most common species here is European buckthorn. The ground layer is variable in composition, but generally dominated by nonnative cool season grasses that were apparently introduced as pasture forage. Native species found occasionally include three-flowered bedstraw, Canada goldenrod, and enchanters nightshade.

Disturbance indicators: Fences and dominance of nonnative grasses indicate former use as a pasture.

Restoration potential: Poor

Because of the prevalence of nonnative species in the ground and shrub layers, restoration of this community would be prohibitive due to the large amount of physical and financial resources required.

Q 5

Wet Meadow

Manage 4

No description given.

Q 7

Shallow Marsh

Manage 3

No description given.

Q 10

Shallow Open Water

Manage 2

No description given.

SEMI-NATURAL AREAS

NOTE: old fields, conifer plantations and other human- created plant assemblages provide some habitat value and can serve to link existing remnant natural communitie. However, there is no available standardized criteria for assessing their overall condition. Therefore, these sites have not received a qualitative ranking.

OF4

This old field has been abandoned for a significant period of time, perhaps decades. It is dominated by the nonnative grasses smooth brome and kentucky bluegrass. There has been a substantial amount of brush that has established in the field, comprising about half of the total cover. Common shrubs here include gray dogwood and smooth sumac.

There are several species of prairie plants that have also colonized the old field. These include heath aster, stiff and showy goldenrod, sky blue aster, and round-headed bushclover. Although these species are not typical of high quality prairie, they help to improve the overall ecological function and quality of this old field.

Disturbance indicators: This area was formerly used for agriculture. It was partially mowed during the field visit for this study and appears to be used as a recreational area by the owner.

Restoration potential: Moderately poor

Without active management, this old field will continue toward its domination by brush and small trees. Under no management it will likely develop into a forest comprised of different species of trees that happen to volunteer. Reintroduction of prairie/savanna species would enhance the site, but would require substantial physical and financial resources.

OF5a

This community is a series of old fields on gently to sharply rolling hills on the east side of Argenta Trail, just south of Interstate 494. This community also includes several small parcels of Oak Woodland-brushland that occur on steep slopes that avoided intense agricultural use.

The nonnative cool season grasses smooth brome and Kentucky bluegrass dominate the old field areas. Similar to many old fields in the study area, a number of native species are beginning to recolonize. Some of these include black-eyed susan, round-headed bushclover, stiff and showy goldenrod, and sky blue aster.

Open-grown bur and pin oaks that generally exceed 24 inches in diameter characterize the small Oak Woodland-brushland areas. Beneath these oaks is a thick shrub layer dominated by thorny species, especially the nonnative European buckthorn. The ground layer varies from sparse to moderate in native species cover, but is often dominated by small shrubs.

Disturbance indicators: Old fields were formerly used for agriculture. The small oak dominated areas were likely grazed for an extended period of time, based on their altered species composition.

Restoration potential: Moderate

Because they are adjacent to wetlands and oak woodland, restoration of these old fields has the potential to improve a large mosaic of natural communities. Similar to old field areas west of Argenta Trail, there are a number of potential activities that could be undertaken in the old fields and smaller oak woodland-brushland. These include cutting of nonnative/invasive brush species, planting of native grasses and forbs, and mowing/controlled burning.

OF8

The nonnative grasses smooth brome and Kentucky bluegrass dominate this old field. Shrubs and tree saplings have become established and comprise about 50 percent of the cover. Most common among these is smooth sumac.

Some native flowers are also re-colonizing the site. Among these are showy goldenrod, black-eyed susan, flowering spurge, and showy tick trefoil. Because this is a former agricultural field, it does not meet the criteria for natural community classification.

Disturbance indicators: Formerly farmed.

Restoration potential: Poor

Because of the dominance of shrubs in this community, it would be difficult to restore to a more open area, such as a prairie. As this area progresses to a more forested one, the planting of oak seedlings would help guide this site toward establishment of an oak forest.

OF9

This old field has been abandoned for a significant period of time, perhaps decades. It is dominated by the nonnative grasses smooth brome and kentucky bluegrass. There has

been a substantial amount of brush that has established in the field, comprising about half of the total cover. Common shrubs here include gray dogwood and smooth sumac.

There are several species of prairie plants that have also colonized the old field. These include heath aster, stiff and showy goldenrod, sky blue aster, and round-headed bushclover. Although these species are not typical of high quality prairie, they help to improve the overall ecological function and quality of this old field.

Disturbance indicators: This area was formerly used for agriculture. It was partially mowed during the field visit for this study and appears to be used as a recreational area by the owner.

Restoration potential: Moderately poor

Without active management, this old field will continue toward its domination by brush and small trees. Under no management it will likely develop into a forest comprised of different species of trees that happen to volunteer. Reintroduction of prairie/savanna species would enhance the site, but would require substantial physical and financial resources.

OF12

This old field has been abandoned for some time, perhaps 20-30 years. Scattered trees and shrubs, as well as some native prairie forbs are colonizing it. The most common trees in this area are bur oak and eastern red cedar. The community has been approximately 30 percent colonized by shrubs, especially gray dogwood and smooth sumac.

Although dominated by smooth brome and Kentucky bluegrass, there are several native grasses and forbs present. Most common among these are stiff goldenrod, round-headed bushclover, dogbane, and rough dropseed. Although this area is recovering some native character, it is insufficient to be classified as a prairie.

The scattered, young bur oak in this area give the appearance of a brush prairie or young savanna and may superficially resemble what would have been present in Inver Grove Heights at the time of Euro-American settlement.

Disturbance indicators: Formerly used for agriculture

Restoration potential: Moderately poor

Although this community could be restored to a brush prairie, it would require a substantial effort including seeding, controlled burns, and brush cutting.

OF14, OF16

This community is actually a series of old fields that border several wetland complexes west of Argenta Trail. These are generally dominated by the nonnative grasses smooth brome and Kentucky bluegrass, with reed canary grass common in lower areas. Native species are beginning to recolonize some of the old field areas that have been abandoned

for a longer period of time. Some of these natives include stiff and showy goldenrod, flowering spurge, heath aster, and heart-leaved aster.

This community also includes some areas where open-grown bur and pin oaks form small brushlands. Beneath these large, scattered oak is typically a dense growth of shrubs, especially European buckthorn. These areas were included in the old field description due to their small overall size.

Disturbance indicators: Formerly used in agriculture.

Restoration potential: Moderate

Because they are adjacent to wetlands and oak woodland, restoration of these old fields has the potential to improve a large mosaic of natural communities. Potential activities that could be undertaken in the old fields and smaller oak woodland-brushland include cutting of nonnative/invasive brush species, planting of native grasses and forbs, and mowing/controlled burning.

OF17

This old field occurs on moderately to sharply rolling terrain. It is dominated by smooth brome, a nonnative cool season grass. Trees and shrubs are volunteering into this area and comprise about 20 percent of the total cover. Included in these are elm, cottonwood and box elder seedlings as well as gray dogwood and smooth sumac.

Other species in the ground layer include Canada goldenrod and the nonnative spotted knapweed. Because this area lacks sufficient native character, it was not given a natural community classification or quality ranking.

Disturbance indicators: Formerly used for agriculture. Currently, there are a number of dirt bike trails that are contributing to rill and gully erosion problems on the site.

Restoration potential: Poor

Because of the large amount of tree and shrub colonization in this community, it would be costly to restore it to a more open area such as prairie. Other restoration options include the planting of native hardwood tree seedlings to foster forest generation. Adjacent upland forest/woodland areas could serve as a good template for such an effort. These areas suggest that white, bur, and pin oak, as well as black cherry, butternut, hackberry, and similar species would best suit the site.

OF19, OF20

This old field is being colonized by several tree and shrub species, with canopy cover already reaching 100 percent in some areas. Tree species found here include silver maple, black cherry, and elm. Shrubs commonly occurring include gray dogwood, tatarian

honeysuckle, and elm. The most common members of the ground layer are the nonnative smooth brome and the native Canada goldenrod.

Disturbance indicators: Formerly used in agriculture.

Restoration potential: Poor

Without intervention, this will likely become a poor quality forest made up of an odd collection of tree species. Planting of native hardwood tree species, particularly oaks, would help guide the long-term composition of this community, thereby improving its composition and functionality.

OF23

A few patches of large, open-grown bur and pin oak trees provide additional character to this old field area. The dominant grasses here are the nonnatives smooth brome and Kentucky bluegrass. Smaller trees and shrubs are beginning to colonize the area, including gray dogwood, smooth sumac, and American elm. There are also a number of native forbs beginning to colonize the old field as well. These include stiff and showy goldenrod, golden alexanders, and health aster. The nonnative forbs spotted knapweed and narrow-leaf vetch occur here occasionally.

Disturbance indicators: Formerly used for agriculture.

Restoration potential: Poor

Because trees and shrubs are colonizing this site, it would be difficult to restore to a native community. Two alternatives might be to cut brush and reintroduce prairie species or to plant native hardwood trees, such as oaks into the existing cover.

OF27, OF30

This old field includes several separate parcels of similar composition. These areas are dominated by the nonnative cool season grasses smooth brome and Kentucky bluegrass. There are numerous areas that are being colonized by native forbs. Among these are stiff and showy goldenrod, heart-leaved and heath aster, and round-headed bushclover. Also, there are a few patches of big and little bluestem. The latter of these two grasses tends to re-colonize disturbed areas slower than the former.

Even though there are native species re-colonizing this area, it does not have enough native community character to be considered for classification and quality ranking.

Disturbance indicators: Formerly used for agriculture.

Restoration potential: Moderate

Since trees or shrubs have not heavily colonized this old field, it would be a good candidate for a prairie restoration planting. Seeding of native grasses and forbs, along with the

reintroduction of prescribed fire and other practices would help make this area more ecologically functional and diverse.

OF28

This is an old field that occurs on property currently being mined for sand/gravel. It is dominated by nonnative cool season grasses, including smooth brome and Kentucky bluegrass. Several nonnative forbs are common, including the invasive spotted knapweed. A few native forbs have recolonized the area, including black-eyed susan, which occurs infrequently.

Disturbance indicators: Farming, gravel mining.

Restoration potential: Poor

Most of this site will be a candidate for mine reclamation. If the site is targeted for open space in the future, it may represent a good opportunity for a sand-gravel prairie restoration.

Conifer Plantations

CP2, CP4

These conifer plantingsare largely composed of red and white pine that average about 12 inches in diameter. A second conifer plantation to the northeast is included in this description. It was planted to jack pine, with some hardwoods volunteering between them.

Both of these plantations, particularly the one dominated by red and white pine, are very close. Many trees are within eight feet of their neighbor. Overall, the health of the trees in these plantations appears good. However, they could benefit from thinning.

Disturbance indicators: Not applicable. This is a human-created planting.

Restoration potential: Not applicable, although thinning of pine is recommended within 5 years to maintain the health of the stands.

CP9

This includes three separate parcels of conifer plantation dominated by red pine. These average about 10 inches in diameter and are dominated by red pine. To maintain the overall health of the pines, thinning will likely need to be undertaken in the next 5-15 years.

Disturbance indicators: Not applicable, conifer plantations are human-created plantings.

CP11, CP13

White, red, jack, and scotch pine dominate this conifer plantation. Spruce occurs less frequently. Most of the trees are about 12 inches in diameter and are approximately 30 years of age. The shrub layer is sparse to absent in most places, with a few small box elder saplings growing.

The ground layer varies from sparse to absent as well, with smooth brome being the most common member here.

Disturbance indicators: Human-created planting.

7. PRESERVATION AND ENHANCEMENT

7.1 POTENTIAL USES FOR THIS INFORMATION

Below are general concepts and recommendations for review and possible adoption by the City of Inver Grove Heights. These recommendations are suggested from a natural community/site protection and management perspective. This holistic approach favors management of the whole over management of a single species or site.

The Local Local Advisory Committee established for this project provided input for local values criteria that served to complement the natural community rankings that were arrived at using standardized criteria. Examples of local value criteria include assessing an area based on whether a natural area/semi-natural area occurs “adjacent to higher quality sites” or is “uncommon in the study area”.

Also, since many of the natural resources discussed in this report may potentially be managed by private citizens, it will be important to share information from this natural resource inventory with developers, citizens, and other groups.

City Ordinances

City ordinances can be important tools for protecting natural resources. Ordinances that provide for setbacks and buffers around sensitive natural areas identified in this inventory are one example. Another example would be to limit removal of trees and other vegetation on residential building lots and allow for and encourage establishment of native trees, shrubs, grasses, and forbs in place of more conventional lawns and landscaping.

Language should also be considered which prohibits purposeful planting of state-listed agricultural “weeds”. In crafting ordinance language, the term “weeds” should be as well defined as possible to prevent misinterpretation.

Existing ordinances such as a City Tree Protection ordinance may already contain language that helps protect the City’s natural resources. Additional language or ordinances could be added where necessary. It is worthwhile to revisit these existing natural resource-related ordinances to review how well they fit in with the concept of protecting landscape functionality/natural areas rather than protecting a small part of the landscape such as individual trees.

Land Use Zoning

Zoning can play an important role in the impact that expansion of the City has on its natural resources. To the extent possible, land uses should be compatible with landscape type, native plant and animal communities, and other natural features.

An example might be providing for the lowest possible housing density adjacent to areas with significant natural communities. Clustered housing could also be encouraged through the City’s PUD Ordinance in these types of areas. Clustered housing could be

concentrated within areas with low natural resource and local values, while adjacent areas of high value could be retained as open space.

Whether low densities or clustered housing is used, buffers around sensitive natural areas should be created and, if possible, both the buffer and natural area should be designated for permanent conservation.

Community Monitoring

Sound management decisions are based on quality information. This concept is as true in the management of natural resources as it is in the management of a city or business. To maintain the long-term quality and management of natural areas, periodic monitoring should be conducted in actively managed areas to allow for adaptive resource management.

Landowner Involvement

Most Manage 1 and Mange 2 sites are held in private ownership. The City (and conservation organizations) can work with the landowner to create a conservation easement. This type of arrangement is particularly advantageous where significant natural areas are located on a parcel of private land and there is some concern for long-term management of these areas.

Further information is provided on the DNR Website including the resource Land Protection Options, a Handbook for Minnesota Landowners http://files.dnr.state.mn.us/assistance/landprot.pdf . This is an outstanding tool to help individual landowners better understand their options, and also for city staff as a resource to help positively engage interested property owners.

Another important resource for private landowners is the publication Beyond the Suburbs: A Landowner's Guide to Conservation Management . This resource can also be found on the MN DNR website at: http://files.dnr.state.mn.us/forestry/beyond_suburbs.pdf

Education

The City, a variety of other public agencies, and private landowners are all involved in making decisions that affect the quality of natural areas in Inver Grove Heights. The better understanding that all of the participants in decision making have of the function of natural communities, the better and more uniform the management of these areas will be. It is important for all interested parties to be informed about their natural resources and how they can be managed. Citizens could be made aware of the benefits of managing their property for natural communities through public meetings and workshops and/or development and circulation of a pamphlet or brochure.

Development Review

Sound management decisions are based on quality information. This concept is as true in the management of natural resources as it is in the management of a city or business. It is highly recommended that the information contained in this report be used by the city during

regular development reviews to avoid, minimize, or mitigate potential damage to natural areas, particularly those of high quality and those that lie within corridors/greenways.

7.2 Ecological Management

Connectivity

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 affects 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. Linkages should consider corridors and natural areas outside the City as well as features within the City.

Vegetative Buffers

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. Conversely, City trail systems should not be located where they defeat the purpose of natural buffers.

Native Plantings

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 Inver Grove Heights Area. A good source of information on indigenous plants is the species list provided in Appendix A of this report.

Other sources are available that include plant species 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 replace the original natural community type that existed before conversion (i.e., prairie, oak forest).

Exotic Species Control

Several non-native species (sometimes called “exotics”) have become problems in natural areas in Inver Grove Heights. These include European buckthorn, tatarian honeysuckle,

Chinese elm, reed canary grass, spotted knapweed, poison hemlock, and leafy spurge. 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 homesite 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.

Habitat Structures

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 book Landscaping for Wildlife by Carroll Henderson is a useful guide for improving habitat with plantings and structures.

7.3 General Natural Community Management Practices

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.

Prairies and Savannas

The health of prairie and savanna plant communities was maintained before European settlement by grazing and fires, which probably occurred annually to every few years on most sites. Some fires occurred naturally, and many were set by native peoples to aid hunting and other activities. 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 generally 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, intense and/or prolonged grazing has degraded prairies and savannas. This reduces forb diversity and encourages the dominance of clonal plants (such as Canada goldenrod) that are unpalatable to livestock in old field

areas. Other factors responsible for the decline of prairie and savanna communities includes tree planting, plowing, frequent mowing, and development.

Less than one percent of the prairie and savanna landscapes that once existed in Minnesota 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 probably most appropriate for tree and shrub species such as black locust, sumac, and buckthorn. Repeated herbicide treatments may be needed for other exotic species such as leafy spurge and reed canary grass.

Remedy disturbance problems where possible, by closing trails where erosion is occurring, reduce or rotate intense grazing (including grazing by white-tail deer) to maintain plant populations.

Use prescribed burns as a management tool to control cool season grasses and other exotics, remove accumulated plant litter, encourage germination of prairie plants from the seedbed, 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.

Consider overseeding where exotic species are removed if elimination of exotics and prescribed burns over several seasons fail to restore desired diversity, areas, or by reseeding the entire area. Restored 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.

In general, ***savannas should be burned less frequently than prairies*** and droughty sites burned less frequently than mesic or wet sites. Average burn frequency for the dry prairies and savannas that characterize Inver Grove Heights is approximately 5 years, with a range of 1-20+ years. In addition, burn frequency should be greater during the first couple of years if control of nonnative species is a management objective.

In general, ***more frequent fires favor grass species and less frequent fires tend to favor brush, trees, and prairie forbs*** (flowering plants).

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 (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. An example would be not burning an entire prairie at once; this would leave refuges for the species of concern and allow for potential re-colonization of burned areas.

Monitor the effectiveness of management activities, and changes in plant and animal species in managed areas. Adjust activities as needed based on monitoring results.

Wetlands

Wetland plant communities are frequently altered or degraded by changes in hydrologic regimes associated with agricultural or urban development. Farming and urban development alter the quantity and quality of stormwater entering wetlands by increasing stormwater runoff and associated 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. Altering these flows may de-water and alter seepage communities and fens.

Goals for wetland plant communities may include maintaining or restoring native plant communities and diversity by re-establishing or approximating original hydrology and natural processes, and providing desirable waterfowl and wildlife habitat. Some communities with variable hydrology, such as cattail marshes and wet meadows, may be relatively easy to restore or enhance. More specialized communities like fens and seepage swamps may be nearly impossible to restore if hydrologic conditions have changed.

Some strategies for enhancing or restoring native plant communities in 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 strategies to reduce runoff into wetlands; 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 used to control reed canary grass and purple loosestrife. Biological controls, such as weevils, have also shown some promise 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 labeled 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 wetland areas and buffers. Plantings should use native species, and may include aquatic plants, grasses, forbs, shrubs, and trees to provide structural diversity and improve habitat.

Monitor management efforts and revise strategies as needed to meet goals.

Forests

Most of the forest areas in Inver Grove Heights have been heavily grazed and in some cases, logged over. Forest communities in Inver Grove Heights are often found on 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 European 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 canopy trees in areas containing exotic shrubs. Where cutting trees is necessary, cut exotic shrubs and treat the stump 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.

Avoid cutting mast-bearing trees such as oak and hickory due to their 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, box elder, Russian olive, black locust and eastern red cedar. Plant higher value native trees and shrubs following removal.

Consider restoring prescribed fire in publicly owned oak forests, they 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 sprouting, as well as 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 infrequently. Historically, the interval between fires in these community types exceeded 20 years, and often averaged over 50 or 100 years.

Oak wilt is a particular concern in Inver Grove Heights due to the presence of oak throughout most of the City. The spread of oak wilt is increased by construction activities, such as those that causes root damage during the growing season. Openings created by oak wilt in the canopy can augment invasion by exotic species if not replanted or managed to restore oak woodlands. Control oak wilt using methods recommended by the Minnesota DNR Division of Forestry.

Oak trees should not be cut, pruned or injured between April 15 and July 1 of each year. Exposed roots injured by construction activities are just as likely to result in oak wilt infection as cut branches. If injury occurs, the wound should be treated with a tree wound dressing within 15 minutes or less to reduce the infection potential. A vibratory plow should be used to sever roots along the edge of any construction area prior to beginning work, to prevent the transfer of oak wilt fungus from exposed roots and allow for regeneration at the point of cutting.

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 of the tree protection zone and/or other construction sites.

7.4 Specific Recommendations

Following are specific recommendations for management of natural resources in Inver Grove Heights. These recommendations focus on the most significant and highest quality natural areas in the City and serve as the next step toward active management of natural resources. Following each recommendation are potential programs, partners and grant programs, and/or funding opportunities.

Wetland Restoration/Banking

Several sites within the City are well suited for use as wetland restoration or banking sites. This includes sites containing degraded wetlands, or in some cases, sites with proper hydrology and soils for wetlands. These sites will become increasingly important as stormwater management for developing areas of the City takes place.

Wetland banking sites provide for mitigation where unavoidable impacts from development occur. Rather than mitigation being provided on a project by project basis, mitigation can

be provided for a number of different projects at one location. This approach is less costly to the City and developers and generally results in better quality wetland restoration. Key areas for wetland restoration/banking include ditched/drained wetlands, particularly where there is an opportunity to provide a buffer to an adjacent, high quality wetland/natural area. These sites may occur along proposed stormwater conveyance routes and can be restored/constructed as part of stormwater ponding improvements.

Partners: Landowners, Board of Soil and Water Resources, Dakota County SWCD

Funding: Met Council Clean Water Initiative, BWSR Wetland Banking Grant, Inver Grove Heights, Dakota County SWCD

Potential High Erosion Areas

Many of the forest/woodland areas within the city lack sufficient groundcover. This situation has the potential to lead to significant sheet erosion, if not rill and gully erosion. Actively eroding areas not only degrades the quality of the upland areas, but also wetlands. In some instances it may shorten the maintenance cycle for storm ponds and other surface water infrastructure. Proactively identifying and managing erosion/gully areas (such as the east side of Markgrafs Lake) has the potential to save the city money in the long-run.

Potential Partners: Landowners, City of Inver Grove Heights

Funding: Stormwater Utility Fund, Conservation Partners Grant Program, Metropolitan Council Clean Water Initiative

Harmon Park Restoration & Management

Harmon Park represents a unique opportunity to the City of Inver Grove Heights to restore prairie and savanna. This would serve to improve the aesthetics and ecological function of the site.

The site is currently dominated by nonnative grasses and shrubs that were planted after retirement from agriculture. Proactively planting prairie will help minimize the long-term management problems posed by nonnative/invasive species and provide local residents with a wonderful opportunity to experience prairie in this rolling, scenic landscape.

The first step in restoration should be to create a short plan that provides a road map on what should be done, when, and how much it will cost. Planning and actual restoration could be paid for by any number of grant sources, greatly minimizing any direct cost to the city.

Potential Partners: MN DNR, Friends of the Mississippi River, National Park Service, U.S. Fish & Wildlife Service, and others.

Inver Wood Golf Course

Inver Wood Golf Course represents an excellent opportunity for the city to restore prairie and savanna.

Numerous out of play areas at the course support remnant savanna and prairie. These areas would be remarkably easy and relatively inexpensive to manage. Restoring prairie/savanna can reduce long-term course maintenance cost, protect water quality, provide color in the form of wildflowers, and improve the functionality of the landscape. This is certainly a win-win situation for the city and its residents.

There are numerous examples of other courses in the Twin Cities, and throughout the country who actively manage natural areas. The Chaska Town Course is one such course where patrons comment very positively about how they appreciate the aesthetic beauty of actively managed natural areas at the course. Chaska Town Course has nearly 60 acres of prairie plantings, over 30 acres of wetland, and 5 acres of forest.

We encourage the city to consider managing out of play areas at Inver Wood in this manner…and there are lots of resources to help along the way.

Potential Resources: New York Audubon Cooperative Sanctuary Program, MN Golf Association (Superintendents)

Greenways/Open Space

A common theme throughout this report has been the importance of connectivity among natural resource areas. Linking natural areas through the use of natural resource corridors adds values to those areas connected.

These values are realized through a greater diversity of flora and fauna and a healthier overall ecosystem. The presence of a corridor also allows genetic material to move among otherwise isolated natural areas, maintaining the gene pool of plants and animals for future generations. Humans also realize the benefits of corridors through enhanced recreational opportunities such as expanded trail systems. However, where sensitive natural resources are present, recreational uses would need to be limited to avoid negative impacts.

The use of corridors embodies many of the specific and general recommendations and management strategies provided in this report. The use of corridors would provide the overall framework under which these recommendations could most effectively be carried out. For example, most of the high quality natural communities identified during the inventory fall within one or more corridor boundaries.

A considerable proportion of the land area within the proposed corridors is sensitive to development due to unsuitable soils, steep slopes, wetlands or floodplains. For this reason, not all land included in corridors decreases land available for residential development, agriculture, or transportation. Corridors can be maintained as part of adjacent developments, construction of public infrastructure, or as part of large regional corridor projects.

It is important to note that the Advisory Committee member for this project in general, did not feel that greenways would substantially benefit wildlife in the study area due to the configuration of natural areas here and the potential future land use. However they do see greenways and corridors as a means to link and preserve natural areas. They see the value of greenways as trail corridors and envision that natural and recreational greenways may not have the same alignment in this area of Inver Grove Heights. Additionally, the recommend that implementation of greenways be considered voluntary on the part of private landowners, and as a private-public partnership.

Potential partners: Dakota County, Dakota County Soil and Water Conservation District, Minnesota DNR, and the National Park Service.

Argenta Trail Wetlands

The deep wetlands in the Argenta Trail area have been monitored for a number of years by citizens as part of the Dakota Wetland Health Evaluation Project. This citizen monitoring project and the information gathered as part of this natural resource inventory indicate that there are a number of factors including the flora and fauna of the wetlands in this complex that make them high quality resources. As a result, this warrants consideration for proactive management and/or protection. This may come in several forms such as conservations easement, partnering for resource management, or proactive development review should portions of the area be sold/considered for development. It will also be important to prevent deleterious changes in the quantity/quality of runoff that reaches the best wetlands in this area in the future.

Marcott Chain of Lakes

The Marcott Chain of Lakes area includes a series of shallow lakes/deep marshes, as well as several moderate to good quality oak forests in the surrounding upland areas. These natural areas were identified in this report as important for the study area, as well as noted as a resource of high interest in the North Dakota County Greenway planning project undertaken by the Dakota County Soil & Water Conservation District in 2001. Field inventories completed for this study indicate that the forests would benefit from active management to reduce the presence nonnative/invasive species, reduce current erosion problems, and improve the overall quality of these upland resources through proactive stewardship. The shallow lakes/deep marshes of the area would benefit from management of the upland areas as well, with the potential for reducing the nutrient/sediment loads that are currently reaching these water bodies. It would be recommendable to (continue) work with area residents to help facilitate protection of these important resources in the city.

Priority Natural Areas

In addition to the recommendations provided above, we recommend that the City work with landowners to enable protection/management of natural areas listed below. The sites below are not given in priority order.

Recommended Priority Sites for Management/Protection

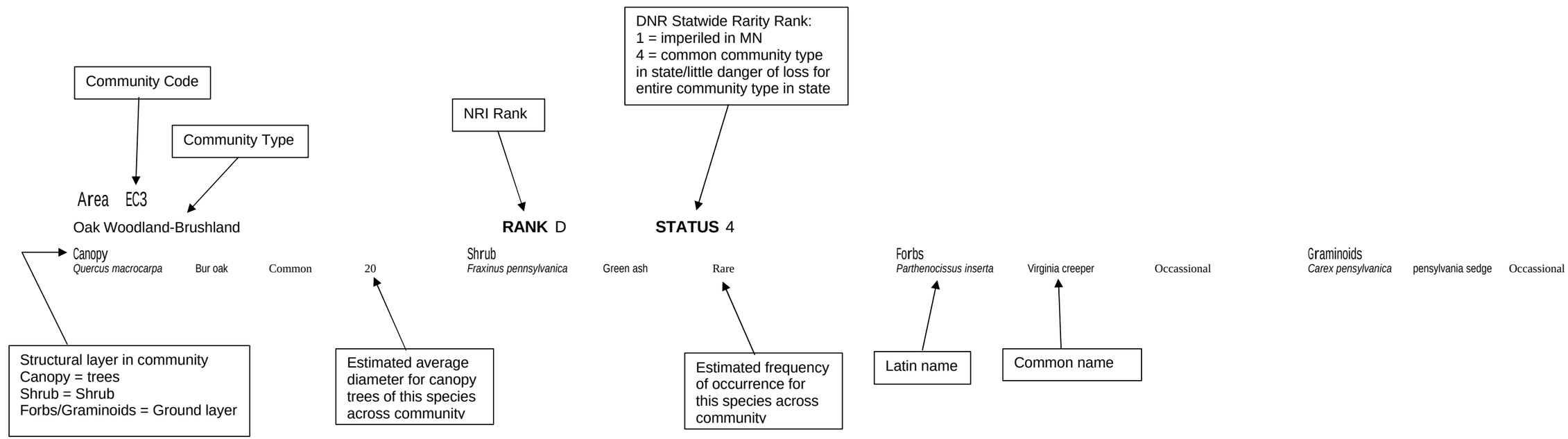
Community ID	Place Name/Community Type
EA 20	Nichols' Sedge Meadow
EA 30	Kladek's Prairie
EI 12	A sedge-dominated floating mat
BB5	Inver Wood Golf Course Savanna
EK 2, EK 10, EK 13	Marcott Lake Oak Forest
EI 5	Wilczek's Marsh
EJ 5	Harmon Hillside Woods
F 9	Argenta Marsh
EA 7	Nichols' Hillside Oaks

Appendix A

Upland Natural Areas Species Lists

This section contains species lists and other data for individual upland natural areas visited as a part of this study. Below is a sample header for an individual community, along with an explanation of the various aspects.

It is important to note that the frequency of occurrence noted for individual plant species (common, occasional, rare) denotes how often a particular plant species was encountered in that community. ***The terminology used in this report to characterize the frequency of occurrence for plants is not, and should not be associated with State- or Federal-listed plant species (Endangered, Threatened, Special Concern).***



Inver Grove Heights Northwest Study Area – Upland Natural Areas

Area EC3

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus macrocarpa	Bur oak	Common	20
Prunus serotina	Black cherry	Occassional	12
Betula papyrifera	Paper birch	Occassional	10
Populus tremuloides	Quaking aspen	Occassional	10
Ulmus americana	American elm	Occassional	8
Quercus ellipsoidalis	Northern pin oak	Occassional	16

Shrub

Fraxinus pennsylvanica	Green ash	Rare
Prunus virginiana	Chokecherry	Rare
Cornus foemina	Gray dogwood	Occassional
Sambucus pubens	Red-berried elder	Occassional
Rubus occidentalis	Black raspberry	Occassional
Rubus strigosus	Red raspberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Lonicera tatarica	Tartarian honeysuckle	Rare
Acer negundo	Box elder	Rare
Ribes missouriense	Missouri gooseberry	Occassional

Forbs

Parthenocissus inserta	Virginia creeper	Occassional
Geranium maculatum	Wild geranium	Rare
Geranium maculatum	Wild geranium	Rare
Vitis riparia	Wild grape	Occassional
Aquilegia canadensis	Columbine	Rare
Prunella vulgaris	Heal-all	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Galium triflorum	Three-flowered bedstraw	Occassional
Circaea lutetiana	Enchanter's nightshade	Occassional
Rhus radicans	Poison ivy	Rare
Aster oolentangiensis	Sky-blue aster	Rare
Athyrium angustum	Lady fern	Rare
Helianthus strumosus	Woodland sunflower	Occassional

Graminoids

Carex pensylvanica	pensylvania sedge	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area EA7

Oak Woodland-Brushland **RANK** BC **STATUS** 4

Canopy

Populus tremuloides	Quaking aspen	Occassional	8
Quercus macrocarpa	Bur oak	Common	14
Quercus ellipsoidalis	Northern pin oak	Occassional	12

Shrub

Cornus foemina	Gray dogwood	Common
Lonicera tatarica	Tartarian honeysuckle	Occassional
Prunus serotina	Black cherry	Occassional
Corylus americana	American hazelnut	Occassional
Prunus americana	Wild plum	Occassional
Viburnum lentago	Nannyberry	Rare
Amelanchier laevis	Smooth juneberry	Occassional
Rhus glabra	Smooth sumac	Common
Celtis occidentalis	Hackberry	Rare
Rubus allegheniensis	Common blackberry	Rare
Ceanothus americanus	New Jersey tea	Rare
Rhamnus cathartica	Common buckthorn	Common

Forbs

Helianthus strumosus	Woodland sunflower	Occassional
Viola pedata	Bird-foot violet	Rare
Viola pedata	Bird-foot violet	Rare
Lespedeza capitata	Round-headed bush-clover	Rare
Solidago rigida	Stiff goldenrod	Occassional
Solidago speciosa	Showy goldenrod	Occassional
Galium boreale	Northern bedstraw	Occassional
Rosa arkansana	Prairie rose	Occassional
Aster cordifolius	Heart-leaved aster	Rare
Desmodium canadense	Tick-trefoil	Rare
Monarda fistulosa	Wild bergamot	Occassional
Apocynum cannabinum	Indian hemp	Occassional
Lithospermum canescens	Hoary puccoon	Rare
Antennaria plantaginifolia	Plantain-leaved pussytoes	Occassional
Lathyrus ochroleucus	Pale vetchling	Rare
Agastache foeniculum	Blue giant-hyssop	Rare
Amorpha canescens	Lead-plant	Rare
Anemone virginiana	Thimbleweed	Rare
Achillea millefolium	Yarrow	Rare
Euphorbia corollata	Flowering spurge	Rare
Thalictrum	Meadow-rue	Rare
Anemone cylindrica	Thimbleweed	Occassional

Graminoids

Phleum pratense	Timothy	Occassional
Panicum lanuginosum	Hairy panic grass	Rare
Panicum lanuginosum	Hairy panic grass	Rare
Andropogon gerardii	Big bluestem	Rare
Andropogon gerardii	Big bluestem	Rare
Carex striata	Walter's sedge	Rare
Panicum wilcoxianum	Wilcox's panic grass	Occassional
Bromus inermis	Smooth brome	Common

Area BA1

Oak Woodland-Brushland **RANK** C **STATUS** 4

Canopy

Shrub

Forbs

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EJ11, EJ5

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus macrocarpa	Bur oak	Common	26
Prunus serotina	Black cherry	Rare	10
Quercus alba	White oak	Rare	20
Quercus ellipsoidalis	Northern pin oak	Common	20
Populus tremuloides	Quaking aspen	Common	10

Shrub

Vitis riparia	Wild grape	Occassional
Cornus foemina	Gray dogwood	Occassional
Rubus occidentalis	Black raspberry	Occassional
Ulmus americana	American elm	Rare
Acer ginnala	Amur maple	Rare
Ribes missouriense	Missouri gooseberry	Occassional
Cornus alternifolia	Pagoda dogwood	Rare
Rhus glabra	Smooth sumac	Occassional
Rhamnus cathartica	Common buckthorn	Common

Forbs

Helianthus strumosus	Woodland sunflower	Occassional
Monarda fistulosa	Wild bergamot	Occassional
Monarda fistulosa	Wild bergamot	Occassional
Solidago flexicaulis	Zig-zag goldenrod	Rare
Solidago rigida	Stiff goldenrod	Occassional
Rosa arkansana	Prairie rose	Occassional
Solidago rigida	Stiff goldenrod	Occassional
Euphorbia corollata	Flowering spurge	Rare
Asclepias syriaca	Common milkweed	Occassional
Apocynum cannabinum	Indian hemp	Rare
Parthenocissus inserta	Virginia creeper	Occassional
Geranium maculatum	Wild geranium	Rare
Rhus radicans	Poison ivy	Occassional
Solidago canadensis	Canada goldenrod	Occassional
Verbena urticifolia	White vervain	Occassional
Solidago speciosa	Showy goldenrod	Occassional

Graminoids

Bromus inermis	Smooth brome	Common
Poa pratensis	Kentucky bluegrass	Occassional
Poa pratensis	Kentucky bluegrass	Occassional
Carex pensylvanica	pensylvania sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional

Area EG3

Oak Forest, Mesic

RANK CD **STATUS** 2

Canopy

Prunus serotina	Black cherry	Occassional	16"
Quercus macrocarpa	Bur oak	Common	16"
Fraxinus pennsylvanica	Green ash	Occassional	18"
Populus tremuloides	Quaking aspen	Occassional	12"
Acer negundo	Box elder	Common	10"
Quercus ellipsoidalis	Northern pin oak	Occassional	24"
Quercus alba	White oak	Occassional	24"

Shrub

Fraxinus pennsylvanica	Green ash	Occassional
Ribes cynosbati	Prickly gooseberry; Dogberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Sambucus canadensis	Common elder	Occassional

Forbs

Athyrium angustum	Lady fern	Rare
Ranunculus abortivus	Kidney-leaf buttercup	Rare
Ranunculus abortivus	Kidney-leaf buttercup	Rare
Geum canadense	White avens	Occassional
Eupatorium rugosum	Common snakeroot	Common
Smilax lasioneura	Carrion-flower	
Geranium maculatum	Wild geranium	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Anemone quinquefolia	Wood anemone	Rare
Hackelia virginiana	Virginia stickseed	Occassional
Pilea pumila	Clearweed	Occassional
Circaea lutetiana	Enchanter's nightshade	Occassional
Parthenocissus inserta	Virginia creeper	Occassional
Galium aparine	Cleavers	Occassional
Urtica dioica	Stinging nettle	Occassional

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area W2

Oak Forest, Mesic

RANK CD **STATUS** 2

Canopy

Betula papyrifera	Paper birch	Rare	10
Fraxinus americana	White ash	Occassional	12
Quercus alba	White oak	Occassional	18
Ulmus americana	American elm	Common	10
Quercus rubra	Northern red oak; Common red oak	Common	12
Quercus macrocarpa	Bur oak	Common	18
Populus deltoides	Cottonwood	Rare	9

Shrub

Parthenocissus inserta	Virginia creeper	Common
Ribes	Currant; Gooseberry	Common
Rhamnus cathartica	Common buckthorn	Common

Forbs

Aquilegia canadensis	Columbine	Occassional
Arisaema triphyllum	Jack-in-the-pulpit	Occassional
Arisaema triphyllum	Jack-in-the-pulpit	Occassional
Circaea	Enchanter's Nightshade	Occassional
Anemonella thalictroides	Rue-anemone	Occassional

Graminoids

Area EG1, F22, F25

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Acer negundo	Box elder	Common	10
Ulmus	Elm	Occassional	
Prunus serotina	Black cherry	Occassional	
Acer saccharinum	Silver maple; Soft maple	Occassional	

Shrub

Lonicera tatarica	Tartarian honeysuckle	Common
Rhus glabra	Smooth sumac	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Rubus strigosus	Red raspberry	Occassional
Ulmus	Elm	Common
Cornus foemina	Gray dogwood	Common

Forbs

Solidago canadensis	Canada goldenrod	Common
Solidago rigida	Stiff goldenrod	Occassional
Solidago rigida	Stiff goldenrod	Occassional

Graminoids

Bromus inermis	Smooth brome	Common

Appendix A: Natural Resources Inventory -- Community Survey

Area EB5,EB6

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Quercus ellipsoidalis	Northern pin oak	Occassional	20
Prunus serotina	Black cherry	Occassional	12
Acer saccharinum	Silver maple; Soft maple	Occassional	14
Populus deltoides	Cottonwood	Occassional	16
Populus tremuloides	Quaking aspen	Occassional	10
Quercus macrocarpa	Bur oak	Occassional	20

Shrub

Prunus americana	Wild plum	Rare
Rhamnus cathartica	Common buckthorn	Common
Ribes missouriense	Missouri gooseberry	Occassional
Acer negundo	Box elder	Occassional
Sambucus canadensis	Common elder	Occassional
Prunus serotina	Black cherry	Occassional

Forbs

Liparis liliifolia	Purple twayblade	Occassional
Galium triflorum	Three-flowered bedstraw	Occassional
Galium triflorum	Three-flowered bedstraw	Occassional
Rosa arkansana	Prairie rose	Occassional
Rhus radicans	Poison ivy	Occassional
Fragaria virginiana	Common strawberry	Occassional
Athyrium angustum	Lady fern	Rare
Desmodium glutinosum	Pointed-leaved tick-trefoil	Occassional
Hackelia virginiana	Virginia stickseed	Rare
Thalictrum dasycarpum	Tall meadow rue	Rare
Circaea lutetiana	Enchanter's nightshade	Occassional
Urtica dioica	Stinging nettle	Rare
Smilacina racemosa	False Solomon's-seal	Occassional
Dioscorea villosa	Wild yam	Occassional
Geranium maculatum	Wild geranium	Occassional
Thalictrum dioicum	Early meadow rue	Occassional

Graminoids

Carex pensylvanica	pensylvania sedge	Rare

Appendix A: Natural Resources Inventory -- Community Survey

Area EC10

Dry Prairie (hill subtype) **RANK** D **STATUS** 2

Canopy

Shrub

Rhus glabra	Smooth sumac	Occassional
Cornus foemina	Gray dogwood	Rare

Forbs

Vicia angustifolia	Narrow-leaved vetch	Occassional
Asclepias verticillata	Whorled milkweed	Occassional
Rumex acetosella	Red sorrel	Rare
Amorpha canescens	Lead-plant	Occassional
Solidago rigida	Stiff goldenrod	Common
Aster oblongifolius	Aromatic aster	Occassional
Aster oolentangiensis	Sky-blue aster	Common
Erigeron annuus	Daisy fleabane	Occassional
Solidago speciosa	Showy goldenrod	Common
Achillea millefolium	Yarrow	Occassional
Euphorbia corollata	Flowering spurge	Common
Solidago nemoralis	Gray goldenrod	Occassional
Helianthemum canadense	Frostweed	Common
Aster ericoides	Heath aster	Common
Antennaria plantaginifolia	Plantain-leaved pussytoes	Occassional
Coronilla varia	Crown-vetch	Rare
Rhus radicans	Poison ivy	Occassional
Lespedeza capitata	Round-headed bush-clover	Occassional
Dalea candida	White prairie-clover	Common

Graminoids

Panicum wilcoxianum	Wilcox's panic grass	Occassional
Stipa spartea	Porcupine grass	Occassional
Bromus inermis	Smooth brome	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area BA11

Dry Prairie (hill subtype)

RANK D **STATUS** 2

Canopy

Shrub

Zanthoxylum americanum	Prickly ash	Rare
Ulmus americana	American elm	Rare
Rhus glabra	Smooth sumac	Common
Cornus foemina	Gray dogwood	Common
Prunus serotina	Black cherry	Rare

Forbs

Aster ericoides	Heath aster	Occassional
Aster oolentangiensis	Sky-blue aster	Occassional
Liatris aspera	Rough blazing star	Rare
Solidago speciosa	Showy goldenrod	Occassional
Euphorbia corollata	Flowering spurge	Occassional
Monarda fistulosa	Wild bergamot	Occassional
Lespedeza capitata	Round-headed bush-clover	Occassional
Ratibida pinnata	Gray-headed coneflower	Occassional
Solidago rigida	Stiff goldenrod	Occassional
Artemisia ludoviciana	Western mugwort; White	Occassional
Lespedeza capitata	Round-headed bush-clover	Occassional
Solidago canadensis	Canada goldenrod	Common
Rudbeckia hirta	Black-eyed Susan	Rare
Ambrosia coronopifolia	Western ragweed	Occassional
Achillea millefolium	Yarrow	Occassional

Graminoids

Poa pratensis	Kentucky bluegrass	Occassional
Stipa spartea	Porcupine grass	Occassional
Andropogon gerardii	Big bluestem	Common
Andropogon gerardii	Big bluestem	Common
Bromus inermis	Smooth brome	Common
Phleum pratense	Timothy	Rare

Area EA2,EA10,EA18

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Populus tremuloides	Quaking aspen	Common	10
Betula papyrifera	Paper birch	Rare	10
Quercus ellipsoidalis	Northern pin oak	Occassional	18
Quercus macrocarpa	Bur oak	Occassional	20
Prunus serotina	Black cherry	Occassional	12

Shrub

Ribes missouriense	Missouri gooseberry	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Corylus americana	American hazelnut	Rare
Vitis riparia	Wild grape	Occassional
Acer negundo	Box elder	Occassional
Crataegus	Hawthorn	Occassional
Viburnum lentago	Nannyberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Sambucus canadensis	Common elder	Occassional
Rhus radicans	Poison ivy	Occassional
Rhus glabra	Smooth sumac	Occassional
Rubus occidentalis	Black raspberry	Occassional
Cornus foemina	Gray dogwood	Occassional

Forbs

Athyrium angustum	Lady fern	Rare
Thalictrum dioicum	Early meadow rue	Rare
Thalictrum dioicum	Early meadow rue	Rare
Galium triflorum	Three-flowered bedstraw	Occassional
Smilacina racemosa	False Solomon's-seal	Occassional
Pteridium aquilinum	Bracken	Rare
Arisaema triphyllum	Jack-in-the-pulpit	Rare
Actaea rubra	Red baneberry	Rare
Matteuccia struthiopteris	Ostrich fern	Rare
Geum canadense	White avens	Rare

Graminoids

Carex pensylvanica	pensylvania sedge	Rare

Appendix A: Natural Resources Inventory -- Community Survey

Area EK16

	RANK	STATUS
Canopy		
Shrub		
Forbs		
Graminoids		

Area EA23,EB4

Oak Woodland-Brushland

	RANK CD	STATUS 4

Canopy			
Quercus ellipsoidalis	Northern pin oak	Common	22
Acer negundo	Box elder	Occassional	8
Populus tremuloides	Quaking aspen	Common	10
Quercus macrocarpa	Bur oak	Common	22
Prunus serotina	Black cherry	Occassional	8

Shrub		
Prunus serotina	Black cherry	Rare
Rhamnus cathartica	Common buckthorn	Common
Zanthoxylum americanum	Prickly ash	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Ribes missouriense	Missouri gooseberry	Occassional
Cornus foemina	Gray dogwood	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Rubus occidentalis	Black raspberry	Rare
Acer negundo	Box elder	Occassional
Sambucus pubens	Red-berried elder	Rare

Forbs		
Rhamnus cathartica	Common buckthorn	Common
Hackelia virginiana	Virginia stickseed	Rare
Hackelia virginiana	Virginia stickseed	Rare
Vitis riparia	Wild grape	Occassional
Parthenocissus inserta	Virginia creeper	Common
Verbena urticifolia	White vervain	Rare
Geum canadense	White avens	Occassional
Circaea lutetiana	Enchanter's nightshade	Common
Smilacina racemosa	False Solomon's-seal	Rare

Graminoids		
Carex pensylvanica	pensylvania sedge	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area EA30

Dry Prairie (sand-gravel subtype) **RANK** D **STATUS** 2

Canopy

Shrub

Cornus foemina	Gray dogwood	Occassional
Juniperus virginiana	Red cedar	Rare
Rubus occidentalis	Black raspberry	Rare
Rubus flagellaris	Northern dewberry	Rare
Rhus glabra	Smooth sumac	Common

Forbs

Apocynum cannabinum	Indian hemp	Occassional
Monarda fistulosa	Wild bergamot	Occassional
Ratibida pinnata	Gray-headed coneflower	Occassional
Heliopsis helianthoides	Ox-eye	Rare
Anemone cylindrica	Thimbleweed	Rare
Solidago speciosa	Showy goldenrod	Common
Solidago rigida	Stiff goldenrod	Common
Antennaria plantaginifolia	Plantain-leaved pussytoes	Rare
Lespedeza capitata	Round-headed bush-clover	Rare
Thalictrum dasycarpum	Tall meadow rue	Rare
Vicia americana	American vetch	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Pycnanthemum virginianum	Virginia mountain-mint	Rare
Rudbeckia hirta	Black-eyed Susan	Rare
Agastache foeniculum	Blue giant-hyssop	Rare
Achillea millefolium	Yarrow	Occassional
Euphorbia corollata	Flowering spurge	Rare
Aster ericoides	Heath aster	Occassional
Artemisia ludoviciana	Western mugwort; White	Rare

Graminoids

Andropogon gerardii	Big bluestem	Common
Panicum wilcoxianum	Wilcox's panic grass	Common
Sorghastrum nutans	Indian grass	Common
Sorghastrum nutans	Indian grass	Common
Poa pratensis	Kentucky bluegrass	Occassional
Bromus inermis	Smooth brome	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area EI1

Oak Forest, Dry

RANK C **STATUS** 3

Canopy

Quercus ellipsoidalis	Northern pin oak	Common	26"
Quercus macrocarpa	Bur oak	Common	28"
Prunus serotina	Black cherry	Occassional	8"
Populus tremuloides	Quaking aspen	Common	10"
Betula papyrifera	Paper birch	Rare	10"
Quercus alba	White oak	Common	24"

Shrub

Sambucus pubens	Red-berried elder	Occassional
Zanthoxylum americanum	Prickly ash	Occassional
Rhamnus cathartica	Common buckthorn	Common
Cornus foemina	Gray dogwood	Rare
Rubus occidentalis	Black raspberry	Rare
Celtis occidentalis	Hackberry	Occassional
Viburnum rafinesquianum	Downy arrowwood	Rare
Prunus serotina	Black cherry	Occassional
Ribes cynosbati	Prickly gooseberry; Dogberry	Occassional
Rhus radicans	Poison ivy	Occassional
Corylus americana	American hazelnut	Occassional
Acer negundo	Box elder	Rare
Ulmus americana	American elm	Occassional
Parthenocissus inserta	Virginia creeper	Occassional

Forbs

Geum canadense	White avens	Rare
Smilacina racemosa	False Solomon's-seal	Occassional
Smilacina racemosa	False Solomon's-seal	Occassional
Zizia aptera	Heart-leaved alexanders	Rare
Helianthus strumosus	Woodland sunflower	Occassional
Caulophyllum thalictroides	Blue cohosh	Rare
Thalictrum dioicum	Early meadow rue	Occassional
Smilax lasioneura	Carrion-flower	Rare
Menispermum canadense	Canada moonseed	Rare
Menispermum canadense	Canada moonseed	Rare
Sanicula marilandica	Black snakeroot	Rare
Actaea rubra	Red baneberry	Rare
Galium triflorum	Three-flowered bedstraw	Occassional
Geranium maculatum	Wild geranium	Occassional
Uvularia grandiflora	Yellow bellwort	Occassional
Pteridium aquilinum	Bracken	Occassional
Circaea lutetiana	Enchanter's nightshade	
Phryma leptostachya	Lopseed	Occassional
Hackelia virginiana	Virginia stickseed	Occassional
Osmorhiza longistylis	Anise-root	Occassional
Eupatorium rugosum	Common snakeroot	Occassional
Desmodium glutinosum	Pointed-leaved tick-trefoil	Common
Aralia nudicaulis	Wild sarsaparilla	Occassional
Viola	Violet	Rare
Trillium cernuum	Nodding trillium	Rare
Athyrium angustum	Lady fern	Occassional
Carex pensylvanica	pensylvania sedge	Occassional
Maianthemum canadense	Canada mayflower	Occassional
Osmunda claytoniana	Interrupted fern	Rare
Arisaema triphyllum	Jack-in-the-pulpit	Rare
Solidago flexicaulis	Zig-zag goldenrod	Rare

Graminoids

Carex	Sedge	Rare
Carex pensylvanica	pensylvania sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area EK 2, EK 13

Oak Forest, Mesic

RANK BC **STATUS** 2

Canopy

Betula papyrifera	Paper birch	Occassional	6"
Quercus alba	White oak	Common	18"
Prunus serotina	Black cherry		10"
Ulmus americana	American elm	Occassional	8"
Quercus ellipsoidalis	Northern pin oak	Occassional	22"
Acer negundo	Box elder	Rare	8"

Shrub

Amelanchier laevis	Smooth juneberry	Rare
Rhamnus cathartica	Common buckthorn	Occassional
Rubus occidentalis	Black raspberry	Occassional
Ribes missouriense	Missouri gooseberry	Occassional
Rubus occidentalis	Black raspberry	Rare
Rubus allegheniensis	Common blackberry	Rare
Viburnum rafinesquianum	Downy arrowwood	Occassional
Sambucus pubens	Red-berried elder	Occassional
Prunus virginiana	Chokecherry	Occassional
Prunus serotina	Black cherry	Occassional
Parthenocissus inserta	Virginia creeper	Occassional

Forbs

Geranium maculatum	Wild geranium	Occassional
Geum canadense	White avens	Occassional
Geum canadense	White avens	Occassional
Carex pensylvanica	pensylvania sedge	Rare
Circaea lutetiana	Enchanter's nightshade	Common
Athyrium angustum	Lady fern	Occassional
Adiantum pedatum	Maidenhair-fern	Rare
Osmunda claytoniana	Interrupted fern	Occassional
Amphicarpaea bracteata	Hog-peanut	Occassional
Smilacina racemosa	False Solomon's-seal	Rare
Thalictrum dioicum	Early meadow rue	Occassional
Carex	Sedge	Rare
Carex rosea	stellate sedge	Rare
Carex tribuloides	blunt broom sedge	Rare

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EB11

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Populus tremuloides	Quaking aspen	Occassional	10
Quercus ellipsoidalis	Northern pin oak	Common	20
Quercus macrocarpa	Bur oak	Common	26

Shrub

Rhamnus cathartica	Common buckthorn	Common
Robinia pseudoacacia	Black locust	Occassional
Rubus allegheniensis	Common blackberry	Common
Sambucus canadensis	Common elder	Occassional
Vitis riparia	Wild grape	Common
Parthenocissus inserta	Virginia creeper	Common
Corylus americana	American hazelnut	Rare
Rhus glabra	Smooth sumac	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Ribes missouriense	Missouri gooseberry	Rare
Rubus occidentalis	Black raspberry	Common

Forbs

Circaea lutetiana	Enchanter's nightshade	Rare
Rumex acetosella	Red sorrel	Rare
Rumex acetosella	Red sorrel	Rare
Smilacina racemosa	False Solomon's-seal	Rare
Hypericum perforatum	Common St. John's-wort	Occassional
Agrimonia gryposepala	Agrimony	Rare
Onoclea sensibilis	Sensitive fern	Rare
Monarda fistulosa	Wild bergamot	Occassional
Athyrium angustum	Lady fern	Rare
Fragaria virginiana	Common strawberry	Rare
Erigeron annuus	Daisy fleabane	Occassional
Aster cordifolius	Heart-leaved aster	Occassional
Achillea millefolium	Yarrow	Occassional
Galium boreale	Northern bedstraw	Occassional
Liparis liliifolia	Purple twayblade	Rare
Oenothera biennis	Common evening-primrose	Occassional
Thalictrum dasycarpum	Tall meadow rue	Rare
Amphicarpaea bracteata	Hog-peanut	Occassional

Graminoids

Bromus inermis	Smooth brome	Common
Poa pratensis	Kentucky bluegrass	Common
Poa pratensis	Kentucky bluegrass	Common
Carex pensylvanica	pensylvania sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional

Area EA2,EA10,EA18

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Populus tremuloides	Quaking aspen	Common	10
Betula papyrifera	Paper birch	Rare	10
Quercus ellipsoidalis	Northern pin oak	Occassional	18
Quercus macrocarpa	Bur oak	Occassional	20
Prunus serotina	Black cherry	Occassional	12

Shrub

Ribes missouriense	Missouri gooseberry	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Corylus americana	American hazelnut	Rare
Vitis riparia	Wild grape	Occassional
Acer negundo	Box elder	Occassional
Crataegus	Hawthorn	Occassional
Viburnum lentago	Nannyberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Sambucus canadensis	Common elder	Occassional
Rhus radicans	Poison ivy	Occassional
Rhus glabra	Smooth sumac	Occassional
Rubus occidentalis	Black raspberry	Occassional
Cornus foemina	Gray dogwood	Occassional

Forbs

Athyrium angustum	Lady fern	Rare
Thalictrum dioicum	Early meadow rue	Rare
Thalictrum dioicum	Early meadow rue	Rare
Galium triflorum	Three-flowered bedstraw	Occassional
Smilacina racemosa	False Solomon's-seal	Occassional
Pteridium aquilinum	Bracken	Rare
Arisaema triphyllum	Jack-in-the-pulpit	Rare
Actaea rubra	Red baneberry	Rare
Matteuccia struthiopteris	Ostrich fern	Rare
Geum canadense	White avens	Rare

Graminoids

Carex pensylvanica	pensylvania sedge	Rare

Appendix A: Natural Resources Inventory -- Community Survey

Area EB20, EB24

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus ellipsoidalis	Northern pin oak	Occassional	
Quercus macrocarpa	Bur oak	Common	20"
Populus tremuloides	Quaking aspen	Common	10"
Betula papyrifera	Paper birch	Rare	8"

Shrub

Corylus americana	American hazelnut	Occassional
Quercus ellipsoidalis	Northern pin oak	Common
Quercus macrocarpa	Bur oak	Occassional
Zanthoxylum americanum	Prickly ash	Occassional
Sambucus pubens	Red-berried elder	Rare
Ulmus americana	American elm	Occassional
Rubus occidentalis	Black raspberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Ribes missouriense	Missouri gooseberry	Occassional
Cornus foemina	Gray dogwood	Occassional
Acer negundo	Box elder	Occassional

Forbs

Galium triflorum	Three-flowered bedstraw	Occassional
Parthenocissus inserta	Virginia creeper	
Parthenocissus inserta	Virginia creeper	
Geum canadense	White avens	Occassional

Graminoids

Area EC12

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Acer negundo	Box elder	10"

Shrub

Forbs

Graminoids

Area EK6

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Ulmus americana	American elm
Acer negundo	Box elder
Populus deltoides	Cottonwood

Shrub

Acer negundo	Box elder

Forbs

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EB5,EB6

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Quercus ellipsoidalis	Northern pin oak	Occassional	20
Prunus serotina	Black cherry	Occassional	12
Acer saccharinum	Silver maple; Soft maple	Occassional	14
Populus deltoides	Cottonwood	Occassional	16
Populus tremuloides	Quaking aspen	Occassional	10
Quercus macrocarpa	Bur oak	Occassional	20

Shrub

Prunus americana	Wild plum	Rare
Rhamnus cathartica	Common buckthorn	Common
Ribes missouriense	Missouri gooseberry	Occassional
Acer negundo	Box elder	Occassional
Sambucus canadensis	Common elder	Occassional
Prunus serotina	Black cherry	Occassional

Forbs

Liparis liliifolia	Purple twayblade	Occassional
Galium triflorum	Three-flowered bedstraw	Occassional
Galium triflorum	Three-flowered bedstraw	Occassional
Rosa arkansana	Prairie rose	Occassional
Rhus radicans	Poison ivy	Occassional
Fragaria virginiana	Common strawberry	Occassional
Athyrium angustum	Lady fern	Rare
Desmodium glutinosum	Pointed-leaved tick-trefoil	Occassional
Hackelia virginiana	Virginia stickseed	Rare
Thalictrum dasycarpum	Tall meadow rue	Rare
Circaea lutetiana	Enchanter's nightshade	Occassional
Urtica dioica	Stinging nettle	Rare
Smilacina racemosa	False Solomon's-seal	Occassional
Dioscorea villosa	Wild yam	Occassional
Geranium maculatum	Wild geranium	Occassional
Thalictrum dioicum	Early meadow rue	Occassional

Graminoids

Carex pensylvanica	pensylvania sedge	Rare

Area W8

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus macrocarpa	Bur oak	Common	24"
Populus tremuloides	Quaking aspen	Occassional	7"
Prunus serotina	Black cherry	Occassional	12"
Ulmus americana	American elm	Occassional	10"

Shrub

Cornus foemina	Gray dogwood	Occassional
Rhamnus cathartica	Common buckthorn	Common
Sambucus canadensis	Common elder	Occassional
Zanthoxylum americanum	Prickly ash	Occassional
Prunus virginiana	Chokecherry	Occassional
Parthenocissus inserta	Virginia creeper	
Rubus occidentalis	Black raspberry	Occassional
Rhus glabra	Smooth sumac	Occassional

Forbs

Smilacina racemosa	False Solomon's-seal	Rare
Arisaema triphyllum	Jack-in-the-pulpit	Rare
Arisaema triphyllum	Jack-in-the-pulpit	Rare
Athyrium angustum	Lady fern	Rare
Onoclea sensibilis	Sensitive fern	Rare
Polygonatum commutatum	Giant Solomon's-seal	Rare
Galium triflorum	Three-flowered bedstraw	Rare
Circaea lutetiana	Enchanter's nightshade	Occassional

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EI15

Oak Forest, Dry

RANK D **STATUS** 3

Canopy

Quercus ellipsoidalis	Northern pin oak	Occassional	13"
Prunus serotina	Black cherry	Rare	
Quercus macrocarpa	Bur oak	Common	18"

Shrub

Parthenocissus inserta	Virginia creeper	Occassional
Rhamnus cathartica	Common buckthorn	Common
Zanthoxylum americanum	Prickly ash	Occassional
Prunus serotina	Black cherry	Occassional
Ulmus americana	American elm	Common
Acer negundo	Box elder	Rare
Ribes cynosbati	Prickly gooseberry; Dogberry	Occassional
Sambucus pubens	Red-berried elder	Rare
Vitis riparia	Wild grape	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Prunus virginiana	Chokecherry	Occassional
Rubus occidentalis	Black raspberry	Occassional
Cornus foemina	Gray dogwood	Occassional

Forbs

Arctium minus	Common burdock	Rare
Ranunculus abortivus	Kidney-leaf buttercup	Occassional
Ranunculus abortivus	Kidney-leaf buttercup	Occassional
Osmorhiza claytonii	Sweet Cicely	Occassional
Urtica dioica	Stinging nettle	Rare
Actaea rubra	Red baneberry	Rare
Athyrium angustum	Lady fern	Rare
Circaea lutetiana	Enchanter's nightshade	Common
Leonurus cardiaca	Motherwort	Rare
Geranium maculatum	Wild geranium	Rare
Smilacina stellata	Starry false Solomon's-seal	Rare
Amphicarpaea bracteata	Hog-peanut	Rare

Graminoids

Area EJ3

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Prunus serotina	Black cherry	Rare	12
Populus tremuloides	Quaking aspen	Rare	8
Acer negundo	Box elder	Occassional	8
Quercus ellipsoidalis	Northern pin oak	Occassional	20
Betula papyrifera	Paper birch	Rare	10
Quercus alba	White oak	Occassional	26

Shrub

Ribes missouriense	Missouri gooseberry	Occassional
Prunus serotina	Black cherry	Rare
Rubus occidentalis	Black raspberry	Occassional
Sambucus canadensis	Common elder	Occassional
Fraxinus pennsylvanica	Green ash	Rare
Acer negundo	Box elder	Occassional
Prunus virginiana	Chokecherry	Occassional

Forbs

Arctium minus	Common burdock	Occassional
Athyrium angustum	Lady fern	Rare
Athyrium angustum	Lady fern	Rare
Hackelia virginiana	Virginia stickseed	Occassional
Polygonum pensylvanicum	Pennsylvania smartweed	Occassional
Amphicarpaea bracteata	Hog-peanut	Rare
Solanum ptycanthum	Black nightshade	Occassional
Prunella vulgaris	Heal-all	Common
Agrimonia gryposepala	Agrimony	Occassional
Circaea lutetiana	Enchanter's nightshade	Occassional
Geum canadense	White avens	Occassional
Chenopodium	Goosefoot	Common
Verbascum thapsus	Mullein	Occassional
Osmunda claytoniana	Interrupted fern	Rare
Cirsium vulgare	Bull thistle	Common
Aquilegia canadensis	Columbine	Rare

Graminoids

Setaria	Bristly foxtail-grass	Occassional
Carex vulpinoidea	fox sedge	Occassional
Carex vulpinoidea	fox sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional
Echinochloa crusgalli	Barnyard grass	Rare

Appendix A: Natural Resources Inventory -- Community Survey

Area EG1, F22, F25

Lowland Hardwood Forest

RANK D **STATUS** 4

Canopy

Acer negundo	Box elder	Common	10
Ulmus	Elm	Occassional	
Prunus serotina	Black cherry	Occassional	
Acer saccharinum	Silver maple; Soft maple	Occassional	

Shrub

Lonicera tatarica	Tartarian honeysuckle	Common
Rhus glabra	Smooth sumac	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Rubus strigosus	Red raspberry	Occassional
Ulmus	Elm	Common
Cornus foemina	Gray dogwood	Common

Forbs

Solidago canadensis	Canada goldenrod	Common
Solidago rigida	Stiff goldenrod	Occassional
Solidago rigida	Stiff goldenrod	Occassional

Graminoids

Bromus inermis	Smooth brome	Common

Area BB5

Dry Oak Savanna

RANK CD **STATUS** 2

Canopy

Quercus ellipsoidalis	Northern pin oak
Populus tremuloides	Quaking aspen
Ulmus americana	American elm
Quercus macrocarpa	Bur oak
Prunus serotina	Black cherry

Shrub

Rubus occidentalis	Black raspberry
Acer negundo	Box elder
Cornus foemina	Gray dogwood
Corylus americana	American hazelnut
Rhamnus cathartica	Common buckthorn
Rosa arkansana	Prairie rose
Sambucus	Elder
Lonicera tatarica	Tartarian honeysuckle
Prunus serotina	Black cherry
Ribes cynosbati	Prickly gooseberry; Dogberry

Forbs

Circaea lutetiana	Enchanter's nightshade
Aster oolentangiensis	Sky-blue aster
Aster oolentangiensis	Sky-blue aster
Lespedeza capitata	Round-headed bush-clover
Aster cordifolius	Heart-leaved aster
Amorpha canescens	Lead-plant
Galium boreale	Northern bedstraw
Eupatorium rugosum	Common snakeroot
Viola pedata	Bird-foot violet
Lithospermum canescens	Hoary puccoon
Anemone cylindrica	Thimbleweed
Euphorbia corollata	Flowering spurge
Solidago speciosa	Showy goldenrod
Antennaria plantaginifolia	Plantain-leaved pussytoes
Heuchera richardsonii	Alum-root
Anemone virginiana	Thimbleweed
Geum triflorum	Prairie smoke
Smilax lasioneura	Carrion-flower
Helianthus strumosus	Woodland sunflower
Ranunculus abortivus	Kidney-leaf buttercup

Graminoids

Stipa spartea	Porcupine grass
Andropogon gerardii	Big bluestem
Andropogon gerardii	Big bluestem
Schizachyrium scoparium	Little bluestem
Schizachyrium scoparium	Little bluestem
Poa pratensis	Kentucky bluegrass
Carex pensylvanica	pensylvania sedge

Appendix A: Natural Resources Inventory -- Community Survey

Area Q3

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus ellipsoidalis	Northern pin oak	Rare	14
Quercus alba	White oak	Common	24
Prunus serotina	Black cherry	Occassional	8
Populus tremuloides	Quaking aspen	Common	10
Betula papyrifera	Paper birch	Occassional	8

Shrub

Lonicera tatarica	Tartarian honeysuckle	Occassional
Ribes missouriense	Missouri gooseberry	Occassional
Rhamnus cathartica	Common buckthorn	Common
Zanthoxylum americanum	Prickly ash	Occassional
Rubus occidentalis	Black raspberry	Occassional
Cornus foemina	Gray dogwood	Occassional
Quercus ellipsoidalis	Northern pin oak	Occassional
Prunus virginiana	Chokecherry	Occassional
Vitis riparia	Wild grape	Occassional

Forbs

Galium triflorum	Three-flowered bedstraw	Occassional
Onoclea sensibilis	Sensitive fern	Rare
Onoclea sensibilis	Sensitive fern	Rare
Rhus radicans	Poison ivy	Occassional
Smilacina racemosa	False Solomon's-seal	Rare
Parthenocissus inserta	Virginia creeper	Occassional
Achillea millefolium	Yarrow	Rare
Campanula rapunculoides	European bellflower	Rare
Hackelia virginiana	Virginia stickseed	Rare
Solidago canadensis	Canada goldenrod	Occassional
Circaea lutetiana	Enchanter's nightshade	Rare
Liparis liliifolia	Purple twayblade	Rare

Graminoids

Poa pratensis	Kentucky bluegrass	Occassional
Carex pensylvanica	pensylvania sedge	Occassional
Carex pensylvanica	pensylvania sedge	Occassional

Area EK10

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Ulmus americana	American elm	Occassional	
Quercus macrocarpa	Bur oak	Occassional	15"
Juniperus virginiana	Red cedar	Occassional	8"
Populus tremuloides	Quaking aspen	Common	8"
Quercus alba	White oak	Occassional	18"

Shrub

Lonicera tatarica	Tartarian honeysuckle	Occassional
Rhus glabra	Smooth sumac	Occassional
Cornus foemina	Gray dogwood	Common
Rhamnus cathartica	Common buckthorn	Occassional
Zanthoxylum americanum	Prickly ash	Common

Forbs

Circaea lutetiana	Enchanter's nightshade	Occassional
Carex pensylvanica	pensylvania sedge	Common
Carex pensylvanica	pensylvania sedge	Common
Aster cordifolius	Heart-leaved aster	
Agrimonia gryposepala	Agrimony	Rare
Rhus radicans	Poison ivy	Occassional

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EE8

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Quercus macrocarpa	Bur oak	
Celtis occidentalis	Hackberry	Rare
Quercus alba	White oak	
Ulmus americana	American elm	
Prunus serotina	Black cherry	
Acer saccharum	Sugar maple	Rare
Quercus ellipsoidalis	Northern pin oak	

Shrub

Celtis occidentalis	Hackberry	
Viburnum lentago	Nannyberry	
Ribes cynosbati	Prickly gooseberry; Dogberry	Occassional
Acer negundo	Box elder	Occassional
Actaea rubra	Red baneberry	
Rhamnus cathartica	Common buckthorn	
Acer saccharum	Sugar maple	Rare
Celtis occidentalis	Hackberry	
Rubus occidentalis	Black raspberry	
Viburnum rafinesquianum	Downy arrowwood	
Prunus serotina	Black cherry	
Amelanchier laevis	Smooth juneberry	
Cornus foemina	Gray dogwood	
Prunus virginiana	Chokecherry	

Forbs

Carex pensylvanica	pensylvania sedge	
Dioscorea villosa	Wild yam	
Dioscorea villosa	Wild yam	
Liparis liliifolia	Purple twayblade	Rare
Athyrium angustum	Lady fern	
Hackelia virginiana	Virginia stickseed	
Galium triflorum	Three-flowered bedstraw	
Maianthemum canadense	Canada mayflower	
Rosa arkansana	Prairie rose	
Geranium maculatum	Wild geranium	
Smilacina racemosa	False Solomon's-seal	
Arisaema triphyllum	Jack-in-the-pulpit	
Circaea lutetiana	Enchanter's nightshade	
Geum canadense	White avens	
Scutellaria lateriflora	Mad-dog skullcap	

Graminoids

Appendix A: Natural Resources Inventory -- Community Survey

Area EB 23, EE2, BA 10,

Oak Woodland-Brushland

RANK CD **STATUS** 4

Canopy

Quercus macrocarpa	Bur oak	Common
Prunus serotina	Black cherry	
Ulmus americana	American elm	
Quercus ellipsoidalis	Northern pin oak	Common
Populus tremuloides	Quaking aspen	Common

Shrub

Rosa arkansana	Prairie rose
Corylus americana	American hazelnut
Prunus serotina	Black cherry
Rubus occidentalis	Black raspberry
Sambucus pubens	Red-berried elder
Rhamnus cathartica	Common buckthorn
Cornus foemina	Gray dogwood
Acer negundo	Box elder
Lonicera tatarica	Tartarian honeysuckle
Ribes cynosbati	Prickly gooseberry; Dogberry

Forbs

Lithospermum canescens	Hoary puccoon
Anemone cylindrica	Thimbleweed
Anemone cylindrica	Thimbleweed
Aster oolentangiensis	Sky-blue aster
Antennaria plantaginifolia	Plantain-leaved pussytoes
Circaea lutetiana	Enchanter's nightshade
Anemone virginiana	Thimbleweed
Smilax lasioneura	Carrion-flower
Carex pensylvanica	pensylvania sedge
Geum triflorum	Prairie smoke
Euphorbia corollata	Flowering spurge
Actaea rubra	Red baneberry
Galium boreale	Northern bedstraw
Solidago speciosa	Showy goldenrod
Rhus radicans	Poison ivy
Aster cordifolius	Heart-leaved aster
Ranunculus abortivus	Kidney-leaf buttercup
Viola pedata	Bird-foot violet
Amorpha canescens	Lead-plant
Eupatorium rugosum	Common snakeroot
Lespedeza capitata	Round-headed bush-clover
Helianthus strumosus	Woodland sunflower
Heuchera richardsonii	Alum-root
Parthenocissus inserta	Virginia creeper

Graminoids

Andropogon gerardii	Big bluestem
Stipa spartea	Porcupine grass
Stipa spartea	Porcupine grass
Poa pratensis	Kentucky bluegrass
Poa pratensis	Kentucky bluegrass
Schizachyrium scoparium	Little bluestem

Rhamnus cathartica	Common buckthorn	Common
Geum triflorum	Prairie smoke	Rare
Rudbeckia hirta	Black-eyed Susan	Occassional
Aster oolentangiensis	Sky-blue aster	Rare
Solidago rigida	Stiff goldenrod	Occassional
Hackelia virginiana	Virginia stickseed	Occassional

Area EA23,EB4

Oak Woodland-Brushland

RANK CD **STATUS** 4

Canopy

Quercus ellipsoidalis	Northern pin oak	Common	22
Acer negundo	Box elder	Occassional	8
Populus tremuloides	Quaking aspen	Common	10
Quercus macrocarpa	Bur oak	Common	22
Prunus serotina	Black cherry	Occassional	8

Shrub

Prunus serotina	Black cherry	Rare
Rhamnus cathartica	Common buckthorn	Common
Zanthoxylum americanum	Prickly ash	Occassional
Fraxinus pennsylvanica	Green ash	Occassional
Ribes missouriense	Missouri gooseberry	Occassional
Cornus foemina	Gray dogwood	Occassional
Lonicera tatarica	Tartarian honeysuckle	Occassional
Rubus occidentalis	Black raspberry	Rare
Acer negundo	Box elder	Occassional
Sambucus pubens	Red-berried elder	Rare

Forbs

Rhamnus cathartica	Common buckthorn	Common
Hackelia virginiana	Virginia stickseed	Rare
Hackelia virginiana	Virginia stickseed	Rare
Vitis riparia	Wild grape	Occassional
Parthenocissus inserta	Virginia creeper	Common
Verbena urticifolia	White vervain	Rare
Geum canadense	White avens	Occassional
Circaea lutetiana	Enchanter's nightshade	Common
Smilacina racemosa	False Solomon's-seal	Rare

Graminoids

Carex pensylvanica	pensylvania sedge	Occassional

Appendix A: Natural Resources Inventory -- Community Survey

Area F27

Oak Woodland-Brushland

RANK D **STATUS** 4

Canopy

Ulmus americana	American elm	Occassional
Populus tremuloides	Quaking aspen	Common
Prunus virginiana	Chokecherry	Occassional
Quercus macrocarpa	Bur oak	Occassional
Fraxinus pennsylvanica	Green ash	Rare
Quercus ellipsoidalis	Northern pin oak	Occassional

Shrub

Vitis riparia	Wild grape	Occassional
Zanthoxylum americanum	Prickly ash	Common
Acer saccharinum	Silver maple; Soft maple	Occassional
Lonicera tatarica	Tartarian honeysuckle	Common
Cornus foemina	Gray dogwood	Common
Sambucus canadensis	Common elder	Occassional

Forbs

Rhamnus cathartica	Common buckthorn	Occassional
Geum canadense	White avens	Occassional
Geum canadense	White avens	Occassional
Galium triflorum	Three-flowered bedstraw	Occassional

Graminoids

Appendix B

Wetland and Upland Information Tables

Wetland Information Summary Table

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
BA1	Shallow Marsh	0.8	-	-	-	-	-
BA1	Wet Meadow	0.2	-	-	-	-	-
BA10	Hardwood Swamp	1	-	0	0	0.106	4
BA2	Shallow Marsh	0.8	PEMC	3	1	0.149	3
BA2	Wet Meadow	0.2	PEMC	3	1	0.149	3
BA4	Shallow Marsh	0.25	PEMC	3	1	0.604	4
BA4	Wet Meadow	0.75	PEMC	3	1	0.604	4
BB2	Shallow Marsh	0.7	PUBF	4	0	0.511	3
BB2	Wet Meadow	0.3	PUBF	4	0	0.511	3
BB3	Shallow Open Water	1	PUBF	4	0	0.454	3
BB4	Deep Marsh	0.8	PUBF	4	0	0.594	2
BB4	Wet Meadow	0.2	PUBF	4	0	0.594	2
BC1	Seasonally Flooded Basin	1	-	0	0	0.24	2
EA1	Wet Meadow	1	PEMC	3	1	0.718	4
EA12	Hardwood Swamp	0.1	PEMC	3	1	0.262	3
EA12	Shrub-Carr	0.4	PEMC	3	1	0.262	3
EA12	Wet Meadow	0.5	PEMC	3	1	0.262	3
EA13	Deep Marsh	0.3	PEMF	3	1	2.184	3
EA13	Sedge Meadow	0.05	PEMF	3	1	2.184	3
EA13	Shallow Marsh	0.35	PEMF	3	1	2.184	3
EA13	Wet Meadow	0.3	PEMF	3	1	2.184	3
EA14	Sedge Meadow	1	-	0	1	0.401	1
EA15	Shallow Marsh	0.8	PEMC	3	1	0.192	2
EA15	Wet Meadow	0.2	PEMC	3	1	0.192	2
EA20	Shallow Marsh	0.6	PEMC	3	1	0.515	4
EA20	Wet Meadow	0.4	PEMC	3	1	0.515	4
EA21	Shallow Marsh	0.6	PUBG	5	1	0.744	4
EA21	Wet Meadow	0.4	PUBG	5	1	0.744	4
EA22	Sedge Meadow	1	PEMC	3	1	1.58	2
EA26	Deep Marsh	0.9	PUBF	4	1	3.226	4
EA26	Wet Meadow	0.1	PUBF	4	1	3.226	4

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
EA27	Deep Marsh	0.4	PUBF	4	1	4.112	1
EA27	Shallow Marsh	0.5	PUBF	4	1	4.112	1
EA27	Wet Meadow	0.1	PUBF	4	1	4.112	1
EA28	Wet Meadow	1	PEMC	3	1	0.321	3
EA3	Deep Marsh	1	PFO1C	7	1	0.133	4
EA4	Wet Meadow	1	-	-	-	-	-
EA5	Deep Marsh	1	PUBF	4	1	0.354	4
EA6	Shallow Marsh	0.6	PFO1C	7	1	0.942	4
EA6	Wet Meadow	0.4	PFO1C	7	1	0.942	4
EB1	Wet Meadow	1	PEMC	3	1	0.769	3
EB12	Hardwood Swamp	0.25	PEMC	3	1	0.49	4
EB12	Wet Meadow	0.75	PEMC	3	1	0.49	4
EB15	Deep Marsh	0.1	-	0	0	0.413	3
EB15	Shallow Open Water	0.9	-	0	0	0.413	3
EB18	Shallow Marsh	0.5	PEMC	3	1	0.831	4
EB18	Wet Meadow	0.5	PEMC	3	1	0.831	4
EB19	Deep Marsh	0.85	PUBF	4	1	0.336	4
EB19	Hardwood Swamp	0.15	PUBF	4	1	0.336	4
EB22	Seasonally Flooded Basin	1	PEMC	3	0	0.867	1
EB26	Deep Marsh	1		0	0	0.644	3
EB7	Shrub-Carr	0.1	PEMC	3	1	1.165	4
EB7	Wet Meadow	0.9	PEMC	3	1	1.165	4
EC1	Wet Meadow	1	PUBF	4	0	0.274	3
EC2	Shallow Marsh	1	PEMA	1	0	0.379	3
EC4	Shallow Open Water	1	-	0	0	0.74	3
EC5	Hardwood Swamp	0.5	PUB/EMF	4	0	0.561	3
EC5	Shallow Marsh	0.25	PUB/EMF	4	0	0.561	3
EC5	Wet Meadow	0.25	PUB/EMF	4	0	0.561	3
EC7	Hardwood Swamp	0.2	PUBF	4	0	0.756	3
EC7	Wet Meadow	0.8	PUBF	4	0	0.756	3
EE4	Shallow Marsh	0.5	-	0	0	0.81	3
EE4	Shallow Open Water	0.1	-	0	0	0.81	3

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
EE4	Wet Meadow	0.4		0	0	0.81	3
EE5	Deep Marsh	0.9	PEMF	3	0	0.868	3
EE5	Wet Meadow	0.1	PEMF	3	0	0.868	3
EE6	Wet Meadow	1	-	0	0	0.098	3
EF1	Deep Marsh	0.5	PUBG	5	0	2.91	3
EF1	Shallow Open Water	0.5	PUBG	5	0	2.91	3
EF12	Deep Marsh	1	-	0	0	0.079	4
EF2	Deep Marsh	0.45	PUB/EMF	4	0	1.572	2
EF2	Shallow Marsh	0.15	PUB/EMF	4	0	1.572	2
EF2	Wet Meadow	0.4	PUB/EMF	4	0	1.572	2
EF6	Shallow Marsh	0.6	PUBF	4	0	0.237	2
EF6	Wet Meadow	0.4	PUBF	4	0	0.237	2
EG2	Deep Marsh	0.55	PUBF	4	0	0.971	1
EG2	Shallow Marsh	0.45	PUBF	4	0	0.971	1
EG5	Hardwood Swamp	0.6	PEMF	3	0	0.164	3
EG5	Shallow Marsh	0.4	PEMF	3	0	0.164	3
EG6	Hardwood Swamp	1	PEMF	3	0	0.083	3
EG7	Wet Meadow	1	PEMC	3	0	0.183	4
EI12	Hardwood Swamp	0.25	PEM/UBF	3	0	3.924	1
EI12	Sedge Meadow	0.6	PEM/UBF	3	0	3.924	1
EI12	Wet Meadow	0.15	PEM/UBF	3	0	3.924	1
EI13	Hardwood Swamp	0.1	PEMF	3	0	1.021	1
EI13	Shallow Marsh	0.9	PEMF	3	0	1.021	1
EI17	Hardwood Swamp	0.1	PEMC	3	0	0.663	4
EI17	Shallow Open Water	0.4	PEMC	3	0	0.663	4
EI17	Wet Meadow	0.5	PEMC	3	0	0.663	4
EI2	Deep Marsh	0.3	PEMF	3	0	1.123	3
EI2	Shallow Marsh	0.45	PEMF	3	0	1.123	3
EI2	Wet Meadow	0.25	PEMF	3	0	1.123	3
EI5	Deep Marsh	0.4	PUBF	4	0	0.707	1
EI5	Sedge Meadow	0.3	PUBF	4	0	0.707	1

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
EI5	Shallow Marsh	0.4	PUBF	4	0	0.707	1
EI6	Shallow Marsh	0.7	PUBF	4	0	0.68	4
EI6	Wet Meadow	0.3	PUBF	4	0	0.68	4
EI7	Deep Marsh	0.15	PEM/UBF	3	0	4.56	1
EI7	Shallow Marsh	0.25	PEM/UBF	3	0	4.56	1
EI7	Shrub-Carr	0.05	PEM/UBF	3	0	4.56	1
EI7	Wet Meadow	0.55	PEM/UBF	3	0	4.56	1
EI8	Hardwood Swamp	0.15	PUBG	5	0	1.572	3
EI8	Shallow Open Water	0.75	PUBG	5	0	1.572	3
EI8	Wet Meadow	0.1	PUBG	5	0	1.572	3
EJ1	Shallow Marsh	0.5	PUBGx	5	1	0.328	4
EJ1	Wet Meadow	0.5	PUBGx	5	1	0.328	4
EJ10	Deep Marsh	0.95	PUB/EMF	4	1	0.931	3
EJ10	Hardwood Swamp	0.05	PUB/EMF	4	1	0.931	3
EJ12	Deep Marsh	0.9	PEMF	3	1	0.488	3
EJ12	Shallow Marsh	0.1	PEMF	3	1	0.488	3
EJ2	Shallow Marsh	0.1	PUBF	4	1	0.118	4
EJ2	Shallow Open Water	0.9	PUBF	4	1	0.118	4
EJ4	Deep Marsh	0.3	PUB/EMF	4	1	0.397	2
EJ4	Shallow Marsh	0.25	PUB/EMF	4	1	0.397	2
EJ4	Wet Meadow	0.45	PUB/EMF	4	1	0.397	2
EJ6	Shallow Marsh	0.4	-	0	0	0.204	1
EJ6	Wet Meadow	0.6	-	0	0	0.204	1
EJ7	Other	0.8	PEMF	3	1	1.021	4
EJ7	Shallow Marsh	0.2	PEMF	3	1	1.021	4
EJ8	Wet Meadow	1	PEMC	3	1	0.616	3
EJ9	Deep Marsh	0.35	PEMC	3	1	0.998	1
EJ9	Hardwood Swamp	0.1	PEMC	3	1	0.998	1
EJ9	Shallow Marsh	0.35	PEMC	3	1	0.998	1
EJ9	Wet Meadow	0.2	PEMC	3	1	0.998	1
EK1	Deep Marsh	0.4	PEMF	3	0	0.98	2

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
EK1	Shallow Marsh	0.25	PEMF	3	0	0.98	2
EK1	Shallow Open Water	0.1	PEMF	3	0	0.98	2
EK1	Wet Meadow	0.25	PEMF	3	0	0.98	2
EK12	Shallow Marsh	0.35	PFO1C	7	0	0.119	4
EK12	Shallow Open Water	0.3	PFO1C	7	0	0.119	4
EK12	Wet Meadow	0.35	PFO1C	7	0	0.119	4
EK14	Alder Thicket	0.3	PEMF	3	0	3.479	1
EK14	Shallow Marsh	0.7	PEMF	3	0	3.479	1
EK4	Shallow Marsh	0.15	PUBG	5	0	3.633	2
EK4	Shallow Open Water	0.75	PUBG	5	0	3.633	2
EK4	Wet Meadow	0.1	PUBG	5	0	3.633	2
EK5	Wet Meadow	1	PUBF	4	0	0.843	3
EK7	Deep Marsh	0.1	PUBG	5	0	5.799	1
EK7	Other	0.6	PUBG	5	0	5.799	1
EK7	Shallow Open Water	0.2	PUBG	5	0	5.799	1
EK7	Wet Meadow	0.1	PUBG	5	0	5.799	1
EK8	Shallow Marsh	0.6	PEMF	3	0	0.123	4
EK8	Wet Meadow	0.4	PEMF	3	0	0.123	4
EK9	Shallow Marsh	0.75	PEM/UBF	3	0	0.714	3
EK9	Wet Meadow	0.25	PEM/UBF	3	0	0.714	3
F10	Shallow Marsh	0.2	PEMC	3	0	0.789	4
F10	Shallow Open Water	0.3	PEMC	3	0	0.789	4
F10	Wet Meadow	0.5	PEMC	3	0	0.789	4
F11	Deep Marsh	0.5	PEMF	3	0	0.921	4
F11	Shallow Open Water	0.5	PEMF	3	0	0.921	4
F12	Shallow Marsh	1	PEMF	3	0	0.081	3
F13	Shallow Open Water	1	PEMF	3	0	1.194	4
F14	Shallow Open Water	0.55	PUB/EMF	4	0	2.113	3
F14	Wet Meadow	0.45	PUB/EMF	4	0	2.113	3
F15	Deep Marsh	1	PUBF	4	0	1.599	4
F15	Wet Meadow	0.2	PUBF	4	0	1.599	4

Wetland ID	Community Type	Portion of Community	Cowardin Classification	Circular 39 Classification	Field Check Level	Acres	Management Classification
F18	Shallow Open Water	1	PUBG	5	0	8.72	3
F19	Shallow Open Water	1	PUBF	4	0	0.561	4
F21	Deep Marsh	0.6	PUB/EMF	4	1	1.874	3
F21	Sedge Meadow	0.1	PUB/EMF	4	1	1.874	3
F21	Shallow Marsh	0.3	PUB/EMF	4	1	1.874	3
F23	Shallow Open Water	1	PFO1C	7	0	0.438	4
F24	Shallow Open Water	1	PUBF	4	0	0.256	4
F26	Hardwood Swamp	1	-	0	0	0.196	1
F29	Hardwood Swamp	1	-	0	0	0.088	4
F3	Shallow Marsh	1	PEMC	3	0	1.041	4
F31	Wet Meadow	1	-	0	0	0.242	3
F4	Wet Meadow	1	PEMC	3	0	0.638	4
F5	Shallow Open Water	1	PUBF	4	0	0.135	3
F6	Shallow Marsh	1	PEMC	3	0	0.243	3
F9	Shallow Open Water	0.95	PEMF	3	0	4.214	1
F9	Wet Meadow	0.05	PEMF	3	0	4.214	1
Q1	Deep Marsh	0.2	PUB/EMF	4	1	3.147	4
Q1	Shallow Open Water	0.8	PUB/EMF	4	1	3.147	4
Q10	Shallow Marsh	0.15	PEMF	3	1	4.864	2
Q10	Shallow Open Water	0.6	PEMF	3	1	4.864	2
Q10	Wet Meadow	0.25	PEMF	3	1	4.864	2
Q2	Deep Marsh	0.05	L1UBH	5	1	1.733	4
Q2	Other	0.95	L1UBH	5	1	1.733	4
Q5	Shallow Marsh	0.2	PEMF	3	1	0.681	4
Q5	Wet Meadow	0.8	PEMF	3	1	0.681	4
Q7	Deep Marsh	0.3	PUB/EMF	4	1	5.887	3
Q7	Shallow Marsh	0.2	PUB/EMF	4	1	5.887	3
Q7	Shallow Open Water	0.5	PUB/EMF	4	1	5.887	3
W1	Hardwood Swamp	0.25	PEMC	3	0	2.64	4
W1	Wet Meadow	0.75	PEMC	3	0	2.64	4
W3	Shallow Marsh	1	-	0	0	0.796	4

Upland Information Summary Table

Community ID	Community Type	Acres	Management Classification	Qualitative Rank
BA1	Oak Woodland-Brushland	26.508	3	C
BA11	Dry Prairie (hill subtype)	2.258	3	D
BB1	Oak Woodland-Brushland	29.281	3	CD
BB5	Dry Oak Savanna	2.353	3	CD
EA10	Oak Woodland-Brushland	11.509	3	D
EA18	Oak Woodland-Brushland	16.699	3	D
EA2	Oak Woodland-Brushland	9.329	4	D
EA23	Oak Woodland-Brushland	25.06	2	CD
EA30	Dry Prairie (sand-gravel subtype)	2.146	2	D
EA7	Oak Woodland-Brushland	13.155	1	BC
EB10	Oak Woodland-Brushland	3.32	3	CD
EB11	Oak Woodland-Brushland	12.063	3	D
EB20	Oak Woodland-Brushland	3.561	4	D
EB23	Oak Woodland-Brushland	7.489	3	CD
EB24	Oak Woodland-Brushland	2.709	4	D
EB4	Oak Woodland-Brushland	2.062	3	CD
EB5	Lowland Hardwood Forest	4.193	3	D
EB6	Lowland Hardwood Forest	6.762	4	D
EC10	Dry Prairie (hill subtype)	0.589	3	D
EC12	Lowland Hardwood Forest	0.94	4	D
EC3	Oak Woodland-Brushland	57.263	3	D
EE2	Oak Woodland-Brushland	6.59	3	CD
EE3	Oak Woodland-Brushland	2.063	3	CD
EE8	Oak Woodland-Brushland	43.04	3	D
EE8	Oak Woodland-Brushland	1.791	3	D
EG1	Lowland Hardwood Forest	1.878	4	D
EG3	Oak Forest, Mesic	4.433	3	CD
EI1	Oak Forest, Dry	45.533	2	C
EI15	Oak Forest, Dry	4.488	4	D
EJ11	Oak Woodland-Brushland	10.083	3	D
EJ3	Oak Woodland-Brushland	15.88	3	D
EJ5	Oak Woodland-Brushland	4.382	3	D
EK10	Oak Woodland-Brushland	1.881	3	D
EK13	Oak Forest, Mesic	3.906	1	BC
EK16	Oak Forest, Dry	8.746	2	
EK2	Oak Forest, Mesic	8.083	1	BC
EK6	Lowland Hardwood Forest	3.162	4	D
F16	Oak Woodland-Brushland	14.451	3	D
F22	Lowland Hardwood Forest	3.134	3	D
F25	Lowland Hardwood Forest	4.769	3	D
F27	Oak Woodland-Brushland	2.342	4	D
Q3	Oak Woodland-Brushland	14.154	4	D
W2	Oak Forest, Mesic	12.085	3	CD
W8	Oak Woodland-Brushland	4.15	4	D

Appendix C

Glossary of Technical Terms

[1]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.

[1] Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.

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 [2]flooding 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.

[2] Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.

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, "grasslike" 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 that 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.
[3]**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.

[3] Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.

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.
[4]**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 form 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 along, 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.

Many of the definitions used in this section are borrowed from Minnesota's St. Croix River Valley and Anoka Sandplain, Worcha et al, Minnesota DNR, 1995.