

Ecological Management Plan

Asylum Lake Preserve

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Prepared for:

Asylum Lake Preserve Management Council

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1. Introduction

1.1 Scope and Rationale

Asylum Lake Preserve is a 274-acre natural area owned and managed by Western Michigan University (WMU). The stewardship of the Preserve is guided by the Declaration of Conservation Restrictions and Management (see Section 1.2), which outlines the following purposes:

1. Promote ecosystem integrity and natural aesthetics
2. Ensure passive recreation
3. Support research and education

Asylum Lake's preservation was formalized in 2004 as a condition of the development of WMU's Business, Technology and Research Park nearby. The Preserve is managed by the 14-member Asylum Lake Policy and Management Council (ALPMC), made up of representatives from local neighborhood associations, environmental groups, and WMU departments.

Active management is often necessary to maintain or restore the ecological integrity of natural systems.¹ The need for active stewardship is especially apparent in highly degraded areas and in natural communities that rely on frequent natural disturbances to maintain their structure, composition, and function. In addition to addressing ecological concerns, management at Asylum Lake Preserve also involves encouraging appropriate human uses of the landscape.

This management plan is intended to provide practical guidance for the stewardship of Asylum Lake Preserve over the next 10 – 15 years, with the expectation that a full revision of the plan will likely be required after that time due to changes in ecological conditions, organizational capacity, or other factors that are difficult to predict beyond that time. However, in keeping with the spirit of adaptive management and the requirement of the Asylum Lake Management Framework² to revisit the plan once every five years, this plan is intended to be reviewed and revised periodically over its lifespan to respond to management progress, setbacks, and changing conditions.

An ecosystem with integrity is composed of a diverse community of plants and animals that interact with each other and the abiotic environment in a way that is resilient, self-sustaining, and supports a healthy environment.

1.2 Relation to Other Plans and Guidance

Declaration of Conservation Restrictions & Preserve Management Framework

The 2004 Asylum Lake Preserve Declaration of Conservation Restrictions outlines the conservation intentions, goals, and covenants of the Asylum Lake Preserve, which the ALPMC is charged with upholding. This document articulates three conservation purposes intended to guide management decisions for the Preserve: promoting ecosystem integrity and natural aesthetics, ensuring passive recreation, and supporting research and education.³

The Asylum Lake Preserve Management Framework outlines the management goals of the Asylum Lake Preserve. The Framework lists the following management goals:

1. To seek the effective pursuit of the conservation purposes.
2. To ensure that activities carried out on the Preserve shall be consistent with the goals of seeking to reduce and reverse environmental degradation and ensure passive recreation.
3. To ensure that all educational, research, and restoration activities carried out on the Preserve have followed “The Educational, Research, and Restoration Activities Protocol for the Asylum Lake Preserve” approved by the Provost in 2004.

This management plan was developed to identify and guide the implementation of specific actions to reach the goals of both the Declaration of Conservation Restrictions and the Preserve Management Framework.

Previous Management Plan

According to the Framework, the ALMPC is charged with regularly updating the management plan. The last management plan was developed for the Preserve in 2008. The 2008 plan provides important information about the Preserve and provides recommendations to address many of the issues regarding ecological management and public engagement on the site. However, the plan lacks clarity in some key areas such as prioritization of management actions and the monitoring of management progress. Also, conditions on the Preserve have changed since 2008 due to changes in human use, ecological succession, and management activities such as invasive species removal and prescribed burning. Ecological studies have also provided new insights on the management of the Preserve. Therefore, the current plan incorporates much of the core content of the previous plan but is otherwise reorganized and updated to better align with best management practices and current site conditions. A full revision of this plan is expected to be needed in 10-15 years, with minor revisions to be completed as necessary before that time.

Ecological Studies

Over the past two decades, several studies have been performed to guide the management of the Preserve, including botanical inventories,^{4,5} ecological assessments,^{6,7} water quality studies,^{8,9} and a herpetological assessment.¹⁰ Results of these studies provide critical information on the Preserve’s natural features and offer recommendations for their management. This information was reviewed and considered during the development of this plan.

Resilient Sites

In 2018, The Nature Conservancy published a dataset classifying lands based on their climate resilience based on landscape diversity and local connectedness.¹¹ Nearly all the natural land at Asylum Lake Preserve has above average resilience relative to other sites in the ecoregion, including important natural areas in less urban contexts – a fairly remarkable result given the Preserve’s urban setting. This means that Asylum Lake Preserve has relatively high microclimatic diversity (due to high topographic variability) and connectivity (due to remaining natural areas along the West Branch of Portage Creek) to provide species with diverse, connected climatic conditions they will need to persist and adapt to changing regional climates. This data was reviewed and taken into account during the development of this management plan.

2. Background

2.1 Location, Landscape Context, and Historic Vegetation

Asylum Lake Preserve sits on 274 acres of land in the southwest corner of the city of Kalamazoo, Michigan. The surrounding land use is a mix of commercial and residential. Parkview Avenue forms the southern boundary of the Preserve, south of which is the WMU Engineering College and Business and Technology Research Park (BTR) and the Parkview Hills Planned Unit Development. Drake Road forms the western boundary of the Preserve, west of which is the Phase II of the BTR, which sits along the eastern boundary of the mostly rural Oshtemo Township. There are apartment complexes and residential homes bordering the property to the north and east. The property has three main entrances, including parking lots along Parkview Avenue and Drake Road, and a pedestrian entrance on Winchell Avenue.

From a geological perspective, Asylum Lake Preserve is situated on a topographically-diverse system of glacial moraines and outwash features formed during the late Wisconsinan period of glaciation.¹² The dominant soils on the site are Kalamazoo loam and Oshtemo sandy loam, both coarse-textured, well-drained soils associated with glacial moraines and outwash features. Ponded Houghton and Sebewa soils composed of organic muck underlie the property's wetlands, which ring Asylum Lake and Little Asylum Lake.¹³ Asylum Lake is fed by springs west of Drake Road, and at the margins of the lake itself. Water from Asylum Lake flows into Little Asylum Lake, then into the West Fork of Portage Creek. These lakes are the uppermost in a chain of lakes and ponds that follow the West Fork of Portage Creek south and east of the Preserve, ultimately flowing into the Kalamazoo River.

Around the time of European colonization, upland vegetation was dominated by mixed oak savanna, a fire-dependent natural community characterized by black oak (*Quercus velutina*) and white oak (*Q. alba*) scattered among herbaceous prairie vegetation. Low-lying areas and riparian areas within the landscape were dominated by a mix of shrub and emergent wetland communities, similar to the communities that exist in those areas today (Figures 1 and 2).

2.2 Land Use History

Starting with the Hopewell around 8,000 ybp and ending with the Potawatomi in the years leading up to European colonization, a series of Indigenous tribes lived in and moved through what is now southwestern Michigan.¹⁴ In addition to hunting, farming, and the establishment of villages and trails, perhaps the greatest ecological influence of Native American activity was the extensive use of fire on the landscape. Fires were occasionally started by lightning from mid-summer storms, but Indigenous peoples frequently set fires at other times of the year to clear land for agriculture, flush game during hunting, open views to see enemies approaching, and various other reasons.¹⁵ These fires spread across the land, maintaining a patchwork of fire-dependent ecosystems, namely the prairies, savannas, and open forests that dominated the southern Michigan landscape. Although no archaeological evidence of Native American activity has yet been uncovered at Asylum Lake Preserve itself,¹⁶ the historical occurrence of oak savanna on the property is likely due in part to human-facilitated fires in the past.¹⁷

The fire regime of the area was dramatically altered following the arrival of European settlers in Kalamazoo County beginning in the early nineteenth century. Over the course of two centuries, the landscape around Asylum Lake Preserve became increasingly cleared and used for intensive agriculture and urban development. In addition to reducing the amount of available habitat, these activities greatly

fragmented the landscape, creating fire breaks that limited the distance fires could travel and disturbances that facilitated the spread of invasive species.

After the General Land Office of the U.S. Government started selling homesteads in the early 1800s, Phineus Hunt first purchased the land occupied by the Preserve in 1831 from the Territory of Michigan's Kalamazoo District Land Office.¹⁸ Soon after, in 1835 Neil Heindes purchased the land from Phineus Hunt.¹⁹ The 1873 county atlas shows that Neil Heindes owned 240 acres south of the lake. Daniel and Jane McMartin owned 101 acres north of the lake, named the McMartin Lake at that time. During the years Neil Heindes owned the property, land was cleared for orchards and buildings were constructed. However, there is no evidence of this farming or construction occurring at the Preserve during this time.²⁰ Neil Heindes died in 1874 and his property was transferred to his descendants.

In the summer of 1887, the Michigan Asylum for the Insane (State of Michigan) purchased the Heindes Farm from Neil's eight surviving children, including most prominently his oldest daughter, Margaret S. Smith, for a total of \$18,000.²¹ In October of 1887, the Michigan Asylum for the Insane (later named the Kalamazoo State Hospital) purchased portion of the D.D. McMartin Farm bordering the McMartin Lake to the north. Sometime later the lake became known as Asylum Lake. The Trustees Report of the Michigan Asylum for 1887-1888 indicates that the land was acquired as part of a 'Colony Farm' and recreation



Mitchell Cottage, part of the Kalamazoo State Hospital.
Credit: WMU Archives and Regional History Collections.

experiment. By 1960, the complex consisted of five cottages to house the patients, a central heating plant, two garages, a pump house, a water tower, water and steam pipes, and connecting tunnels. The facility was phased out and finally abandoned in 1969. All buildings and most of the aboveground architecture were demolished in 1971. In 1977 the water tower was demolished and the entrances to tunnels were destroyed, though remnants of these structures still exist above and below ground.^{22,23}

Ownership of the land was transferred from the State of Michigan to Western Michigan University in 1975 through the Public Acts No. 316 with the restriction that the property be used "solely for public park, recreation, or open space purposes...".²⁴ During the years 1976 to 1999, WMU leased the property for growing agricultural crops, including corn. In 1998, following a protracted campaign by local environmental leaders, the city of Kalamazoo and WMU agreed to create an endowment for the preservation and conservation of the Asylum Lake Preserve. At the same time the Kalamazoo Community Foundation established the Asylum Lake Preservation Fund to be used at the Preserve to develop and maintain the land for public passive recreation.

During 2000 and 2001, the City of Kalamazoo expanded Drake Road along the west border of the Preserve into a boulevard. At the same time WMU began construction on the BRT south of Parkview Avenue. The WMU Board of Trustees adopted a Declaration of Conservation Restrictions on April 16, 2004. This document outlines the purpose of the property as promoting ecosystem integrity and natural aesthetics, ensure passive recreation, and support research and education. It also included the Asylum Lake Management Framework developed to outline the implementation of the Declaration of Conservation

Restrictions. The Framework Document develops the structure and duties of the Asylum Lake Policy & Management Council (ALPMC), including the creation of a management plan for the Preserve.²⁵ This Asylum Lake Management Plan is a result of the Declaration of Conservation Restrictions.

Since its declaration as a Preserve, the Asylum Lake property has been used by the public for activities such as walking, running, cross country skiing and other passive recreation activities. Ecological management began with the prairie restoration in the Prairie and Savanna 1 management units in 2000. Since then, management has continued with the periodic use of prescribed fire in grassland areas and control of invasive shrubs in forested portions of the property. Several ecological studies have been conducted on the Asylum Lake Preserve, as summarized in Section 1.2.

2.3 Current Natural Communities

Asylum Lake Preserve contains four natural community types as defined by Michigan Natural Features Inventory (MNFI),^{26,27} plus a reconstructed grassland community composed of a variety of native and exotic grassland and savanna species (Table 1, Figure 2).

Table 1. Community types at Asylum Lake Preserve

Community Type	Acres	State Rank ²⁸	Global Rank ²⁹
Dry-Mesic Southern Forest	92.4	S3	G4
Grassland	99.5	N/A	N/A
Southern Wet Meadow	22.7	S3	G4
Submergent Marsh ^a	51.6	S4	GU
Inundated Shrub Swamp	0.5	S3	G4

^a acreage includes aquatic zone.

Dry-Mesic Southern Forest

The upland forests at Asylum Lake Preserve are classified as dry-mesic southern forest, also known as an oak-hickory forest.^{30,31,32} A mixture of white oak, black oak, and red oak (*Q. rubra*), and to a lesser degree hickory (*Carya* spp.) and other oak species (*Quercus* spp.), typically dominate the canopy of dry-mesic southern forests and other oak ecosystems such as savannas. Historically a savanna with a sparse canopy and grassland understory, the forests at the Preserve have developed into a closed-canopied forest in part due to fire suppression.^{33,34} Oak ecosystems developed in concert with landscape-scale fire, set by Indigenous people and less often ignited by lightning.³⁵ In the absence of regular fire, oak ecosystems undergo “mesophication,” a process where shade-tolerant and fire-sensitive red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and other mesophytic saplings grow densely to the exclusion of oaks. The dense shade cast by these trees, along with a dense layer of leaf litter that accumulates due the absence of fire, also severely limits ground layer diversity. Today, fire is a necessary management tool in oak ecosystems for maintaining understory light availability and encouraging plant and animal diversity, by reducing the density of shrubs and trees and stimulating the germination and recruitment of fire-adapted species.^{36,37}

The forests at the Preserve retain some attributes of ecosystem integrity and also shows signs of degradation due to decades of intensive land use and fire suppression. Large-diameter white oak trees

generally dominate the canopy, while black cherry is a secondary dominant.^{38,39} Because white oak trees are slow-growing, and often prized for their value as lumber, a canopy dominated by large, old white oak trees indicates limited recent canopy disturbance (i.e., logging), and are an indicator of ecological integrity. Prior to European colonization, a large oak savanna extended east toward Kalamazoo from Genesee Prairie to the west of

Fire is a necessary management tool in oak ecosystems for maintaining understory light availability and promoting biodiversity.

Asylum Lake Preserve and included much of what is now the Preserve. Today, many species typical of oak savannas persist at low abundances in the understory of the Preserve's forest, including Culver's root (*Veronicastrum virginicum*), northern bedstraw (*Galium boreale*), early meadow rue (*Thalictrum dioicum*), elm-leaved goldenrod (*Solidago ulmifolia*), and alum root (*Heuchera americana*). Limited oak regeneration threatens the persistence of oak ecosystems across the Eastern United States, including those on the Preserve.⁴⁰ Black cherry and other mesophytic species dominate the sapling class, while oak saplings are scarce in most areas. Invasive shrubs often limit oak regeneration, as well as herbaceous understory diversity. Past management actions on the Preserve's forests have significantly reduced the density of invasive shrubs such as glossy buckthorn and bush honeysuckle.^{41,42}

Grassland

The majority of the grasslands at Asylum Lake Preserve are reconstructed communities established in 2000 in former agricultural fields by sowing seeds of native prairie species. These areas have characteristics typical of several related Michigan natural communities, most notably dry-mesic prairie, mesic prairie, and oak openings. However, they are not considered true natural communities due to their anthropogenic origins. Still, they support important ecosystem functions and share some of the physical structure and species composition as their naturally-occurring counterparts.

These areas are dominated mostly by big bluestem (*Andropogon gerardii*), and to a lesser extent, other native warm-season grasses. Bur oaks (*Q. macrocarpa*), which often occur in savannas and on the edge of prairies, were also planted sporadically throughout the Preserve's grasslands. Seed establishment was poor in certain patches, which are now dominated by exotic species including red clover (*Trifolium pratense*), Kentucky bluegrass (*Poa pratensis*), and quackgrass (*Elymus repens*). The native forb diversity is low, with the highest concentration of forbs occurring along the Preserve's western boundary. Encroachment by undesirable woody species is problematic, particularly in the west-central part of the preserve, where large areas are dominated by exotic crabapples (*Malus* spp.) and an incursion of the invasive tree black locust (*Robinia pseudoacacia*).

In this context, "grassland" also includes areas of successional old field in the south-central part of the preserve. These unrestored areas are composed of a mix of native and exotic vegetation that established spontaneously since the land was last used for agriculture. As such, these areas, which are mix of herbaceous vegetation and young trees and shrubs, have little fidelity to any natural community type and have suboptimal ecosystem integrity.

Southern Wet Meadow

The emergent wetlands along the boundaries of Asylum Lake and Little Asylum Lake represent a southern wet meadow natural community.⁴³ Southern wet meadow is a minerotrophic peatland, characterized by a substrate of saturated organic soil, generally well-decomposed sedge and grass peat, and hydrology that is strongly influenced by groundwater seepage. Floristically, southern wet meadow is dominated by sedges, typically tussock sedge (*Carex stricta*) and lake sedge (*C. lacustris*), with grasses such as blue-joint grass (*Calamagrostis canadensis*) and prairie cordgrass (*Spartina pectinata*) often abundant or co-dominant. Native shrubs such as dogwoods (*Cornus* spp.), willows (*Salix* spp.), and poison sumac (*Toxicodendron vernix*) are often a minor but consistent component of southern wet meadow.

While there are patches of remnant, sedge-dominated southern wet meadow, the wet meadow zone on the Preserve also includes minor elements of emergent marsh and southern shrub-carr which are intermixed throughout. Importantly, most of the wet meadow zone at Asylum Lake Preserve is dominated by exotic invasive species. The majority of the meadow is dominated by cattails, much of which is the native broad-leaved cattail (*Typha latifolia*). However, the invasive narrow-leaved cattail (*T. angustifolia*) is mixed in, as is the hybrid between the two (*T. x glauca*). An increasing number of broad-leaved cattail populations are showing high rates of hybridization.⁴⁴ Non-native phragmites (*Phragmites australis* var. *australis*) is also established on the western extent of Asylum Lake, where it was managed with herbicide application in 2019 but still persists, and in a small patch in the shallow bay along the south shore of Asylum Lake. The invasive shrub glossy buckthorn (*Frangula alnus*) is occasional in the wet meadow, and has been cut and treated in the near shore transition between meadow and oak uplands. Occasional groundwater seeps are found around the margins of both lakes.

Submergent Marsh, Aquatic, and Inundated Shrub Swamp



Submergent and emergent wetlands occur at the boundary of wetland and aquatic habitats on the Preserve.

The aquatic habitats of Asylum Lake Preserve support a diverse submergent marsh natural community.⁴⁵ Submergent marsh is found throughout Michigan in all aquatic environments. A variety of submerged aquatic macrophytes typically characterize this community, including pondweeds (*Potamogeton* spp.), milfoils (*Myriophyllum* spp.), bladderworts (*Utricularia* spp.), sweet-scented water-lily (*Nymphaea odorata*), yellow pond-lily (*Nuphar variegata* and *N. advena*), and water shield (*Brasenia schreberi*). The diverse and dense aquatic plant community within submergent marsh is the foundation for a thriving fish community, as well as a diversity of aquatic and semi-aquatic insects such as dragonfly larvae.

Asylum Lake, and to a lesser degree Little Asylum Lake, support a very diverse aquatic plant community, including ten species of pondweeds and two species of milfoils. However, the invasive curly-leaved pondweed (*Potamogeton crispus*) and Eurasian water milfoil (*Myriophyllum spicatum*) are both established in the lakes on the Preserve. Asylum Lake is approximately 50 feet deep and turns over seasonally. High phosphorus levels in the water column, due to storm drain outflows originating from surrounding developed land, is a persistent problem.

Beavers (*Castor canadensis*), an important part of aquatic and wetland ecosystems, have taken up residence at the Preserve. Once nearly extirpated from lower Michigan, beaver populations have expanded in recent decades. While their return is generally welcomed, they occasionally cause issues for the Preserve by felling trees and blocking the outflow from Asylum Lake to Little Asylum Lake by constructing dams. A “beaver deceiver” flow device has been installed to limit the ability for beavers to create blockages in the outflow.

A small inundated shrub swamp occurs in the northeastern corner of the Preserve in an isolated depression. These swamps are characterized by shallow water with duckweeds (*Lemna* spp.) and watermeal (*Wolffia* spp.), and either ringed or dominated by buttonbush (*Cephalanthus occidentalis*) and winterberry (*Ilex verticillata*).

Figure 1. Vegetation Prior to European Colonization in the Vicinity of Asylum Lake Preserve

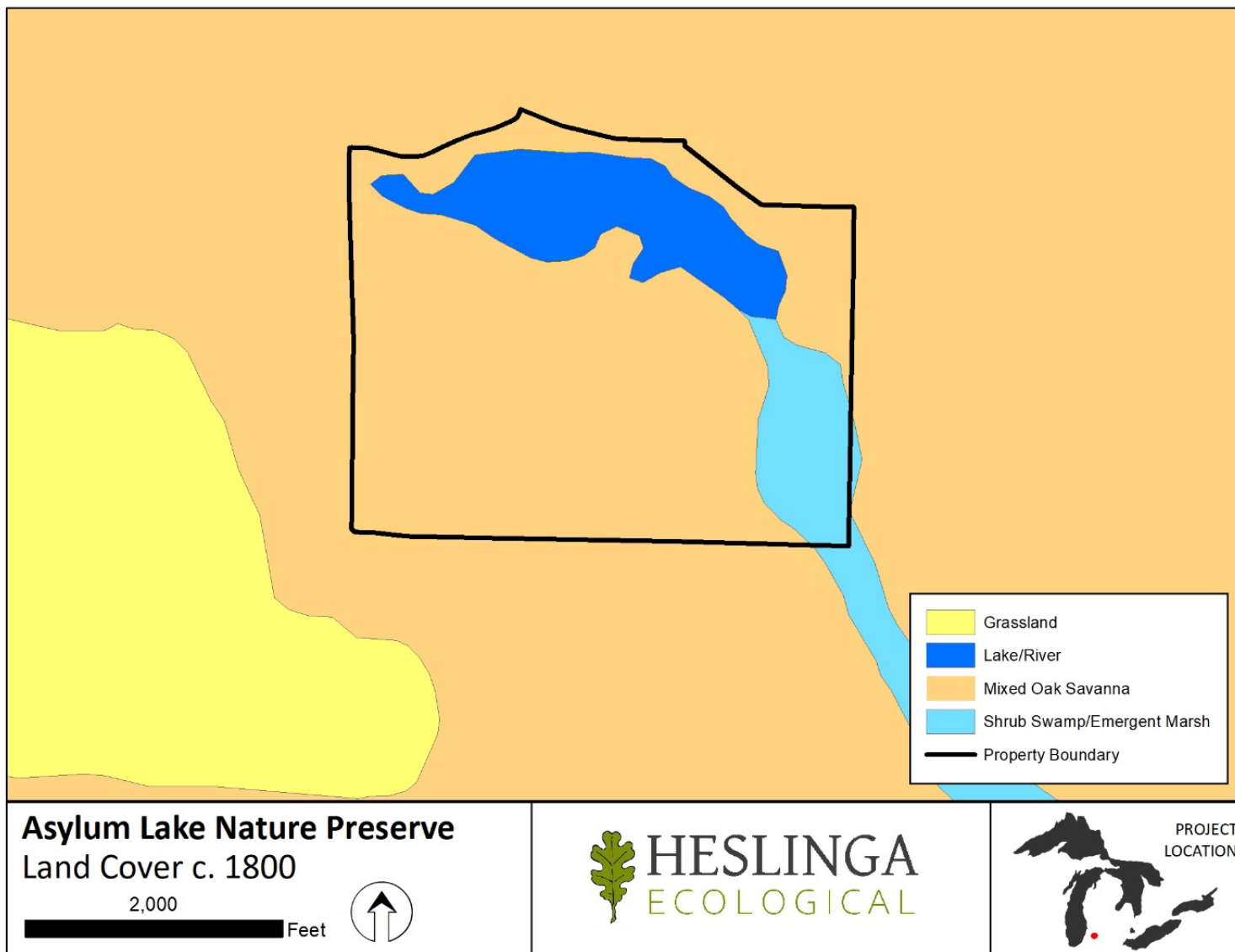


Figure 2. Current Land Cover at Asylum Lake Preserve

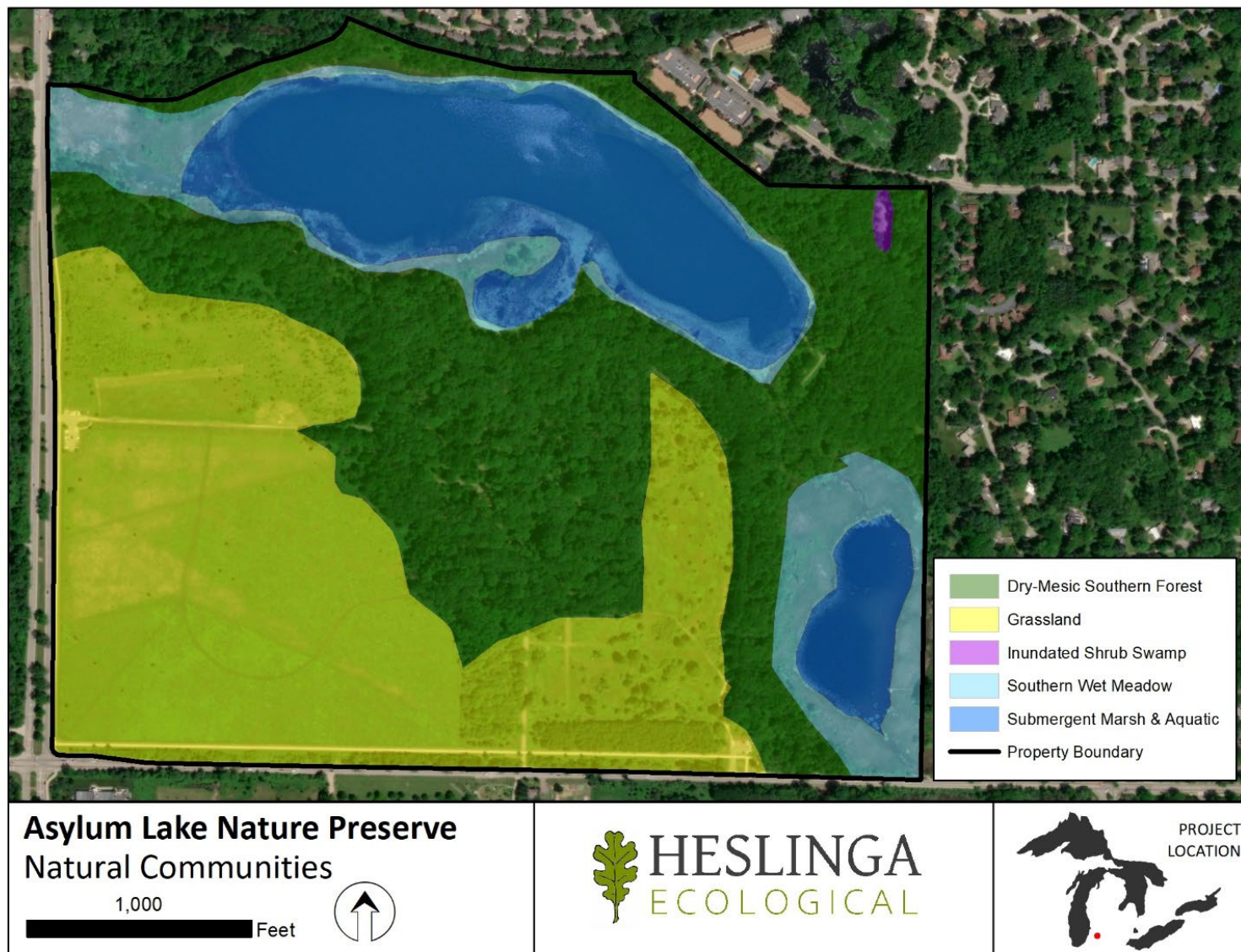


Figure 3. Management Units at Asylum Lake Preserve



2.4 Imperiled Species

Several imperiled (i.e., listed as threatened [T], endangered [E], or special concern [SC] in Michigan) species have been confirmed at Asylum Lake Preserve in the recent past, highlighting the property's importance from a regional biodiversity perspective.

Only one listed plant species is extant at the Preserve. A large population of starry campion (*Silene stellata*, T) was documented in an oak savanna remnant just north of the property in the 1980s but had been significantly reduced by 2009.⁴⁶ A few plants were observed on the property in 2018.⁴⁷ Other imperiled plant species exist in the historical record, but none have been observed during more recent botanical surveys.

The Preserve has a rich diversity of herpetofauna. Rare species include eastern box turtle (*Terrapene carolina carolina*, SC), Blanding's turtle (*Emydoidea blandingii*, SC) and black rat snake (*Pantherophis spiloides*, SC).^{48, 49}

Several imperiled resident and migratory birds, including Henslow's sparrow (*Ammodramus henslowii*, E), grasshopper sparrow (*Ammodramus savannarum*, SC), red-headed woodpecker (*Melanerpes erythrocephalus*, SC), common loon (*Gavia immer*, T), red-shouldered hawk (*Buteo lineatus*, T), osprey (*Pandion haliaetus*, SC), least bittern (*Ixobrychus exilis*, T), Louisiana waterthrush (*Parkesia motacilla*, T), bald eagle (*Haliaeetus leucocephalus*, SC), hooded warbler (*Setophaga citrina*, SC), prothonotary warbler (*Protonotaria citrea*, SC), cerulean warbler (*Setophaga cerulea*, T), have been observed on the property in the recent past.^{50,51} While several of these species are undoubtedly transients, their occurrence on the Preserve indicates the value to species of conservation value of maintaining a diversity of connected, quality habitats on the property.

2.5 Current Stressors and Human Use

Invasive Species

Invasive plant species are frequent throughout the property. Invasive shrubs including glossy buckthorn and bush honeysuckle (*Lonicera spp.*) dominated portions of the forest understory until recently, when efforts by ecological services firm Wildtype have significantly reduced their density throughout the forested areas of the Preserve. Exotic trees, including Norway maple (*Acer platanoides*) and black locust also occur, although their abundance has also been reduced by recent management. Garlic mustard (*Alliaria petiolata*), an exotic woodland forb is scattered throughout the property's uplands and presents a potential threat to native ground-layer flora. In wetland areas, purple loosestrife (*Lythrum salicaria*), narrow-leaf cattail, hybrid cattail, and phragmites are present, with cattail often forming dense, monotypic stands that have displaced native wet meadow vegetation. Ecosystem recovery at Asylum Lake Preserve will not be possible without achieving some control of invasive species, beginning with areas of the property that have been identified as high priorities for restoration (see section 2.6).

Invasive forest pests and pathogens are other potential threats to ecological health. In particular, oak wilt (*Ceratocystis fagacearum*) is a fungal disease lethal to oak trees that is increasingly prevalent in urban and suburban areas of southern Michigan. Oak wilt has not been found at Asylum Lake Preserve, but is a concern because of its ability to cause widespread tree mortality in otherwise healthy oak stands. Oak wilt preferentially infects oak species of the red oak group. The high prevalence of white oak on the Preserve may offer some natural resistance to oak wilt.

Various other invasive forest pests and pathogens, including sudden oak death (*Phytophthora ramorum*), spotted lanternfly (*Lycorma deliculata*), and Asian long-horned beetle (*Anoplophora glabripennis*), have not been found on or near the Preserve but are of long-term concern because of their potential to spread rapidly and cause widespread tree mortality. Control of the invasive tree-of-heaven (*Ailanthus altissima*), a preferred host of spotted lanternfly, will slow the spread of that invasive insect.

White-Tailed Deer

White-tailed deer (*Odocoileus virginianus*) populations have dramatically expanded in suburban landscapes over the past several decades. The conversion of large habitat patches to a fragmented patchwork of roads, buildings, and farms created an abundance of food-rich edge habitats, ideal conditions for deer to thrive. Suburban landscapes also provide a substantial refuge from hunters, the sole predator of deer in southern Michigan. Excessive deer herbivory can virtually eliminate the forb community in forest understories, reducing ground-layer diversity and the ability of certain trees to regenerate.⁵² The forest at Asylum Lake Preserve has a low diversity and abundance of ground-layer forbs and young trees. This may be linked to dense shade, competition from invasive species, and/or land use history, but it may also indicate an overabundance of deer. Deer are frequently seen in abundance on the property and in the surrounding neighborhoods, but their population has not been accurately estimated. Deer population surveys were conducted by students from Kalamazoo Christian High School in 2017 and 2020 and Kalamazoo College in 2020. Both surveys presented anecdotal evidence of high deer density on the Preserve and the adjacent Winchell neighborhood. The population is almost certainly greater than 20 deer per square mile, the level often considered to be damaging to plant communities.⁵³



White-tailed deer are abundant at Asylum Lake Preserve.

Fire Suppression

Asylum Lake Preserve occurs within a landscape historically dominated by mixed oak savanna, a fire-dependent system that regularly burned. Past fires would have spread into nearby wetlands as well, maintaining open conditions and rich communities of fire-dependent species. The suppression of wildfire associated with European colonization has been a major reason for the conversion of historic oak savannas to closed-canopy forests composed of a mix of fire tolerant and fire sensitive species.⁵⁴

At Asylum Lake Preserve, the effects of fire suppression are perhaps most apparent in the abundance of black cherry, red maple, box elder (*Acer negundo*) and other fire-intolerant trees and shrubs – including invasive species – in the canopy and subcanopy of the mixed woodland. Periodic fires limit the survival of those species and reduce overall stem density, creating open conditions necessary for the regeneration of oaks, hickories, and a more diverse suite of ground-layer flora.

Climate Change

Climate change is likely to have significant impacts on all natural communities in Michigan. Like the rest of the Great Lakes region, Michigan is already experiencing changes in temperature and precipitation.⁵⁵ Under some climate change scenarios, the average annual temperature in the region could increase by as

much as 8° F by the end of this century. The total amount of annual precipitation is not projected to change significantly, but Southwest Michigan is likely to undergo increases in winter and spring precipitation, while summer precipitation could decrease by 50 percent.⁵⁶ At minimum, species composition will almost certainly change at Asylum Lake Preserve as species' ranges shift northward, and as productivity rates and disturbance regimes are altered by hotter and drier summer conditions.⁵⁷ Together, these conditions make the property's natural communities moderately to highly vulnerable to climate change, although expected impacts vary across communities.⁵⁸ For example, oak species are expected to fare well due to their adaptations for hotter, drier conditions. The consequences for oak ecosystems are still not clear. Some mesophytic species such as red maple that threaten fire-suppressed oak ecosystems are also predicted to fare well.⁵⁹

Despite these anticipated changes, Asylum Lake Preserve is located in a region of the landscape that is predicted to have above average resilience to climate change. In large part, this is due to the high topographic and hydrological variability onsite, which creates many microhabitats for a range of species to persist even with more extreme changes in climate. The property's resilience capacity is also boosted by its connections along a chain of lakes and wetlands to other regionally-significant natural areas.⁶⁰

Habitat Area and Fragmentation

Asylum Lake Preserve supports several community types within a relatively small footprint. On one hand, this results in relatively high biodiversity in a relatively small area. On the other hand, this means that some habitat areas (e.g., the prairie) may be too small to support certain species that require larger habitat blocks (e.g., certain grassland birds). It also means that the habitats on the Preserve are somewhat fragmented, leading to undesirable edge effects such as the spread of invasive species and the proliferation of white-tailed deer. Some of these issues can be mitigated through management, others are realities of the landscape and may simply limit the types and quality of habitats that the Preserve can support.

Water Quality

A 2008 study of water quality on the Preserve found that both lakes receive a high level of nutrients and pollutants from stormwater entering mainly from drains near Drake Road and Stadium Drive.⁶¹ Large concentrations of phosphorous were found at the bottom of the lake and in the sediments. Heavy metals such as mercury were also found in bottom waters and in sediments, most likely from atmospheric and stormwater sources. Anoxic conditions were recorded indicating high sediment oxygen demand. These conditions impair aquatic ecosystem health. The recovery of wetland and aquatic habitats on the preserve will not be possible without first addressing inputs of low-quality stormwater. A subsequent assessment in 2019 found that conditions had not improved and recommended a stormwater control project.⁶² A portion of this project is currently under the bidding process with the goal of completion in 2023, a critical step in reducing nutrients and pollutants entering the Preserve's watercourses which will aid in the recovery of ecological integrity.

Past Land Use

Agriculture and other kinds of development on the property over the past 200 years have greatly impacted the ecology of the Preserve today. Extended human use of the Preserve is mostly responsible for the low plant diversity and the proliferation of non-native species, indirectly through trampling and directly through planting, respectively. It also means that the native seedbank has been severely depleted or

destroyed in many areas, requiring planting and other resource-intensive management actions to restore.⁶³ Finally, legacy pesticides, including Atrazine, used in grassland management units, may have legacy contamination issues that limit native plant recruitment and growth.

Current Human Use

Consistent with the original intent to provide opportunities for passive recreation, research, and education, Asylum Lake Preserve has an extensive system of trails that wind through its natural areas. Two parking lots provide access to the trail system, which is heavily used by the public. While most visitors adhere to the rules, off-leash dogs are a persistent problem that impacts both wildlife and other visitors' enjoyment. The Preserve is occasionally used by local institutions for research and education. It is important to note that ecological integrity and natural aesthetics take precedence over accommodations for human use.

Also, the Preserve's urban setting means that surrounding land use has acute impacts on the ability for the Preserve to support biodiversity. Noise and light pollution enter the property from nearby roads and buildings, potentially impacting wildlife activity and the visitor experience. Additional development in the surrounding landscape will also reduce habitat for wildlife, for example increasing concentrations of wildlife populations on the Preserve. These issues may become more acute if or when proposed developments around the Preserve reduce limited available habitat. It would be prudent for the Council to begin a conversation on what preventative - proactive measures could be implemented.

2.6 Management Units

Asylum Lake Preserve is split into nine management units, delineated by a combination of current land cover, desired future conditions, and site geography. The Forest and Prairie units are further divided into subunits to facilitate planning and management (Figure 3). Table 2 below describes each main unit in three tiers of descending management priority. Within each priority tier, units are listed in alphabetical order. Prioritization was based on several considerations including ecological quality, potential to contribute to community engagement goals, and ease/effectiveness of management.

Table 2: Management Unit Descriptions and Prioritization

Priority 1			
Unit	Acreage	Communities	Description & Rationale
Forest 1	76.7	<ul style="list-style-type: none"> · Dry-Mesic Southern Forest · Grassland (old field) 	Relatively intact dry-mesic forest with some oak savanna remnants and mature white oak canopy. Ground layer sparse due to fire suppression, shade, and/or deer herbivory. Invasive shrubs have been recently removed. High aesthetic, cultural, and educational value along trails.
Prairie	55.2	<ul style="list-style-type: none"> · Grassland (planted prairie) 	Iconic restored ecosystem forms the western gateway to the Preserve and has high educational and ecological value. Issues with invasive species and low plant diversity could be corrected with relatively straightforward management.
Savanna 1	17.9	<ul style="list-style-type: none"> · Grassland (planted prairie) 	Restoration plantings, including widely-spaced oaks, are well established and recognizable as a functioning oak savanna. Native plant diversity remains low but could be increased with management.
Priority 2			
Unit	Acreage	Communities	Description & Rationale
Forest 2	25.0	<ul style="list-style-type: none"> · Dry-Mesic Southern Forest · Inundated Shrub Swamp 	Relatively intact dry-mesic forest (trending towards dry southern forest on slopes north of Asylum Lake) with similar composition to Forest 1 except with some xeric species. Includes small inundated shrub swamp. Steep slopes and proximity to apartment buildings limits management options.
Savanna 2	17.5	<ul style="list-style-type: none"> · Grassland (old field) 	Unmanaged old field with some areas succeeding into young mixed oak forest. Highly visible from south entrance. High potential for restoration, but a comprehensive approach would take significant resources.
Wet Meadow / Emergent Marsh	11.6	<ul style="list-style-type: none"> · Southern Wet Meadow · Emergent Marsh 	Wetland fringing Asylum Lake dominated by cattail and containing several other invasive species. Likely holds a diverse native seedbank, but long-term restoration is unlikely to be successful without addressing nutrient inputs.
Wet Meadow/ Shrub-Carr	11.1	<ul style="list-style-type: none"> · Southern Wet Meadow · Southern Shrub-Carr 	Wetland fringing Little Asylum Lake dominated by cattail and containing several other invasive species. Likely holds a diverse native seedbank, but long-term restoration is unlikely to be successful without addressing nutrient inputs.
Priority 3			
Unit	Acreage	Communities	Description & Rationale
Asylum Lake	44.5	<ul style="list-style-type: none"> · Submergent Wetland · Aquatic 	High aesthetic and ecological value, but ability to manage is limited without addressing poor water quality inputs.
Little Asylum Lake	7.1	<ul style="list-style-type: none"> · Submergent Wetland · Aquatic 	High aesthetic and ecological value, but ability to manage is limited without addressing poor water quality inputs.

Management Goals

3.1 Defining Management Goals, Objectives, and Strategies

The goals identified in this section are broad statements that represent the property’s desired future conditions and provide the overall direction of management. Objectives (Section 4) are statements that specify what needs to be done to achieve these goals, how much needs to be done, when and where it needs to be done, in order to achieve the goals. Strategies (Section 5) provide more specificity by identifying the actions, tools, or techniques required to achieve the objectives, and who is responsible for completing the work.

Table 3: Defining Management Goals, Objectives, and Strategies

Term	Definition and Purpose
Goals	Broad statements describing desired future conditions. Goals provide the big-picture direction for management.
Objectives	Specific statements that identify benchmarks important for achieving the goals, based on relevant literature, professional experience, and best management practices. Objectives directly affect where, when, and how management is carried out (i.e., the strategies). Specific targets identified in the objectives allow managers to track management progress via the monitoring plan (Section 6).
Strategies	On-the-ground management actions, tools, or techniques required to meet the objectives.

3.2 Focal Features and Issues

Prior to widespread European colonization of southern Michigan in the early 1800s, the landscape now occupied by the Preserve and its surroundings was characterized by native grasslands, including treeless prairies and savannas with scattered clumps of oak trees.⁶⁴ Developed under a climate that is hotter and drier than today, and maintained under frequent fire ignited largely by Indigenous peoples, only an estimated 0.02% of these once-dominant ecosystems persist to this day.^{65,66} Remnant patches typically possess only a few representative species and the Asylum Lake Preserve is no exception. Large-diameter white, red, and black oak trees still capture the general aesthetic of historical oak savanna, but the decades of intensive human use during the “Hospital Period” (see section 2.2) has led to the extirpation of much, but not all, of the characteristic native biodiversity.⁶⁷ Across the Preserve, native communities have been starved for light, crowded out by invasive species, pressured by a profusion of deer, and threatened by low water quality. Many of these issues can be reversed or corrected with appropriate management. In nearly every case, ecosystem recovery is an ongoing process that plays out over a period of many years or decades, and must be done strategically and according to the best available science.

Across the Preserve, native communities have been starved for light, crowded out by invasive species, pressured by a profusion of deer, and threatened by low water quality.

The guiding principle for managing ecosystem integrity at the Preserve is to build from what remains and restore what has been lost, while looking ahead to ecosystem function in a climate-altered future.

Because of ecological stressors and limited management resources, it is not possible to restore all areas of the Preserve, at least in the timeframe of this plan. Choices need to be made on where to focus management efforts and with what level of resource input.

While promoting ecosystem integrity and natural aesthetics remain paramount, management goals for the Asylum Lake Preserve also include improving human use of this property for passive recreation, education and research. Promoting the positive perception of the property to community members will aid in the success of ecological management activities and help ensure the preservation of the property. This property provides an excellent opportunity for the integration of research and education through Western Michigan University and other educational bodies. The restoration projects have the potential

Accommodations for public access and other human uses should not be made at the expense of ecological integrity or natural aesthetics.

to become models for integrating and coordinating studies across educational disciplines and community members. In this way, Asylum Lake Preserve can be used as a teaching tool for all educational levels and community members in keeping with the ideals of the Declaration of Conservation Restrictions. It is important to note that accommodations for passive recreation, research, and education should not be made at the expense of ecological integrity or natural aesthetics.

The importance of maintaining and restoring ecosystem integrity as well as providing opportunities for education and passive recreation was emphasized in the original goals for the Preserve established by the Declaration of Conservation Restrictions in 2004 (see section 1.2), as well as the 2008 management plan. As a step-down plan from the 2004 Declaration and a revision of the 2008 plan, this management plan provides additional clarity and specificity while continuing to honor and adhere to previously established goals. This plan provides two updated goals for the Preserve: an ecological integrity goal and a community engagement goal.

3.3 Management Goals

Goal 1: Ecological Integrity

Restore and maintain an integrated network of regionally representative natural communities where the impacts of past land use, fire suppression, invasive species, and other threats are minimized, allowing healthy, biodiverse, and resilient ecosystems to thrive.

Goal 2: Community Engagement

Maintain a multi-use urban natural area that provides quality opportunities for environmental education, research, and passive recreation while protecting the integrity of the Preserve's natural features.

3. Management Objectives

4.1 Introduction

Best practices for management planning⁶⁸ recommend that where possible, objectives be developed according to SMART criteria (i.e., Specific, Measurable, Achievable, Result-oriented, and Time-fixed). Adhering to these criteria helps ensure the objectives provide clear, useable guidance for management as well as built-in accountability in terms of evaluating management progress. However, the degree to which SMART criteria are adhered to corresponds to the complexity of recommended management. More general objectives are appropriate for areas requiring only passive or low-intensity management, including some at Asylum Lake Preserve. Rationale statements provided for each objective summarize the scientific information, expert opinion, and/or professional judgment used to formulate each objective.

Four objectives, one for each main habitat type on the Preserve (forest, grassland, wetland, and aquatic), were developed under the ecological integrity goal. One objective was developed under the community engagement goal.

4.2 Ecological Integrity Objectives

The ecological integrity goal at Asylum Lake Preserve is to restore and maintain an integrated network of regionally representative natural communities where the impacts of past land use, fire suppression, invasive species,⁶⁹ overuse by human visitors, and other threats are minimized, allowing healthy, biodiverse, and resilient ecosystems to thrive. The following objectives were developed to guide progress towards that goal.

Forest Objective

Over the life of this plan:

In existing forested areas, restore and maintain a canopy dominated by oak species with an open understory and a diverse, dense herbaceous ground layer to provide habitat for a diversity of forest wildlife and support ecosystem function. Specifically, achieve an overall canopy cover of 60-80 percent with occasional canopy openings to allow sufficient light penetration to support herbaceous ground-layer vegetation (at least 50 percent cover) and a sparse subcanopy (10-30 percent cover) of oaks, hickories, and native shrubs. By 2033, reduce woody invasive species abundance to less than 1 percent cover and maintain herbaceous invasive species abundance at less than 5 percent cover, creating conditions for oaks to regenerate and other native vegetation to expand and persist.

In old field areas (i.e., subunit F7 in Forest 1), passively maintain conditions that allow natural succession to a diverse, healthy forest dominated by oaks and other native tree species. As resources allow, accelerate the transition to forest by removing exotic vegetation, conducting prescribed fire, planting trees, and/or reducing deer browse.

Rationale

The existing forests at Asylum Lake are dominated by a relatively mature canopy of white oak, interspersed with other oaks, hickories, and black cherry. There is very little regeneration of oaks or other trees in the understory, although some sapling-stage oak and black cherry occur in certain areas. Similarly,

the ground layer is very sparse overall, with only a few canopy gaps supporting fragments of oak savanna vegetation.

In large part, the lack of oak regeneration and ground layer vegetation are consequences of the dense canopy, which is currently around 80% cover. More light (i.e., a total canopy cover of 60-80%, consisting of large canopy gaps within a matrix of closed canopy forest) is necessary for seedlings of oak, hickory, and other shade-intolerant species to grow.⁷⁰ Subcanopy shading also limits oak regeneration and ground layer vegetation, but most of the understory of Forest 1 and Forest 2 have been cleared of invasive and mesophytic woody species over the past decade or so. Given the amount of canopy closure, mechanical thinning of canopy trees by selective girdling and/or cutting is likely necessary to let in sufficient light to achieve this target. Ultimately, a subcanopy with 20-30 percent cover and native vegetation covering at least 50 percent of the forest floor will indicate greater structural diversity, habitat quality, and ecosystem health within the forest.

Ecosystem function and biodiversity in the forested areas of the Preserve are limited by fire suppression and intensive deer browse. Oak forests are fire-dependent communities, and as such, are difficult to restore without the use of prescribed fire. The canopy and subcanopy closure that limits oak regeneration and ground layer vegetation is a direct response to fire suppression. Re-introducing fire to certain parts of the forest (e.g., portions of Forest 2 that abut residential areas) may be challenging given the urban setting and the complexity of property boundaries. Where its use is possible, regular fires in conjunction with mechanical thinning may be the most effective way to restore and sustain the forest's ecosystem integrity over the long-term. Similarly, programs to reduce deer numbers, while undoubtedly controversial, may be worth exploring as a way to increase the chances of successful restoration of forests on the Preserve. These restoration tools are included as strategies in Section 5.2.



Fire is an essential component of dry-mesic southern forests.

Much progress has been made in recent years to reduce invasive shrubs within existing forests on the Preserve, and this work should continue to reduce the ability of invasive species to limit the recovery and persistence of native vegetation. Reducing woody invasive species to less than 1 percent cover and herbaceous invasive species to less than 5 percent cover overall is likely achievable within the timeframe of this plan and will indicate that invasive species are a background component of the community, no longer posing an imminent threat to native vegetation or requiring intensive effort to control.

Subunit F7 of the Forest 1 Unit is an approximately 8-acre old field surrounded by forest. To increase connectivity and forest size and reduce habitat fragmentation on the Preserve, this area should eventually be returned to forested conditions. However, unlike the existing forest which has its structure and composition largely intact, active restoration of the old field would be a large and resource-intensive project. In the short term, limited management resources may be better spent elsewhere on the Preserve. Passive or low-intensity measures (including but not limited to prescribed fire) to allow native tree species

to establish and to keep invasive species at bay will keep this area in a holding pattern until resources can be secured for comprehensive restoration.

Notably, although the forests on the Preserve are currently best defined as dry-mesic southern forests, the end management goal – for the existing forests and the old field alike – is not necessarily to re-create pristine dry-mesic southern forests conditions. Rather, the focus is on restoring and maintaining healthy, naturally-regenerating, oak-dominated forests with high structural and species diversity (Figure 4). Since many species associated with oak ecosystems are expected to be “winners” in future climate scenarios, encouraging their regeneration and growth will be important for maintaining future resilience of the forest.⁷¹

The small inundated shrub swamp in the northeast corner of Forest 2 is treated as an inclusion within the surrounding forest. The shrub swamp requires no specific management at this time other than maintaining natural cover on the slopes above it to eliminate the potential for erosion and runoff. Runoff from Winchell Ave and hydrologic connectivity with wetlands offsite to the north may limit other management options.

Grassland Objective

Over the life of this plan, restore and maintain a complex of prairie and oak savanna habitats to support grassland-dependent wildlife and reflect historically representative communities. Maintain a total woody canopy cover of 10 – 20 percent across all grassland units as a whole. The woody component should be comprised primarily of oak, and be concentrated in the savanna units and directly adjacent to forest units to keep large, contiguous areas of prairie open for grassland birds while softening the transition between prairie and forest. Maintain invasive species abundance below 1% cover to limit their impact on native vegetation and ecosystem function. Increase herbaceous forb diversity to improve pollinator resources and aesthetics, achieving a floristic quality index value of 20 or greater by 2033. As resources allow, remove old field vegetation and plant appropriate native species to accelerate the transition of Savanna 2 to a functioning oak savanna composed of an increasing number of native prairie and savanna species.

Rationale

Grasslands are habitats where grasses and forbs represent a significant to dominant proportion of the plant biomass and diversity. In Michigan as across the Midwest and Great Plains, these habitats were historically represented by treeless prairies and savannas with a sparse canopy dominated by various oak species. Only a fraction of a percent of the original grassland in Michigan remains, making them a major priority for restoration across the region.⁷²

Only a fraction of a percent of the original grasslands in Michigan remain, making them a major priority for restoration across the region.

The existing native grasslands (i.e., Savanna 1 and Prairie units) at Asylum Lake Preserve are reconstructed communities that share characteristics of dry-mesic prairie, mesic prairie, oak openings, and related natural communities. Maintaining a healthy, functioning network of communities with a diversity of grasses, forbs, and some trees is the primary management goal in these areas, rather than achieving fidelity to any specific natural community type (Figure 4).

Together, the grassland units should have 10-20 percent canopy cover overall, reflecting the blend of prairie (typically less than 5% cover) and savanna communities (typically 5 – 60% cover) on the Preserve.⁷³ Large treeless areas are necessary for certain grassland-dependent birds, including the imperiled Henslow's sparrow and grasshopper sparrow, which have been observed utilizing grasslands on the property.^{74,75} Woody cover should be concentrated in Savanna 1 and Savanna 2 to maintain the variable structure and light conditions necessary to sustain the diversity of those systems. Any trees within the Prairie Unit should be concentrated along the edges of the Savanna 1, Savanna 2, and Forest 2 units to create a more diverse habitat gradient that functions and appears more natural than an abrupt line between grassland and forest. The woody canopy across all grassland units should be composed mostly of oak. Bur oak, white oak, and black oak are key components of savannas in the region and are especially well-adapted to frequent fires.

Thanks to recent management focused on the removal of woody invasive species including exotic crabapples, common buckthorn, and black locust, invasive species abundance is relatively low in most areas of grassland on the Preserve. Maintaining invasive species cover below 1 percent over the life of the plan will limit their ability to impact native vegetation.

Some areas of grassland, particularly in the Prairie 1 unit, are almost entirely dominated by big bluestem, and/or persistent exotic species including red clover, Kentucky bluegrass, and quackgrass. Native forb diversity is very low in these areas. Increasing the total FQI of the grasslands collectively to greater than 20 will increase ecosystem integrity, provide greater habitat resources for insects, birds, and other wildlife, and improve aesthetics for human visitors.

Like the old field section of Forest 1, the Savanna 2 unit is a highly degraded old field that has yet to undergo restoration. Comprehensive restoration of this area will undoubtedly be an expensive and time-consuming process requiring persistent action over a period of many years. Actively transitioning Savanna 2 into a healthy, diverse, and functioning oak savanna is not advised until adequate resources are secured. Until that time, passive or low-intensity measures to limit the impact of invasive species will help prepare Savanna 2 for future restoration.

Wetland Objective

Over the life of the plan, restore southern wet meadow, southern shrub-carr, and emergent marsh communities to benefit wetland biodiversity and ecosystem function. After excessive nutrient inputs are addressed (see Aquatic Objective), reduce cattail to less than 25 percent cover, phragmites to less than 1 percent cover, and all other invasive species to less than 5 percent cover overall. Maintain native wetland shrub cover below 35 percent. By 2033, increase the area of wet meadow such that tussock sedge, lake sedge, blue-joint grass, prairie cordgrass, and other native wetland graminoids collectively sum to at least 80 percent cover.

Rationale

Healthy southern wet meadows are exceptionally biodiverse natural communities, especially where they intermix with related systems like emergent marsh and southern shrub-carr, as they do at Asylum Lake Preserve. Their importance for supporting biodiversity, providing a rich transition between aquatic and terrestrial habitats, and playing a role in protecting water quality make them a priority for restoration.

In recent decades, much of the biological richness of the Preserve's wet meadows has been lost due to the spread of cattails (native, exotic, and hybrid) and other invasive species, particularly phragmites and purple loosestrife (*Lythrum salicaria*). The spread of these species has been greatly facilitated by warm, nutrient-rich stormwater runoff entering the Preserve. Unlike many native species, cattails and other invasive species have a disproportionate ability to take advantage of the high level of nutrients carried by stormwater, leading to their rapid expansion. Comprehensive management of these species – and the subsequent recovery of native vegetation – will likely not be successful (or in the very least be a frustrating and expensive venture) until excessive nutrient runoff is addressed in some fashion.

Once nutrient inputs have been mitigated to the extent possible, reducing cattail cover to less than 25 percent cover overall will provide the physical space and lack of competition for native vegetation to recover. Phragmites is highly invasive with the ability to rapidly form dense monoculture, so should be kept below 1% cover to reduce its threat to native vegetation. (Because of this, some treatment of phragmites is warranted even before nutrient issues are addressed). Phragmites has recently spread from the

The recovery of native wetland vegetation will likely not be successful until excessive nutrient runoff is addressed.

western extent of Asylum Lake to form satellite populations in the eastern extent. Eliminating these populations before they become firmly established is clearly warranted and strongly encouraged. Keeping other invasive species to below 5% cover will reduce their impact on native communities, while acknowledging the difficulty in managing species like purple loosestrife and reed canary grass (*Phalaris arundinacea*), which routinely co-exist with desirable native vegetation while reducing available space for those native species to grow.

Wetland seedbanks can remain viable for many years, as seeds of many species are adapted to stay dormant in oxygen-poor wetland soils until conditions are favorable for germination.⁷⁶ The displacement of many sedge-dominated portions of wet meadow with cattails has occurred on the Preserve only in the last couple of decades. As such, native wet meadow vegetation may recover spontaneously following the removal of invasive species. If native vegetation does not rebound within the first one or two growing seasons after invasive species removal, seeding may be needed to accelerate restoration. Planting should focus on native wetland sedges and grasses that form the matrix of wet meadow communities, ultimately achieving 80% cover of native graminoids across wetland units.

Southern wet meadows are open communities having less than 25 percent tree canopy cover and 50 percent shrub canopy cover.⁷⁷ Keeping the shrub component to less than 35 percent cover will ensure that the Preserve's wetlands remain open with sufficient sunlight to sustain matrix-forming sedges and grasses.

Aquatic Objective

Over the life of the plan, maintain healthy submergent wetland and aquatic communities to provide quality habitat for fish, herpetofauna, waterfowl, and other lacustrine wildlife, and support healthy emergent wetland communities adjacent to these systems. Maintain a dominance of native vegetation within the littoral zone. Reduce excessive sediment and nutrient inputs to the extent possible by implementing the planned stormwater treatment project along Drake Road. As resources allow,

research and implement other best management practices to limit the amount of sediment, phosphorus, chloride, and other pollutants entering the Preserve's waterways.

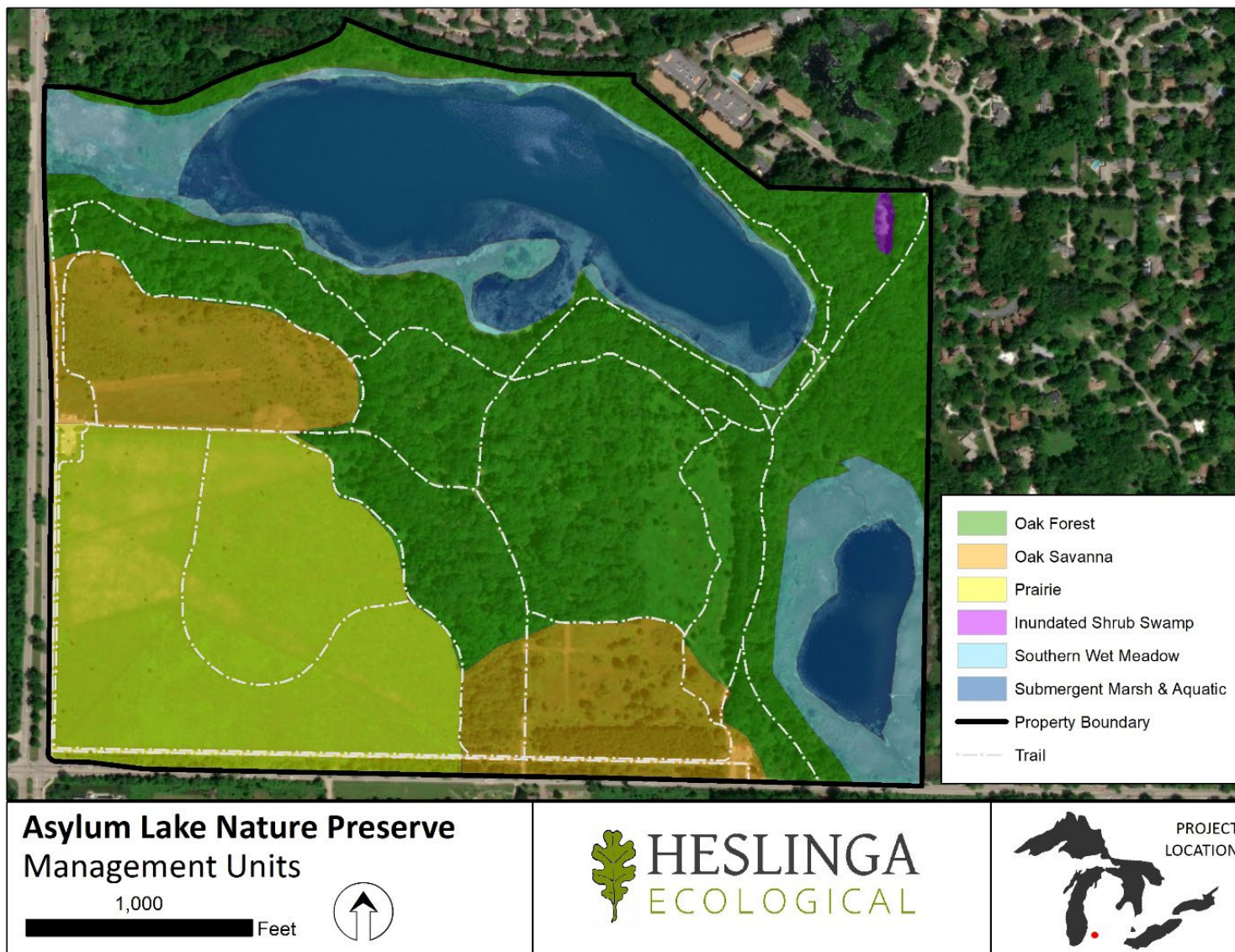
Rationale

By far the greatest impairment to ecosystem integrity in both lakes on the Preserve is the input of low-quality stormwater that carries with it excess nutrients (e.g., phosphorus) and pollutants (e.g., sodium chloride from road salts). Engineering for a mechanical treatment device and infiltration basin along the east side of Drake Road began in 2021. Construction of this system is expected to begin in 2023. This system will capture coarse sediments and help filter out excess nutrients and pollutants before the water enters Asylum Lake. This system will facilitate the recovery of ecosystem integrity in the lakes and surrounding wetlands on the Preserve. It will also provide an opportunity to identify effective means to mitigate sodium chloride pollution. ALPMC is grateful to the State of Michigan for providing initial funding for the project.

Notably, this objective contains no measurable benchmarks for water quality. This is because causing measurable decreases in certain pollutants, especially phosphorus, is largely outside of management control. Even though the treatment and infiltration project is expected to help, it is unlikely that there will be measurable changes to phosphorus for many years because it will take a very long time for the lake to flush out the huge amount of phosphorus in its sediments. Any decrease in phosphorus is not expected to be detectable over the life of this plan. Implementing other best management practices to reduce inputs of sediment and nutrients may accelerate the process of recovery.⁷⁸

Maintaining a predominance of native vegetation (i.e., greater than 50 percent of all vegetation) within the littoral zone will ensure that there is adequate habitat for fish and other aquatic organisms. Treatment may be warranted if invasive species such as Eurasian watermilfoil or curly-leaf pondweed begin to form large monocultures throughout the lakes. However, as in wetland areas, management of aquatic invasive species will likely not be effective over the long term unless nutrient inputs are adequately addressed.

Figure 4. Desired Future Conditions at Asylum Lake Preserve



4.3 Community Engagement Objective

The community engagement goal for Asylum Lake Preserve is to maintain a multi-use urban natural area that provides quality opportunities for environmental education, research, and passive recreation while protecting the integrity of the Preserve's natural features. The following objective was developed to guide progress towards that goal.

Community Engagement Objective

Over the life of the plan, maintain trails, parking areas, signs, and other infrastructure as necessary to facilitate education, research, and passive recreation while avoiding negative impacts to the Preserve's ecological integrity. As resources allow, better publicize preserve rules to reduce incompatible uses. By 2025, decommission or re-route problematic trails and evaluate the potential for a universally accessible trail route. Maintain regular contact with university faculty, students, and others to encourage the use of the Preserve for education, research, and stewardship.

Rationale

One of the purposes of establishing Asylum Lake Preserve was to provide opportunities for passive recreation, education, research, and enjoyment. Among other reasons for providing such access, exposure to the outdoors can have a significant impact on individual's mental and physical wellness, and on public health in the larger community. Located in an urban setting, the Preserve is a prime opportunity for WMU to exemplify one of its key stated goals – wellness. In all cases, actions to enhance public access must be balanced with the need to limit impacts to ecological integrity.

Maintaining trails, parking areas, signage, and other infrastructure to a reasonable standard is the minimum needed to allow safe access and basic enjoyment of the property by the public. Off-leash dogs and other activities that negatively impact natural areas and/or the safety or enjoyment of other visitors are occasionally problematic on the Preserve. Although some signage exists onsite, visitor guidelines are somewhat incomplete. Improving the visibility and completeness of posted rules at trailheads and at other key locations (including online) is a strong step towards reducing incompatible uses.

Some trails on the Preserve have been in existence for a long time and do not necessarily follow best practices for accessibility and sustainability. Inventorying problematic trail sections and taking corrective actions (e.g., closing, re-routing, or re-building) has occurred in recent years. Further actions will help protect sensitive natural features from erosion, trampling, and other unwanted impacts and will improve the visitor experience. Exploring options for making a portion of the trail system universally accessible will lay the groundwork for improving access for those with mobility limitations, including visitors who use wheelchairs or strollers. Taking these actions within the next few years (i.e., by 2025) reflects the ALPMC's commitment to providing sustainable, safe, and inclusive access to the Preserve. Ultimately, creating a more user-friendly and welcoming space will help promote the positive perception of the property to community members, aiding in the success of management activities and ensuring the long-term preservation of the property.

Given its connection to WMU, this property provides an excellent opportunity for the integration of research and education with the restoration of native ecosystems. Beyond ecology and restoration, the Preserve also provides opportunities for students and faculty to explore issues related to water quality, land use, recreation, geology, and archeology. Maintaining regular connections with university contacts

in various departments will ensure a pipeline of opportunities that enrich learning and provide positive outdoor experiences for students and faculty across academic disciplines.

4. Management Strategies

5.1 Introduction

This section outlines management strategies to address the goals and objectives identified in the previous sections. Management strategies identify the general techniques used to achieve management objectives. Details such as the specific tools, timing, and location by which strategies are implemented are referred to as *prescriptions*, and are generally not discussed in this plan. Prescriptions are affected by many factors, including seasonal variation, changes in habitat conditions, and shifts in organizational capacity. Therefore, the effectiveness of certain prescriptions towards achieving management objectives may change from year to year and are largely left to annual work planning.

The work outlined in this plan is intended to be feasible given the resources reasonably expected to be available to the ALPMC over the 10-year life of this plan. However, it is impossible to predict the full suite of management strategies that will be required over this period, particularly as ecological and organizational conditions change over time. While some strategies (e.g., prescribed fire, invasive species control) are likely essential regardless of any changes, other strategies may need to be amended or added to respond to shifts in conditions identified by implementing the monitoring plan (Section 6)

5.2 Ecological Integrity Strategies

Forest Strategies

The Forest objective is to, over the life of this plan:

In existing forested areas, restore and maintain a canopy dominated by oak species with an open understory and a diverse, dense herbaceous ground layer to provide habitat for a diversity of forest wildlife and support ecosystem function. Specifically, achieve an overall canopy cover of 60-80 percent with occasional canopy openings to allow sufficient light penetration to support herbaceous ground-layer vegetation (at least 50 percent cover) and a sparse subcanopy (10-30 percent cover) of oaks, hickories, and native shrubs. By 2033, reduce woody invasive species abundance to less than 1 percent cover and maintain herbaceous invasive species abundance at less than 5 percent cover, creating conditions for oaks to regenerate and other native vegetation to expand and persist.

In old field areas (i.e., subunit F7 in Forest 1), passively maintain conditions that allow natural succession to a diverse, healthy forest dominated by oaks and other native tree species. As resources allow, accelerate the transition to forest by removing exotic vegetation, conducting prescribed fire, planting trees, and/or reducing deer browse.

To achieve this objective, in order of priority,⁷⁹ the ALPMC will work with qualified contractors as needed to:

1. Continue the use of periodic prescribed fire in key portions of existing forested areas. If resources allow, conduct 3-4 such burns over the life of the plan, as multiple burns are often necessary to achieve results at the outset of restoration. Consider varying the seasonality of the burns, as burns conducted at different times of the year yield different management results. For example, early spring burns can stimulate native ground-layer vegetation and set back certain invasive species, while growing-season burns are more effective at reducing woody vegetation. The

seasonality of burns should always be considered when using prescribed fire to achieve specific management outcomes. Thus, well-used prescribed fire could make the next two strategies easier to implement.

2. Using appropriate mechanical and/or herbicide treatments, continue removing invasive species as necessary to bring their abundance to less than 1 percent cover. Prioritize the treatment of garlic mustard and other fast-spreading species, targeting smaller or incipient populations first before they become large infestations that are more difficult to remove.
3. Selectively girdle invasive trees (e.g., Norway maple) and less-desirable native trees (e.g., sugar maple, black cherry) to allow more light to reach the ground layer. Prioritize areas around existing canopy openings with some desirable ground-layer vegetation. Leave dead trees standing to provide wildlife habitat, except along trails where snags could present safety hazards.
4. If a canopy cover of 60-80% cannot be achieved by removing the above species, selectively girdle oaks to thin the canopy. Prioritize the removal of stressed, diseased, or otherwise low-quality individuals. Perform any cutting of oaks outside the growing season to reduce the potential for oak wilt infection.
5. By 2027, form a subcommittee or working group to explore the possibility of managing deer populations on the Preserve. Involve the Michigan Department of Natural Resources and local authorities as needed to ensure legal, logistical, and public relations concerns are adequately addressed. Coordinate efforts with the City of Kalamazoo, consistent with the draft Comprehensive Deer Management Program.⁸⁰ Take action according to recommendations generated by the group.
6. As resources allow, begin to actively transition old field areas (i.e., the east-central portion of Forest 1) to forest.
 - a. Remove non-native vegetation with combinations of herbicide, burning, and/or mowing.
 - b. Plant native herbaceous vegetation in place of what was removed. This serves as temporary groundcover until a tree canopy is established and forest conditions develop. As such, the precise seed mix is not critical, and can contain a variety of prairie, savanna, and woodland species.
 - c. Plant trees, selecting a diversity of native species that are site appropriate, have some resistance to deer browse and disease, and are expected to thrive in future climate scenarios. Protect young trees as necessary from deer browse and fire.

Grassland Strategies

The Grassland objective is to, over the life of this plan:

Restore and maintain a complex of prairie and oak savanna habitats to support grassland-dependent wildlife and reflect historically representative communities. Maintain a total woody canopy cover of 10 – 20 percent across all grassland units as a whole. The woody component should be comprised primarily of oak, and be concentrated in the savanna units and directly adjacent to forest units to keep large, contiguous areas of prairie open for grassland birds while softening the transition between prairie and forest. Maintain invasive species abundance below 1% cover to limit their impact on native

vegetation and ecosystem function. Increase herbaceous forb diversity to improve pollinator resources and aesthetics, achieving a floristic quality index value of 20 or greater by 2033. As resources allow, remove old field vegetation and plant appropriate native species to accelerate the transition of Savanna 2 to a functioning oak savanna composed of an increasing number of native prairie and savanna species.

To achieve this objective, in order of priority, the ALPMC will work with qualified contractors as needed to:

1. Continue conducting regular prescribed burns in the Prairie and Savanna 1 units. Aim for completing 2 -5 burns in each unit over the life of the plan and consider varying the seasonality of burns to achieve different fire effects. For example, dormant season burns stimulate growth of warm-season grasses, while summer burns tend to reduce grasses and woody vegetation and favor certain forbs. As needed to achieve a 10-20 percent canopy, protect young oaks from fire until they are large enough to withstand regular burning. When conducting grassland burns, burn through areas of adjacent forest to soften the lines between community types.
2. Using appropriate mechanical and/or herbicide treatments, remove invasive species as necessary to limit their impact on native vegetation. Prioritize the treatment of honeysuckle, black locust, and other woody invaders to maintain open grassland conditions.
3. In grass-heavy areas with limited forb diversity, strategically reduce grass abundance through combinations of herbicide treatments, growing-season burns, mowing, and/or disking. After treatment, overseed these areas with a diverse forb mix to improve aesthetics, pollinator resources, and mean coefficient of conservatism (e.g., Floristic Quality Index).
4. As resources allow, begin active restoration in Savanna 2 to transition it to a functioning oak savanna dominated by native species.
 - a. Remove non-native vegetation and native mesophytic tree species (e.g., maple and black cherry) with combinations of herbicide, burning, and/or mowing, and selectively girdle or cut undesirable trees to thin the existing canopy.
 - b. Plant native prairie and savanna vegetation in place of what was removed.
 - c. If warranted depending on canopy conditions, plant bur oak, black oak, and other trees, selecting a diversity of native species that are site appropriate, fire-tolerant, have some resistance to deer browse and disease, and are expected to thrive in future climate scenarios. Protect young trees as necessary from deer browse and fire.
 - d. Thin the young monoculture of black oak along the southern margin of Savanna 2 while instituting the recommendations in 4a-c.

Wetland Strategies

The Wetland objective is to, over the life of this plan:

Over the life of the plan, restore southern wet meadow, southern shrub-carr, and emergent marsh communities to benefit wetland biodiversity and ecosystem function. After excessive nutrient inputs are addressed (see Aquatic Objective), reduce cattail to less than 25 percent cover, phragmites to less than 1 percent cover, and all other invasive species to less than 5 percent cover overall. Maintain

native wetland shrub cover below 35 percent. By 2033, increase the area of wet meadow such that tussock sedge, lake sedge, blue-joint grass, prairie cordgrass, and other native wetland graminoids collectively sum to at least 80 percent cover.

To achieve this objective, in order of priority, the ALPMC will work with qualified contractors as needed to:

1. Complete the stormwater treatment project on the west side of the property to reduce nutrient and pollutant levels in the lakes and surrounding wetlands.
2. Once steps have been taken to mitigate excess nutrient inputs, use appropriate herbicide treatments to reduce cattail dominance and the abundance of other invasive species. Small or incipient patches of phragmites or other highly-aggressive species should be targeted prior to or during the completion of the stormwater treatment project to prevent them from becoming a major problem in the short term.
3. Following invasive species treatment, in areas with wet meadow vegetation (either aboveground or in the seedbank), perform a prescribed burn to remove dead biomass, reduce shrubs, and spur the growth of native wet meadow species. Repeat prescribed burns as needed to encourage the recovery and expansion of these species consistent with management targets.
4. Depending on the effectiveness of fire at reducing the shrub component, use appropriate mechanical and herbicide treatments to selectively thin shrubs to below 35 percent cover.
5. If the wet meadow community is slow to recover following the above actions (i.e., little seedbank response within 1 - 2 growing seasons following treatment), seed key areas with a diverse mix of native wetland species to accelerate the re-establishment wet meadow vegetation, including a diversity of both forbs (wildflowers) and graminoids (grasses, sedges, and rushes).

Aquatic Strategies

The Aquatic objective is to, over the life of the plan:

Over the life of the plan, maintain healthy submergent wetland and aquatic communities to provide quality habitat for fish, herpetofauna, waterfowl, and other lacustrine wildlife, and support healthy emergent wetland communities adjacent to these systems. Maintain a dominance of native vegetation within the littoral zone. Reduce excessive sediment and nutrient inputs to the extent possible by implementing the planned stormwater treatment project along Drake Road. As resources allow, research and implement other best management practices to limit the amount of sediment, phosphorus, chloride, and other pollutants entering the Preserve's waterways.

To achieve this objective, in order of priority, the ALPMC will work with qualified contractors, academic partners, or others as needed to:

1. Complete the stormwater treatment project on the north shore of Asylum Lake to reduce nutrient and pollutant levels in the lakes and surrounding wetlands.
2. If exotic invasive vegetation (e.g., Eurasian watermilfoil, curly-leaf pondweed) exceeds the abundance of native vegetation in the littoral zone, perform appropriate mechanical and/or chemical treatments to reduce invasive species abundance relative to native species abundance.

3. As opportunities arise, research and implement best management practices to reduce excess sediment and nutrient inputs. BMPs may include, but are not limited to, repairing eroding trails, implementing measures to better control dog feces, and working with neighboring landowners to reduce stormwater runoff.
4. As needed, maintain the Beaver Deceiver and install cages around specimen trees to allow beavers to persist on the Preserve while minimizing conflicts with other uses or values.

4.3 Community Engagement Strategies

The Community Engagement objective is to, over the life of the plan:

Over the life of the plan, maintain trails, parking areas, signs, and other infrastructure as necessary to facilitate education, research, and passive recreation while avoiding negative impacts to natural features. As soon as resources allow, better publicize preserve rules to reduce incompatible uses. By 2025, decommission or re-route problematic trails and evaluate the potential for a universally accessible trail route. Maintain regular contact with university faculty, students, and others to encourage the use of the Preserve for education, research, and stewardship.

To achieve this objective, in order of priority, the ALPMC will work with others as needed to:

1. Continue maintaining existing trails, parking areas, and other infrastructure to ensure safe public access and a positive visitor experience. This may be a good task for community volunteers to help with.
2. As needed, update or replace entrance signs to include changes to preserve policies, such as closed trails. Post guidelines using positive and welcoming language. Consider posting preserve guidelines on the Preserve's website as well. Interpretive signs or other information about the Preserve's natural features, ecology and/or restoration could be included onsite and/or online to further educational goals.
3. By 2025, decommission, reroute, or rebuild trails as necessary to correct problems identified in the recent trail assessment. Periodically update the assessment as needed and take action accordingly.
4. By 2025, evaluate the feasibility of constructing a loop trail that allows meaningful access to nature for people with mobility limitations. Consider need, routing, integration with natural features and other trails, and the costs of both construction and long-term maintenance. Take action accordingly.
5. By 2027, explore the possibility of creating a "Friends of Asylum Lake Preserve" group to conduct self-directed cleanup and restoration efforts consistent with this plan.
6. Communicate regularly with faculty and students from WMU, Kalamazoo College, and/or other local institutions to promote the use of the Preserve for research and education.
7. As resources allow, to benefit wildlife and enhance the visitor experience, explore options for reducing noise, visual, and light pollution on the Preserve. This may include, but is not limited to, planting green screens of native conifers along the west and south boundaries, and pursuing inclusion in the Dark Sky Association. Any actions to mitigate noise, visual, and light pollution

should take into consideration other potential impacts to ecological integrity (e.g., impact of trees on habitat suitability for grassland birds).

6. Monitoring Plan

6.1 Introduction

Regular monitoring is an important part of natural areas stewardship. Ongoing evaluation of management outcomes allows land managers to identify and alter ineffective strategies or adapt to changing conditions on the ground. Monitoring also helps identify potential problems and track changes over time.

The monitoring protocols in this plan are designed to track progress towards the objectives identified in Section 4. They are also designed to balance the need for useful, accurate data with the need for efficient use of limited time and financial resources. Most monitoring protocols in this plan can be done quickly and easily by individuals with limited training, while a few (e.g., floristic quality assessments and water quality monitoring) require higher levels of expertise to implement.

As with all long-term monitoring, it is important to maintain consistency in survey methodology (and preferably, personnel) from year to year so that error can be minimized and temporal changes in site conditions can be identified with a reasonably high degree of confidence. Although others may be recruited to help with monitoring, it is ultimately the responsibility of the ALPMC to make sure monitoring is conducted on time and to an acceptable standard.

The monitoring plan for Asylum Lake Preserve contains two sections: 1) monitoring the progress toward achieving management objectives, and 2) ongoing, informal monitoring.

6.2 Management Objectives Monitoring

Monitoring progress towards achieving management objectives is central to effective natural areas stewardship. The monitoring protocols in this section were developed to evaluate the specific benchmarks contained in each objective.

Ecological Integrity

Vegetation metrics are not expected to change dramatically from year to year, so biennial monitoring (i.e., once every two years) of vegetation abundance is likely sufficient to evaluate progress toward meeting the Preserve's ecological integrity objectives. For Protocol 1 (see below), monitoring personnel may be ALPMC members, community volunteers, qualified contractors, or others who are able to identify common native and invasive species and have a basic understanding of how to estimate percent cover of vegetation. For this monitoring, personnel do not need extensive botanical or scientific expertise to conduct the surveys. Because visually estimating percent cover metrics is somewhat subjective and estimates can vary among surveyors, ideally, two or more surveyors should perform the monitoring each time. Multiple surveyors can work together or independently. In either case, an average of the surveyor's estimates should be used as the reported number. Protocols 2 and 3 (see below) likely require outside consultants or contractors with specialized experience in field botany and water quality, respectively.

Protocols

1. Every other year beginning in 2023, between July 1 and September 30, walk through each management unit and gather the following data (for consistency with previous efforts, use plots surveyed in Bassett and Knoll 2009 and Slaughter 2022:

Forest 2 and currently forested areas of Forest 1 (i.e., all but subunit F7)

Visually estimate the percent cover⁸¹ of the following vegetation metrics in at least 10 representative locations within the unit, using the average as the final value:

- Canopy cover.⁸² Also record dominant canopy species.
- Subcanopy cover.⁸³ Also record dominant subcanopy species.
- Ground-layer vegetation cover⁸⁴
- Woody invasive species cover⁸⁵
- Herbaceous invasive species cover

Non-forested area of Forest 1 (i.e., subunit F7)

No monitoring is necessary beyond informal monitoring (see Section 6.3 below).

Prairie, Savanna 1, and Savanna 2

- Shrub and tree cover.⁸⁶ Also record dominant shrub and tree species.
- Invasive species cover

Wet Meadow/Emergent Marsh and Wet Meadow/Shrub-Carr

- Cattail cover
- Phragmites cover
- Other invasive species cover
- Shrub cover
- Total cover of native wetland graminoids (grasses and sedges). Also record dominant graminoid species.

Asylum Lake and Little Asylum Lake (littoral zone only)

- Native vegetation cover and exotic vegetation cover⁸⁷

2. In 2033, conduct a floristic quality assessment of all grassland units. A minimum of three visits during the growing season (early season, mid-season, late-season) should be conducted to capture species with different phenologies.

Community Engagement

No specific monitoring is necessary beyond informal monitoring and internal reviews (see Section 6.3 below).

6.3 Informal Monitoring

Informal monitoring is done on an ongoing, opportunistic basis, and is not necessarily tied to specific management objectives. Informal monitoring simply involves making observations of general site conditions that may be relevant to management, but fall outside of the objectives monitoring protocols above. These observations – which may include notable plants or wildlife, new invasive species populations, forest pests, safety issues, public use, changing ecological conditions, and the like – may be done at any time of the season, by anyone with a basic understanding of the property’s natural features and their management. The key is to note and record relevant observations (perhaps by reporting them to a monitoring point person such as a WMU natural areas manager or sub-committee of the ALPMC) so they can be incorporated into future management as appropriate. An example monitoring form, used to standardize and report such observations, is provided in the appendix.

Photo monitoring is a type of informal monitoring that could be useful at Asylum Lake Preserve to create a visual record of changing conditions over time. Photo monitoring involves establishing set points on the landscape from which photos are periodically taken, usually in areas expected to change dramatically in response to stewardship work. Photo points can be marked digitally (i.e., as GPS points) or discreetly in the field so ALPMC personnel can locate them and take photos as needed. Alternatively, photo points can be marked in the field in a way that invites community members to participate in the monitoring process. Signs can be installed at photo points with instructions for the public on how to take monitoring photos and email or post them to a social media account maintained by ALPMC. In either case, comparing photos over several years will create a visual time lapse of ecosystem recovery, useful both internally to inform future management and externally to help promote stewardship work on the property.

6.4 Evaluation and Reporting

Annually, before the end of the year, a qualified person identified by the ALPMC will prepare a brief internal memo summarizing monitoring results from the previous season. In the memo, directly address progress towards meeting management objectives, and suggest any changes to management strategies according to monitoring results. Share progress, setbacks, highlights, and recommendations with the ALPMC and other stakeholders as needed. Use these annual summaries as a basis to plan work for the upcoming year.

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- ⁷⁵ eBird.org web application. Data from "Asylum Lake Preserve" hotspot. Accessed March 21, 2022. Available online: <https://ebird.org/hotspots>.
- ⁷⁶ VanDerValk, A.G., Pederson, R.L. and C.B. Davis. 1992. Restoration and creation of freshwater wetlands using seed banks. *Wetlands Ecology and management* 1: 191-197.
- ⁷⁷ Cohen, J.G., Kost, M.A., Slaughter, B.S. and D.A. Albert. 2014. A field guide to the natural communities of Michigan. Michigan State University Press, East Lansing.
- ⁷⁸ Steve Kohler, personal communication.
- ⁷⁹ In this context, "in order of priority" means that strategies are listed in general order of their importance or effectiveness towards achieving management objectives. In some cases, this prioritization also reflects the need for some strategies to be implemented before others (e.g., site preparation prior to planting). In reality, the order in which strategies are implemented should be reviewed often and adjusted as needed by land managers based on specific site conditions, management needs, and available resources.
- ⁸⁰ No Author. 2022. Addressing the urban deer population in Kalamazoo. Neighborhood Association Ad Hoc Committee: Comprehensive Deer Management Program – Report and Recommendations. Submitted to the Kalamazoo City Commission on February 1, 2022. Available at: https://www.kalamazoo.org/files/assets/public/plans-and-reports/2022.02.01_deer-mgt-report_neigh.assn-ad-hoc-cmte_final.pdf
- ⁸¹ In this plan, percent cover should be estimated within imaginary plots defined as a circle of a certain radius (e.g., 10m) around the observer. Plot boundaries can be estimated by the observer and need not be measured precisely. At least 10 such plots, located in representative areas of the management unit chosen by the observer, should be evaluated, and the average percent cover should be used as the reported value.
- ⁸² Canopy includes all woody vegetation greater than 10m tall.
- ⁸³ Subcanopy includes all woody vegetation between 1m and 10m tall.
- ⁸⁴ Includes all vegetation less than 1m tall, as contrasted with leaf litter or bare ground.
- ⁸⁵ By way of reminder, in this plan, invasive species are defined as aggressive exotic plant species that have the ability to expand rapidly and displace native vegetation in intact natural areas (e.g., garlic mustard, honeysuckle, phragmites). Invasive species do not include naturalized exotic plant species that may persist but do not generally limit ecosystem function in established natural areas (e.g., most escaped ornamental trees and exotic cool-season grasses).
- ⁸⁶ Include all woody vegetation greater than 1m tall.
- ⁸⁷ Used to determine dominance of native vegetation.

Appendix:

Example Monitoring Form

General Preserve Monitoring Form

Preserve:

Reported by:

Monitoring Period: ☐ Winter ☐ Spring ☐ Summer ☐ Fall

Date of monitoring visit:

Date report submitted:

1. Potential Violations

I observed (or saw evidence of):

Yes No

- ☐ ☐ Vandalism
- ☐ ☐ Dumping/excessive litter
- ☐ ☐ Boundary encroachment
- ☐ ☐ Motor vehicle use
- ☐ ☐ Biking or riding horses
- ☐ ☐ Off-leash pets
- ☐ ☐ Camping or fires
- ☐ ☐ Hunting/fishing/trapping
- ☐ ☐ Other potential violation (specify)

Comments:

2. Trails, Signs, and Infrastructure

Yes No

- ☐ ☐ Trails well-marked and easy to follow
- ☐ ☐ Trails free of major obstructions
- ☐ ☐ Boundaries well-marked and easy to follow
- ☐ ☐ Preserve sign in good condition
- ☐ ☐ Other signs (rules, interpretive) in good condition
- ☐ ☐ Other infrastructure (boardwalks, etc.) in good condition

Comments:

3. Natural Features

I observed (or saw evidence of):

Yes No

- ☐ ☐ New invasive species population
- ☐ ☐ Significant change in known invasive species population
- ☐ ☐ New threatened/endangered/special concern species
- ☐ ☐ Significant change in known T/E/SC population
- ☐ ☐ Other notable (non-T/E/SC) flora or fauna
- ☐ ☐ Erosion or water quality issues
- ☐ ☐ Other

Comments:

4. Additional questions

- Does anything you observed require immediate attention to address?
- What work, if any, have you done on the preserve since your last report (e.g., trail maintenance, invasive species removal, etc.)?
- Do you have any specific recommendations for management of the preserve?
- Provide any additional comments below: