Thompson County Park

Natural Resources Management Plan

Prepared for
Dakota County Parks and Recreation
by Barr Engineering Co.

ADOPTED January 21, 2020

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1 History/Culture

1.1 Location

Located in the southeast corner of the seven-county Minneapolis-St. Paul metropolitan area, the Dakota County Park System serves over 400,000 county residents plus regional visitors. With more than 5,000 acres and a fast-growing network of greenways, Dakota County's nature-based recreation system helps to meet the needs of Minnesota's third-most populous county.

Thompson County Park, is one of six parks owned and operated by Dakota County (Figure 1-1). This 58-acre park is nestled into a West St. Paul neighborhood of single-family houses to the north, west, and south. Across Thompson Lake, at the park's northwest edge, lies the St. Croix Lutheran Academy, which has granted the County an easement to continue a walking loop around the lake. To the east, U.S. Highway 52 forms a barrier that is punctuated by the River to River Greenway's pedestrian/bike bridge leading to Kaposia Park, Kaposia Landing, and the Mississippi River.

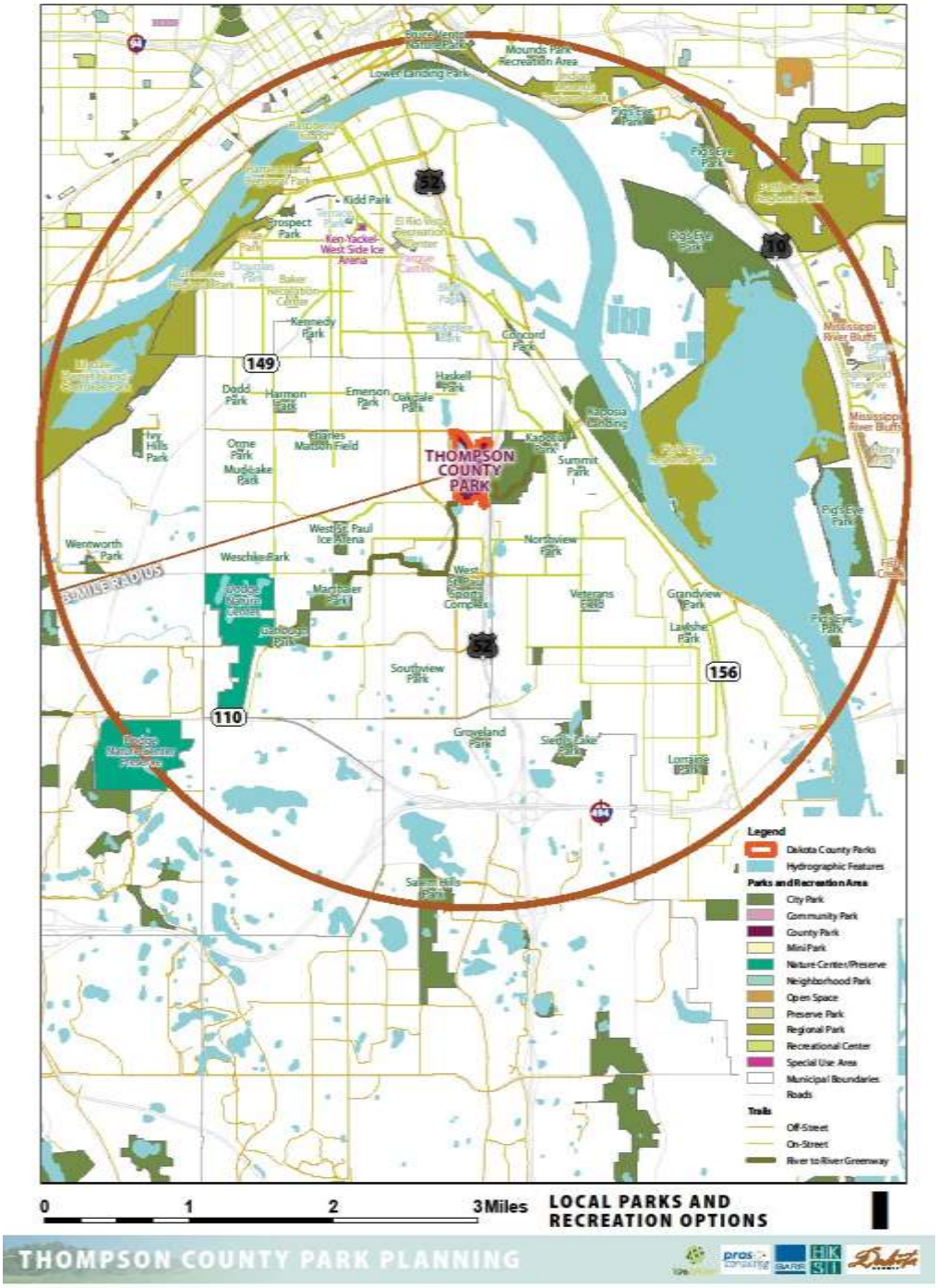


Figure 1-1
Local Parks and Recreation Options

Figure 1-1 Local Parks and Recreation Options

1.2 Cultural and Historic Context

The Thompson County Park area has a rich and extensive history, stretching back over 10,000 years when the earliest American Indian tribes lived in this region. They had a significant impact on the landscape by often setting fires to increase its natural productivity. This allowed for the oak savanna plant community to dominate the region. In more recent history, the Dakota village of Kaposia was established around 1750 on the east bank of the Mississippi River and moved to the west bank, about a mile east of the modern-day park site, in 1826. Dakota County was established in 1849, prompting Euro-American settlement. With the forced removal of Dakota from the area in the mid-1850s, Euro-Americans arrived in increasing numbers to farm the land, clearing and tilling the savanna for food crop production. The City of West St. Paul was established in 1889. Farming and industry continued to develop into the early 1900s along with the establishment of recreational parks, including a city park at the location of present day Thompson Park in 1929. Since Thompson County Park was established in 1976, several initiatives have enhanced the recreational opportunities.

1.2.1 History of Thompson County Park

Thompson park was named after William Thompson, one of the first Euro-American settlers in West St. Paul, having arrived in 1851. Thompson owned the western half of the present-day park. The eastern half of the present-day park was the location of dairy and vegetable farms. One owner were the Kraushaars, who later raised sheep. "Men from the stockyards would drive the herd, led by a nanny goat, north on Concord Street and then up through Simon's Ravine to the farm in West St. Paul."

Agriculture was profitable in West St. Paul and large farms were divided into garden lots. Up through the 1970's, the future park remained in hayfield and small gardens, while urban development grew up all around it.

In 1924, East Coast philanthropist William E. Harmon established a fund of $100,000 to build playgrounds in 50 cities across the country. West St. Paul was the seventh city chosen for one of the $2,000 grants. The city used the grant to create Harmon Park at Bernard Street and Allen Avenue in 1925. Thompson Lake, which is West St. Paul's largest lake, became the site of the city's second major park in 1929. It was established as a recreational park by the West St. Paul Commercial Club, which subsequently moved its old clubhouse to the park to use as a pavilion. The club worked to promote the park as a local gathering space for concerts, picnics, parades, and more. The lake provided ice blocks in winter and was a popular swimming hole in the summer. In 1964, the club sold the six-acre property to the City of West St. Paul, which was planning to connect the park with the nearby Kaposia Park, in South St. Paul. Kaposia Park was established in 1937 as a Works Progress Administration project during the Great Depression. Simon's Ravine runs generally southwest-northeast through this park. The plan to connect Thompson and Kaposia Parks fell through due to issues with watershed rights and property negotiation, and Highway 52 was constructed in 1968. In 1971, the City of West St. Paul indicated that it was willing to donate the six-acre Thompson Park to Dakota County. In 1974, the Dakota County board voted to buy 62 acres to combine with the already procured six-acre Thompson Park and develop a county park. It became official in 1976, and trails were added in the early 1980s.

In 1989, the Dakota County Board approved a development plan to upgrade facilities at the park in several stages. The first phase included physical "improvements" to Thompson Lake—dredging the lake, installing a lake aeration system, building a fishing pier, and stocking the lake with game fish—and the establishment of a day camping area. Today, dredging lakes or wetlands is not allowed in Minnesota under the Wetland Conservation Act. The second phase included construction of a swimming beach and activity/event center. The third phase included construction of flower gardens, terraces, and decks, along with additional trails. The North Urban Regional Trail (NURT, today called the River to River Greenway) was planned around 2002 to run from Big Rivers Regional Trail in Lilydale to Concord Avenue and the Mississippi River Regional Trail in South St. Paul, thereby connecting Lilydale, Mendota Heights, West St. Paul, and South St. Paul. The eight-mile trail crosses U.S. Highway 52 to connect Thompson County Park with Kaposia Park.

2 Current Conditions

An oak savanna in Anoka County has similar appearance to what Thompson County Park looked like prior to European Settlement.

2.1 Natural Resources History

The land that is Thompson County Park has been altered through time due to human activities and development. Prior to European settlement, an oak savanna plant community blanketed its slightly rolling topography. Oak savannas are described as scattered trees and groves of oaks of scrubby form with some shrub thickets. This community thrived on the sandy loam soils of the park. Oak savannas and prairies were perpetuated by Native Americans who deliberately set fires to provide habitat hunting and gathering. These were productive soils, and settlers in the late 1800s cleared the trees and thickets to plant gardens, row crops, and to graze cattle. By the early 1900s, the area became very productive supplying food to St. Paul markets, and farmsteads persisted for many years (Figure 2-1). With increasing pressure to urbanize, farming ceased in the 1970s, and the site became the park. Native plants were almost completely eliminated from the land. The fields were abandoned and allowed to colonize with opportunistic vegetation, much of which was not indigenous. Since that time the majority of the site has morphed into a low diversity forest of mostly non-native and weedy trees. The herbaceous vegetative layer distinctly lacks the array of beautiful wildflowers and grasses that in a native condition would cover the ground.

The head of Simon's ravine occupies the southern end of the park. Prior to 1970, the ravine stretched down to the Mississippi River. The 1968 construction of Highway 52 severed this ecological connection ending the free movement of plants and animals in and out of the park and to and from the river. Today the undeveloped area of the park is an island of moderate-quality vegetation within a matrix of urban development. Without the connection to the river, this detached island does not provide adequate habitat for many species of mammals, reptiles, and amphibians but has become home to a diversity of songbirds.

2.1.1 Plant Community Types

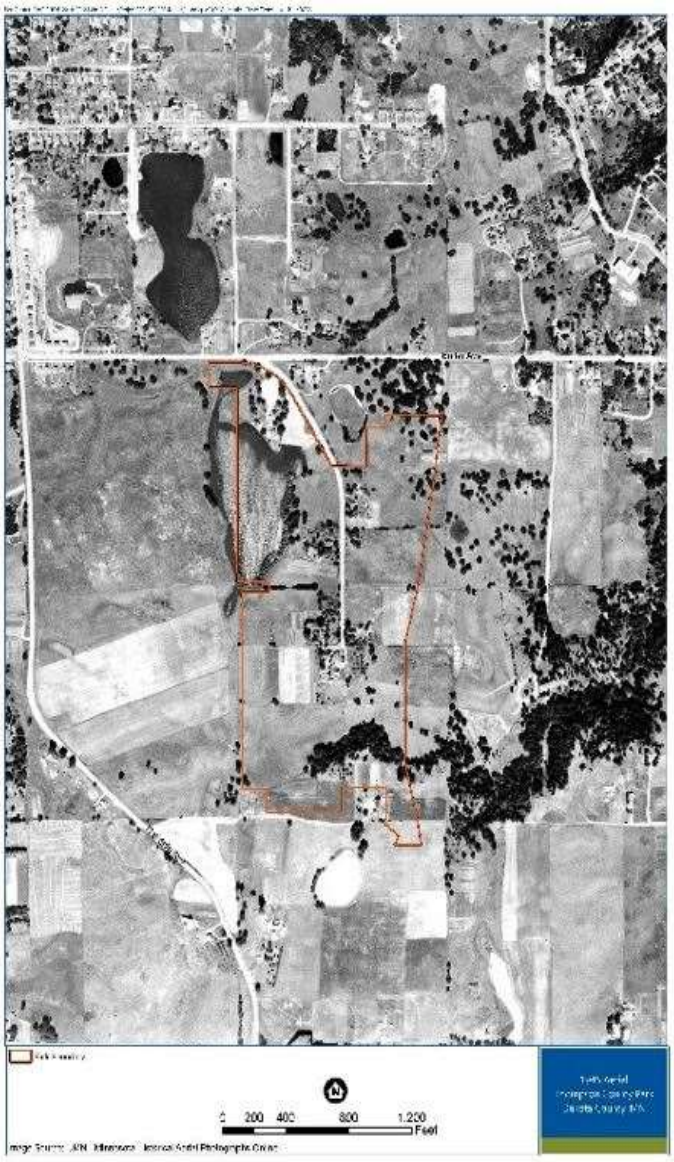


Figure 2-1 Several farmsteads were located within the area that is now the park in 1945

Plant community types within the park today were mapped based on the Minnesota Land Cover Classification System (MLCCS) survey previously conducted by Dakota County staff and the DNR. MLCCS came into being as a response to increasing development pressure within the metro region in the 1980's and 1990's. This 2005 Metro-wide initiative mapped land cover by plant community and percent impervious cover (e.g., buildings, roads, and parking lots).

Today, for this current natural resources management plan, County staff ecologists and consulting ecologists checked and updated the data that describes the plant communities. A description of the plant communities of the park follow. Figure 2-2 illustrates the distribution of plant communities within the park.

Figure 2-2 Vegetative Cover Types

2.1.1.1 Old Field

Old field in the southeastern section of the park.

Open, herbaceous-dominated areas within the park are former fields that have not yet been entirely colonized by trees. Non-native grasses such as smooth brome, reed canary grass, and Kentucky bluegrass dominate along with broadleaved, weedy species such as Canada goldenrod, leafy spurge, and stinging nettle. Plant diversity is low compared to native prairies. The size of the old fields in the park has been slowly shrinking as trees and shrubs encroach on the edge of these open areas. Eventually, if left unmanaged, these former old fields will succeed to degraded deciduous forest (become "afforested"). The Old Field plant community provides marginal wildlife habitat because of the lack of plant diversity.

2.1.1.2 Degraded Native Forest

A few native oak trees persisted through agricultural times and comprise the canopy of the plant community called Degraded Native Forest by the MLCCS system. Bur oaks dominate this community in the park with basswood, American elm, and box elder as subdominants. Ironwoods occasion the mid-story, but common buckthorn dominates. The forest floor contains a low diversity consisting primarily of common herbaceous weed species (burdock, garlic mustard, reed canary grass, woodbine, and raspberry) but does include a few native species such as sweet cicely, jewelweed, white snakeroot, and Pennsylvania sedge—all species that can withstand cattle overgrazing and earthworm invasion. These areas are ranked as medium ecological quality (defined below). They have been altered by fire suppression and over-grazing, and today contain a significant amount of buckthorn. Garlic mustard, a very aggressive, introduced herbaceous forest plant, has invaded throughout the park.

2.1.1.3 Degraded Deciduous Forest (Former Old Field)

Since becoming a park, this young forest has formed on abandoned farm fields. Few native oaks have colonized these areas, likely because deer and rabbits heavily browse oak seedlings and because buckthorn and earthworms suppress oak seedling growth. The forest canopy is almost exclusively comprised of box elder and black walnut. A grove of black locust (considered an invasive tree) occurs just south of the Dakota Lodge. Other tree species include silver maple, Siberian elm, green ash, black cherry, and hackberry. Large-sized common buckthorn and Tartarian honeysuckle were removed from the park in February of 2018. These species comprised a thicket in the woodland prior to their removal. The cut stumps, re-sprouts, and seedlings still exist; without additional management, these invasive species will grow again to fill in the shrub layer. The buckthorn-dominated understory is accompanied by a non-native herbaceous layer including species such as catmint, motherwort, creeping Charlie, burdock, and garlic mustard. This weedy forest, a legacy of Euro-American disruption, is currently of low ecological value.

2.1.1.4 Shoreline

The shoreline of Thompson Lake has been disturbed over time by several factors including: an increased "bounce" of the lake water level (the rise/fall of the water level), invasive plant establishment, and trampling by people. Past efforts to restore the shoreline have paid off. Improvements should be continued to reduce erosion, improve native plant diversity, reintroduce extirpated species, and control invasive species. Except in newly restored areas, narrowleaf cattail and reed canary grass dominate the shoreline communities, driving down plant diversity and degrading wildlife habitat.

Casual trails near the shoreline result in erosion.

Area of native shoreline vegetation as the result of restoration efforts.

2.1.1.5 Developed

The northern portion of the park has been developed for peoples' active use. Lawn extends between buildings, parking lots, and recreational areas. The turf is managed with herbicides and fertilizer. Raingardens have been installed to capture runoff from the parking lots in order to clean runoff before reaching Thompson Lake. Due to lack of weeding, these raingardens have become overrun with non-native thistle and reed canary grass and other aggressive weedy plants. The biodiversity and habitat value of developed areas is low. In spite of this, songbirds are found throughout this area, especially during migration in spring and fall.

Private residential properties border the park to the north. These contiguous properties share oak forest with the park and would best be protected through shared management and/or purchasing or obtaining a conservation easement to protect this valuable resource.

2.1.2 Ecological Quality

A valuation of park ecological quality was performed by the consultant. It was based upon current plant community integrity and the history of the site. Few native oak savanna plant species have survived the historic farming of the site, resulting in a legacy of degraded communities today which consist of an array of non-native, native, and invasive plant species growing upon disturbed soils. Nutrient cycles and hydrologic cycles were altered through agriculture; although they have had time to stabilize, but today are altered by urban landcover. This is not a unique situation, for it has occurred throughout the region.

Ecological quality was assessed, and each plant community type shown in Figure 2-3 was given a high, medium, or low ecological quality rating based on the following criteria:

> **High.** Sites with little or no human disturbance, important to preserve. Less than five percent of the site is covered with invasive plant species. Most natural processes are occurring, including

disturbances such as fire or flooding, if appropriate. There is little or no evidence of post settlement Euro-American disturbances such as logging, grazing, or soil compaction.

Medium. Sites with at least 50 percent of the vegetation comprising native species. Invasive species occupy between five and 40 percent of the site. Some Euro-American disturbance may be seen.

Low. Sites with a clear history of Euro-American disturbance, and with greater than 40 percent invasive species present. Natural processes are disturbed such as altered soils through tilling or compaction, fire suppression, and altered hydrology.

Figure 2-3 Ecological Quality Map

Wildlife

A variety of urban-tolerant wildlife inhabit the park. White-tailed deer are the dominant large animal impacting the park through extensive browsing. Fox, rabbit, squirrel, woodchuck, and raccoon have also been observed in the park. It is likely that nocturnal animals such as bat and owl are utilizing different niches within the park. Game species such as wild turkey and mallard have utilized resources within the park to raise their young.

A total of 71 bird species, of which 51 are Neotropical migratory birds, have been observed in the park within the last four years (eBird, 2018; see Table 2-1). Waterfowl species observed at the park include the Canada goose, wood duck, mallard, and hooded merganser. There were 47 passerine, four woodpecker, and one hummingbird species observed within the park since 2014. Raptors, such as the bald eagle, Cooper's hawk, broad-winged hawk and red-tailed hawk, frequently are observed. Various other types of birds such as pigeons and doves, loons, grebes, wading birds, cormorants, pelicans, and kingfishers have been observed at the park.

Table 2-1 2014-2018 Thompson County Park Bird List

Bird Species	Type		
Waterfowl	Canada goose* Wood duck* Mallard* Hooded merganser		
Passerines (Birds of a large order by feet that are adapted for perching, including all songbirds).	American crow American goldfinch* American redstart* American robin* Baltimore oriole* Black-and-white warbler* Black-capped chickadee Black-throated green warbler* Blue jay Blue-gray gnatcatcher* Brown thrasher Brown-head cowbird* Cedar waxwing* Chestnut-sided warbler* Chipping sparrow* Clay-colored sparrow* Common grackle Common yellowthroat*	Dark-eyed junco* Eastern wood-pewee* European starling Golden-crowned kinglet* Golden-winged warbler* Gray catbird* Great crested flycatcher* House finch House sparrow House wren* Indigo bunting* Magnolia warbler* Nashville warbler* Northern cardinal Northern parula	Palm warbler* Red-eyed vireo* Red-winged blackbird* Rose-breasted grosbeak* Ruby-crowned kinglet* Scarlet tanager* Song sparrow* Swainson's thrush* Tennessee warbler* Warbling vireo* White-breasted nuthatch White-throated sparrow Yellow-rumped warbler* Yellow-throated vireo*
Hawks and	Cooper's hawk* Bald eagle Broad-winged hawk* Red-tailed hawk*		
Woodpeckers	Red-bellied woodpecker Downy woodpecker Hairy woodpecker Pileated woodpecker		
Upland Game	Wild Turkey		
Pigeons and	Mourning dove* Rock pigeon		
Hummingbirds	Ruby-throated hummingbird*		

Bird Species	Type		
Loons and	Common loon* Pied-billed grebe*		
Wading Birds	Great blue heron* Great egret* Black-crowned night heron*		
Cormorants and Pelicans	Double-crested cormorant* American white pelican*		
Kingfishers	Belted kingfisher*		

2.1.2.1 Fish Survey Results

Based on the Minnesota Department of Natural Resources (MNDNR) Thompson Lake stocking report, the latest stocking of fish occurred in 2017 with 100 adult channel catfish. Other species listed by MNDNR in Thompson Lake include largemouth bass, bluegill, green sunfish, golden shiner, black crappie, and black bullhead. Bluegill adults have been continuously stocked from 2008 to 2016. A survey was conducted on September 25 and 26 of 2018, in which the predominant species found were bluegill, sunfish, black bullhead, and pumpkinseed sunfish. Other species were also found—see Table 2-2.

Table 2-2 Fish Survey Results

Species	2003 fish per net	2008 Fish per net	2013 Fish per net	2018 Fish per net (n = 8)	Normal Range (MN DNR)
Black bullhead (*Ameiurus melas*)	58.0	49.0	17.2	47.3	2.5-70
Black crappie (*Pomoxis nigromaculatus*)	5.4	0.6	0.4	7.3	1.3-28
Bluegill sunfish (*Lepomis macrochirus*)	102.6	14.4	11.0	69.4	1.8-43
Channel catfish (*Ictalurus punctatus*)	-	-	0.2	1.6	NA
Golden shiner (*Notemigonus crysoleucas*)	0.8	0.2	1.0	1.5	0.4-3.9
Green sunfish (*Lepomis cyanellus*)	14.0	9.8	-	1.6	0.4-3.8
Hybrid sunfish (*Lepomis sp.*)	3.2	2.2	2.8	3.0	NA
Northern pike (*Esox lucius*)	-	1.6	0.2	0.4	NA
Pumpkinseed sunfish (*Lepomis gibbosus*)	-	4.2	3.2	16.6	0.8-9.3

2.1.3 Water Resources

2.1.3.1 Thompson Lake

The 169-acre watershed of Thompson Lake is comprised of mixed urban land uses (residential, commercial, and institutional) and contains a high percentage of impervious cover. The inflows to Thompson Lake are primarily from stormwater from this watershed. Two inlet structures are located at the north end of the lake—one large one coming from a pipe off Butler Road that drains most of the watershed and a smaller one that drains the St. Croix Lutheran School ball fields. The outflow located at the south end of the lake is controlled by an adjustable outlet structure. At normal lake level (946.5 feet. above sea level), a uniform low flow is allowed to pass through the outlet structure, while at higher lake levels (due to storm events) higher flows are passed over the outlet structure. All lake outflows pass through a 42-inch storm sewer to Emerson Pond at the southwestern corner of the park. The Thompson Lake outflow discharges through Emerson Pond to a pipe that runs under Simon's Ravine and under Highway 52, eventually to the Mississippi River.

Erosion is occurring along the southeastern bank of Thompson Lake near Dakota Lodge due to heavy use by anglers. Vegetation that holds bank soil in place has been trampled and is slowly washing into the lake adding small amounts of sediment and phosphorus to the lake.

Thompson Lake is impaired for recreational use due to excessive nutrients and salts and is on the MPCA's 2014 Impaired Waters list. Phosphorus is the primary polluting nutrient. A watershed restoration and protection strategies (WRAPS) study along with a total maximum daily load (TMDL) developed from 2012 to 2014 identified watershed runoff as the primary source of phosphorus to the lake; the TMDL identified a phosphorus waste load reduction of 30percent to be necessary to achieve MPCA water quality standards.

A forebay structure and a stormwater pre-treatment wetland have just been constructed at the north end of the lake within Thompson Park. The project treats stormwater runoff prior to discharge into Thompson Lake, thereby reducing phosphorus concentrations in the lake which will result in improved lake clarity and lead eventually to removal of the lake from the Impaired Waters list. The pre-treatment wetland consists of a series of two stormwater settling and infiltration areas that will treat runoff from 83 percent of the watershed. Water quality modeling indicates that the proposed project will reduce phosphorus loading to the lake by 39 percent, achieving the waste load reduction identified in the TMDL. The project will provide additional public benefits including native habitat enhancement, education opportunities, trail improvements, and improved aesthetics.

2.1.3.2 Emerson Pond

Emerson Pond occupies the southwestern corner of the park and treats stormwater runoff from a large urban watershed, as well as water overflowing from Thompson Lake. The pond was designed with steep, deep slopes to properly accommodate the large volume of stormwater it receives. The slopes are covered by a degraded forest comprised mostly of non-native and invasive species. It provides some habitat value to songbirds and waterfowl but has little value to people.

3 Park Stewardship

3.1 Natural Resources Issues and Opportunities

This section describes environmental issues that are contributing to the ecological degradation of the park, and potential solutions to these problems.

3.1.1 History of Soil Disturbance

Prior to European settlement, oak savanna was the dominant plant community in the area that constitutes the park today. This once diverse plant community contributed to building deep, fertile, well-structured soils that supported a large diversity of wildlife species. European settlers cleared trees and shrubs from the area and plowed prairie and the ground for agriculture. They also over-grazed pasture for domestic livestock, which eliminated many native species. The upper horizons of the soil profile were greatly disturbed by plowing, and so was the soil food web that had existed for thousands of years. Most native plant species were eliminated from the area in this process. Over the span of approximately 100 years of agricultural land use, much soil was lost because plowed fields, devoid of vegetative cover, are left exposed over the winter and early spring and wash away. Remaining soils were left with much less soil organic matter and lowered fertility. To sum up, agriculture has left the soils in worse condition than compared to the savanna soils of pre-settlement times: they are more compact, have lost their structure, and are lower in nutrient value. Today, however, the soils in the natural areas of the park are in the process of rebuilding, primarily through the action of roots and soil organisms and through organic matter accumulation. This process improves the success of newly planted communities as well as the continued sustainability of those natural communities long-term.

Opportunities:

- Develop the proposed park trail system and keep vehicles and hikers on the trails. Soil compaction should be avoided at all cost, especially around mature trees infiltration areas such as wetlands and lakeshores.

- Nurture native plant communities and do not disturb the soil after plantings are established. Plants feed essential microorganisms by exuding sugars and proteins into the soil in exchange for nutrients and moisture. Healthy root systems improve the soil in this way. Soil microorganisms, however, are easily damaged when the soil is tilled or compacted. It would be critical to avoid tillage once planting is complete.

- Add Organic matter to the surface of soils to feed microorganisms. Microorganisms along with plants build soil structure and fertility, making plant communities more resilient to insects, disease, and climate impacts. For example, when preparing a planting bed, supplement soil with compost.

- Teach park users about the soil food web and how it positively effects our lives. Foster a healthy attitude toward the land—instead of using the land as a commodity. Foster stewardship with the goal of long-term sustainability.

3.1.2 Lack of Native Plant Diversity

When agriculture ceased, and the site became a county park, the land of the park revegetated primarily with aggressive, locally growing species (this process is a form of what ecologists call "recruitment", namely, recruiting propagules from the local area which provide the basis for what grows at a site). The elimination of native plants by farming, limited the opportunity of native species to re-establish. Today, plant diversity is limited because aggressive native and non-native species proliferate on these old field sites. Some aggressive plant species found in the park today, such as smooth brome, creeping Charlie, Siberian elm, boxelder, and black locust, likely existed on the farms, and most were introduced by the settlers. This is an issue because wildlife, including pollinators, caterpillars, and birds, are best supported by a diverse native plant community, which had evolved here over thousands of years, which is also why ecologists say that invasive plant species tend to drive down biodiversity. The next section explores this concept further.

Opportunities:

- Control or eliminate invasive plants, especially those that develop into monocultures, in order to make room for a diversity of native plants.

- Plant and manage native or near-native plants (in response to climate change) to increase plant diversity.

3.1.3 Invasive Species

Not all introduced plants are invasive. Many never get established and some merely get added to the diversity of the community and do not become a problem. An invasive plant is defined as a plant that is not native and has negative effects on the economy, the environment, or on human health. They are those aggressive plant species that grow and reproduce rapidly, because few checks and balances occur in the community, since they have been transplanted into an ecosystem that is foreign to them. This situation almost always tends to cause major changes to the areas where they become established. These plant species often form single-species (monotypic) stands that prevent a diversity of native plant species growth. Many invasive plant species have colonized Thompson Park. Besides degrading wildlife habitat, invasive species can result in the erosion of topsoil and the degradation of water quality. An example of this is garlic mustard which dominates the woodland floor of the park with vigorous spring growth but goes dormant in August leaving the soil open to erosion from heavy storm events.

Invasive plant species in the park include:

- Upland: garlic mustard, black locust, Siberian elm, common buckthorn, Tartarian honeysuckle, Amur maple, Norway maple, Japanese hedge parsley, yellow and white sweet clover, common burdock, wild parsnip, leafy spurge, spotted knapweed, Canada thistle, creeping Charlie, and smooth brome.

- Lowland and Lakeshore: narrowleaf cattail, reed canary grass, and purple loosestrife.

Species on the MN DNR Early Detection Watch List* to watch for are teasel, Dalmatian toadflax, giant hogweed, *Phragmites australis,* Grecian foxglove, Japanese knotweed, Japanese hops, multiflora rose, oriental bittersweet, tree of heaven, and yellow star thistle. As of summer, 2019, these species were not present in the park.

* Early detection target species are non-native, invasive species with limited distribution in Minnesota that are assessed as high risk.

Opportunities:

- Further develop, and follow-through with, a comprehensive invasive species management program.
- Teach park users about the impacts of invasive plant species and show them how they can be identified and controlled by such methods as:
    - Cleaning shoes before walking through the park.
    - Cleaning watercraft before and after entering the lake.
    - Watching for invasive species in the park and notifying park staff of their appearance.
    - Organize an early detection program for the park
    - Organize garlic mustard pulling events in the park during the spring of the year

3.1.4 Earthworms

This comes as a surprise to many people that earthworms are an invasive species, are not native to the U.S., and are impacting many forests in Minnesota including those in Thompson Country Park. They have been here so long and are so common that people think they have always been here—but these forests did not evolve in the presence of earth worms. Earthworms, of which there are many species including night crawlers, rapidly consume the duff on the forest floor leaving the forest floor bare by mid-summer. This results in soil moisture and nutrient loss and compaction of surface soils, which prevents the reproduction of native tree and wildflower species that require the protection of a duff layer to germinate. Forests that have been taken over by earthworms lack wildflowers, and ferns, and young native trees. This is the case at Thompson Park. Unfortunately, there are no effective earth worm management techniques. Planting forest species such as Pennsylvania sedge that tolerate earthworms can provide soil stability and some native plant diversity in these areas.

Opportunities:

Plant native forest species that are able to tolerate the presence of earthworms, including Pennsylvania sedge, zig-zag goldenrod, columbine, and jack-in-the-pulpit.

- Plant native and near native trees that are not reproducing naturally in the park
- Plant a variety of native herbaceous plants throughout the park

- Educate park users about the impact of earthworms and how they affect Minnesota forests

3.1.5 Tree Pathogens

Three highly impactful tree pathogens exist in Thompson Park: Oak wilt on red oak, Dutch elm disease on American elm, and emerald ash borer on green ash. Oak wilt exists in the park's northeastern woodland and has affected many trees, some of which are off park property. Only a few small American elms exist in the park because of Dutch elm disease, and emerald ash borer is just taking hold on ash trees in the park. Emerald Ash Borer is a pest that spreads fast and will quickly infect all ash trees in the park. Most of the ash in the park are small (under 10-inch diameter). It is Dakota County Park policy to allow emerald ash borer to run its course and to remove ash trees only where they are a threat to peoples' safety such as along trails. Loss of trees may result in invasive species encroachment (if not controlled), habitat loss, and a hazard for pedestrians. In areas of heavy tree loss, disease-resistant tree species will be planted in the park.

Opportunities:

- Plant disease-resistant American elms.
- Allow oak wilt disease in red oaks to run its course, while reducing the spore load in areas of bur and white oaks so as to reduce the possibility of overland infection.
- Keep an eye on bur oaks and treat if they become infected. Manage and stop oak wilt in bur oaks, as much as possible.
- Allow emerald ash borer to run its course. Observe what, if any, trees survive and nurture them to maturity.
- Try to utilize the CoGen wood burning facility operated by District Energy located in downtown St. Paul for disposal of large amounts of woody material.

3.1.6 Habitat Fragmentation and Severed Ecological Connection to the Mississippi River

Thompson County Park is an island of natural area that is surrounded by urban development. Most wildlife and plant species have difficulty moving freely in and out of the park, and therefore the species within the park have been limited. Noise and light pollution also pose a threat to plants and animals in the park. Prior to the construction of roads and highways (Highway 52, Concord Street, and the railroad paralleling Concord Street), Simon's Ravine provided an uninterrupted connection between the Mississippi River and Thompson Park. Today many animals and plants are unable to move between the park and the river because of these obstructions. The park is physically isolated by urban development from the river and other natural areas. An exception, however, are birds and insects that can easily fly between the river via Kaposia Park to Thompson Park. Many bird species can be found in the park especially during spring and fall migration when they stop over to feed on the way to their breeding grounds.

Opportunities:

- Develop additional bird and pollinator habitat in the park through native plantings.
- Teach park users about habitat fragmentation and what they can do in their yards to help bridge the gap between local natural areas.
- Take full advantage of the River to River Greenway (Figure 3-1) and Metro Corridors that connect Thompson County Park to other natural areas in the region.
    - The initial phase of natural resource restoration work in Thompson County Park will be implemented in partnership with the City of West Saint Paul for public lands that are connected to the Park via the River to River Greenway. Garlough Park and Marthaler Park on the western edge of this proposed project are located adjacent to Garlough Elementary Environmental Magnet and Dodge Nature Center, thus providing a gateway to additional lands open to the public that contain native plantings and extend the habitat corridor westward. With these parks to the west Thompson County Park forms an eastern bookend to a gap in native plant cover, as recognized by the discontinuity of the Metro Conservation Corridor in this area (See Figure X). Future project staging will work to establish native prairie plantings between these Parks along the River to River Greenway, most notably near the Wentworth Library and former Thompson Oaks golf course.

      The proposed workplan for the first stage of this project would include the following:

      <u>Thompson County Park - 30 ac total (estimated $372,000 project cost)</u>
      3 ac prairie/savanna enhancement
      12 ac prairie/savanna restoration
      15 ac woodland enhancement/restoration
      <u>West St Paul - ~30 ac total (estimated $134,000 project cost)</u>
      18 ac woodland enhancement/restoration
      8 ac prairie restoration
      1800 ft shoreline restoration

3.1.7 Deer Overabundance

White-tailed deer are present in the Park in numbers that vegetative food sources of the Park cannot sustainably support. Deer browse on both woody and herbaceous plants. The regeneration of many plants has been inhibited through over-browsing by deer. For example, mature white, red, and bur oak exist in the park, but almost no recruitment of young oak trees is occurring due to predation by deer on seedlings. Seedlings are consumed by deer, and possibly rabbits, before they can establish. This is also the case for many wildflowers, ferns, and other herbaceous plants that cannot establish in the park because of deer browse. This situation is exacerbated by a lack of predators to control deer and rabbit populations.

Opportunities:

- Implement a deer management program.
- Teach park users how these beautiful animals severely impact our native forests and how the damage can be averted.
- Protect oak seedlings with fencing or tree protectors until they are large enough to withstand browsing by deer and rabbits.
- Select plant species that are resistant to deer browsing.

Figure 3-1. Greenways Connecting to Thompson County Park.

3.1.8 Poor Lake Water Quality

The introduction provides a description of Thompson Lake water quality issues and the issues with eroding shoreline. See Sections 2.1.1.4 and 2.1.4.

Opportunities:

- Continue working with the City of West St. Paul and the Lower Mississippi Watershed Management Organization to promote water quality improvement in the Thompson Lake watershed.
- Continue working with St. Croix Lutheran school to reduce impacts to the lake (e.g., lessen nutrient loading by changing fertilizing practices on the athletic fields).
- Establish native shoreline plantings and fishing structures recommended in the Park Master Plan to prevent shoreline erosion and keep soil out of the lake.
- Implement storm water management facilities when constructing new park facilities.

3.1.9 Past Natural Resource Management

To date, recreation has been the highest priority for the park, having received the most funding. Cultural amenities and buildings were built along with pedestrian and automobile circulation and parking. Nature was allowed to take its unguided course in the park without much management. There has not been a focus on the management of the park's natural resources.

Opportunities:

- Continue educating park users, park managers, County Park Commission, and the County Board about the value and fragility of natural resources in the Dakota County Park system. Provide justification for budgeting for natural resources management.
- Apply for grants to restore and manage natural resources in the park.
- Continue to inspire park managers about the great value of their work.
- Elicit the support of the public for natural resource management in the park.

3.1.10 Climate Change

One of the most significant ecological issues affecting the park, and expected to increasingly affect the park, is global warming. In Minnesota, climate change is manifesting with warmer winters (especially higher night-time lows), increasing precipitation and storm intensity (more heavy rains and fewer slow, soaking events), and greater snow events. According to DNR State Climatologist Kenny Blumenfeld, what has not yet been experienced in Minnesota is increased summer day-time temperatures and drought. These conditions are, however, predicted to amplify within the next ten years. Park users and managers can expect more heat and drought in the near future.

Climate change further aggravates the ecological issues discussed above. As the park experiences greater swings in temperature and precipitation, organisms from insects and birds to trees and wildflowers, and soil microorganisms, will be forced to tolerate conditions beyond those that they have adapted to. Diseases establish on stressed plants and animals, native species might die out and invasive species take their place, and thus we lose our rich natural heritage.

The stewardship section of this plan puts forth a strategy and methods for protecting the natural resources of Thompson County Park. As park users and managers, we must be alert to the changes occurring in this and all Dakota County parks. A monitoring system could be put in place to track changes and an adaptive management approach taken.

Opportunities:

- Implement a monitoring program to track changes in wildlife and in the plant communities of the park
- Further develop and implement the existing management approach of adaptive management
- Consider ways to reduce fossil fuel consumption in all activities within the park. Develop a climate mitigation plan for the Dakota County park system
- Implement the stormwater management projects suggested in the Thompson Park Master Plan
- Facilitate the movement of select, more southerly species to the park, in anticipation of shifts in habitat suitability

3.2 Natural Resources Goals and Objectives

The purpose of protecting and regenerating natural resources at Thompson Park is to:

1) Allow people to experience the natural heritage of the area
2) Demonstrate the native plant community regeneration process
3) Provide habitat for native plants, birds, insects, mammals, amphibians and reptiles

3.2.1 Understanding

Thompson Park is essentially an island of natural open space within a paved urban complex of non-native plant species and a disrupted, urban landscape. The site, prior to becoming a park, was severely degraded through agriculture; and today few native plant species are present, and the soils are altered. Restoring native plant communities to the park will take thoughtful planning and importantly, diligent management. One might consider the park a garden because it will need careful tending long into the future in order to sustain native plant communities. However, if done wisely, the amount of maintenance and effort of management can be minimized. Using native plants that have evolved to the unique conditions of this site over the course of thousands of years, is a good place to start. Increasing the diversity of the flora and fauna to the full extent of the range of variability will increase the resiliency of the natural communities.

As was mentioned before, the park is also experiencing a changing climate. Warmer winters and increased precipitation are currently occurring. Warmer summers with droughts are predicted. This is influencing and will increasingly influence the evolution of the plant communities within the park. Therefore, an adaptive management approach is suggested (described below) to adjust management over time as appropriate. The intention is to help nudge the plant community in the direction of an assemblage of native or 'near native' species (native species from nearby provenances to the south), as the current climate changes at unprecedented speed, so that it does not degrade with exotic, weedy species.

3.2.2 Overall Park Management Goals

- Regenerate a landscape that contains a mosaic of upland plant communities across a continuum from oak forest to oak savanna
- Restore wetlands and shorelines to contain a mosaic of plant communities across an continuum from deep water marsh to ephemeral pools
- Increase native plant diversity across the site
- Minimize the invasive species cover
- Prevent new non-native species encroachment
- Manage deer and other animal populations
- Reduce erosion
- Improve lake water quality
- Implement organic lawn care practices

There are a number of private residences bordering the park that contain some habitat values. County staff will reach out to these landowners and explore opportunities to inform and protect quality natural resources both in and adjacent to the park.

Dakota Co. Natural Resources Management System Plan Vision

The water, vegetation, and wildlife of Dakota County parks, greenways, and easements will be managed to conserve biodiversity, restore native habitats, improve public benefits, and achieve resilience and regionally outstanding quality, now and for future generations.

3.2.3 Resource Specific Goals and Objectives

3.2.3.1 Oak Forest

Goal:

To manage the oak forest such that native mesic oak forest regenerates in a manner that is typical of this community type (see description in Section 3). To preserve and regenerate existing oaks. To facilitate the introduction of certain/select more southerly forest species adaptive to a warming climate. To establish a diverse and resilient native plant mid- and under-story.

Objectives:

- Manage to achieve the structure and composition appropriate for each oak forest types found in the park (see DNR Field Guide native plant community descriptions).
- Control the spread of oak wilt, especially in bur oaks.
- Manage emerald ash borer through removal of dead trees.
- Achieve a forest structure with complete canopy, open mid-story, and a continuous ground cover of native plants.
- Extend the field of view for park user safety, e.g., keep buckthorn under control.
- Plant trees native to MN mesic forests.
- Remove non-native canopy trees.
- Consider introducing climate adaptive plant species native to northern Iowa, southwestern Wisconsin, and southeastern Minnesota.
- Manage the ground layer to achieve perennial, native, or climate adaptive native species at a part-to-continuous cover density. Prevent erosion and increase diversity by planting native herbaceous species.
- Promote the growth of plant species that provide food, cover, and nesting habitat for songbirds.
- Strive to meet all requirements of their life cycle.
- Control invasive plant species to a maximum cover of five percent.
- Aggressively manage invasive species that are new to the area, striving to eradicate them from the park.
- As much as possible remove all non-native trees.
- Introduce fire as a management tool.
- Manage deer to minimal numbers.

3.2.3.2 Oak Savanna

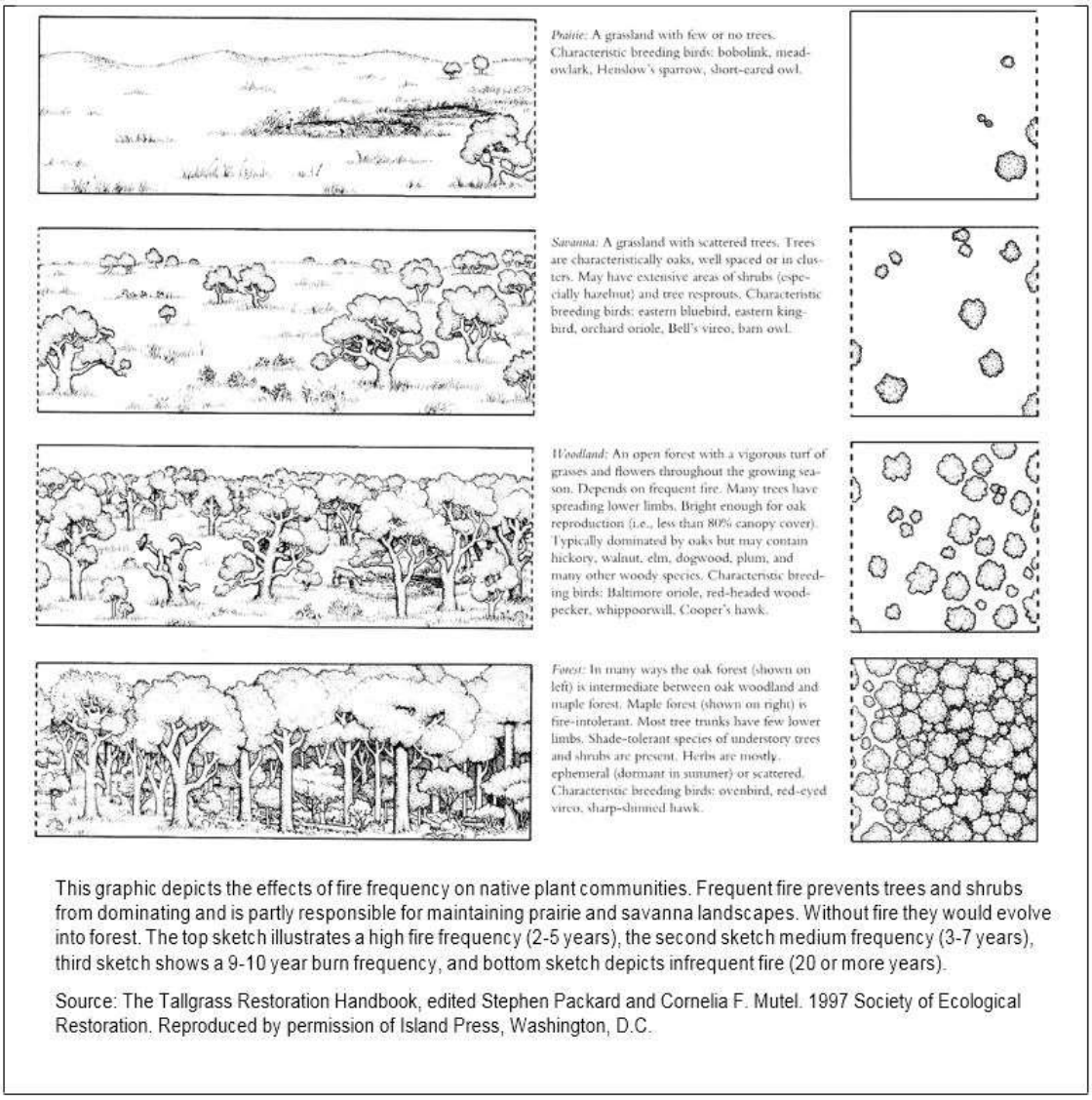
Goal:

To establish and maintain an open oak savanna plant community similar to what would have existed on the site prior to European settlement. To establish a diversity of native plants that thrive under the management conditions that provide habitat for a diversity of wildlife, especially birds and insects. To consider facilitating the introduction of select savanna species as a preparation for climate change.

Objectives:

- Manage to achieve the structure and composition appropriate for oak savanna found in the park (see DNR Field Guide native plant community descriptions).

- Allow canopy trees to occupy no more than 10 to 20 percent aerial coverage (herbaceous vegetation will dominate this community type).
- Establish a diversity of native herbaceous plants (see Appendix A). Short grasses, sedges, and forbs are preferred.
- Minimize the extent of shrub establishment to develop an open landscape safe for the park users.
- Consider introducing climate adaptive plant species native to northern Iowa, southwestern Wisconsin, and Southern Minnesota.
- Plant trees native to the MN oak savanna, primarily bur oak.
- Fire is a primary management tool for the park. Figure 3-2 depicts the role in maintaining native plant communities.
- Control invasive plant species to a maximum cover of five percent.
- Aggressively manage invasive species new to the area to extirpate them from the park.
- Introduce grazing/browsing as a management tool (e.g., goats).
- Manage deer to minimal numbers.



This graphic depicts the effects of fire frequency on native plant communities. Frequent fire prevents trees and shrubs from dominating and is partly responsible for maintaining prairie and savanna landscapes. Without fire they would evolve into forest. The top sketch illustrates a high fire frequency (2-5 years), the second sketch medium frequency (3-7 years), third sketch shows a 9-10 year burn frequency, and bottom sketch depicts infrequent fire (20 or more years).

Source: The Tallgrass Restoration Handbook, edited Stephen Packard and Cornelia F. Mutel. 1997 Society of Ecological Restoration. Reproduced by permission of Island Press, Washington, D.C.

Figure 3-2 Prairie-Forest Continuum

3.2.3.3 Disturbed Woodland

Goal:

To manage the woodland primarily to provide songbird cover and feeding habitat, along with nesting potential. To transition the woodland from a mix of non-native and native trees to a dominance of native trees, which may include climate adaptive 'near-native' trees. To establish a diverse native plant mid and understory.

Objectives:

- Manage to achieve the structure and composition appropriate for oak woodland found in the park (see DNR Field Guide native plant community descriptions).

- Achieve a woodland structure with complete canopy and a mix of age classes, an open midstory, and a patchy to continuous ground cover of native plants.
- Plant trees native to MN mesic forests (see Appendix A).
- Phase the removal of non-native and softwood canopy trees.
- Consider introducing climate adaptive plant species native to northern Iowa, southwestern Wisconsin, and southern Minnesota. See Near-Native Tree List, Appendix A.
- Manage the ground layer to achieve perennial, native, or climate adaptive native species at a partial to continuous cover density. Prevent erosion and increase diversity by planting native herbaceous species (see Table 3-1).
- Promote the growth of plant species that provide food and cover for songbirds.
- Control invasive plant species to a maximum cover of 5 percent.
- Aggressively manage invasive species new to the area to eradicate them from the park.
- Manage the ground layer to achieve perennial, native, or climate adaptive native cover at near 100 percent density.
- Extend the field of view for park user safety, e.g., control buckthorn.
- Manage deer to minimal numbers.

3.2.3.4 Lake Shoreline

Goal:

To manage the shoreline to stabilize eroding slopes and to establish/preserve native habitat. To establish diverse native plant communities within the littoral zone, the emergent zone, the transitional zone, and up through the upland buffer community.

Objectives:

- Stabilize shoreline with native plants or structural practices as necessary.
- Establish a diversity of native herbaceous plant species (see Table 3-1).
- Selectively plant appropriate native woody plant species.
- Control invasive plant species to a maximum cover of five percent.
- Aggressively manage invasive species new to the area to eradicate them from the park.
- Retain a minimum of 30-foot native plant buffer from the ordinary high water line of the lake to the lawns.

3.2.3.5 Mature Trees within Lawns (Oaks)

Goal:

To preserve mature trees growing in the lawns by implementing good stewardship practices.

Objectives:

- Eliminate lawn mower damage to tree bark by placing a wood mulch buffer of 2 to 6 inches in depth and a radius out to at least the drip line of each tree.
- Prevent the spread of damaging insects and diseases by inspecting the trees each spring and fall.
- Prevent excessive wind damage by regularly pruning (at least every five years).
- Protect critical root zones during construction to prevent damage to roots.

3.2.3.6 Stormwater Management Facilities

Goal:

To manage stormwater facilities to efficiently function to treat stormwater while having a neat appearance and supporting a diversity of plant species.

Objectives:

- Achieve stable soils: no erosion within basins.
- Promote the growth of dense native vegetation.
- Integrate with surrounding habitat.
- Control invasive plant species to a maximum cover of five percent.
- Aggressively manage invasive species new to the area to extirpate them from the park.
- Regularly remove sediment from pre-treatment devices (by the City of West St. Paul).

3.3 Priority Natural Resources Features

Priority natural resource features in Thompson County Park are those features of significant natural history, geologic uniqueness, exceptional habitat, or rare species. These features have been given priority for conservation and enhancement in the Thompson Park Master Plan and are featured for specific management in this plan.

3.3.1 Oak Woodland at Simon's Ravine

Even though this site was ranked by the DNR as exhibiting medium ecological quality, it is in fact the highest quality native plant community in the park. Therefore, this plant community is a priority for conservation and enhancement. Notably, because of its intact soil profile, which has never been tilled and because of the mature oaks and basswood trees that occur here, this community rises to the top in terms of conservation priority. Resources could be directed here to:

- Preserve trees through oak wilt management (oak wilt occurs at the north end of the park)
- Regenerate oaks and other tree species through appropriate fire management, planting, and protection from predation by deer and rabbits
- Manage invasive plant species such as buckthorn and garlic mustard
- Plant native herbaceous species and protect them from predation during establishment (see Table 3.1)
- Establish the intentional trail routes shown in the Park Master Plan

3.3.2 Thompson Lake and Shoreline

Great efforts are being made to improve lake water quality by Dakota County, the City of West St. Paul, and the Lower Mississippi Watershed Management Organization. This work will continue in the watershed as urban development continues and changes. The lake is a great attraction to the park and enjoyed by many people. Resources should be directed to the lake in order to:

- Restore the native vegetation of the shoreline
- Conduct periodic drawdowns that promote the establishment of aquatic plants on shorelines and in littoral zones around the lake, which help improve water quality and wildlife habitat
- Manage invasive species such as narrow leaf cattail and purple loosestrife
- Construct fishing access and trails shown in the Park Master Plan in order to prevent trampling of the plant community
- Continue to work with the MN DNR on their fish stocking and fish management program
- Thoughtfully manage storm water draining into the lake from the watershed within the park
- Continue to work with the City of West St. Paul and the Mississippi Watershed Management Organization to promote water quality improvement practices within the watershed

3.3.3 Birds

Birds are one of the greatest wildlife resources in the park. Many pass through to feed during migration, and some nest and raise their young within the park. Improving opportunities for feeding and providing quality cover will help birds to flourish and allow for their enjoyment by people within the park. Resources can be directed to:

- Restore the native plant communities shown in this plan in order to improve feeding and nesting opportunities
- Educate park users on the importance of managing cats and dogs in urban areas to protect birds from predation
- Facilitate activities such as spring bird-watching walks to introduce park users to the diversity of bird species that move through the park

3.3.4 Potential Oak Savanna

Although oak savanna does not currently occur in the park, the potential and ease of regeneration of this original plant community is significant. With relatively low investment, a good diversity of herbaceous plants and appropriate trees can be planted to reconstruct this community. Resources should be directed to the savanna to:

- Introduce a diversity of plant species including those important for pollinators
- Manage invasive plants
- Use fire as a management tool
- Educate park users on the value of this beautiful plant community
- Implement trails and other features as shown in the Park Master Plan in order to direct people into and through the savanna without negative impacts

3.3.5 Mature Oaks

The mature oaks in the lawns at the north end of the park (the developed areas) and in the park outside of Simon's Ravine are legacy trees: many are upwards of 200 years old. They deserve special treatment to ensure that they continue to thrive. These trees can be further protected by:

- Establishing a wood chip buffer around the trunks, for those oaks growing within lawn, to protect their critical root zones and to prevent lawn mowers from ripping their bark.
- Inspecting each year for oak diseases and infestations such as bur oak blight, oak wilt, and chestnut borer.
- Pruning every five years, under the auspices of a certified arborist.
- Posting an interpretive sign discussing the virtues of these venerable old trees.

Also, consider establishing new oak plantings throughout the park. Plant bur and white oak in the lawns, as well as in the oak forests and oak savanna as appropriate. Protection from deer during establishment years is critical.

3.4 Management Recommendations

3.4.1 Native Plant Community Restoration

3.4.1.1 Restoration Strategy

The restoration of native plant communities at Thompson Park will begin within a core of highest ecological potential (Figure 3-3). Here, an intense focus on invasive species removal will begin, with an aim of eliminating competition and clearing a zone for native plant establishment. In areas with little native plant presence, such as the future oak savanna, the effort will be more significant, whereas in other areas, such as Simon's Ravine, tree removal and herbaceous plant eradication will hardly be noticed. The goal is to establish a thoroughly prepared, planted, and cared-for stand of native plants, and to then repeat these steps in adjacent areas to expand the area of restoration, working outward from core habitat. Eventually, the entire park could be in the process of restoration and regeneration. Figure 3-6 depicts potential phasing of restoration efforts, as well as the likely sequence of implementation. The speed at which regeneration is implemented will depend upon funding and Dakota County's staff capacity for overseeing management and maintenance.

These steps are critical to the success of native plant community restoration:

1. Thorough site preparation to eliminate invasive species. This process should take a year or two, but will save future effort by thoroughly depleting invasive species and the seed they leave behind. Skimping on this step will result in expensive on-going management efforts.
2. Appropriate planting in a timely and species-specific manner. If well-chosen, then species that fit the growing conditions of the site will succeed. Whether they are planted as seeds, plugs or potted plants, careful attention must be given to the timing and technique that will ensure their successful establishment.
3. Regular maintenance to encourage the establishment of native plants and control of invasive species. Unfortunately, invasive plant species will always appear in the park. Seed will be blown in by the wind, washed in by water, or carried in by animals. Regeneration efforts must be taken seriously and implemented in quantities that can be maintained. If future management budget looks unlikely, then the initial steps of site preparation and planting will be futile since they could be lost due to a lack of maintenance. Only undertake plantings that can be maintained long-term.

Figure 3-3 Existing Ecological Core

3.4.1.2 Adaptive Management Approach

An adaptive management approach for native plant community restoration will be followed at Thompson Park. Adaptive management is an iterative process of decision making in the face of uncertainty, with an aim of reducing uncertainty over time via system monitoring. It is a systematic approach for improving resource management by learning from management outcomes including but not limited to:

- Weed establishment and weed eradication success
- Native plant establishment failure and success
- Wildlife habitat improvement projects
- Disturbance by people and wildlife
- Climate impacts

Adaptive management can be a slow process of testing a management technique, observing its effectiveness, and then adjusting the technique in response. This iterative process takes time but is vital to successful management.

All Park Habitats:

- Conduct an annual spring site assessment to identify issues and define management goals for that year. Develop a maintenance plan for the year (timing and activities involved).
- Each year, walk the park natural areas every four to six weeks during growing season to inspect for invasive weed encroachment, dead or diseased plants, erosion problems, and miscellaneous issues.
- Cut and treat (herbicide) all buckthorn in the park every third or fourth year. This should become as regular a maintenance task as mowing the lawns. Buckthorn is pervasive throughout the park. Its dense growth tends to block views and is a safety issue. . In areas with little or no native ground cover, such as the disturbed woodland, consider grazing goats to set back woody invasive plants.

The following is a description of each of the native plant communities that are targeted for Thompson County Park, as taken from *The DNR Field Guide*. "Layers", in the vegetation sections, originate from physiognomic descriptions of vegetation structure and composition, based on height classes, which is a conventional way of describing vegetation.

3.4.1.3 Restoration Process and Long-Term Maintenance

The following table (Table 3-1) describes the basic steps in the process of plant community restoration:

Table 3-1 Plant Community Restoration

Existing Plant Community	Restoration Process	Long-Term Maintenance
Oak-Basswood Forest (Target Community: Oak-Basswood Forest, MHs38)	• Remove undesirable woody and perennial vegetation (e.g., cut, mow, herbicide, burn). Preserve oak, basswood, ironwood, and other hardwood species. A phased approach may be needed based on budget and level of invasive trees to be removed. • Prep soil and plant seed or live herbaceous plants and shrubs where areas of invasive species have been removed. Plant desirable native or near-native (to facilitate species from a more southerly provenance to prepare for species shifts due to changing climate) trees in gaps where trees have been removed. See Appendix A for a list of near-native tree species. • Mulch and water live plants. • Install plant protection from deer and rabbit predation.	• During the first three years after a regeneration effort, spot treat invasive plants with herbicide four times per growing season (May, June, September, and October). • After these first three years, spot mow, brush saw, and herbicide-treat invasive woody plant species once every 3 to4 years. Also treat invasive herbaceous species once per year in spring or fall for best effectiveness. • Use fire as a management tool. Prescribe a burn every 3 to 4 years when biomass accumulation is sufficient to carry fire. • Remove oak trees killed by oak wilt. • Manage emerald ash borer as per the County's Emerald Ash

Existing Plant Community	Restoration Process	Long-Term Maintenance
		Borer Management Plan. • Supplemental planting for oak regeneration and overall species diversity as needed, about every 5-10 years, and seed onto the black following prescribed burns.
Disturbed Woodland **(Target Community: Dry-Mesic Oak Woodland)**	• Remove undesirable or diseased woody and perennial vegetation (e.g., cut, mow, graze, herbicide, burn, etc.). Create small clearings (canopy gaps) that open the canopy and allow in light stimulate growth of newly planted trees. Preserve black walnut and other hardwood species (there are not many). Tree species to remove include black locust, green ash, box elder, silver maple, Siberian elm, and select cottonwoods. • Prep soil for seed or live plant installation. • Plant native or near-native trees. • Install seed or live herbaceous plants with the goal of increasing diversity and building fuels for running future ground fires. • Mulch and water any live plants as necessary. • Install plant protection from deer and rabbit predation.	• Phase the removal of non-native and softwood canopy trees. Create gaps in the canopy 50 -to100 feet wide to allow sunlight to hit the woodland floor. This will allow for the regeneration of oaks and other desirable species. • Use grazing by goats to clear invasive vegetation from the woodland floor. A plan could be developed with a grazing specialist to determine where and when grazing would be most effective. • During first three years after canopy gap creation, spot treat invasive plants with herbicide four times per growing season (May, June, September, and October). • After establishment period, spot mow and herbicide-treat invasive woody plant species

Existing Plant Community	Restoration Process	Long-Term Maintenance
	• Phase canopy gap creation to fully restore hardwood trees. Create additional gaps every 5 to 10 years, or until all undesirable canopy trees have been removed.	and cut with brush saw. Herbicide application during dormant season is ideal (1 to 2 times a year). • Perform prescribed burn every 3 to 4 years if possible or as soon as biomass accumulation is sufficient to carry a fire. • Manage emerald ash borer as per Park policy (EAB Management Plan). • Phase canopy-gap creation to fully restore hardwood trees. Create additional gaps every 5 to 10 years until all undesirable canopy trees have been removed.
Oak Savanna **(Target Plant Community: Mesic Oak Savanna)**	• Remove undesirable and diseased woody and perennial vegetation (e.g., cut, mow, herbicide, burn, etc.). It is ideal to take two years to eliminate perennial non-native grasses and perennial weeds to thoroughly kill the root system and give time for seed in the soil to germinate. This will greatly reduce future maintenance budget by eliminating this weed source. • Determine appropriate vegetation to be planted as per growing conditions. Some bur oaks may be planted, but tree planting will be limited to achieve a	• For the first two years after planting, mow herbaceous plants as appropriate (at least 3 to 4 times the first year, and once the second) to reduce annual weed competition. During the establishment phase of approximately 3 to 5 years, spot apply herbicide to perennial weeds in May, June, July, and September. • After the establishment period, mow once every other year to minimize the extent of shrub establishment and to

Existing Plant Community	Restoration Process	Long-Term Maintenance
	maintainable savanna landscape. Consider planting native shrubs in limited amounts. Savanna shrubs block views and reduce perceived safety. • Prep soil for planting (e.g., till, harrow, smooth, rake, burn, etc.). • Install seed and/or live plants (drill seed, broadcast seed, plant trees and shrubs). • Prevent erosion by appropriate means such as disc-anchored straw or hydromulch. • Water any live plants as necessary. • Install plant protection from deer and rabbits as needed. • Interseed and/or plant live plugs after the third grown season for additional diversity. Experiment with seeding "onto the black" following a prescribed burn.	retain an open landscape safe for the park users. Grazing could be used as a substitute for mowing. • Fire may be a primary management tool for the park. Prescribe a burn every 3 to 4 years. • After establishment period (3 to 5 years), spot treat invasive plants with herbicide twice per growing season. • Interseed or plant to increase native cover to increase native plant diversity.
Stormwater Management Facilities	• Clear and excavate construction area. • Install stormwater control features (e.g., pipes, catch basins, curb cuts, underdrains, weir, emergency overflow system). • Install filter media and planting soil. • Grade and stabilize stormwater facility.	• Inspect 4 times per year during growing season for trash, sediment, erosion, weeds. • Remove trash once per month. • Clean sump manholes and sediment deltas annually. • Mow once every year in early spring prior to green-up.

Existing Plant Community	Restoration Process	Long-Term Maintenance
	• Prep soil for seed and live plant install (e.g., till, harrow, smooth, rake). • Install seed and live plants (drill seed, broadcast seed, plant trees, plugs, and shrubs). • Mulch and water live plants as necessary. • Install plant protection from deer, geese, and rabbits as needed.	• Prune trees every two years for the first five years after planting, and every 5th year thereafter. • Weed by hand or apply herbicide to control invasive perennials twice per growing season. • Replant where plantings fail every year as necessary. • Refresh mulch every other year.
Lake Shoreline (Target Native Plant Communities: Inland Lake Clay/Mud Shore and also a gradientfrom dry to wet including Mesic Oak Savanna, Mesic Prairie, Wet Prairie, Wet Meadow, Emergent Marsh)	• Drawdown the lake every few years to control invasive species such as hybrid cattail and curlyleaf pondweed. • Where possible, grade shoreline to a gradual slope to lengthen the emergent zone of the lake in order to improve habitat. Logs and edge roughness also enhance habitat value for many species. • Work with St. Croix Lutheran High School, the western shore owner, to plant buffers on their property and to establish stormwater management facilities to reduce erosion and sediment running into the lake. ○ Remove undesirable or diseased woody and perennial vegetation (e.g., cut, mow, herbicide, burn) in areas to be restored.	• Control shrub growth to develop an open landscape safe for the park users with good views to the lake. Undesirable shrubs and invasive trees should be removed. This could be done in concert with the buckthorn removal event that is to occur throughout the natural areas of the park every 3 to 4 years. • During the establishment period of approximately 3 to 5 years, spot apply herbicide to perennial weeds in May, June, July, and September. • After establishment period, spot treat invasive plants with herbicide twice per growing season. Depending on weed pressures, the

Existing Plant Community	Restoration Process	Long-Term Maintenance
	○ Stabilize the ad hoc paths leading down to the lake. Stabilization may be a combination of installing boulder stepping stones, turf reinforcement mat, and vegetative buffer. ○ Prep soil for seed and live plant installation. ○ Plant seed and live plants (drill seed, broadcast seed, plant trees and shrubs). ○ Mulch and Water live plants as necessary. ○ Install plant protection from geese, deer, rabbits, muskrat, and beaver as needed.	shoreline may need aggressive treatment of reed canary grass and cattails. • Plant as needed to increase native cover and diversity.
Mature Trees within Turf Lawn	• Vigilantly protect heritage trees. The mature oaks in the lawns are 150 to 200 years old. They can live another 100 years. Construction projects should be designed around these trees with a minimum setback of 50 feet. • During construction, a chain-link fence should be erected 50 feet from the trunk of the trees to create a zone of no construction impact. • When planting trees within the high-use areas of the park (lawns), consider planting long-lived hardwood species such as bur oak, white oak,	• Place and maintain a 24-inch-deep wood-mulch buffer around the base of each tree to protect the trees from lawnmower damage. Extend buffer out to critical root zone or more. • Inspect trees annually for disease and insect problems by a certified arborist. Treat for issues discovered as appropriate. • Prune mature trees every five years to improve tree health and reduce wind resistance. Only prune during non-oak wilt

Existing Plant Community	Restoration Process	Long-Term Maintenance
	Kentucky Coffeetree, and hackberry.	season (October through March).

3.4.2 Target Plant Communities

Target plant communities were determined to direct a vision for native plant community restoration in the park. The target communities were formulated by analyzing the park's existing plant communities, soils, aspect, and moisture levels, as well as by taking into consideration the historic plant communities of the site, especially via historical aerial photography. Four primary plant communities have been delineated. They will exist in a continuum, with transition zones between the communities, and managed to be open rather than closed communities. The target plant communities of the park are:

- Lake Shoreline/Deepwater Marsh
- Oak Savanna
- Oak Forest
- Mixed Hardwood Forest

Figure 3-4 shows the target plant communities developed for the park. Park managers will determine species to plant in these communities, and they will follow the guidelines of the management chapter to steward the evolution of these communities.

Figure 3-4. Target Plant Communities

A Note on Biotic Communities:
Scientists have long debated about how to characterize biotic communities. One view was that communities were analogous to the organism, such that each community is like an organ of the body, working together for a common purpose. In this view, community structure is defined by discrete, well-defined boundaries and most of the species tend to only associate with each other. This is called a "closed" community. An opposite view of community organization emerged that suggested the community, far from being a distinct unit like an organism, was merely a "fortuitous association of organisms" (Ricklefs, 1990) whose adaptation enabled them to live together under the particular physical and biological conditions that characterize a particular place. This is called an "open" community. Open communities have no natural boundaries; therefore, their limits are arbitrary with respect to the geographical and ecological distributions of their component species, which may extend their ranges independently into other associations. Today, most ecologists side with the open community model rather than the closed one. For the purposes of this plan, however, discreet community units were developed to help guide the restoration of the park. By no means are these community units meant to be discreet with sharp boundaries. Rather, for the most part, they should grade into each other, across a gradient of physical conditions such as temperature, moisture, salinity, light exposure, and space availability. Ultimately, most

the edges and boundaries of community units should be soft and fuzzy, not hard and discreet.

3.4.2.1 Lake Shoreline, Deepwater Marsh

The shoreline vegetation of Thompson Lake transitions between submerged aquatic plants within the lake up to forest above the dry edge of the lake (see Figure 3-5). Consider that prior to urban development in the region this water body was actually a deepwater marsh.

Only after urban development occurred, which increased surface stormwater runoff considerably, did this water body take on its present form as a shallow lake. Therefore, this water body still shows many of the signs of a marsh community. All of the vegetation types within this continuum will be restored and maintained as follows.

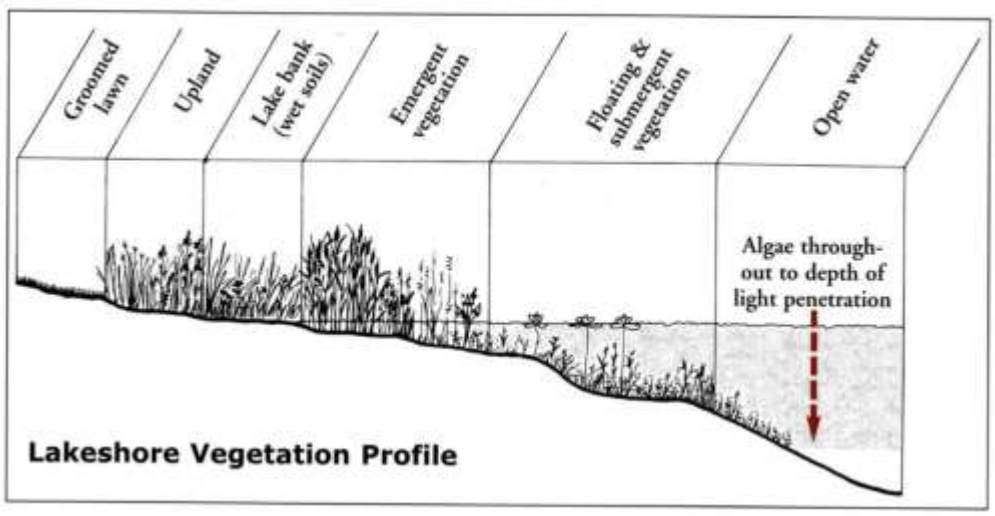


Figure 3-5 Lakeshore Vegetation Profile. "Groomed lawn" may or may not be present at Thompson Lake

Floating and Submerged Vegetation: This vegetative zone reaches typically from water 18 inches deep to the depth that light penetrates. At Thompson Lake, this zone is well established. Curlyleaf pondweed is an exotic plant in the lake that is displacing native plant species. This can result in algal blooms when curlyleaf decomposes and releases plant nutrients when they go dormant in early summer. There are methods of controlling this weed through lake level drawdown over the winter. This may be considered when it becomes a problem. Other submerged aquatic plant species abound in this shallow lake including coontail, northern water milfoil, and elodea. Additional submerged aquatic species could be introduced to the lake if desired to improve fish cover and wildlife feeding opportunities. Wild celery is an example of a species that is a very desirable diving duck food.

Emergent Vegetation: This zone reaches typically from an inch of water to eighteen inches deep. In Thompson Lake, there are areas where this community is beautifully developed with species such as wild iris, arrowhead, and giant burr reed. Much of this zone, however, is dominated by the invasive hybrid cattail (Typha x glauca) which greatly impacts wildlife habitat value. Hybrid cattail typically comes into lakes and wetlands via culverts or aquatic fowl, and it can form via floating mats, which can disperse via wind action, thus readily invading new areas of shoreline. Cattail was removed in three places of the lakeshore during the winter of 2019 in association with the stormwater wetland facility built at the north end of the lake. Cattail will continue to establish and will need to be controlled. It is best to control cattail when it is first established. It is much more expensive to remove established clones. When hybrid cattail is removed, native emergent species should be planted to fill the void.

Lake Bank: This is the zone of saturated soils adjacent to the water. A great diversity of wildflowers, grasses, and sedges typically grow in this zone. At the east side of Thompson Lake near the Visitors Center is a good example of a restored bank with a diversity of native plants. Most of the lake bank is dominated by reed canary grass, which drives diversity down and degrades wildlife habitat value. This zone of the lake should be restored by eliminating reed canary grass and establishing native plants all around the lake.

In 2005, the Minnesota DNR published descriptions of plant communities found throughout Minnesota in *The Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province (DNR Field Guide)*. These descriptions can also help guide the goals for future conditions in the park. The following are recommendations based on the description of lakeshore and marsh communities taken from the *DNR Field Guide*.

Inland Lake Clay/Mud Shore, LKi54

"Plant communities on clay, mud, or silt substrates—often mixed with organic detritus—on shores of inland lakes and ponds. Vegetation is typically zonal, reflecting seasonal changes in water level. LKi54 includes plant communities in shallow basins and along the edges of ponds and lakes where spring flooding is followed by summer drawdown, exposing mudflats that are colonized by plants."

Vegetation Structure and Composition

Vegetation cover ranges from sparse to dense but varies seasonally (along with composition). Distinct upper and lower zones are usually present, with lower zones often expanding as water levels fall over the summer.

"Upper Zone lies above normal water levels where seasonal flooding, erosion by storm waves, and ice-scouring prevents formation of stable plant communities, especially on larger bodies of water."

"**Lower zone** is present at or just above normal water levels, extending below normal water levels on exposed substrates during periods of low water. At normal water levels, lower zones are washed by waves almost daily. Lower zones include plant communities on mudflats exposed in ponds or shallow basins and bays during annual summer drawdown. Plant species in lower zones include terrestrial forms of aquatic plants and seedlings of terrestrial plants. Many of the plants are annuals that germinate from seeds buried in sediments or dispersed by wind or water.

Landscape Setting and Soils

"LKi54 occurs in shallow basins and along lake and pond margins. Substrates consist of silt or clay mixed with marl or with sedimentary peat composed of plant and animal residues. When water levels are high, and sediments are flooded, planktonic, benthic, and aquatic organisms produce organic detritus and deposit inorganic salts, which influence nutrient content and chemistry or sediments."

Natural History

"Wave action and ice scouring are important in maintaining the open structure of shoreline communities. Wave action is most important during periods of high wind, especially storms. Ice scouring occurs primarily during spring breakup, when winds push large pieces of ice on shore. Lakeshore communities typically vary in extent over the growing season and from year to year under influence of repeated flooding and drawdown and erosion and deposition of sediment and organic debris. These influences often result in zonal patterns of vegetation. Characteristic plants include annual species whose seeds are dispersed by wind or water or that can remain dormant for long periods buried in sediment and germinate when conditions are suitable (often as water levels fall and expose sediments along the shore). Also present in shoreline communities are perennial herbaceous species tolerant of inundation, erosion, and stranding. Many of the perennial species are rhizomatous, and there may be a tendency for species to be dispersed by floating propagules."

Similar Native Plant Community Classes

- **RVx54 Clay/Mud River Shore**
  Rvx54 shares a number of species with LKi54; distinguishing the low classes is most difficult along riverine lakes where shorelines are influenced both by seasonal flooding and by wave action.
- **LKi32 Inland Lake Sand/Gravel/Cobble Shore**
  LKi32 occurs in similar settings and along shore of many of the same lakes as LKi54, and the two communities may share some species, especially when LKi32 is present on sand.

NPC Types in Class

LKi54 has been poorly sampled in Minnesota, but is known to occur throughout the state. Delineation of the community is based primarily on characteristics of the physical environment.

- LKi54a Clay/Mud Shore (Inland Lake)
  LKi54a is present on silt or clay substrates along the shores of ponds, small lakes, and protected shallow bays. Species composition of the lower zone is similar to that of LKi54b2 (see below). The upper zone contains species such as false indigo (*Amorpha fruticosa*) and woolgrass (*Scirpus cyperinus*) that do not persist in the lower zone. KLi54a occurs throughout the state.

- LKi54b Mud Flat (Inland Lake)
  LKi54b occurs in shallow basins on mud sediments that are flooded in the spring and exposed later in the season as water levels fall. Soils typically consist of silt and clay mixed with marl or with sedimentary peat composed of plant and animal residues precipitated from standing water. LKi54b is divided into two subtypes based on salinity.
    - LKi54b1 Saline Subtype
      Present on mud substrates with high concentrations of dissolved salts. Plant species diversity is low, with vegetation composed of species adapted to high concentrations of dissolved salts, including red saltwort (*Salicornia rubra*), salt grass (*Disthichilis spicata*), Nuttall's alkali grass (*Puccinellia nuttalliant*), seabite (*Suaeda calceoliformis*), plains bluegrass (*Poa arida*), and prairie bulrush (*Scirpus maritimus*). LKi54b1 had only been documented in Minnesota at one site in the extreme western part of the state in the Minnesota River Prairie Subsection of the CGP.
    - LKi54b2 Non-Saline Subtype
      Present on exposed clay or mud substrates along shorelines or in shallow basins. Vegetation is composed of terrestrial forms of aquatic plants and seedlings of annual plants that develop from seeds buried in the sediments or dispersed from other communities. Most of the vegetation, especially by late summer, is composed of seedlings of umbrella or nut sedges (*Cyperanus squarrosus, C. odoratus*, and other *Cyperus* species), spikerushes (*Eleocharis intermedia), E. obtusa, E acicularis*, and other *Eleocharis* species), rushes (*Juncus nodusus, J. tenuis, J. pelocarpus*, and other *Juncus* species), bulrushes (*Scirpus validus* and other *Scirpus* species), smartweeds (*Polygonum amphibium* ssp., *emersum*, *P. lapathifolium*, and other *Polygonum* species), plantains (*Plantago major* and *P. rugelii*), goosefoots (*Chenopodium species*), beggarticks or bur marigolds (*Bidens cernua*, *B. frondosa*, and other *Bidens* species), arrowheads (*Sagittaria latifolia, S. cristata*, and *S. rigida*), giant bur reed (*Sparganium eurycarpum*), and golden dock (*Rumex maritimus*). These species often form dense stands by later summer or autumn. Floating-leaved aquatic species such as water lilies (*Nuphar* spp. and *Nymphea* spp.) are common, often as rosettes or leaves sprouting from large rhizomes on the mud surface. Other rooted macrophytes such as pondweeds (*Potamogeton* spp.), water stargrass (*Zosterella dubia*), mud plantain (*Heteranthera limosa*), and water shield (*Brasenia schreberi*), are also common but can be quite different in appearance from their more typical submerged growth forms. LKi51b2 occurs in shallow ponds, lakes, and bays across Minnesota.

Management actions and goals for restoration of northern wet meadow/carr include:
Managing the shoreline of Thompson Lake for as a consistent water level as possible, but in the likely event that the water levels fluctuate greatly, then try to maintain at least some vegetation that will survive. Plant a variety of vegetation to maximize resiliency in the face of flashy hydrology. Plant plugs and scatter seed. Perform drawdowns periodically express seedbanks. Monitor for invasive aquatic vegetation such as hybrid cattails and reed canary grass.

Northern Bulrush-Spikerush Marsh, MRn93

Emergent marsh communities typically dominated by bulrushes or spike-rushes. Present along lakeshores and stream borders.

Vegetation Structure and Composition

Floating-leaved and **submergent aquatic plant** cover is variable, frequently with duckweed (*Lemna* spp.) and infrequently with greater duckweed (*Spirodela polyrhiza*) and pondweed (*Potamogeton* spp.).

Graminoid cover is variable, often consisting of dense, clonal, single-species patches interspersed with areas of open water. Community most often is dominated by bulrushes, including soft stem bulrush (*Scirpus validus*) and river bulrush (*S. fluviatilis*), or by red-stalked spikerush (*Eleocharis palustris*), with lesser amount of rice cut grass (*Leersia oryzoides*).

Forb cover is variable. Typical species include broad-leaved arrowhead (Sagittaria latifolia), water smartweed (Polygonum amphibium), and bur reeds (Sparganium spp.).

Shrubs are absent.

Landscape Setting and Soils

MRn93 occurs in shallow water (typically 20-40 in [50-100 cm] deep) along wave-washed and protected lakeshores and along stream borders. Substrates are usually mineral soil, sometimes held together by mats of plant roots. MRn93 appears to occur on permanently flooded sites but may be intermittently exposed during periods of low water.

Natural History

MNr93 develops in settings where standing water is present most of the year, providing conditions favorable to hydrophytic plants. The community is most common along shorelines where exposure to waves hinders accumulation of peat and formation of floating mats. Variation in vegetation composition within the class is likely due to variation in water level, substrate, and exposure to wave action.

Similar Native Plant Community Classes

- **MRn83 Northern Mixed Cattail Marsh**
  MRn83 is similar to MRn93 but occurs in shallow water on softer substrates more protected from wave action. MRn83 is dominated by cattails (*Typha* spp.), with abundant sedges (*Carex* spp) and forbs such as marsh cinquefoil (*Potentilla palustris*), northern bugleweed (*Lycopus uniflorus*), and tufted loosestrife (*Lysimachia thrysiflora*). MRn93 is dominated by bulrushes (*Scirpus* spp.) and submergent aquatic species such as pondweeds and water milfoil (*Myriophyllum* spp.).
- **MRp93 Prairie Bulrush-Arrowhead Marsh**
  MRp93 is similar to MRn93 but occurs south and west of MRn93, in the Prairie Parkland Province. There are too few detailed records available to identify species differences between the two classes.

NPC Types in Class

Very little data are available for MRn93, but field observation indicate that the class can be divided into two community types based on dominant species.

- MRn93a Bulrush Marsh (Northern)
  Emergent marshes typically dominated by bulrushes.
- MRn93b Spikerush – Bur Reed Marsh (Northern)
  Emergent marshes dominated by spikerushes or bur reeds.

Management actions and goals for restoration of northern wet meadow/carr include:

Although Thompson Lake does not typically experience much wave action, some can occur on the southeast shore, where this community may tend to occur. Major concern is the presence and current dominance of hybrid cattails, which should be removed. After cattail removal occurs, replant with appropriate species of MRn93 along the SE shore using transplants in the emergent and transitional zones and seed or transplants in the uplands. Cattails should be monitored and controlled for many years following planting. Other major concerns are high and flashy lake levels. Try to attenuate this as much as possible. Conduct periodic drawdowns of the lake.

MRn83—Northern Mixed Cattail Marsh

"Emergent marsh communities typically dominated by cattails. Present on floating mats along shorelines in lakes, ponds, and river backwaters or rooted in mineral soil in shallow wetland basins."

Vegetation Structure and Composition

"**Floating-leaved and submergent aquatic plant** cover is sparse, with species such as duckweed and greater duckweed frequent, and common bladderwort and common coontail occasionally present. Seasonally prolific, floating clones of the liverworts may be present, becoming stranded during water table drawdown.

Graminoid cover is variable, with lake sedge and bristly sedge commonly present.

Forb cover is strongly dominated by cattails, usually with >50% cover. Other common forbs include emergent species such as broad-leaved arrowhead, marsh skullcap, small or three-cleft bedstraw, and bur marigold and beggarticks.

Shrubs are absent or very sparse.

Notes: vegetation is often composed of dense stands of cattails interspersed with pools of open water. Associated species are highly variable."

Landscape Setting and Soils

"MRn83 occurs in shallow basins and depressions and along the shores of lakes, ponds, and river backwaters. Substrates range from muck or shallow well decomposed peat to floating peaty mats. Substrate surface is usually covered with plant litter, especially dead cattail stalks. MRn83 is often transitional between shallow aquatic communities and wet meadows."

Natural History

"MRn83 develops in areas where standing water is present most of the year, providing conditions

favorable for hydrophytic plants. Occurrences of the community with plants rooted in muck or peat substrates may succeed to shallow aquatic communities if the water table rises for prolonged periods, or to wet meadows if the water table drops or if silt or sedimentary peat accumulation causes the substrate surface to become elevated above the water surface. Floating mats, which rise and fall with changes in water level, are presumably successionally stable but may be fragmented by strong winds or beaver activity. Variation in species composition observed in the class is likely due to differences in water depth, the permanence of standing water, and variation in substrate. Fires during severe droughts can remove accumulated peat in fens or wet meadows, effectively lowering the growing surface and creating the wetter conditions that favor marsh over fen or wet meadow vegetation."

Similar Native Plant Community Classes

- **MRn93 Northern Bulrush-Spikerush Marsh**

  "MRn93 can be similar to MRn83 but occurs in deeper water and is more affected by wave action. MRn93 is dominated by bulrushes and submergent aquatic species such as pondweeds and water milfoils, while MRn83 is dominated by cattails, with abundant sedges and forbs such as tufted loosestrife and great water dock."

- **MRp83 Prairie Mixed Cattail Marsh**

  "MRp83 is very similar to MRn83 but occurs south and west of MRn83, in the Prairie Parkland Province."

- **MRu94 Lake Superior Coastal Marsh**

  "MRu94 is similar to MRn83 but is restricted to estuaries and embayments near the mouths of rivers flowing into Lake Superior, where seiches cause regular fluctuations in water level. MRu94 generally has higher species diversity, while MRn83 is more likely to be strongly dominated by cattails."

Management actions and goals for restoration of northern mixed cattail marsh include:

- Monitor water levels and document over time
- Burn rarely, and when it is done, do so in conjunction with surrounding uplands
- Monitor for hybrid cattail and giant reed grass and control if present; allow other, native species to fill in the space
- Monitor for and control exotic herbaceous species.

This community is common in the deeper lakeshore areas of Thompson Lake, especially along the northern, western, and northeastern shorelines. The primary concern for restoration of this community is control of exotic herbaceous species such as hybrid cattail (*Typha* x *glauca*). Special attention should be focused on the transitional boundaries so as not to develop hard edges between wet prairie, wet forest, and other community types—rather, they should grade into one another. Many brush removal activities have already been underway in areas around Thompson Lake, but not much work has happened in the marshes or other wetlands yet.

3.4.2.2 Ephemeral Wetland

A small ephemeral wetland exists just southeast of the lake. By examination of topography, it appears that it may have been the lake's natural overflow point prior to the construction of the lake outlet structure. Today it is a low, temporarily flooded wetland that has been partially restored with a diversity of native wet meadow plants. The eastern aspect of this wetland that abuts the north-south historic farm road has not been restored. This area could be planted with native sedges, grasses, and wildflowers to provide habitat for a diversity of amphibians, insects, and reptiles. In addition, there are several small wetlands that occur, scattered across the park.

The following are recommendations based on the description of a wet meadow community, taken from the *DNR Field Guide*.

Northern Wet Meadow/Carr, WMn82

"Open peatlands dominated by dense cover of broad-leaved graminoids or tall shrubs. Present on mineral to sapric peat soils in basins and along streams."

Vegetation Structure and Composition

"Moss cover most often is < 5% but can range to > 75%. Brown mosses are usually dominant, but Sphagnum can be dominant on some sites.

Graminoid layer consists of dense stands of mostly broad-leaved graminoids, including bluejoint, lake sedge, tussock sedge, and beaked sedge.

Forb cover is variable, with tufted loosestrife, marsh bellflower, marsh skullcap, and great water dock common, and small or three-cleft bedstraw, bulb-bearing water hemlock, northern bugleweed, linear-leaved, marsh, or down willow-her, water smartweed, and northern marsh fern occasional.

Shrub cover is variable. Tall shrubs such as willows, red-osier dogwood, and speckled alder can be dense, along with meadowsweet. Paper birch, black ash, red maple, American elm, and tamarack saplings are occasionally present in the shrub layer.

Trees taller than 16 ft (5m) are rarely present and if so, have low cover (< 25%)."

Landscape Setting and Soils

"WMn82 occurs in wetland basins on a variety of landforms. It is also associated with streams and drainageways, drained beaver ponds, shallow bays, and semifloating mats on lakes. Soils range from mineral or muck soil to sapric peat. Organic sediments are typically shallow but can be deep (> 15 inches) in basins filled by sedimentary peat."

Natural History

"WMn82 is subjected to moderate inundation following spring runoff and heavy rains, and periodic drawdowns during summer. Peak water levels are high enough and persistent enough to prevent trees (and often shrubs) from becoming established, although there may be little or no standing water much of the growing season. As a result of water level fluctuations, the surface substrate alternates between aerobic and anaerobic conditions. Any organic matter that may accumulate over time is usually oxidized during drawdowns following drought or is removed by fire. Where deep peat is present in the

community, it likely was formed previously on the site by a peat-producing community—such as forested rich peatland—that was flooded by beaver activity and ultimately converted to a wet meadow. Deep peat may also develop from debris settling into basins with standing water, forming sedimentary peat. Because surface water in WMn82 is derived from runoff, stream flow, and groundwater sources, it has circumneutral pH (6.0-8.0) and high mineral nutrient content. Although mosses are typically sparse in WMn82 because of alternating flooding and drawdown, moss cover can be relatively high in settings where water levels have become stabilized. In these situations, it appears that Sphagnum can quickly invade the community, especially on floating mats that are completely above the water surface. The water chemistry in these sites can be rapidly converted by *Sphagnum* to rich fen and even poor fen conditions before characteristic wet meadow species, especially wide-leaved sedges, have been replaced by plants of rich or poor fen species such as narrow-leaved sedges. The process of succession of WMn82 to rich or poor fens is readily reversed by return of higher or more variable water levels, such as from beaver activity or variation in precipitation."

Similar Native Plant Community Classes

- **OPn81 Northern Shrub Shore Fen**
  "OPn81 often has abundant broad-leaved graminoids and can appear similar to occurrences of WMn82 with abundant speckled alder (WMn82a). OPn81 typically occurs on deep peat, often along lakeshores, and is more likely to have high cover of leatherleaf, bog birch, or sweet gale in addition to speckled alder. WMn82 commonly occurs on mineral soil or shallow peat and is often situated away from lakeshores; WMn82 is more likely to have abundant willows and red-osier dogwood in addition to speckled alder."
- **FPn73 Northern Rich Alder Swamp**
  "PFn73 may resemble occurrences of WMn82 that have significant amounts of speckled alder (WMn82a). FPn73 is typically associated with rich swamp forests—especially Northern Rich Spruce Swamp (Basin) (FPn62), Northern Cedar Swamp (FPn63), and Northern Rich Tamarack Swamp (Western Basin)(FPn82)—and is more likely to have tree > 6 ft (2m) tall, including paper birch, red maple, and balsam fir, and shade-tolerant swamp forest species in the ground layer."

NPC Types in Class

- WMn82a Willow-Dogwood Shrub Swamp
- WMn82b Sedge Meadow
  - WMn82b1 Bluejoint Subtype
  - WMn82b2 Tussock Sedge Subtype
  - WMn82b3 Beaked Sedge Subtype
  - WMn82b4 Lake Sedge Subtype

Management actions and goals for restoration of northern wet meadow/carr include:

- Restore hydrology to allow for periodic drawdowns in summer
- Allow to burn occasionally but not if deeper peat is present
- Control invasive species such as hybrid cattail, giant reed grass, or reed canary grass

There are small wetlands in the park and many occurrences of this community class. The primary concern for restoration of this community is control of exotic herbaceous species. Special attention should be focused on the transitional boundaries so as not to develop hard edges between wet prairie, wet forest, and other community types—rather, they should grade into one another. Many brush removal activities have already been underway in upland areas throughout the park, but not much work has happened in the wetland zones yet.

3.4.2.3 Upland

Above the lake bank, in soils unaffected by lake water, is upland forest with oaks, aspen, and cottonwoods. This upland will be managed to regenerate oak woodland and savanna (see oak forest and oak savanna below).

3.4.2.4 Oak Savanna

Oak savanna was the dominant vegetation type that occupied this land prior to European settlement and is a logical target plant community for the park considering its ecological and natural history value, as well as its maintainability. Oak savanna can be maintained by fire which is an economical tool for plant community regeneration. Establishment of oak savanna at Thompson Park will involve the removal of weedy trees and weedy understory that have colonized the park since the time of agriculture and replacing them with bur oaks and other appropriate savanna plant species including shrubs, wildflowers, and grasses.

The following are recommendations based on the description of a mesic oak savanna community, taken from the *DNR Field Guide*.

Southern Mesic Oak Savanna, UPs24

"Sparsely treed communities with tallgrass-dominated grouped layers on somewhat poorly drained to well-drained loam soils mainly formed in unsorted glacial till, sometimes in a thin loess layer over till, and locally in lacustrine sediments and outwash deposits. Present primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe."

Vegetation Structure & Composition (There are no plot data for this class; description is based on inference from UPs23 and UPs14)

"**Graminoid cover** is interrupted to continuous (50-100%). Tallgrasses dominate, but several midheight grasses are also important. Big bluestem and Indian grass are the dominant tallgrasses, with prairie dropseed either codominant or subdominant component. On the drier end of the gradient, little bluestem, porcupine grass, and side-oats grama are important."

"Forb cover is sparse to patchy (5-50%). Forb species composition also responds to moisture. A number of species are common across the moisture gradient, including heart-leaved alexanders, heath aster, stiff and Canada goldenrods, purple and white prairie clovers, silverleaf scurfpea, stiff sunflower, white sage,

northern bedstraw, and smooth blue aster. Maximillian's sunflower, tall meadow-rue, prairie phlox, and gray-headed coneflower are most common on the moister end of the gradient. Rough blazing star, Missouri and gray goldenrods, and bird's foot coreopsis are common in the drier end."
"**Climbing plants** and **vines** are a minor component. Virginia creeper is frequently present, and wild grape is occasionally present."
"Shrub layer is typically patchy (25-50% cover) and composed of low (<20 in) semi-shrubs, taller (up to 6ft) shrubs, and oak seedlings and saplings (<6 ft). The low semi-shrubs leadplant and prairie rose and poison ivy are generally common. Common taller shrubs are chokecherry, American hazelnut, smooth sumac, gray dogwood, wolfberry, low juneberry, and wild plum."
"Trees are scattered or in scattered clumps with total cover <70% and typically 25-50%." Bur oak is most common, but northern pin oak is also usually present.

Landscape Setting & Soils
"Historically, UPs24 occurred most commonly in low relief prairie landscapes on ground moraines and end moraines, and less commonly on lacustrine deposits and finer-textured outwash. Soils are somewhat poorly drained to well drained, mostly moderately permeable to permeable, fine- and medium-textured loams and loamy sands. Soils are mollisols, characterized by thick, dark, organic-enriched upper horizons with high base saturation and dominantly bivalent cations."
Natural History
"Savannas form where fire recurs frequently enough to prevent trees and shrubs from dominating, but where frequency and severity are low enough to allow fire-tolerant trees to become established and sometimes reach maturity. Historically, savannas occurred in physical proximity to prairies, but where features such as streams, lakes, and steep topography impeded the spread of fires, providing local amelioration of the prairie fire regime. All savannas are highly sensitive to fire suppression, quickly succeeding to woodland and eventually to forest, and the higher productivity of sites where UPs24 occurs makes it even more susceptible to succession than UPs14. UPs24 occupies sites where soil moisture availability remains high on average because of soil texture and composition, although the water table is below the rooting zone during the growing season except for brief periods. Before Euro-American settlement, grazing, browsing, and trampling by large ungulates were probably regular occurrences in UPs24. The contribution of this disturbance to the composition and structure of the vegetation is poorly understood, although confined grazing by domestic livestock can quickly destroy mesic savannas, promoting replacement of most of the native species by introduced ones. The fertile soils and gentle relief of UPs24 are ideal for row-crop agriculture, and almost all of the land that supported UPs24 has been converted to cropland; areas not converted have either been so heavily pastured that almost none of the native herbaceous flora survives, or they have become woodland or forest with fire suppression."
Similar NPC's

- **UPs23 Southern Mesic Prairie**
  "UPs23 has similar herbaceous composition to UPs24—although forbs may be more important relative to graminoids in UPs24 than in UPs23—but generally lacks trees, while UPs24 has at least sparse (> 10%) tree cover, dominated by bur oak. Because of partial shading in UPs24, cool-season graminoids may be more important relative to warm-season grasses than in UPs23. "
- **UPs14 Southern Dry Savanna**

"Differences in the herbaceous flora between UPs14 and UPs24 are probably similar to the differences between UPs13 and UPs23. Shrub cover is probably greater in UPs24 than in UPs14—UPs24 might have more the appearance of a shrub thicket than that of a tree-studded prairie. Differences in substrate characteristics (predominantly sandy or gravelly outwash and lacustrine deposits versus predominantly loamy till) are sufficient in most cases to distinguish the two classes; classification uncertainty is likely only when UPs14 is on loamy slopes (UPs14c)."

Management actions and goals for restoration of southern mesic savanna include:

- Removal of all woody tree and shrub species, except Bur Oak, to open canopy and allow for oak regeneration and shade tolerant forb production.
- Reintroduction of fire in a shifting patchwork of prescribed burns every 3-5 years.
- Reintroduction of selected grazing to abate the encroachment of woody species.

Mesic savanna will be concentrated in the center part of the park and spreading out from that center, but could occur in a patchwork of areas across the park. The primary concern for restoration of these areas is opening up the canopy, thinning the understory of buckthorn, honeysuckle, and other invasive woody shrubs, and removal of fire intolerant tree species. Frequent burning can help control the invasion of woody shrubs and trees. The addition of conservation grazing and browsing can be affective also. Special attention should be focused on the transitional boundary between forest and open grasslands so that habitats do not fall into discrete zones. Some activities have already been underway in the center, core habitat area, and should continue to expand from there.

3.4.2.5 Oak Forest

Simon's Ravine holds a remnant oak forest. Although the understory is degraded, and buckthorn has encroached, it is the best example of a relatively intact native plant community in the park. Restoration of this community will involve the management of invasive species such as buckthorn, honeysuckle, and garlic mustard, along with the planting of native wildflowers, grasses, and sedges. New tree species could be added over time as the climate shifts. This could include the introduction of shagbark hickory, mockernut hickory, and chinkapin oak.

The following are recommendations based on the description of an appropriate forest community, taken from the *DNR Field Guide*.

Southern Mesic Oak-Basswood Forest, MHs38

"Mesic hardwood or, occasionally, hardwood-conifer forests. Present on wind-deposited silt on bedrock bluffs, on calcareous till on rolling till plains, and, rarely, on weakly calcareous till on stagnation moraines."

Vegetation Structure and Composition

"**Ground layer** cover is patchy to interrupted (25%-75%); important species include zigzag goldenrod, large-flowered bellwort, and Virginia waterleaf. Other common species include Clayton's sweet cicely, Virginia creeper, bloodroot, lopseed, common enchanter's nightshade, early meadow-rue, sarsaparilla,

Pennsylvania sedge, and honewort."

"Shrub layer cover is patchy to interrupted (25-75%); common species include sugar maple, ironwood, prickly gooseberry, and chokecherry."

"Subcanopy cover is interrupted to continuous (50-100%); important species include ironwood, sugar maple, and basswood. Blue beech, American elm, red elm, and bitternut hickory are occasionally present."

"Canopy cover is interrupted to continuous (50-100%); the most common species are basswood, northern red oak, and sugar maple. Bur oak, green ash, or white oak can be abundant in some stands, and on rare occasions a supercanopy with abundant white pin is present."

Natural History

"In the past, catastrophic disturbances were rare in MHs38. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was in excess of 1,000 years, and the rotation of catastrophic windthrow was about 360 years. Events that resulted in partial loss of trees, especially light surface fires, were much more common, with an estimated rotation of about 35 years. Based on the historic composition and age structure of these forests, MHs38 had two growth stages separated by a period of transition.

- **0-35 years**—Young forests recovering from fire or wind, dominated by northern red oak mixed with basswood, American elm, and some quaking aspen.
- **35-75 years**—A transition period marked by the gradual decline of northern red oak and its replacement by sugar maple. Basswood, American elm, and ironwood increase during this period, and white oak becomes established.
- **> 75 years**—Mature forests of sugar maple mixed evenly with basswood, American elm, ironwood, northern red oak, and white oak.

Similar Native Plant Community Classes to MHs38

- **MHs37 Southern Dry-Mesic Oak Forest**

  MHs37 and MHs38 can be very similar, and the ranges of the two classes overlap in east-central and southeastern Minnesota. MHs37 usually occurs on drier sites than MHs38 and is much less likely to have abundant sugar maple in the canopy.

- **MHs39 Southern Mesic Maple-Basswood Forest**

  MHs39 and MHs38 are very similar, and the ranges of the two classes overlap strongly. The presence of species adapted to moist soils or dense shade—especially spring ephemerals such as Dutchman's breeches, cut-leaved toothwort, and white trout lily—and the presence of large patches of wood nettle help to differentiate MHs39 from MHs38.

- **MHs49 Southern Wet-Mesic Hardwood Forest**

  MHs49 can be somewhat similar to MHs38 but occurs on level wet-mesic sites on silty alluvium or glacial till and is more likely to have species adapted to high water tables or common on heavy moist soils.

NPC Types in Class

- MHs38a White Pine-Oak-Sugar Maple Forest
- MHs38b Basswood-Bur Oak-(Green Ash) Forest
- MHs38c Red Oak-Sugar Maple-Basswood-(Bitternut Hickory) Forest

Management actions and goals for restoration of Southern Mesic Oak-Basswood Forest include:

- Attempt to burn on a rotation of about 35 years. This may be difficult due to high moisture conditions and/or low amounts of cured fuel. Burning during periods of drought and on days when winds are relatively high may be the best strategy.
- Make canopy gaps to simulate partial loss of trees. Gaps should be large enough for light to reach the ground—at least 100 ft X 100 ft. Preferentially remove undesirable trees or trees such as boxelder or exotic species.
- Control woody and herbaceous invasive species

Mesic oak forest occurs in the Southern part of the park, in the western extent of "Simon's Ravine", which is a relatively fire-protected area. The primary concern for restoration of this community is control of woody exotic species, increasing the diversity of the ground layer, and regenerating multiple age classes of canopy and subcanopy tree species. Special attention should be focused on the transitional boundary between forest and other community types, so that habitats do not fall into discrete zones. Some brush removal activities have already been underway throughout this area, which should be continued.

3.4.2.6 Mixed Hardwood Forest

The area where mixed hardwood forest is targeted is currently a degraded forest of mostly undesirable trees with a weedy understory. The forest, however, serves as bird habitat. Regeneration of this forest to mixed hardwoods will involve selective cutting to remove undesirable trees and the planting of appropriate hardwoods. Buckthorn and other invasive species should be controlled. Planting of the ground plain can occur in small areas which are subsequently enlarged. The idea of a "polka-dot forest/woodland" could be implemented. This involves the location of small clearings of regeneration where trees are cleared, and native species are planted and then carefully managed to allow for their reproduction and spreading into adjacent areas.

The following are recommendations based on the description of an oak woodland community taken from the *DNR Field Guide*.

Southern Dry-Mesic Oak Woodland, FDs37

"Dry-mesic hardwood forests on undulating sand flats, hummocky moraines, and river bluffs. Present mostly on fine sand or sand-gravel soils. Often on south- or west-facing slopes but common also on flat to undulating sandy lake plains. Historically, fires were common in this community, and many stands are on sites occupied by brushlands 100–150 years ago."

Vegetation Structure and Composition

"Ground-layer cover is patchy to continuous (25–100%). Pointed-leaved tick trefoil, Clayton's sweet cicely, hog peanut, Canada mayflower, and wild geranium are commonly present. Pennsylvania sedge is the most abundant graminoid. Dewey's sedge and starry sedge may also be present."

"Shrub-layer cover is patchy to continuous (25–100%). Common species include black cherry, red maple, chokecherry, American hazelnut, gray dogwood, prickly ash, Virginia creeper, and poison ivy".
"Subcanopy cover is patchy to interrupted (25–75%). The most common species are black cherry, red maple, and bur oak."
"Canopy cover is usually interrupted to continuous (50–100%)". Bur oak and northern pin oak are the most common species. Northern red oak, white oak, and red maple are occasionally present. Older trees are often open-grown, indicating previously more open conditions on the site."

Natural History
"In the past, fires were very common throughout the range of FDs37. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was about 110 years, and the rotation of mild surface fires about 10 years. The rotation of all fires combined is estimated to be 9 years. Windthrow was not common, with an estimated rotation exceeding 1,000 years. Based on the historic composition and age structure of these forests, FDs37 had two growth stages.

- 0–75 years—Young forests recovering from fire, dominated by bur oak with some northern red oak or white oak. Quaking aspen, northern pin oak, and black cherry are minor components.
- > 75 years—Mature forests dominated by a mixture of bur oak, white oak, northern pin oak, and some northern red oak, with minor amounts of American elm. (In the past, sites now occupied by FDs37 typically supported more open communities, including brush-prairie or savanna. Air photos from the 1930s show these sites to have scattered oaks rather than forest canopies. With suppression of wildfires since the mid-1800s, these sites have developed denser tree canopies and herbs typical of mesic forests have become common in the understory."

The examples of FDs37 found in TCP are best described by the mature forest growth stage.

Similar Native Plant Community Classes to FDs37

- **FDs36 Southern Dry-Mesic Oak-Aspen Forest**
  "FDs36 can be similar to FDs37, and the ranges of the two communities overlap in the central part of the Hardwood Hills Subsection in the MIM and adjacent parts of the RRV. FDs36 tends to occur on loamy rather than fine sand or sand-gravel soils."
- MHs 37 Southern Dry-Mesic Oak Forest
  "MHs37 can be similar to FDs37 but is more likely to occur on loamy soils (at least in the upper soil layers) than on fine sand or sand-gravel soils. MHs37 occurs on sites less affected by fire in the recent past and therefore generally lacks the open-grown canopy trees often present in FDs37."
- FDs27 Southern Dry-Mesic Pine-Oak Woodland
  "The range of FDs27 occasionally overlaps with FDs37 in the area around the Twin Cities, where it occurs on deep sands that accumulate along valley walls of tributaries to the Mississippi River. Indicator species of FDs27 are: flowering spurge, heart-leaved aster, downy rattlesnake plantain, bitternut hickory, eastern red cedar, white pine, white snakeroot, and black raspberry."

Management actions and goals for restoration of southern dry-mesic oak (maple) woodland include:

- Restore the mild surface fire regime through a patchwork of prescribed burning (natural frequency rotation average 10 years)
- Clearcutting may mimic the effects of catastrophic fires (natural rotation was 110 years), which supports more open communities. Tree removal should target non-representative trees, such as box elder.
- Control woody and herbaceous invasive species

3.4.3 Management Units Map

Management units have been designated for the purpose of directing management activities. See Figure 3-6 below.

Figure 3-6 Management Units

3.4.4 Implementation Schedule

Compared to the natural areas in other Dakota County regional parks, those of Thompson Park are significantly smaller. In other parks, a single, typical restoration phase is the acreage of all Thompson Park natural areas combined. At Thompson Park there are two options for restoration timing: 1) restore them all at once, and 2) phase implementation. Option One would provide a tremendous boost to the ecological quality a diversity of the park. However, because it would involve the removal of many weedy trees, public reaction might be significantly negative. The second, phased approach is depicted in Figure 3-7 as follows:

Phase 1: Starting within the ecological core of the park, a significant effort can be undertaken to "anchor in the park" a diversity of quality habitats from shoreline to savanna to oak forest. This would establish significant habitat for plants, songbirds, and pollinator species. Upon completion of the establishment of native plants within the Phase One area, efforts can move to the next phase. Before moving to the next phase of implementation, funds must be secured to maintain the first phase restoration. If adequate funding is not available to maintain any phase of work, restoration of the next phase should not proceed.

Phase 2: Phase 2 adds a concentric ring of habitat around the Phase 1 core and serves both to expand habitat and to create a protective buffer around the ecological core. Phase 2 efforts would ideally be done all at once, but budget constraints may require this, and all phases, to be broken into smaller projects. Some parts of this phase may be moved up into Phase 1, since removal of ash trees (due to EAB) will tend to accelerate restoration efforts here.

Phase 3: This phase comprises an effort to restore the northern oak forest that has been degraded by oak wilt, buckthorn, garlic mustard, and other invasive species. It is a priority because of its proximity to the cultural area of the park. The oak savanna restoration included in this phase will create a habitat connection to the ecological core.

Phase 4: Here a mixed hardwood forest/woodland is planned to gradually replace the existing degraded woodland. To avoid rapid canopy opening, this will take many years by slowly creating small clearings of trees and planting appropriate hardwoods. Park managers may choose to begin the creation of these small clearings in tandem with Phase 1 in order to get a jump on this long process.

Figure 3-7 Restoration Phasing

3.4.5 Deer Management

Deer are a significant hindrance to native plant community regeneration because of their extensive grazing on establishing native plants. Managing deer at Thompson Park should first involve conducting a deer count to understand the extent of the deer population, which the County has done extensively in other parks, but not as much in this park. This is typically conducted from an aircraft, which the County has done in the past. Dakota County staff should work with the City of West St. Paul on this effort since the range of deer and their impacts are well outside the boundaries of the park. After the deer population is known, a management program can be developed. The MN Department of Natural Resources is available to advise an effective approach. Many methods of control are available including fencing, sterilization and culling.

3.4.6 Bird and Pollinator Species Management

Birds and pollinators are priority species for habitat management in Thompson Park. Habitat improvement will be accomplished through the native plant community regeneration efforts described in this document. Healthy woodlands, savanna, and shorelines host a great diversity of these species.

It is important to establish a diversity of habitat types within the park because different birds and insects require different food, shelter, and nesting types. Management staff will continue to improve a variety of vegetative layers (e.g., ground, understory, mid-story, and canopy layer) for birds to carry out their life cycles. For example, to provide the appropriate habitat for forest birds, it is critical to have a diverse and well-structured forest composed of various species of large trees, medium-sized trees and small trees (structural heterogeneity). Standing dead trees (snags) and logs and fallen tree tops on the forest floor (coarse woody debris) may look rather messy, but they provide excellent habitat for birds and other wildlife. This diversity of habitat will be achieved by implementing the native plant community regeneration plan. **Appendix A** provides a list of plant species that provide habitat for birds and pollinators.

A considerable threat the songbirds in metropolitan areas face is predation by feral cats and domestic cats that are allowed to roam outdoors. As part of the public education conducted at the park, this issue could be addressed to encourage cat owners to keep them indoors.

Pollinator species are animals that move pollen from the male anther of a flower to the female stigma of another. Insect pollinators include bees, wasps, ants, mosquitos, butterflies, moths, and flower beetles, among others. Vertebrate pollinator species are primarily birds and bats, although rodents pollinate species in some habitats. Because of habitat loss and insecticide use, pollinators are on the decline nationally. Improving the native plant communities of the park will allow the park to host a greater diversity and larger number of pollinator species. Interestingly, the federally threatened rusty-patched bumble bee has been documented in the park. As is the case with birds, a diversity of plant species and plant community vertical structure host a larger diversity of insects. This will improve as regenerating plant communities establish in the park.

3.4.7 Lake Management

The improvement of Thompson Lake water quality has been the charge for the Lower Mississippi Watershed Management Organization (LMWMO), the City of West St. Paul, and Dakota County. Representatives from these entities have been addressing ways to clean stormwater before it reaches Thompson Lake to prevent pollutant from reaching the lake. An example of their efforts is a Lake Cleanup project (2018 to 20) that consisted of removing contaminated sediments and the development of a catch basin, a pond, and a wetland at the north end of the lake that traps sediment and pollutants before they enter the lake. Dakota County will continue to work with these organizations to improve water quality with the goal of removing Thompson Lake from the Minnesota Pollution Control Agency's Impaired Waters List.

Lakeshore regeneration efforts are an ongoing priority for the park. Some reaches of shoreline have already been restored as part of the Lake Cleanup project. The continuation of this work will further improve the lake's water quality and wildlife habitat. This process is described in Section 3.4.1.3.

Thompson Lake provides an ideal opportunity for children of the area to learn to fish. This has been a priority of the park for many years. Park staff works with the MN DNR Fisheries to monitor and stock a variety of fish in Thompson Lake, as well as sponsor an annual "Take a Kid Fishing" event. This should continue. To further improve fish habitat in Thompson Lake, an aeration system is recommended to maintain an area of open water through the winter, which will allow oxygen to diffuse into the water to better sustain large predator fish. There are many options for aeration systems, and the MN DNR can assist in making recommendations.

3.4.7.1 Lake Monitoring

In the summer of 2017, monitoring for eutrophication parameters (chlorophyll-a, total phosphorus, and Secchi disk transparency) took place within Thompson Lake though the Met Council's Citizen Assisted Monitoring Program (CAMP). The LMWMO recruit and coordinate with citizen volunteers and then present the monitoring results. Thompson Lake met the water quality standards for shallow lakes for both Secchi depth and chlorophyll-a in 2017 but continues to exceed (not meet) the standard for total phosphorus. As a rule of thumb, one pound of phosphorous equates to 100 pounds of algae in a lake. Dakota County will work with LMWMO to continue monitoring Thompson Lake water quality. The LMWMO plans to continue to conduct annual monitoring of Thompson Lake through the CAMP program for the foreseeable future.

Fish population monitoring has been conducted on an as-needed basis in conjunction with the MN DNR. In September of 2018, the County hired a consultant to survey the lake. The survey results showed a fairly decent fish population existed, including norther pike, bluegills, sunfish, bullheads, and some very large channel catfish. The last survey was conducted in the spring of 2019 that unfortunately showed no large fish had over-wintered. This was due to lake level drawdown for the construction of the pond at the north end of the lake in combination with a halting of aeration and coupled with extreme cold and deep snow. It is recommended the fish monitoring continue on an as-needed basis to determine fish stocking needs and coordinating with the MN DNR fisheries staff.

3.5 Plant Community Monitoring Recommendations

The monitoring of native plant communities and wildlife in Thompson Park can provide park managers with an understanding of populations and their condition. This information allows for informed management decisions. Monitoring procedures and recommendations are presented in detail in the 2019 Lebanon Hills Natural Resources Management Plan. Refer to pages 186-192 of this document for monitoring protocol for Thompson County Park.

3.6 Native Plant Community Management Costs

This section presents projected costs for the implementation of management activities within Thompson Park. They were developed from costs incurred from similar projects in the region for the years 2017 to 2018.

Table 3-2 Native Plant Community Regeneration Cost per Acre

Landscape Feature	Acres	Regeneration Cost Per Acre		
Savanna	13.4	$3,000	to	$15,000
Oak Forest	14.0	$5,000	to	$20,000
Mixed Hardwood	13.5	$5,500	to	$25,000
Lake Shore Zone	1.8	$40,000	to	$200,000

Table 3-3 Native Plant Community Annual Maintenance Cost per Acre (Years 1 to 4)

Landscape Feature	Acres	Annual Maintenance Cost Per Acre (1-3 Years)			Annual Maintenance Cost Per Acre (4+ Years)		
Savanna	16.5	$1,200	to	$1,800	$700	to	$1,000
Oak Forest	14.0	$1,600	to	$2,300	$850	to	$1,200
Mixed Hardwood	13.5	$1,600	to	$2,300	$850	to	$1,200
Lake Shore Zone	1.8	$4,000	to	$9,000	$2,500	to	$8,000

Table 3-4 Native Plant Community Annual Maintenance Cost per Year (Years 1 to 4)

Landscape Feature	Annual Maintenance Cost (1-3 Years)			Annual Maintenance Cost (4+ Years)		
Mature Trees in Lawn	$500	to	$1,000	$300	to	$500
Thompson Lake Aeration System	$500	to	$1,500	$500	to	$1,500

3.7 Funding Sources

Table 3-5 lists a variety of grant funding sources that are available for natural resource improvement projects at Thompson Park.

Table 3-5 Grant Funding Sources

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Forest Stewardship Program	Natural Resources/ Habitat Protection	MN DNR	Cost share program to provide technical advice and long-range planning to interested land owners. Forest stewardship plans are the outcome of the program. Plans are designed to meet landowner goals while maintaining the sustainability of the land.	Financial assistance to woodland owners for completing projects to practice good forest stewardship on their land. A typical project is between 3 and 20 acres but could be smaller or larger depending on land goals.	https://www.dnr.state.mn.us/woodlands/cost-share.html	Private Forest Program Coordinator DNR Forestry 500 Lafayette Road, Box 44 St. Paul, MN 55155 (651) 259-5261
Conservation Partners Legacy Grant Program; Traditional Projects	Natural Resources/ Habitat Protection	MN DNR	Grant program to restore or enhance prairies, wetlands, forests, or habitat for fish, game, or wildlife in Minnesota. Program provides competitive grants of $5,000 to $400,000 with a 10% non-state match requirement and a total project cost cap of $575,000. Restoration and enhancement projects will only be funded on lands in public ownership or waters designated as public waters. All project sites must be open to the public for all seasons of hunting and fishing.	Eligible applicants are limited to local, regional, state, and national non-profit organizations, including government entities. Private individuals and for-profit organizations are not eligible to apply for these grants.	http://www.dnr.state.mn.us/grants/habitat/cpl/ecp-grant-cycle.html	LSCPLGrants.DNR@state.mn.us Kathy Varble, CPL Grant Program Coordinator 651-259-5233 (St. Paul) Conservation Partners Legacy Grant MN DNR 500 Lafayette Road Box #20 St. Paul, MN 55155

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Conservation Partners Legacy Grant Program; Metro Projects	Natural Resources/ Habitat Protection	MN DNR	Grant program to restore or enhance prairies, wetlands, forests, or habitat for fish, game, or wildlife in Minnesota. Program provides competitive grants of $5,000 to $400,000 with a 10% non-state match requirement and a total project cost cap of $575,000. Restoration and enhancement projects will only be funded on lands in public ownership or waters designated as public waters.	Eligible applicants are limited to local, regional, state, and national non-profit organizations, including government entities. Projects must be located within the 7 county metro area or within city limits of cities with a population of 50,000 or greater (e.g., Duluth, Rochester, St. Cloud). Private individuals and for-profit organizations are not eligible to apply for these grants.	http://www.dnr.state.mn.us/grants/habitat/cpl/ecp-grant-cycle.html	LSCPLGrants.DNR@state.mn.us Jessica Lee, CPL Grant Program Coordinator 651-259-5233 (St. Paul) Conservation Partners Legacy Grant MN DNR 500 Lafayette Road Box #20 St. Paul, MN 55155

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Tax Base Revitalization Account (TBRA)	Brownfields	Metropolitan Council	TBRA is one of the three incentive accounts created by the 1995 Livable Communities Act adopted by the Minnesota Legislature. The TBRA provides grants to investigate or clean up contaminated property for subsequent residential, commercial, or industrial development. Funded activities include: Phase I and Phase II environmental site assessments, RAP development, demolition and site preparation (only if necessary to access contamination), soil or ground water remediation, soil vapor mitigation, asbestos abatement work, lead paint removal, or stabilization.	Cities, counties, and local development authorities located in the 7-county metro area and participating in the Metropolitan Livable Communities Housing Incentives Program are eligible to apply for funds. Applications involving public-private partnerships are most competitive. Cleanup grant applicants must have an MPCA-approved RAP, but investigation grants can fund RAP development.	https://metrocouncil.org/Communities/Services/Livable-Communities-Grants/Tax-Base-Revitalization-Account-(TBRA).aspx	Marcus Martin Phone: (651) 602-1054 Email: marcus.martin@metc.state.mn.us

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Conservation Corps Minnesota Clean Water Fund: Crew Labor	Water Quality	BWSR	**Available funds for Conservation Corps crew labor only** for the purpose of protecting, enhancing, and restoring water quality in lakes, rivers, and streams and to protect groundwater and drinking water sources from degradation. Project proposals should demonstrate measurable outputs to achieve water quality objectives through the implementation of BMPs. Projects that focus on retaining water on the land through native plantings versus habitat restoration are preferred.	Counties, Cities, SWCDs, Watershed Districts, and Watershed Management Organizations.	http://conservationcorps.org/clean-water-funding	Brian Miller at (651) 209-9900 ext. 19 brian.miller@conservationcorps.org
Conservation Initiative Funding Program	Water Quality	Dakota County Soil & Water Conservation District	The Dakota SWCD offers funding and/or technical assistance for projects that demonstrate innovative stormwater management, low impact development and/or conservation design principles.	Dakota County land owners, developers, and local units of government	http://www.dakotacountyswcd.org/cif.html	Contact Dakota County SWCD (651) 480-7777

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Metro Conservation Corridor Partnership Habitat Restoration Program	Natural Resources/ Habitat Protection	MN DNR	Partnerships sought by Great River Greening to implement habitat restoration on protected lands and waters with priority given to projects that 1) protect and restore water quality (projects must include monitoring), 2) protect, restore, and enhance land and habitat, and 3) reduce the spread of invasive species along streams, rivers, and land transportation routes.	Partners can be counties, watershed districts, cities, non-profits, and others within the 12-county metropolitan area. Projects must be within a mapped Metro Conservation Corridor.	http://www.dnr.state.mn.us/metroconservationcorridors/index.html	For more information, please contact: Nick Bancks, 651-917-6282 Minnesota Land Trust, nickbancks@minnesotalandtrust.org Bart Richardson, 651-259-5796 MnDNR, bart.richardson@state.mn.us

Grant Program	Category	Sponsor Agency	General Info	Eligibility	Link to Website	Contact Information
Clean Water Partnership Loan Program	Water Quality	MPCA	The MPCA is accepting applications for water resource projects to be funded through the CWP Loan Program (approximately $11 mill available). Applications will be accepted from local governmental units (LGUs) interested in leading a project for protection or improvement of groundwater or surface water bodies from nonpoint sources. Applicants awarded loan funds may begin project work after the loan agreement is executed and project workplan is approved. No reimbursable costs may be incurred prior to execution of the loan agreement.	Only LGUs that meet the following criteria are eligible to apply for loans: • LGU has the ability to pledge its full faith and credit to ensure repayment of a project implementation loan • LGU has the authority to generate cash revenues for the repayment of a loan • LGU has the authority to enter into a loan agreement with the MPCA. LGUs that meet these requirements include counties, cities, townships, tribes, watershed districts, and watershed management organizations. Joint powers organizations composed of previously mentioned entities are also eligible but must submit a resolution from at least one LGU that meets the eligible criteria stating that they will participate in the project as a loan sponsor. Local soil and water conservation districts and other LGUs that are not eligible to serve as a loan sponsor may partner as a project sponsor with another government entity, such as a county or watershed district, which will serve as the loan sponsor.	https://www.pca.state.mn.us/water/financial-assistance-nonpoint-source-water-pollution-projects-clean-water-partnership-and	Cindy Penny: cynthia.penny@state.mn.us or 651-757-2099

Appendix A

Plant Lists

1. Oak-Basswood Forest Species
2. Hardwood Forest Species
3. “Near-Native” Tree Species
4. Oak Savanna Species
5. Lake Shoreline Species

Plant Lists

Oak-Basswood Forest Species: Ground Layer **Forbs**	
Red Baneberry	*Actaea rubra*
Fragrant Hyssop	*Agastache foeniculum*
White Snakeroot	*Ageratina altissima*
Tall Thimbleweed	*Anemone virginiana*
Spreading dogbane	*Apocynum androsaemifolium*
Columbine	*Aquilegia canadensis*
Wild Sarsaparilla	*Aralia nudicaulis*
American Spikenard	*Aralia racemosa*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Wild Ginger	*Asarum canadense*
Poke Milkweed	*Asclepias exaltata*
Heart-leaved Aster	*Aster cordifolius*
Calico Aster	*Aster lateriflorus*
Big-leaved Aster	*Aster macrophyllus*
Tail-leaved Aster	*Aster sagittifolius*
Tall Bellflower	*Campanula americana*
Blue Cohosh	*Caulophyllum thalictroides*
Pointed-leaved Tick-trefoil	*Desmodium glutinosum*
Wild Yam	*Dioscorea villosa*
Virginia wild rye	*Elymus virginicus*
Wood Strawberry	*Fragaria vesca*
Common Strawberry	*Fragaria virginiana*
Cleavers	*Galium aparine*
Elegant bedstraw	*Galium concinnum*
Three-Flowered Bedstraw	*Galium triflorum*
Wild Geranium	*Geranium maculatum*
White Avens	*Geum canadense*
Round-Lobed Hepatica	*Hepatica americana*
Virginia Waterleaf	*Hydrophyllum virginianum*
Touch-Me-Not	*Impatiens spp.*
Wood-Nettle	*Laportea canadensis*
Pale Vetchling	*Lathyrus ochroleucus*
Canada Mayflower	*Maianthemum canadense*
Racemose False Solomon's-Seal	*Maianthemum racemosum*
Two-Leaved Miterwort	*Mitella diphylla*
Indian Pipe	*Monotropa uniflora*
Clayton's Sweet Cicely	*Osmorhiza claytonii*

Oak-Basswood Forest Species: Ground Layer **Forbs**	
Anise-Root	*Osmorhiza longistylis*
Lopseed	*Phryma leptostachya*
Clearweed	*Pilea spp.*
Jacob's Ladder	*Polemonium reptans*
Solomon's Seal	*Polygonatum biflorum*
Hairy Solomon's-Seal	*Polygonatum pubescens*
Kidney-Leaf Buttercup	*Ranunculus abortivus*
Hooked Crowfoot	*Ranunculus recurvatus*
Bloodroot	*Sanguinaria canadensis*
Gregarious Black Snakeroot	*Sanicula gregaria*
Mariland Black Snakeroot	*Sanicula marilandica*
Zig Zag Goldenrod	*Solidago flexicaulis*
Long-Leaved Chickweed	*Stellaria longifolia*
Early Meadow Rue	*Thalictrum dioicum*
Yellow Bellwort	*Uvularia grandiflora*
Pale Bellwort	*Uvularia sessilifolia*
Culver's Root	*Veronicastrum virginicum*

Oak-Basswood Forest Species: Ground Layer **Grasses, Rushes, and Sedges**	
Common Wood Sedge	*Carex blanda*
Stellate Sedge	*Carex radiata*
Charming Sedge	*Carex blanda*
Plains Oval Sedge	*Carex brevior*
Field Oval Sedge	*Carex molesta*
Long-stalked Sedge	*Carex pedunculata*
Pennsylvania Sedge	*Carex pensylvanica*
Rosy Sedge	*Carex rosea*
Nodding Fescue	*Festuca subverticillata*

Oak-Basswood Forest Species: Ground Layer **Ferns and Fern Allies**	
Maidenhair Fern	*Adiantum pedatum*
Lady Fern	*Athyrium filix-femina*
Rattlesnake Fern	*Botrychium virginianum*
Interrupted Fern	*Osmunda claytoniana*
Bracken	*Pteridium aquilinum*

Oak-Basswood Forest Species: Shrub Layer	
Pagoda Dogwood	*Cornus alternifolia*
Gray Dogwood	*Cornus racemosa*
Roundleaf Dogwood	*Cornus rugosa*
American Hazelnut	*Corylus americana*
Low Bush Honeysucke	*Diervilla lonicera*
Chokecherry	*Prunus virginiana*
Prickly Gooseberry	*Ribes cynosbati*
Missouri Gooseberry	*Ribes missouriense*
Smooth Wild Rose	*Rosa blanda*
Red Raspberry	*Rubus idaeus*
Black Rasperry	*Rubus occidentalis*
Red-berried Elder	*Sambucus racemosa*
Snowberry	*Symphoricarpos albus*
Nannyberry	*Viburnum lentago*
Arrowwood Viburnum	*Viburnum rafinesquianum*

Oak-Basswood Forest Species: Canopy	
Sugar Maple	*Acer saccharum*
Paper Birch	*Betula papyrifera*
Blue beech	*Carpinus caroliniana*
Bitternut Hickory	*Carya cordiformis*
Hackberry	*Celtis occidentalis*
Butternut	*Juglans cinerea*
Ironwood	*Ostrya virginiana*
Black Cherry	*Prunus serotina*
White Oak	*Quercus alba*
Northern Pin Oak	*Quercus ellipsoidalis*
Bur Oak	*Quercus macrocarpa*
Red Oak	*Quercus rubra*
American Basswood	*Tilia americana*
American Elm	*Ulmus americana*

Hardwood Forest Species: Ground Layer Forbs	
Red Baneberry	*Actaea rubra*
Fragrant Hyssop	*Agastache foeniculum*
White Snakeroot	*Ageratina altissima*
Wild Leek	*Allium tricoccum*
Wood Anemone	*Anemone quinquefolia*
Columbine	*Aquilegia canadensis*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Wild Ginger	*Asarum canadense*
Poke Milkweed	*Asclepias exaltata*
Heart-leaved Aster	*Aster cordifolius*
Calico Aster	*Aster lateriflorus*
Big-leaved Aster	*Aster macrophyllus*
Tall Bellflower	*Campanula americana*
Blue Cohosh	*Caulophyllum thalictroides*
Dutchman's Breeches	*Dicentra cucullaria*
Common Snakeroot	*Eupatorium rugosum*
Wood Strawberry	*Fragaria vesca*
Common Strawberry	*Fragaria virginiana*
Fragrant Bedstraw	*Galium triflorum*
Wild Geranium	*Geranium maculatum*
White Avens	*Geum canadense*
Virginia Waterleaf	*Hydrophyllum virginianum*
Spotted Touch-me-not	*Impatiens capensis*
Pale Vetchling	*Lathyrus ochroleucus*
Canada Mayflower	*Maianthemum canadense*
Two-Leaved Miterwort	*Mitella diphylla*
Indian Pipe	*Monotropa uniflora*
Clayton's Sweet Cicely	*Osmorhiza claytonii*
Jacob's Ladder	*Polemonium reptans*
Solomon's Seal	*Polygonatum biflorum*
Bloodroot	*Sanguinaria canadensis*
Gregarious Black Snakeroot	*Sanicula gregaria*
Maryland Black Snakeroot	*Sanicula marilandica*
Solomon's Plume	*Smilacina racemosa*
Zig-Zag Goldenrod	*Solidago flexicaulis*
Long-Leaved Chickweed	*Stellaria longifolia*
Early Meadow Rue	*Thalictrum dioicum*
Large-flowered Bellwort	*Uvularia grandiflora*
Pale Bellwort	*Uvularia sessilifolia*
Yellow Violet	*Viola pubescens*

Hardwood Forest Species: Ground Layer **Grasses, Rushes, and Sedges**	
Pennsylvania Sedge	*Carex pensylvanica*
Canada Wild Rye	*Elymus canadensis*
Big Bluestem	*Andropogon gerardii*
Little Bluestem	*Schizachyrium scoparium*
Switch Grass	*Panicum virgatum*
Side Oats Gramma	*Bouteloua curtipendula*
Indian Grass	*Sorghastrum nutans*
Bottlebrush Grass	*Elymus hystrix*
Silky wild rye	*Elymus villosus*
Virginia Wild Rye	*Elymus virginicus*
Nodding Fescue	*Festuca subverticillata*
Common Wood Sedge	*Carex blanda*
Pennsylvania Sedge	*Carex pensylvanica*
Stellate Sedge	*Carex radiata*
Rosy Sedge	*Carex rosea*
Sprengel's Sedge	*Carex sprengelii*

Hardwood Forest Species: Ground Layer **Ferns and Fern Allies**	
Lady Fern	*Athyrium filix-femina*
Sensitive Fern	*Onoclea sensibilis*
Interrupted Fern	*Osmunda claytoniana*
Maidenhair Fern	*Adiantum pedatum*
Bracken	*Pteridium aquilinum*
Rattlesnake Fern	*Botrychium virginianum*

Hardwood Forest Species: Shrub Layer	
Pagoda Dogwood	*Cornus alternifolia*
Gray Dogwood	*Cornus racemosa*
Red-twigged Dogwood	*Cornus sericea*
American Hazelnut	*Corylus americana*

Hardwood Forest Species: Shrub Layer	
Beaked Hazelnut	*Corylus cornuta*
Virginia Creeper	*Parthenocissus quinquefolia*
Chokecherry	*Prunus virginiana*
Prickly Gooseberry	*Ribes cynosbati*
Missouri Gooseberry	*Ribes missouriense*
Smooth Wild Rose	*Rosa blanda*
Red Raspberry	*Rubus idaeus*
Black Raspberry	*Rubus occidentalis*
Red-berried Elder	*Sambucus racemosa*
Snowberry	*Symphoricarpos alba*
Nannyberry	*Viburnum lentago*
Downy Arrow-wood	*Viburnum rafinesquianum*

Hardwood Forest Species: Canopy	
Sugar Maple	*Acer saccharum*
Red Maple	*Acer rubrum*
Paper Birch	*Betula papyrifera*
Blue Beech	*Carpinus caroliniana*
Bitternut Hickory	*Carya cordiformis*
Hackberry	*Celtis occidentalis*
Green Ash	*Fraxinus pennsylvanica*
Butternut	*Juglans cinerea*
Black Walnut	*Juglans nigra*
Ironwood	*Ostrya virginiana*
Black Cherry	*Prunus serotina*
Swamp White Oak	*Quercus bicolor*
Northern Pin Oak	*Quercus ellipsoidalis*
Bur Oak	*Quercus macrocarpa*
Northern Red Oak	*Quercus rubra*
American Basswood	*Tilia americana*
American Elm	*Ulmus americana*

"Near Native" Tree Species		Notes
Ohio Buckeye	*Aescleus glabra*	Can be aggressive
Bitternut Hickory	*Carya cordiformis*	Native to southern Dakota County
Pignut Hickory	*Carya glabra*	
Shellbark Hickory	*Carya laciniosa*	
Shagbark Hickory	*Carya ovata*	

American Chestnut	*Castanea dentata*	Use blight-resistant hybrids
Redbud	*Cercis canadensis*	
Yellowwood	*Cladrastis kentukea*	
Kentucky Coffee Tree	*Gymnocladus dioicus*	
Red Mulberry	*Morus rubra*	Can be aggressive
Sycamore	*Platanus occidentalis*	
Scarlet Oak	*Quercus coccinea*	
Shingle Oak	*Quercus imbricaria*	
Chinkapin Oak	*Quercus muehlenbergii*	
Pin Oak	*Quercus palustris*	

Oak Savanna: Ground Layer **Forbs**	
Nodding Onion	*Allium cernuum*
Yarrow	*Achillea millefolium*
Giant Yellow Hyssop	*Agastache nepetoides*
Prairie Onion	*Allium stellatum*
Pearly Everlasting	*Anaphalis margaritacea*
Thimbleweed	*Anemone virginiana*
Spreading Dogbane	*Apocynum cannabinum*
Columbine	*Aquilegia canadensis*
Poke Milkweed	*Asclepias exaltata*
Purple Milkweed	*Asclepias purpurascens*
Butterflyweed	*Asclepias tuberosa*
Whorled Milkweed	*Asclepias verticillata*
Large-leaved Aster	*Aster macrophyllus*
Ground Plum	*Astragalus crassicarpus*
White Wild Indigo	*Baptisia alba*
Prairie Coreopsis	*Coreopsis palmata*
Pale Purple Cconeflower	*Echinacea palida*
Upland Boneset	*Eupatorium sessilifolium*
Flowering Spurge	*Euphorbia corollata*
Wood Strawberry	*Fragaria vesca*
Common Strawberry	*Fragaria virginiana*
Cream Gentian	*Gentiana alba*
Wild Geranium	*Geranium maculatum*
Prairie Smoke	*Geum triflorum*
Woodland Sunflower	*Helianthus hirsutus*
Western Sunflower	*Helianthus occidentalis*
Rough-leaf Sunflower	*Helianthus strumosus*
Round-lobed Hepatica	*Hepatica americana*
Alumroot	*Heuchera richardsonii*
Round-headed Bush Clover	*Lespedeza capitata*
Button Blazing Star	*Liatris aspera*
Meadow Blazing Star	*Liatris ligulistylis*
Canada Mayflower	*Maianthemum canadense*
Racemose False Solomon's-Seal	*Maianthemum racemosum*
Starry Solomon's Plume	*Maianthemum stellatum*
Wild Bergamot	*Monarda fistulosa*
Spotted Bee Balm	*Monarda punctata*
Wood Betony	*Pedicularis canadensis*
Large-flowered Beardtongue	*Penstemon grandiflorus*

Oak Savanna: Ground Layer **Forbs**	
White prairie clover	*Petalostemum candidum*
Purple prairie clover	*Petalostemum purpureum*
Virginia mountain mint	*Pycnanthemum virginianum*
Long-headed Coneflower	*Ratibida columnifera*
Dwarf Raspberry	*Rubus pubescens*
Black-eyed Susan	*Rudbeckia hirta*
Sweet Black-Eyed Susan	*Rudbeckia subtementosa*
Zig-Zag Goldenrod	*Solidago flexicaulis*
Old Field Goldenrod	*Solidago nemoralis*
Stiff Goldenrod	*Solidago rigida*
Rosey Twisted-stalk	*Streptopus lanceolatus*
Lindley's Aster	*Symphyotrichum ciliolatus*
Side-Flowering Aster	*Symphyotrichum lateriflorus*
New England Aster	*Symphyotrichum novae-angliae*
Sky Blue Aster	*Symphyotrichum oolentangiense*
Tail-leaved Aster	*Symphyotrichum sagittifolius*
Yellow Pimpernel	*Taenidia integerrima*
Goat's Rue	*Tephrosia virginiana*
Rue-Anemone	*Thalictrum thalictroides*
Tall Meadow Rue	*Thalictrum dasycarpum*
Early Meadow-Rue	*Thalictrum dioicum*
Prairie Spiderwort	*Tradescantia occidentalis*
Hoary Vervain	*Verbena stricta*
Culver's Root	*Veronicastrum virginicum*
Golden Alexanders	*Zizia aurea*

Oak Savanna: Ground Layer **Grasses, Rushes, and Sedges**	
Big Bluestem	*Andropogon gerardii*
Sideoats Grama	*Bouteloua curtipendula*
Blue Grama	*Bouteloua gracilis*
Hairy Grama	*Bouteloua hirsuta*
Bearded Shorthusk	*Brachyelytrum erectum*
Stellate Sedge	*Carex radiata*
Charming Sedge	*Carex blanda*
Dewey's Sedge	*Carex deweyana*
Graceful Sedge	*Carex gracillima*

Oak Savanna: Ground Layer **Grasses, Rushes, and Sedges**	
Pennsylvania Sedge	*Carex pensylvanica*
Bottlebrush Grass	*Elymus hystrix*
Virginia Wild Rye	*Elymus virginicus*
Nodding Fescue	*Festuca subverticillata*
Mountain Rice Grass	*Oryzopsis asperifolia*
Switchgrass	*Panicum virgatum*
Little Bluestem	*Schizachyrium scoparium*
Indiangrass	*Sorghastrum nutans*
Prairie Dropseed	*Sporobolus heterolepis*

Hardwood Forest Species: Canopy	
Quaking Aspen	*Populus tremuloides*
Bur Oak	*Quercus macrocarpa*
Pin Oak	*Quercus palustris*

Lake Shoreline Species: Ground Layer **Forbs**	
Sweet Flag	*Acorus calamus*
Fragrant Hyssop	*Agastache foeniculum*
Heart-Leaved Water-Plantain	*Alisma subcordatum*
Ordinary Water-Plantain	*Alisma triviale*
Swamp Milkweed	*Asclepias incarnata*
Butterfly flower	*Asclepias tuberosa*
Red-Stemmed Aster	*Aster firmus*
Flat-Topped Aster	*Aster umbellatus*
Panicled Aster	*Aster lanceolatus*
Beggar-Ticks (Multiple Species)	*Bidens species*
False Nettle	*Boehmeria cylindrica*
Marsh Bellflower	*Campanula aparinoides*
Indian Paintbrush	*Castilleja coccinea*
Turtlehead	*Chelone glabra*
Bulb-Bearing Water-Hemlock	*Cicuta bulbifera*
Spotted Water-Hemlock	*Cicuta maculata*
Dodder	*Cuscuta spp.*
Spotted Joe-Pye Weed	*Eupatorium maculatum*
Common Boneset	*Eupatorium perfoliatum*
Sweet Joe-Pye Weed	*Eupatorium purpureum*
Grass-Leaved Goldenrod	*Euthamia graminifolia*
Common Strawberry	*Fragaria virginiana*
Marsh Bedstraw	*Galium labradoricum*
Small Bedstraw	*Galium tinctorium*
Three-Cleft Bedstraw	*Galium trifidum*
Sneezeweed	*Helenium autumnale*
Giant Sunflower	*Helianthus giganteus*
Sawtooth Sunflower	*Helianthus grosseserratus*
Large St. John's-Wort	*Hypericum majus*
Spotted Touch-Me-Not	*Impatiens capensis*
Spotted Touch-Me-Not	*Impatiens cmx.*
Blue Flag Iris	*Iris versicolor*
Lesser Duckweed	*Lemna spp.*
Meadow Blazing Star	*Liatris ligulistylis*
Gayfeather	*Liatris pycnostachya*
Loesel's Twayblade	*Lilium loeselii*
Michigan Lily	*Lilium michiganense*
Great Lobelia	*Liparis siphilitica*

Lake Shoreline Species: Ground Layer **Forbs**	
Cardinal Flower	*Lobelia cardinalis*
Great Blue Lobelia	*Lobelia siphilitica*
Common Water Primrose	*Ludwigia palustris*
Wild Lupin	*Lupinus perennis*
Cut-Leaved Bugleweed	*Lycopus americanus*
Rough Bugleweed	*Lycopus asper*
Northern Bugleweed	*Lycopus uniflorus*
Fringed Loosestrife	*Lysimachia ciliata*
Yellow Loosestrife	*Lysimachia terrestris*
Tufted Loosestrife	*Lysimachia thyrsiflora*
Blue Monkey Flower	*Mimulus ringens*
Purple Monkey-Flower	*Mimulus ringens*
Wild Bergamot	*Monarda fistulosa*
Yellow Pond-Lily	*Nuphar luteum*
Waterlily	*Nymphaea odorata*
Obedient Plant	*Physostegia virginiana*
Clearweed	*Pilea cmx.*
Water Smartweed	*Polygonum amphibium*
Nodding Smartweed	*Polygonum lapathifolium*
Pennsylvania Smartweed	*Polygonum pensylvanicum*
Rough Cinquefoil	*Potentilla norvegica*
Virginia mountain mint	*Pycnanthemum virginianum*
Hispid Buttercup	*Ranunculus hispidus*
Bristly Buttercup	*Ranunculus pensylvanicus*
Gray-Headed Coneflower	*Ratibida pinnata*
Icelandic Yellow Cress	*Rorippa palustris*
Dwarf Raspberry	*Rubus pubescens*
Goldenglow	*Rudbeckia laciniata*
Golden Dock	*Rumex maritimus*
Broad-Leaved Arrowhead	*Sagittaria latifolia*
Sessile-Fruited Arrowhead	*Sagittaria rigida*
Marsh Skullcap	*Scutellaria galericulata*
Mad-Dog Skullcap	*Scutellaria lateriflora*
Water-Parsnip	*Sium suave*
Grass-Leaved Goldenrod	*Solidago graminifolia*
Riddell's Goldenrod	*Solidago riddellii*
Showy Goldenrod	*Solidago speciosa*
Unbranched Bur Reed	*Sparganium emersum*
Branching Bur Reed	*Sparganium androcladum*

Lake Shoreline Species: Ground Layer **Forbs**	
Giant Bur-Reed	*Sparganium eurycarpum*
Greater Duckweed	*Spirodela polyrhiza*
Smooth Aster	*Symphyotrichum laeve*
New England Aster	*Symphyotrichum novae-angliae*
Sky Blue Aster	*Symphyotrichum oolentangiense*
Marsh St. John's-Wort	*Triadenum fraseri*
Cattail	*Typha spp.*
Blue Vervain	*Verbena hastata*
Ironweed	*Vernonia fasciculata*

Oak-Basswood Forest Species: Ground Layer* **Grasses, Rushes, and Sedges**	
Canada Blue Joint Grass	*Calamagrostis canadensis*
Big Bluestem	*Andropogon gerardii*
Bog Reed-Grass	*Calamagrostis stricta*
Bluejoint	*Calamagrostis canadensis*
Bebb's Oval Sedge	*Carex bebbii*
Bottlebrush Sedge	*Carex comosa*
Lesser-Panicled Sedge	*Carex diandra*
Palm Sedge	*Carex muskingumensis*
Pointed-Broom Sedge	*Carex scoparia*
Fox Sedge	*Carex stipata*
Tussock Sedge	*Carex stricta*
Fox Sedge, Brown	*Carex Vulpinoidea*
Fragrant Cyperus	*Cyperus odoratus*
Sedge Galingale	*Cyperus diandrus*
Red-Rooted Cyperus	*Cyperus erythrorhizos*
Straw-Colored Umbrella Sedge	*Cyperus strigosus*
Three-Way Sedge	*Dulichium arundinaceum*
Rough Barnyard Grass	*Echinochloa muricata*
Least Spikerush	*Eleocharis acicularis*
Elliptic Spikerush	*Eleocharis elliptica*
Ovoid Spikerush	*Eleocharis ovata*
Canada Wild Rye	*Elymus canadensis*
Riverbank Wild Rye	*Elymus riparius*
Virginia Wild Rye	*Elymus virginicus*
Northern Manna Grass	*Glyceria borealis*
Tall Manna-Grass	*Glyceria grandis*

Oak-Basswood Forest Species: Ground Layer* **Grasses, Rushes, and Sedges**	
Canada Rush	*Juncus canadensis*
Narrow-Panicled Rush	*Juncus brevicaudatus*
Common Rush	*Juncus effusus*
Soft Rush	*Juncus effusus*
Knotty Rush	*Juncus nodosus*
Rice Cut Grass	*Leersia oryzoides*
Common Reed	*Phragmites australis*
Fowl Bluegrass	*Poa palustris*
Hard-Stemmed Bulrush	*Schoenoplectrus acutus*
River Bulrush	*Schoenoplectrus fluviatilis*
Blunt Scale Bulrush	*Schoenoplectrus smithii*
Softstem Bulrush	*Schoenoplectrus validus*
Hardstem Bulrush	*Scirpus acutus*
Green Bulrush	*Scirpus atrovirens*
Woolgrass	*Scirpus cyperinus*
Wool-Grass	*Scirpus cyperinus*
Softstem Bulrush	*Scirpus validus*
Indian Grass	*Sorghastrum nutans*
Prairie Cordgrass	*Spartina pectinata*

Oak-Basswood Forest Species: Shrub Layer*	
Downy Serviceberry	Amelanchier arborea
False Indigo	Amphora fruiticosa
Black Chokeberry	Aronia melanocarpa
Buttonbush	Cephalanthus occidentalis
Red-Osier Dogwood	Cornus sericea
Winterberry	Ilex verticillata
Elderberry	Sambucus canadensis
High Bush Cranberry	Vibernum trilobum
Arrowwood Viburnum	Viburnum rafinesquianum
Meadowsweet	Spiraea alba

*May be found in wetlands and uplands throughout this general community type.

Oak-Basswood Forest Species: Canopy	
Sugar Maple	Acer saccharum
Allegheny Serviceberry	Amelanchier laevis
Hackberry	Celtis occidentalis
Tamarack	Larix laricina
Quaking Aspen	Populus tremuloides
Swamp White Oak	Quercus bicolor
Bur Oak	Quercus macrocarpa
Basswood	Tilia americana