

Natural Features Inventory and Management Recommendations for Indian Springs, Lower Huron, and Willow Metroparks



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Cover photos: Alan Tepley, MNFI Ecologist, in a wet-mesic prairie at Indian Springs Metropark with grass-of-Parnassus (*Parnassia glauca*), shrubby cinquefoil (*Potentilla fruticosa*), fringed gentian (*Gentianopsis crinita*) (inset left), and bottle gentian (*Gentiana andrewsii*) (inset right).

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Introduction

During the summer of 2003 Michigan Natural Features Inventory (MNFI) conducted surveys for exemplary natural communities and rare plants in three Huron-Clinton Metroparks, Lower Huron, Willow, and Indian Springs. In addition, surveys were conducted to evaluate management needs on lands considered to have good potential for supporting high quality natural communities with active land management and restoration. This report summarizes the findings of MNFI's surveys and evaluations of Lower Huron, Willow, and Indian Springs Metroparks.

This work is part of a larger, ongoing effort to identify ecologically significant areas within each Huron-Clinton metropark. In previous years, MNFI has documented numerous high quality sites and rare species and suggested management recommendations aimed at protecting and enhancing native biodiversity at 6 metroparks including Delhi, Dexter-Huron, Hudson Mills, Kensington, Oak Woods, and Stony Creek (Kost and Choberka 2002, Kost and O'Connor 2003).

Landscape Context

Regional landscape ecosystems of Michigan have been classified and mapped at three hierarchical levels (section, subsection, and sub-subsection) based on an integration of climate, physiography (topographic form and geologic parent material), soil, and natural vegetation (Albert 1995). The regional classification provides a framework for understanding broad patterns of natural community and species occurrences and natural disturbance regimes across the state, which is useful in integrated resource management and planning, as well as for biological conservation. The classification is hierarchically structured with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections.

All of the Huron-Clinton Metroparks occur within the Washtenaw Subsection (VI.1) of southern Lower Michigan (Figure 1) (Albert 1995). The Washtenaw Subsection contains three sub-subsections that differ from each other in their soils, glacial landforms, climate, and vegetation. Indian Springs Metropark occurs within the Jackson Interlobate Sub-subsection (VI.1.3), and Lower Huron and Willow Metroparks occur on the

Maumee Lake Plain Sub-subsection (VI.1.1) (Albert 1995). The local landforms found within each metropark reflect those typical of their regional landscape ecosystems and respective sub-subsections.

The Jackson Interlobate Sub-subsection contains broad expanses of glacial outwash sands that surround sandy and gravelly end moraines and ground moraines (Albert 1995). The soils on the moraines are typically well drained or excessively well drained and in the 1800s supported drought-tolerant, fire-dependent natural communities such as oak barrens, oak savanna, oak forest, and hillside prairie. The outwash soils vary from excessively well drained sands, which once supported oak barrens, oak forests, woodland prairies, and dry sand prairies, to poorly drained organic deposits that supported a variety of open and forested wetland types. Wetlands communities typically found within the Jackson Interlobate Sub-subsection include open types such as sedge meadow, prairie fen, wet-mesic prairie, and emergent marsh. Forested wetlands in this sub-subsection may include relict conifer swamp, poor conifer swamp, southern swamp, southern floodplain forest, and shrub-carr.

Indian Springs Metropark is located within the Jackson Sub-subsection, along the headwaters of the Huron River in northwestern Oakland County. A large outwash plain covers all but the far western and southeastern portions of the metropark, which are located on coarse-textured end moraines (Figure 2). Groundwater seepage at the base of the end moraine in the southwestern portion of the metropark supports a diverse wetland complex along the upper reaches of the Huron River.

Lower Huron and Willow also occur along the Huron River, however, the glacial landforms at these metroparks are very different from those at Indian Springs (Figures 3 and 4). Lower Huron and Willow occur within the Maumee Lake Plain Sub-subsection, which is comprised of a flat, clay lake plain, dissected by broad glacial drainageways of sandy soil (Albert 1995). Within the glacial drainageways, beach ridges and small sand dunes are common. Clay soils of the lake plain are generally wet with low permeability and poor drainage. In the past, these poorly drained soils supported broad expanses of lowland hardwood

forest. In contrast, the soils on the upland beach ridges and dunes of the sandy glacial drainageways are excessively drained and once supported extensive bur oak and white oak savannas. The sandy glacial drainageways also supported vast wet prairies and marshes, which commonly occurred in depressions on poorly to very poorly drained soils (Comer et al. 1993). Most of Lower Huron occurs on lacustrine clay and silt, with only small areas of the metropark occurring on lacustrine sand and gravel (Figure 3). At Willow, the north and southeastern portions of the metropark lie on broad, relatively level areas of lacustrine sand and gravel, while the central and southwestern portions occur on lacustrine clay and silt (Figure 4). Small beach ridges and other local topographical variations in landforms occur within the both metroparks, but are too small to be mapped. The Huron River flows through both Lower Huron and Willow on its journey to Lake Erie through the flat lake plain.

Vegetation circa 1800

By interpreting the General Land Office survey notes for Michigan recorded during the period of 1818-1856, MNFI ecologists were able to piece together a relatively accurate picture of the state's vegetation in the early 1800s (Comer et al. 1995). A digital map of vegetation encountered by the land surveyors during this period reveals that Indian Springs Metropark supported several different natural communities including black oak barrens, mixed hardwood swamp, and mixed conifer swamp (Figure 5). Indian Springs Metropark occurs within an immense matrix of black oak barrens. The open conditions of oak barrens were maintained by frequent fires that resulted from both human activities and lightning strikes. In the southeastern portion of the metropark the surveyors from the General Land Office (GLO) referred to the area as "barren land" because of the paucity of trees other than widely spaced black oak (*Quercus velutina*) and white oak (*Quercus alba*). A large mixed hardwood swamp was noted in the same location where the Huron Swamp occurs today. Species noted from this area by the GLO surveyors included American elm (*Ulmus americana*), basswood (*Tilia americana*), ash (*Fraxinus* spp.), American beech (*Fagus grandifolia*), and maple (*Acer* spp.). North of the hardwood swamp in the northeastern portion of the metropark near Timberland Lake the surveyors encountered tamarack (*Larix laricina*).

Thus, this area has been mapped as mixed conifer swamp (Figure 5).

The digital map of vegetation *circa* 1800 for Lower Huron depicts the park as primarily forested (Figure 6). In the early 1800s a vast mixed hardwood swamp, which covered over 13,000 acres stretched into the northwest portion of the metropark until it met the Huron River. The original surveyors from General Land Office referred to this area as "swamp land" and recorded the following species in the general area: American elm, American beech, maple, basswood, aspen (*Populus* spp.), red oak (*Quercus rubra*), white oak, and spice bush (*Lindera benzoin*). Directly across the river, in the northeastern portion of the metropark a slightly drier forest (e.g., mesic) comprised of many of the same species occurred on better drained, sandy soils. Bordering the beech-sugar maple-dominated mesic forest to the east and south the GLO surveyors noted a very large area as "dry barrens" and recorded widely spaced black oak and white oak. This lakeplain oak opening, which is labeled black oak barren on Figure 6, occurred on sandy soil and only extended into a small portion of today's Lower Huron Metropark near the Tuliptree Picnic Area. In the central portion of the metropark, several types of forest were noted including beech-maple forest and an oak-dominated forest (Figure 6). In the area near the far southern portions of the metropark, surveyors made note of the wet, low conditions of the land and recorded species commonly associated with mixed hardwood swamp such as American elm, basswood, ash, and maple. This hardwood swamp occupied nearly 10,000 acres, encompassing portions Willow Metropark to the southeast. Located near the Huron River, just south of the metropark boundary, the surveyors noted an "Indian town", which was likely comprised of members of the Huron nation, known locally as the Wyandot Indians.

Willow is located south of Lower Huron Metropark along the Huron River. In the 1800s, the area supported two different types of forest. An extensive mixed hardwood swamp, which extended into Lower Huron Metropark and stretched for nearly 10,000 acres, occurred in the western and central portions of Willow. In the area shown as beech-maple forest in Figure 7, the GLO surveyors noted the "rich soil" and "good land", and referred to the area as "well timbered". On the lake plain, these mesic forests typically contained a diverse

mix of tree species and in some places, like Willow and Oakwoods Metropark to the east, were dominated by species other than American beech and sugar maple (*Acer saccharum*). A close look at the original notes of GLO surveyors reveals that the area was predominately forested with white oak, basswood, American elm, black oak, and species of ash and hickory (*Carya* spp.). The presence of black oak and white oak, which require open conditions for establishment and early growth, indicate that in the past some portions of this area likely supported fire-dependent, lakeplain oak openings (e.g., oak savanna). Indeed, a vast (39,102 acres or 15,824 ha) wet prairie bordered this forest to the east and fires associated with the prairie were likely to have been a frequent form of natural disturbance for some portions of the forest.

Present Land Cover

The 1995 Land Cover maps (Figures 8, 9 and 10) were produced by using the Southeast Michigan Council of Governments (SEMCOG) 1995 land cover data set. The accuracy of land cover types within each metropark was further enhanced through photo interpretation and ground truthing.

Comparisons between *circa* 1800s vegetation and present land cover reveal drastic changes across the landscape (Figures 8 - 10). As stated above, Indian Springs Metropark occurs within a landscape that was dominated by oak barrens in the 1800s. Vegetation cover at that time would have consisted of widely scattered black oak and white oak with prairie grasses and forbs forming the ground flora. Today, these areas support abandoned agricultural fields (e.g., old fields) and recreation areas (golf course, picnic areas, etc.), or have been replaced by residential or commercial development. In some locations like the southeast portion of the Indian Springs, the old fields continue to harbor majestic white oaks that date back to the 1800s.

Changes within the wetlands at Indian Springs are less apparent. Much of the area that was originally occupied by mixed hardwood swamp continues to support a forest canopy today. This area, which is known as the Huron Swamp, has undergone several episodes of logging but tree cover has returned. Although the area is shown in Figure 8 to be a solid block of hardwood swamp, it is actually a heterogeneous mixture of low sandy rises covered with mesic southern forest, and shallow depressions supporting a wide variety of

wetlands, including sedge meadow, emergent marsh, forested vernal pools, hardwood swamp, and conifer swamp. While the changes between *circa* 1800s and 1995 land cover do not appear to be quite as significant for the Huron Swamp, other portions of Indian Springs have undergone considerable alteration.

Much of the mixed conifer swamp at Indian Springs has converted to lowland hardwoods (e.g., hardwood swamp), emergent marsh, or shrub-carr (Figures 5 and 8). In the 1800s, the mixed conifer swamps in this area were typically dominated by tamarack, which was harvested for use as lumber and fence posts. Later, tamarack was also harvested for use as wheel spokes by the early automotive industry. The conversion of tamarack-dominated wetlands to other wetland types has also been facilitated by periodic outbreaks of the larch sawfly and fire suppression (see community abstract on relict conifer swamp at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>). Small areas of tamarack remain at Indian Springs near Timberland Lake and within a small depression in the southeast portion of the metropark near the Doppler radar tower.

At Lower Huron and Willow, changes in land cover between the 1800s and today are characterized by large reductions in forest cover and an increase in open herbaceous lands, which include old fields and lands for recreation areas. Where once much of the surrounding landscape supported forest, prairie, and lakeplain oak openings, cropland and residential and commercial developments now stand. Small blocks of forest remain along the floodplain of the Huron River at both Lower Huron and Willow. In addition, small areas of forest also remain at Lower Huron near the Fox Woods Picnic Area and along the Bob White Trail. Cutoff from the Huron River corridor, several isolated patches of forest remain at Willow including west of the sledding parking area, north of the parking lots for the Pool-Activity Area, and south of the Elder Creek Picnic Area.

Southeast Michigan is experiencing rapid urbanization accompanied by a loss of natural habitats. With the continued loss of wildlife habitat throughout the region, protecting and stewarding the remaining natural areas within Huron-Clinton metroparks becomes increasingly important to the long-term protection of biodiversity in southeast Michigan.

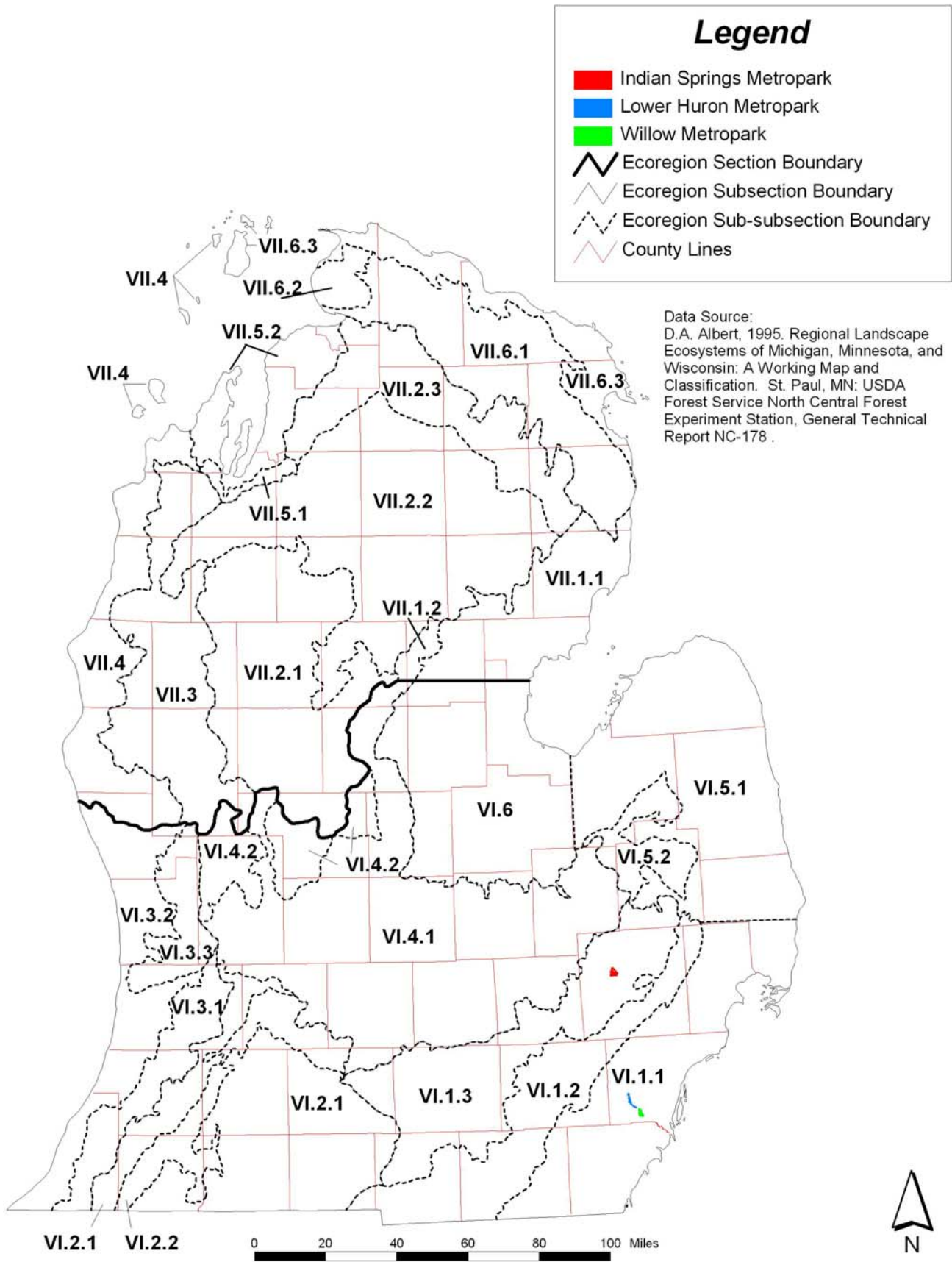


Figure 1. Ecoregions of Lower Michigan.

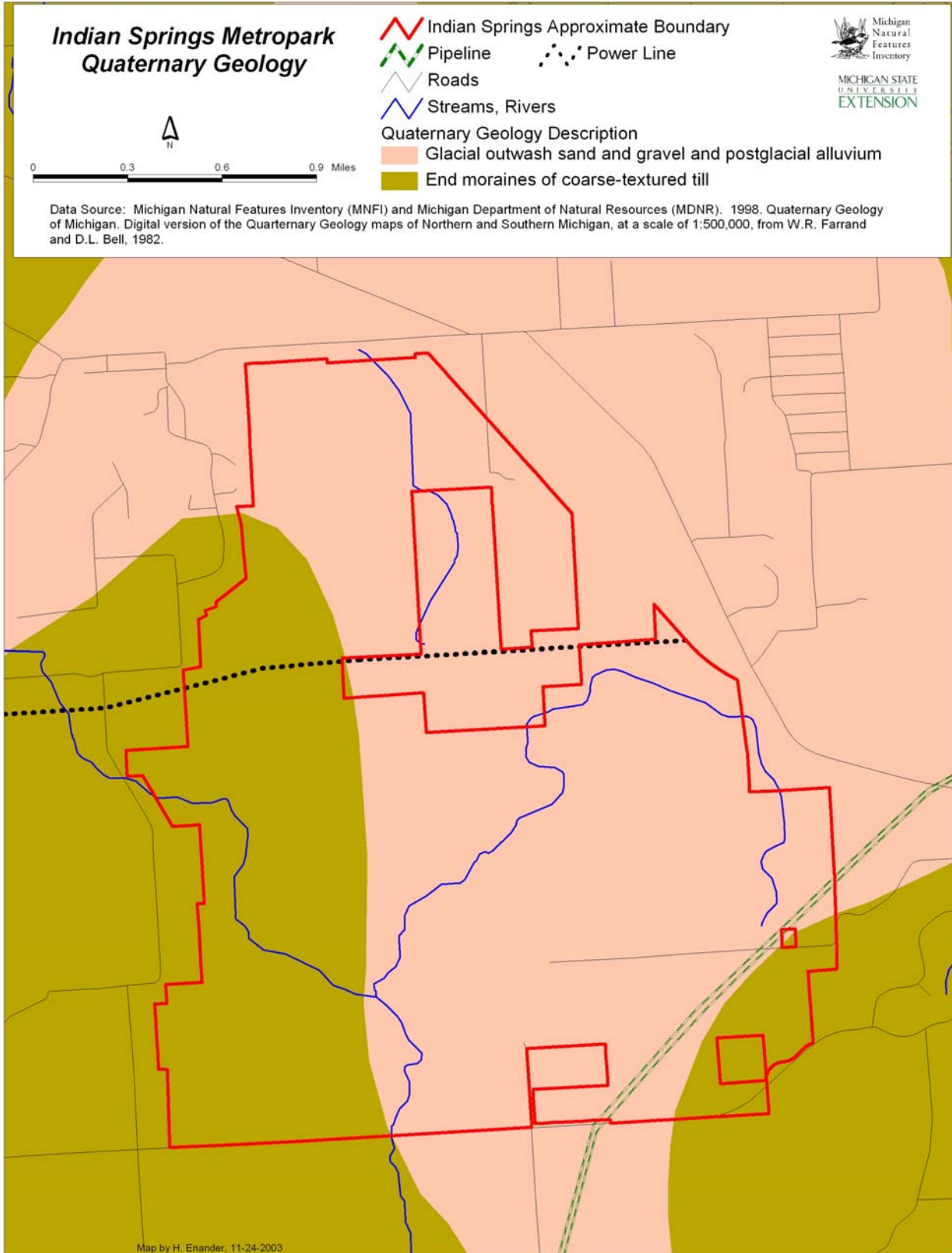


Figure 2. Surface Geology of Indian Springs Metropark.

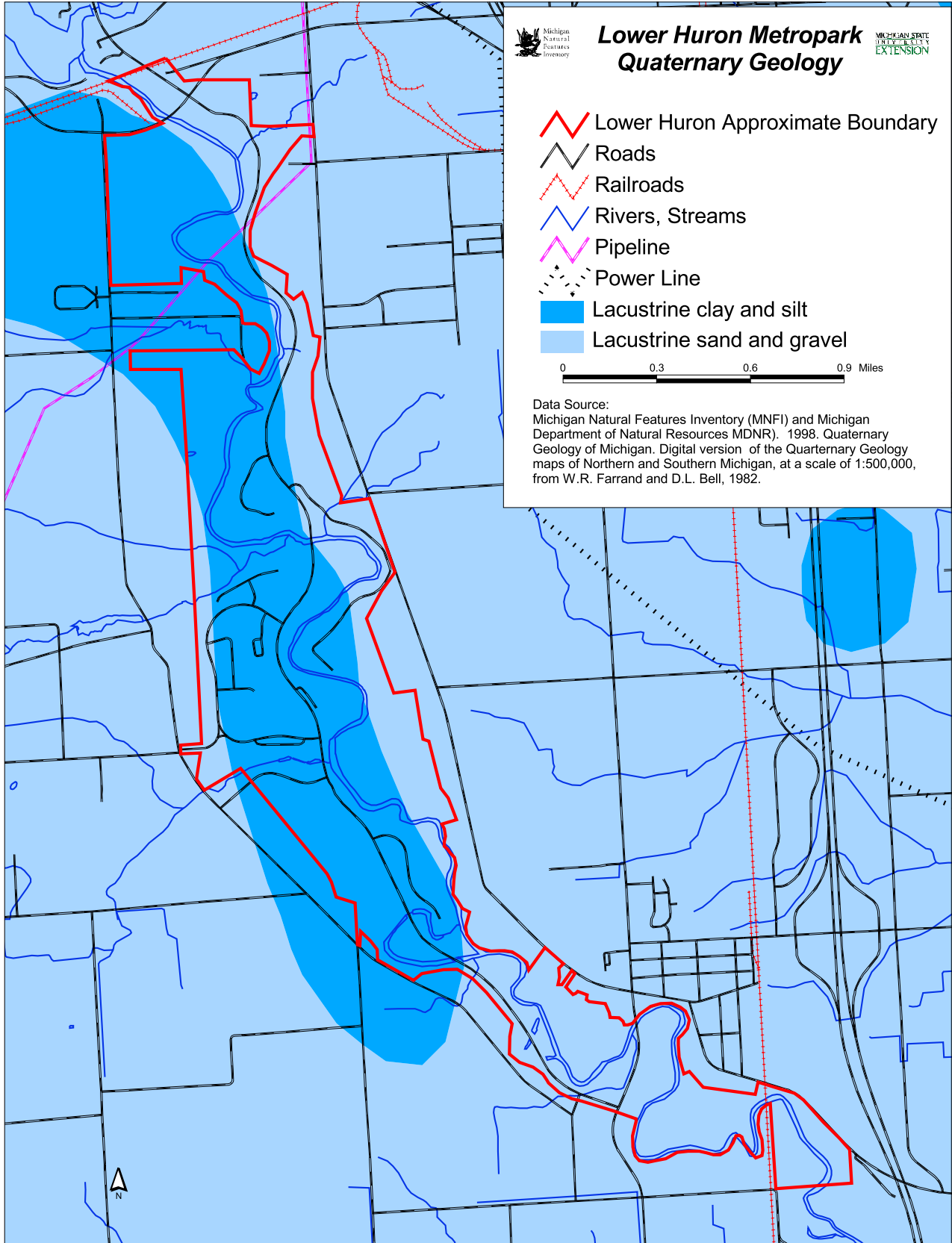


Figure 3. Surface Geology of Lower Huron Metropark.

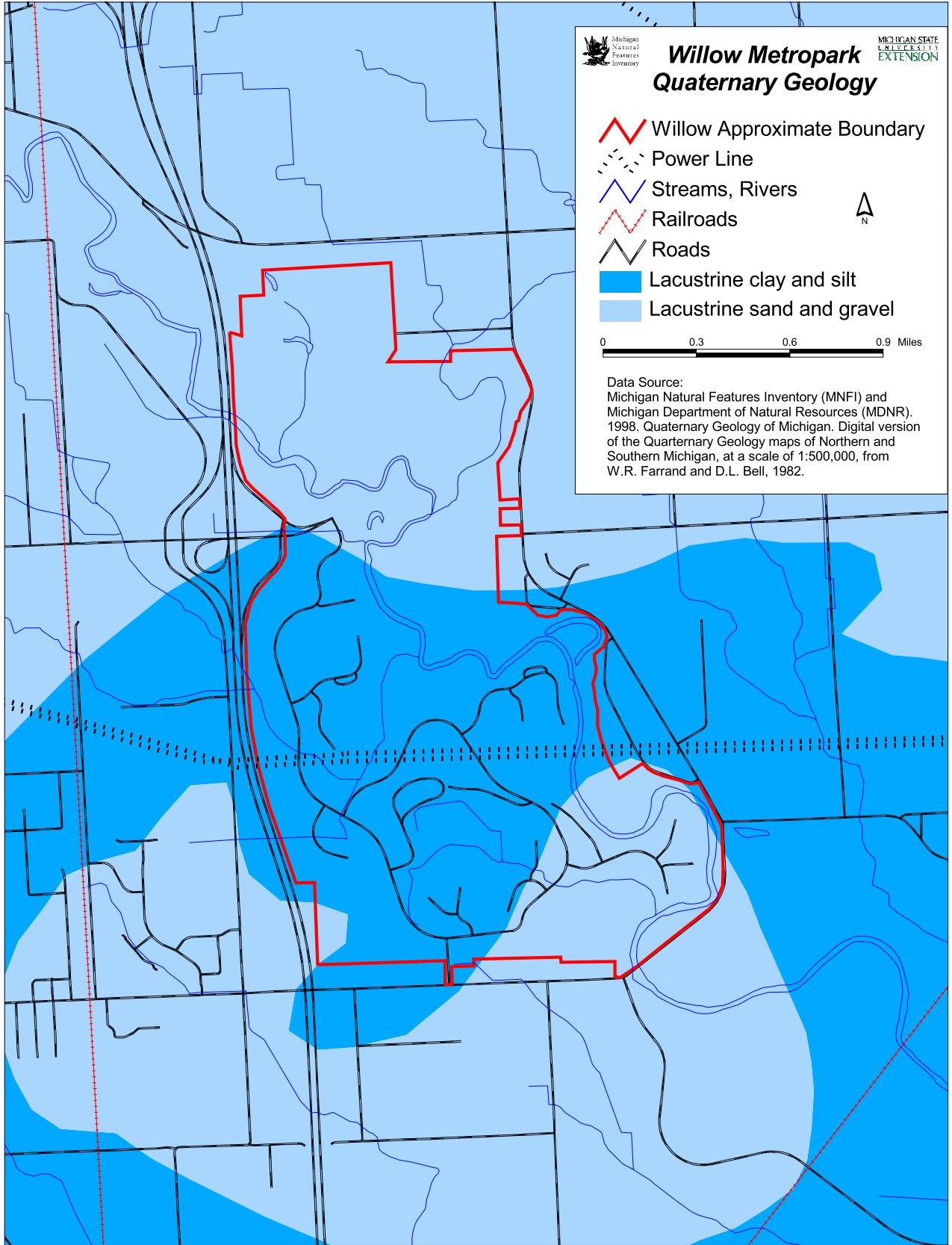


Figure 4. Surface Geology of Willow Metropark.

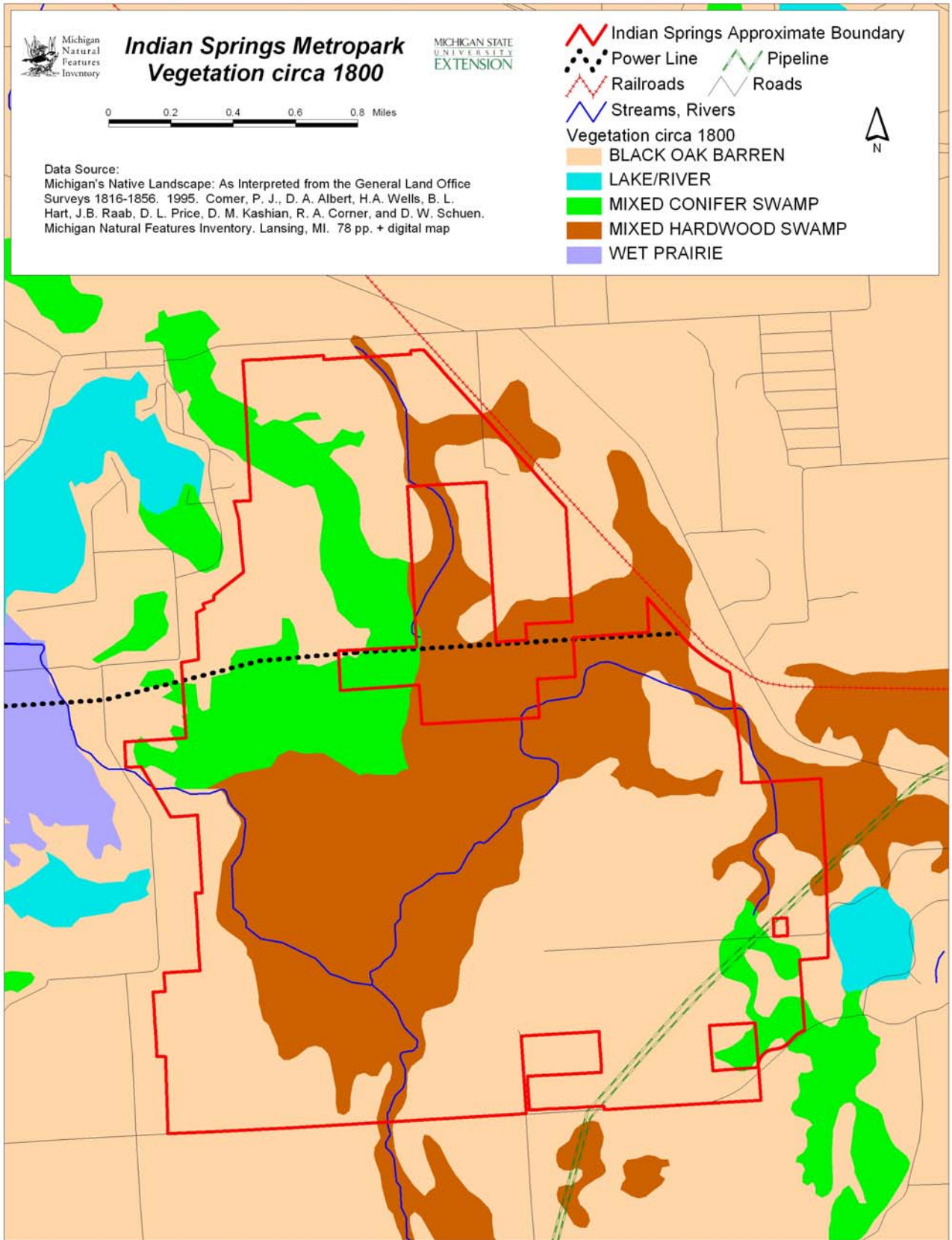


Figure 5. Vegetation *circa* 1800 of Indian Springs Metropark.

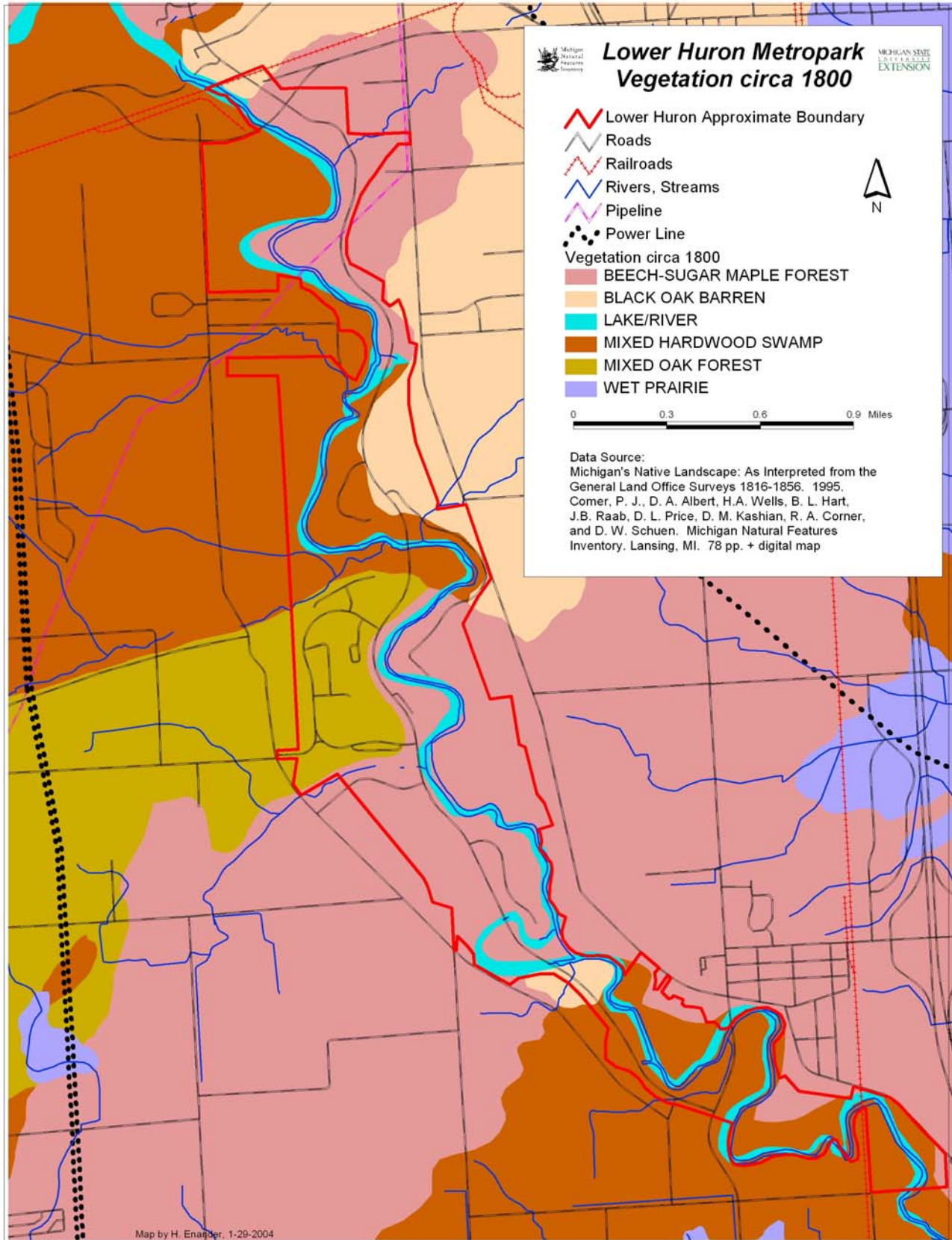


Figure 6. Vegetation *circa* 1800 of Lower Huron Metropark.

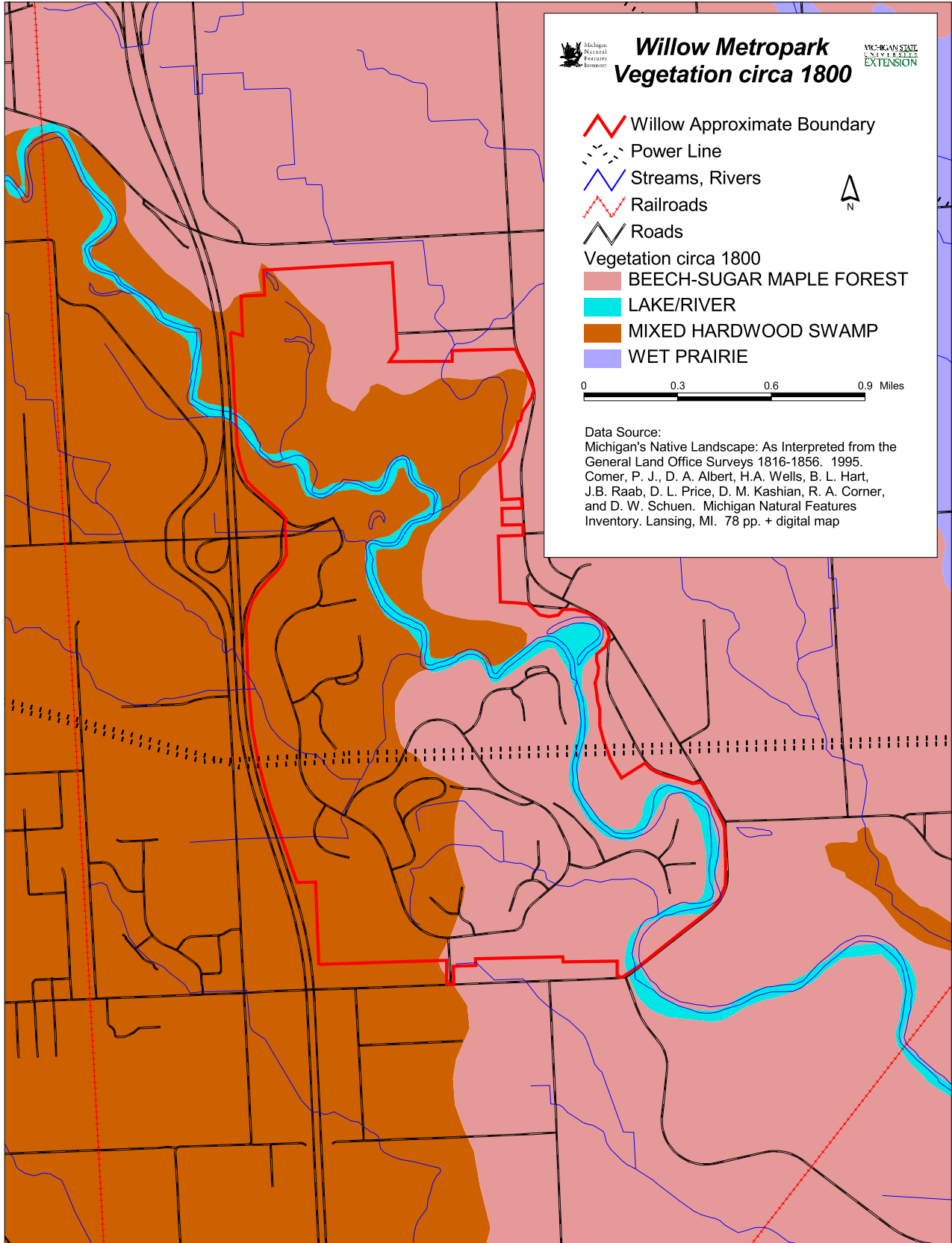


Figure 7. Vegetation circa 1800 of Willow Metropark.

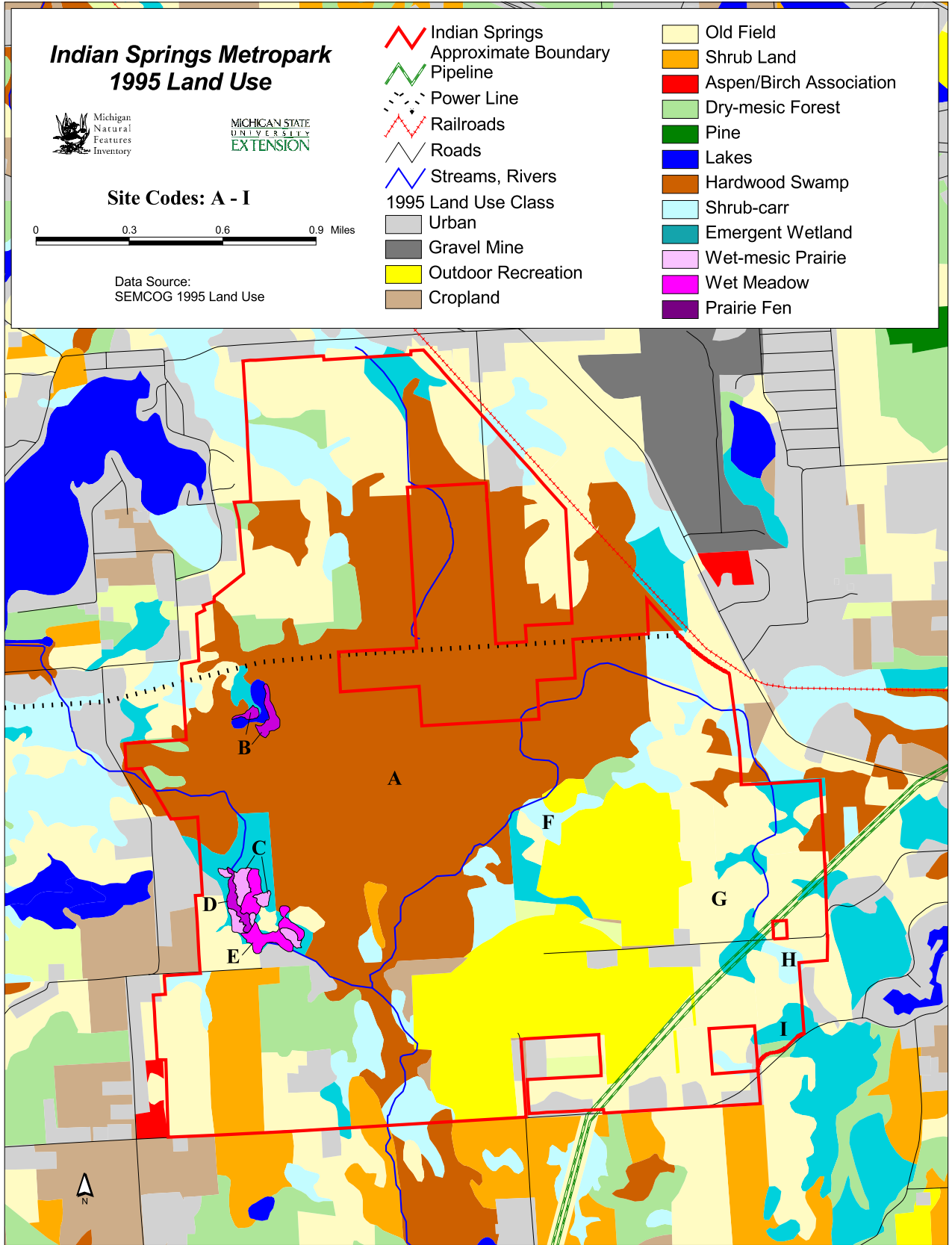


Figure 8. 1995 Land Cover of Indian Springs Metropark.

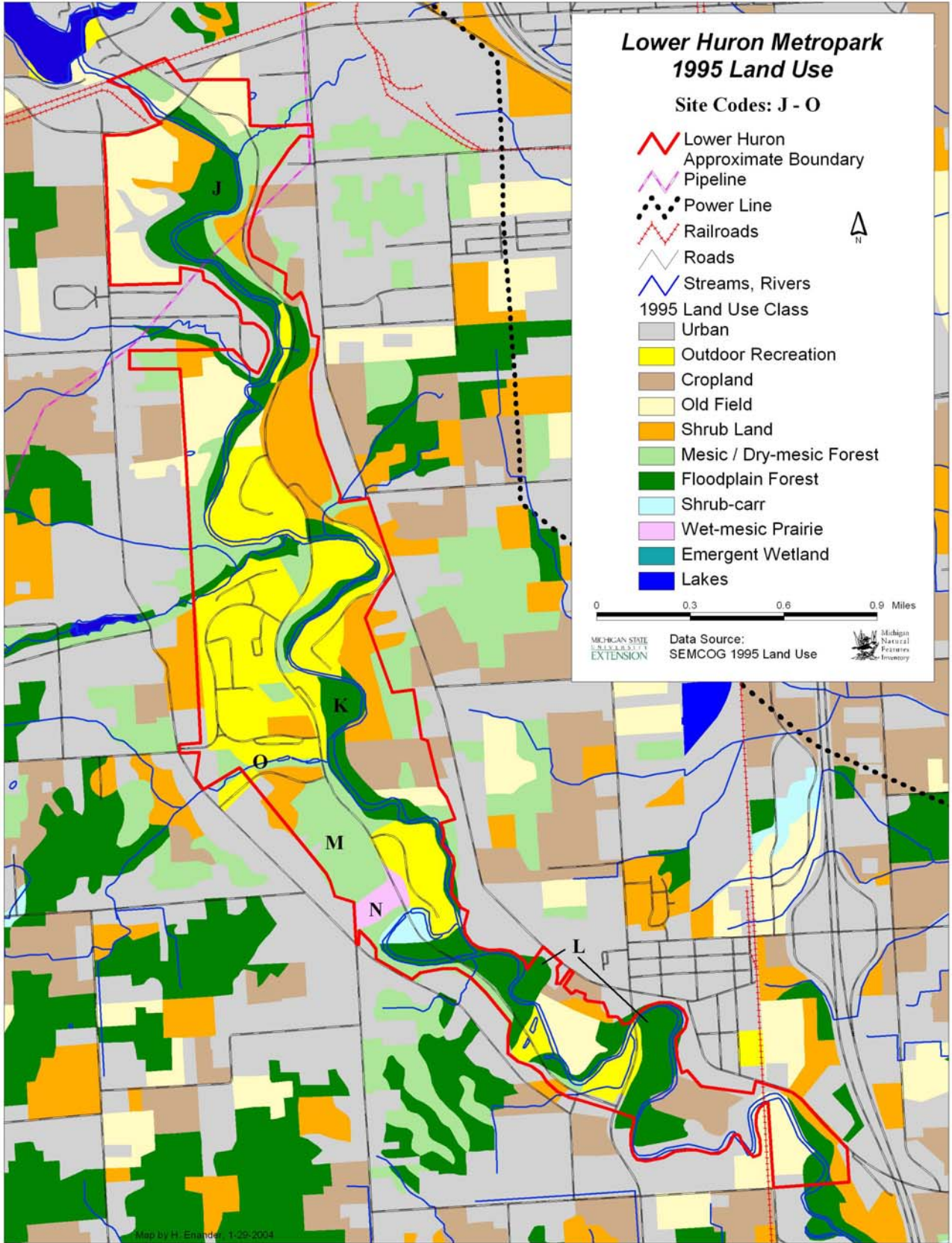


Figure 9. 1995 Land Cover of Lower Huron Metropark.

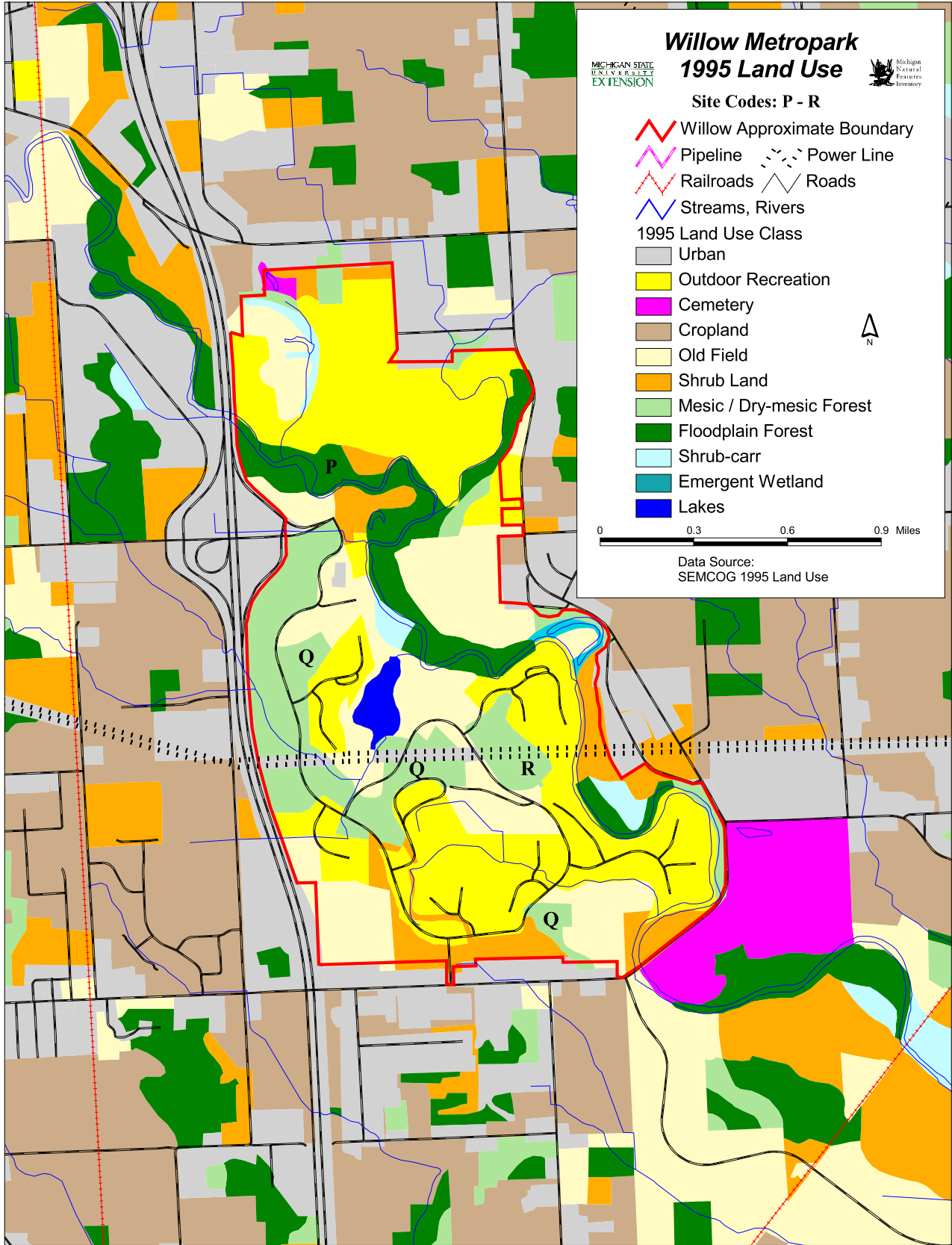


Figure 10. 1995 Land Cover of Willow Metropark.

Methods

Natural Communities

Natural community surveys were conducted in conjunction with rare plant surveys. Prior to surveys aerial photos were interpreted to determine the types of natural communities likely to be present within each of the metroparks. Field surveys concentrated on identifying high quality natural areas and recording management concerns such as evidence of fire suppression, excessive deer herbivory, hydrologic manipulation, farming, logging, and invasive species. Species lists were compiled for high quality sites and those deemed to have potential to significantly improve with restoration. Site names and site codes used in the accompanying maps (Figures 8 - 10) are listed in Table 1. Partial species lists were recorded for many of the areas we visited and are included as appendices for each metropark (Appendices 1 - 3). Site descriptions and management recommendations were written for all high quality natural communities and sites thought to have good potential for significant improvement with restoration and management. Species lists for this report were tabulated with the Florist Quality Assessment Program and species nomenclature follows Herman et al. (2001).

Rare Plant Inventories

Rare plant species were targeted for survey based on the natural communities determined to be present in the park through aerial photo review and known historical and current rare plant distribution patterns within the region. Table 2 lists the rare species by associated natural community that were focused on during the surveys. Rare plant inventories were performed by meander survey of

appropriate habitat during periods when the plants are most recognizable (usually flowering or fruiting periods). When a rare plant was encountered, an MNFI special plant form was filled out, selected photos were taken, and when necessary a voucher specimen was collected for later determination.

Table 1. Survey site names and associated site codes for accompanying maps (Figures 8 - 10).

<u>Site Name</u>	<u>Site Code</u>
Indian Springs Metropark	
Huron Swamp	A
Timberland Lake Fen	B
Indian Springs Wet-mesic Prairie	C
Indian Springs Prairie Fen	D
Indian Springs Wet Meadow	E
Nature Center Shrub-carr	F
Crosby Lake Road Old Fields	G
Crosby Lake Road Swamp	H
White Lake Road Wet Meadow	I
Lower Huron Metropark	
Haggerty Road Floodplain Forest	J
Paw Paw Trail Floodplain Forest	K
Lower Huron Floodplain Forests	L
Bobwhite Trail Forest	M
Bobwhite Borrow Pit	N
Fox Woods Ravine	O
Willow Metropark	
Willow Floodplain Forests	P
Willow Woodlands	Q
Indian Ridge Prairie	R

Table 2. Rare plants sought by associated natural communities. Status abbreviations are as follows: E, state endangered; LT, federally threatened; T, state threatened; SC, state special concern.

Community	Scientific Name	Common Name	State Status
Mesic Southern Forest			
	<i>Castanea dentata</i>	American chestnut	E
	<i>Aristolochia serpentaria</i>	Virginia snakeroot	T
	<i>Carex oligocarpa</i>	Eastern few-fruited sedge	T
	<i>Carex platyphylla</i>	broad-leaved sedge	T
	<i>Dentaria maxima</i>	large toothwort	T
	<i>Galearis spectabilis</i>	showy orchis	T
	<i>Gentianella quinquefolia</i>	stiff gentian	T
	<i>Hybanthus concolor</i>	green violet	T
	<i>Hydrastis canadensis</i>	goldenseal	T
	<i>Panax quinquefolius</i>	ginseng	T
	<i>Polymnia uvedalia</i>	large-flowered leaf-cup	T
	<i>Spiranthes ovalis</i>	lesser ladies'-tresses	T
	<i>Tipularia discolor</i>	crane-fly orchid	T
	<i>Triphora trianthophora</i>	three-birds orchid	T
	<i>Adlumia fungosa</i>	climbing fumitory	SC
	<i>Jeffersonia diphylla</i>	twinleaf	SC
	<i>Liparis lilifolia</i>	purple twayblade	SC
Southern Floodplain Forest			
	<i>Chelone obliqua</i>	red turtlehead	E
	<i>Arabis perstellata</i>	rock-cress	T
	<i>Camassia scilloides</i>	wild hyacinth	T
	<i>Carex conjuncta</i>	sedge	T
	<i>Carex davisii</i>	Davis's sedge	T
	<i>Carex lupuliformis</i>	false hop sedge	T
	<i>Carex typhina</i>	cat-tail sedge	T
	<i>Corydalis flavula</i>	yellow fumewort	T
	<i>Diarrhena americana</i>	beak grass	T
	<i>Fraxinus profunda</i>	pumpkin ash	T
	<i>Justicia americana</i>	water-willow	T
	<i>Lycopus virginicus</i>	Virginia water-horehound	T
	<i>Mertensia virginica</i>	Virginia bluebells	T
	<i>Morus rubra</i>	red mulberry	T
	<i>Nelumbo lutea</i>	American lotus	T
	<i>Silphium perfoliatum</i>	cup-plant	T
	<i>Trillium recurvatum</i>	prairie trillium	T
	<i>Valerianella chenopodifolia</i>	goosefoot corn-salad	T
	<i>Wisteria frutescens</i>	wisteria	T
	<i>Carex squarrosa</i>	squarrose sedge	SC
	<i>Euonymus atropurpurea</i>	wahoo	SC
	<i>Gymnocladus dioica</i>	Kentucky coffee-tree	SC
	<i>Hybanthus concolor</i>	green violet	SC
	<i>Lithospermum latifolium</i>	broad-leaved puccoon	SC
	<i>Viburnum prunifolium</i>	black haw	SC

Table 2. Rare plants sought by associated natural community (continued).

Community	Scientific Name	Common Name	State Status
Southern Swamp			
	<i>Isotria medeoloides</i>	smaller whorled pogonia	E, LT
	<i>Plantago cordata</i>	heart-leaved plantain	E
	<i>Populus heterophylla</i>	swamp cottonwood	E
	<i>Dryopteris celsa</i>	log fern	T
	<i>Eupatorium fistulosum</i>	hollow-stemmed joe-pye-weed	T
	<i>Isotria verticillata</i>	whorled pogonia	T
	<i>Poa paludigena</i>	bog bluegrass	T
	<i>Cuscuta glomerata</i>	rope dodder	SC
	<i>Lysimachia hybrida</i>	swamp candles	SC
Lakeplain Wet-Mesic Prairie			
	<i>Gentiana flavida</i>	white gentian	E
	<i>Rhynchospora globularis</i>	globe beak-rush	E
	<i>Scleria pauciflora</i>	few-flowered nut-rush	E
	<i>Aristida longespica</i>	three-awned grass	T
	<i>Asclepias sullivantii</i>	Sullivant's milkweed	T
	<i>Bartonia paniculata</i>	panicked screw-stem	T
	<i>Silphium laciniatum</i>	compass plant	T
	<i>Sisyrinchium atlanticum</i>	Atlantic blue-eyed grass	T
	<i>Hypericum gentianoides</i>	gentian-leaved St. John's-wort	SC
	<i>Ludwigia alternifolia</i>	seedbox	SC
	<i>Scleria triglomerata</i>	tall nut-rush	SC
Prairie Fen			
	<i>Berula erecta</i>	cut-leaved water-parsnip	T
	<i>Cypripedium candidum</i>	small white lady's slipper	T
	<i>Muhlenbergia richardsonis</i>	mat muhly	T
	<i>Phlox maculata</i>	spotted phlox	T
	<i>Polemonium reptans</i>	Jacob's ladder	T
	<i>Sanguisorba canadensis</i>	Canadian burnet	T
	<i>Valeriana edulis</i> var. <i>ciliata</i>	edible valerian	T
	<i>Sporobolus heterolepis</i>	prairie dropseed	SC
Dry sand prairie			
	<i>Panicum leibergii</i>	Leiberg's panic-grass	T
	<i>Ruellia humilis</i>	hairy ruellia	T
	<i>Solidago missouriensis</i>	Missouri goldenrod	T
	<i>Trichostema brachiatum</i>	false pennyroyal	T
	<i>Trichostema dichotomum</i>	bastard pennyroyal	T
	<i>Penstemon pallidus</i>	pale beard-tongue	SC
	<i>Tradescantia virginiana</i>	Virginia spiderwort	SC
	<i>Triplasis purpurea</i>	sand grass	SC
Dry-Mesic Southern Forest			
	<i>Eupatorium sessilifolium</i>	upland boneset	T
	<i>Angelica venenosa</i>	hairy angelica	SC
	<i>Celtis tenuifolia</i>	dwarf hackberry	SC
	<i>Quercus shumardii</i>	Shumard's oak	SC

Results

The surveys identified 12 new element occurrences (EOs). (All state and federally listed rare species and high quality natural communities are referred to as elements and their occurrence at a specific location is referred to as an element occurrence or EO.) In addition, the presence of 9 previously identified EOs was reconfirmed. Natural community surveys identified 4 new high quality community occurrences and revisited 2 previously identified exemplary natural communities (Table 3). Surveys for rare plants resulted in 10 new element occurrences and 8 existing plant records were also reconfirmed (Table 4). It is possible that additional rare species may be found in the future, especially with active restoration and management. All new natural community and rare plant occurrences have been entered into the statewide database (Biotics) managed by MNFI and all previously existing records have been updated.

Natural Community Inventory Results

Natural community surveys resulted in the identification of 4 new natural community occurrences and information was updated on 2 previously known community EOs (Table 4).

At Indian Springs, information was updated for the Huron Swamp, a southern swamp community occurrence that had been previously identified (Figure 8: A) (Table 3). A prairie fen was documented at Timberland Lake (Figure 8: B). A wetland complex was identified along the Huron River in the southwestern portion of the metropark that contained three natural communities, wet-mesic prairie, prairie fen, and southern wet meadow (Figure 8: C, D, and E, respectively).

At Lower Huron, information was updated on the Haggerty Road Floodplain Forest, a previously documented community occurrence of southern floodplain forest (Figure 9: J).

In addition to these exemplary natural communities, all three metroparks contain areas that have great potential of becoming high quality natural communities with ecological restoration. The high quality natural communities and sites with

good potential for restoration and are listed below along with their associated stewardship needs (Table 5). Detailed site descriptions and management recommendations for each area are included in the Site Summaries and Management Recommendations section (page 21).

Rare Plant Inventory Results

Rare plant surveys resulted in 8 new rare plant occurrences at Lower Huron including red mulberry (*Morus rubra*) (2 new EOs), Kentucky coffee-tree (*Gymnocladus dioica*) (2 new EOs), eastern wahoo (*Euonymus atropurpurea*), wisteria (*Wisteria frutescens*), squarrose sedge (*Carex squarrosa*), and cup-plant (*Silphium perfoliatum*). New rare plant occurrences for eastern wahoo and beak grass (*Diarrhena americana*) were also discovered at Willow (Table 4). At Lower Huron, previously known records of beak grass (2 EOs), goldenseal (*Hydrastis canadensis*), cup-plant, Virginia snakeroot (*Aristolochia serpentaria*), and eastern wahoo were reconfirmed. Records of stiff gentian (*Gentianella quinquefolia*) and ginseng (*Panax quinquefolius*) from Lower Huron were sought but could not be relocated. Various communities at Indian Springs were thoroughly searched but no rare plants were found.

At Lower Huron and Willow, rare plants were found primarily in southern floodplain forests, with some species also occurring in adjacent dry-mesic southern forest and old fields. Plants found exclusively on the forested floodplain included goldenseal, beak grass, Virginia snakeroot, Kentucky coffee-tree, and squarrose sedge. Red mulberry, eastern wahoo, and cup-plant were found at the open edges of river banks and terraces in addition to closed-canopy floodplain. Wisteria occurred along the forested edge of a terrace above the Huron River at the north end of Lower Huron. A thorough search was conducted for previously documented populations of ginseng and stiff gentian at Lower Huron but failed to reconfirm their presence even though ample habitat exists within the metropark.

Table 3. Natural Community Occurrences.

Community	Site Name (used for this report)	Year First Observed	Year Last Observed	EO#	Metropark
wet-mesic prairie	Indian Springs Wet-Mesic Prairie	2003	2003	9	Indian Springs
prairie fen	Indian Springs Prairie Fen	2003	2003	126	Indian Springs
southern wet meadow	Indian Springs Wet Meadow	1998	2003	19	Indian Springs
prairie fen	Timberland Lake Fen	2003	2003	127	Indian Springs
southern swamp	Huron Swamp	1966	2003	10	Indian Springs
southern floodplain forest	Haggerty Road Floodplain Forest	1981	2003	2	Lower Huron

Table 4. Rare Plant Occurrences. Status abbreviations are as follow: T, state threatened; SC, state special concern.

Species	Site Name (used for this report)	Status	Year First Observed	Year Last Observed	EO #	Metropark
<i>Aristolochia serpentaria</i> Virginia snakeroot	Haggerty Road Floodplain Forest	T	1985	2003	16	Lower Huron
<i>Diarrhena americana</i> beak grass	Haggerty Road Floodplain Forest	T	1985	2003	11	Lower Huron
	Paw Paw Trail Floodplain Forest		1985	2003	11	Lower Huron
	Lower Huron Floodplain Forests		1991	2003	13	Lower Huron
	Willow Floodplain Forests		2003	2003	22	Willow
<i>Hydrastis canadensis</i> goldenseal	Haggerty Road Floodplain Forests	T	1984	2003	51	Lower Huron
<i>Gentianella quinquefolia</i> stiff gentian	Lower Huron Floodplain Forests	T	1991	1991	12	Lower Huron
<i>Morus rubra</i> red mulberry	Lower Huron Floodplain Forests	T	2003	2003	40	Lower Huron
	Paw Paw Trail Floodplain Forests		2003	2003	41	Lower Huron
<i>Panax quinquefolius</i> ginseng	Haggerty Road Floodplain Forests	T	1995	2000	96	Lower Huron
<i>Silphium perfoliatum</i> cup-plant	Haggerty Road Floodplain Forest	T	1965	2003	15	Lower Huron
	Lower Huron Floodplain Forests		2003	2003	24	Lower Huron
<i>Wisteria frutescens</i> wisteria	Lower Huron Floodplain Forests	T	2003	2003	2	Lower Huron
<i>Carex squarrosa</i> squarrose sedge	Lower Huron Floodplain Forests	SC	2003	2003	16	Lower Huron
<i>Euonymus atropurpurea</i> eastern wahoo	Haggerty Road Floodplain Forest	SC	1995	2003	3	Lower Huron
	Lower Huron Floodplain Forests		2003	2003	11	Lower Huron
	Willow Floodplain Forests		2003	2003	12	Willow
<i>Gymnocladus dioicus</i> Kentucky coffee-tree	Haggerty Road Floodplain Forest	SC	2003	2003	55	Lower Huron
	Paw Paw Trail Floodplain Forest		2003	2003	56	Lower Huron
	Lower Huron Floodplain Forests		2003	2003	56	Lower Huron

Table 5. Management recommendations for high quality natural communities and sites with good potential for improvement through restoration and management.

Metropark		
Site Name	Community Type	Management Recommendations
Indian Springs Metropark		
Huron Swamp	southern swamp and mesic southern forest	- remove invasive species - reduce deer densities
Timberland Fen	prairie fen	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Indian Springs Wet-mesic Prairie	wet-mesic prairie	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Indian Springs Fen	prairie fen	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Indian Springs Wet Meadow	southern wet meadow	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities
Crosby Lake Old Fields	potential oak barrens and woodland prairie restoration site	- remove invasive species - reduce shrub and tree cover - implement prescribed fire program - reduce deer densities - plant native prairie seeds
Nature Center Shrub-carr	Shrub-carr and potential restoration of wet-mesic prairie and wet meadow	- reduce shrub and tree cover - remove invasive species - implement prescribed fire program - reduce deer densities
Lower Huron Metropark		
Haggerty Road Floodplain Forest	southern floodplain forest	- remove invasive species - reduce deer densities - reduce impacts of forest fragmentation by directing succession of adjacent open fields towards forest
Paw Paw Trail Floodplain Forest	southern floodplain forest	- remove invasive species - reduce deer densities

Table 5. Management recommendations (continued).

Lower Huron Metropark (continued)		
Site Name	Community Type	Management Recommendations
Lower Huron Floodplain Forests	southern floodplain forest	<ul style="list-style-type: none"> - remove invasive species - reduce deer densities - reduce impacts of forest fragmentation by directing succession of adjacent open fields towards forest
Bobwhite Trail Forest	mesic southern forest	<ul style="list-style-type: none"> - remove invasive species - reduce deer densities
Fox Woods Ravine	mesic southern forest and dry-mesic southern forest	<ul style="list-style-type: none"> - remove invasive species - reduce deer densities - prevent leaf dumping into ravine - implement prescribed fire program in level, sandy uplands on northwest side of ravine
Bobwhite Borrow Pit	lakeplain wet-mesic prairie	<ul style="list-style-type: none"> - remove invasive species - implement prescribed fire program - reduce deer densities
Willow Metropark		
Willow Floodplain Forests	southern floodplain forest	<ul style="list-style-type: none"> - remove invasive species - reduce deer densities - reduce impacts of forest fragmentation by directing succession of adjacent open fields towards forest
Indian Ridge Prairie	woodland prairie and oak barrens	<ul style="list-style-type: none"> - remove invasive species - reduce shrub and tree cover - eliminate mowing of cemetery during growing season - implement prescribed fire program - plant native prairie seeds
Willow Woodlands	Dry-mesic southern forests	<ul style="list-style-type: none"> - reduce deer densities - reduce impacts of forest fragmentation by directing succession of adjacent open fields towards forest

Site Summaries and Management Recommendations

Indian Springs Metropark

Huron Swamp (Site Code: A)

The Huron Swamp is a forested community comprised primarily of southern swamp and mesic southern forest. These communities form a mosaic of closed canopy forest that occupies over 1,200 acres in the central and northern portions of the metropark (Figure 8). The southern swamp contains numerous soft bottomed (Houghton-Adrian muck), flooded depressions dominated by red maple (*Acer rubrum*), American elm (*Ulmus americana*), and black ash (*Fraxinus nigra*) (Appendix 1). Intermixed throughout the swamp are low upland rises that support mesic southern forest, which is dominated by sugar maple and American beech. Both the southern swamp and mesic southern forest harbor diverse understory and ground floras. In addition, forested vernal pools underlain by clay and dominated by silver maple occur throughout the site and provide critical breeding habitat for amphibians, as well as an insect-rich food resource for northward-migrating songbirds in the spring.

Interspersed along the edges of the forested communities are patches of southern wet meadow and southern shrub-carr, diverse wetlands common throughout the Midwest. Southern shrub-carr occupies a transition zone between the forests and the more open, sedge- and grass-dominated southern wet meadows. A small prairie fen is nestled within the northeastern portion of the swamp along the shores of Timberland Lake (see Timberland Lake Fen description below). The area surrounding the fen appears to have once supported a relict conifer swamp (e.g., rich tamarack swamp) but hardwoods, especially red maple, are now abundant and poised to outcompete the shade-intolerant tamarack.

Management for the swamp forest and mesic southern forest should focus on invasive species control and reducing deer densities. Garlic mustard (*Alliaria petiolata*) has become established in the northern portion of the swamp and is capable of rapidly spreading throughout the site. This species prefers shaded, moist alkaline soils and the Huron Swamp provides it with perfect habitat. A thorough and intense effort to control this species should be implemented now before it becomes widespread.

Winter application of herbicide to basal rosettes has been shown to be an effective control measure. Signs of heavy deer herbivory were widespread but appeared especially heavy near the northern portions of the swamp. Because an overabundance of deer can negatively impact both plant and animal species diversity, deer densities should be reduced within the metropark to protect biodiversity.



Heavy browsing by deer has eliminated the shrub layer from the low, upland rises in the Huron Swamp. The loss of a shrub layer negatively impacts populations of shrub- and ground-nesting birds and small mammals.

Timberland Lake Fen (Site Code: B)

A prairie fen occurs along the edges of Timberland Lake (also known as Meyers Lake) in the eastern portion of the Huron Swamp (Figure 8). The fen occurs on a flat lake basin that has filled with marl and organic sediments. The community is dominated by sedges (*Carex lasiocarpa* and *C. sterilis*), and twig-rush (*Cladium mariscoides*) (Appendix 1). Other common species occurring within the prairie fen include sundew (*Drosera rotundifolia*), pitcher-plant (*Sarracenia purpurea*), Ohio goldenrod (*Solidago ohioensis*), Riddell's goldenrod (*Solidago riddellii*), shrubby cinquefoil, bog birch (*Betula pumila*), sage willow (*Salix candida*), poison sumac (*Toxicodendron vernix*), and tamarack. Shrub and trees species are slowly encroaching on the prairie fen and management efforts directed at maintaining open conditions should be considered. Several possible alternatives

exist for reducing shrub and tree encroachment on the fen. Trees and large shrub species can be cut and their stumps treated with herbicide to prevent resprouting. Woody species can be drowned by temporarily blocking the outflow of Timberland Lake and flooding the lake basin. This will simulate beaver flooding, which is likely to have occurred periodically at site in the past. Prescribed fire could also be used to maintain diversity and open conditions.

Invasive species occurring within the fen include reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), and glossy buckthorn (*Rhamnus frangula*). Each of these species poses a significant threat to the fen and should be removed. Of particular concern is the potential for glossy buckthorn to spread of into the adjacent Huron Swamp and seriously degraded both communities. Effective long-term control strategies will require the application of herbicides and annual monitoring. For details on control methods and the ecology of specific invasive species see:

<http://tncweeds.ucdavis.edu/esadocs.html>

Indian Springs Wet-mesic Prairie (Site Code: C)

A wet-mesic prairie occurs as part of a large, non-forested wetland complex in the southwestern portion of Indian Springs Metropark (Figure 8) (see photos on front cover). The wetland complex is comprised of a wet-mesic prairie, prairie fen, and southern wet meadow (e.g., sedge meadow) that drain into the headwater of Huron River, which meanders through the wetlands. The mosaic of wetland communities occurs along the margins of a coarse-textured end moraine and an extensive outwash plain (Figure 2). Wet-mesic prairie occurs on wet, sandy loam soil, slightly above the narrow outwash channel that carries the headwater stream of the Huron River. Prairie fen occurs on organic soil (muck) directly adjacent to the stream channel, which only about 1 meter wide. Further from the stream are groundwater-fed depressions filled with organic soil that support sedge meadow, a community dominated by sedges.

The flora of the wet-mesic prairie closely resembles that of a prairie fen with grasses, sedges, and forbs as dominates and dense pockets of shrubs and occasional trees. Common species within the wet-mesic prairie include sedge (*Carex sterilis*), grass-of-Parnassus (*Parnassia glauca*), fringed gentian (*Gentianopsis crinita*), bottle gentian

(*Gentiana andrewsii*), shrubby cinquefoil (*Potentilla fruticosa*), grey dogwood (*Cornus foemina*), and tamarack (Appendix 1).



Large ant mounds, which are common in remnants of native prairie communities, are abundant throughout the wet-mesic prairie at Indian Springs.

In the past, the open conditions of wet-mesic prairies were maintained by frequent fires, which resulted from both Native American activities and lightning strikes. In the absence of fire, shrubs and trees now dominate much of the community. Management of the wet-mesic prairie should include selective removal of shrubs and trees accompanied by herbicide application to cut stumps. In addition, prescribed fire should be used on a regular basis to help maintain open conditions and species diversity.



A massive common buckthorn threatens to disperse invasive weed seeds throughout the wet-mesic prairie wetland complex.

Several invasive plants occur within the wet-mesic prairie including common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus frangula*), spotted knapweed (*Centaurea maculosa*), bluegrass (*Poa pratensis*), and Queen Anne's lace (*Daucus carota*). While all of the invasive species threaten the biological integrity of the wet-mesic prairie, the most pernicious species in this habitat are the buckthorns and spotted knapweed. These species should be controlled through a combination of cutting and herbicide application.

Indian Springs Prairie Fen (Site Code: D)

As stated above, a prairie fen occurs as part of a non-forest wetland complex in the southwestern portion of Indian Springs (Figure 8). The prairie fen occupies a narrow channel that carries the Huron River, which is a headwater stream at this site, measuring only 1m in width. The prairie fen occurs on alkaline organic soil and its hydrology is maintained by a constant seepage of calcareous groundwater. Wet-mesic prairie and southern wet meadow border the community. Common species within the prairie fen include sedge (*Carex sterilis*), grass-of-Parnassus, fringed gentian, shrubby cinquefoil, and tamarack (Appendix 1).

Like the wet-mesic prairie mentioned above, fire was an important natural disturbance regime for prairie fen in the past and the community should be managed with prescribed fire to help maintain diversity and open conditions. In addition, shrub and tree cover should be reduced through cutting accompanied by herbicide application to cut stumps. At present few invasive species were observed within the prairie fen. However, if species such as common or glossy buckthorn or purple loosestrife (*Lythrum salicaria*) are found in the future they should be removed immediately and the removal sites monitored annually. See community abstract for more information on prairie fens at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Indian Springs Wet Meadow (Site Code: E)

A group of sedge-dominated southern wet meadows (e.g., sedge meadows) occurs intermixed among pockets of wet-mesic prairie and a narrow prairie fen in the southwestern portion of Indian Springs (Figure 8). The wet meadows occur on alkaline organic soil and their hydrology is supported by calcareous groundwater seepage. The tussock forming sedge, *Carex stricta*, dominates

most of the wet meadows, but *Carex lacustris*, a wider leaved sedge, is also dominant in some places (Appendix 1). Other abundant species occurring within the wet meadows include blue joint grass (*Calamagrostis canadensis*), joe-pye-weed (*Eupatorium maculatum*), sensitive fern (*Onoclea sensibilis*), swamp aster (*Aster puniceus*), marsh fern (*Thelypteris palustris*), and gray dogwood (*Cornus foemina*). Shrub and tree encroachment have significantly reduced the acreage of open sedge meadow. Without management directed at maintaining open conditions, the wetland is likely to convert to shrub-carr in the future. Common shrub and tree species include grey dogwood, silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolonifera*), pussy willow (*Salix discolor*), red ash (*Fraxinus pennsylvanica*), and American elm.

Management for the community should include a significant reduction in shrub and tree cover, control of invasive species, and prescribed fire. Shrub and tree encroachment into the open sedge meadow can be controlled by cutting shrubs and trees and applying herbicide directly to the cut stumps. Reducing shrub and tree cover will help maintain the open conditions required by most of the community's plant and animal species. Several invasive species were observed within the wet meadows including glossy buckthorn, autumn-olive (*Elaeagnus umbellata*), and reed canary grass. The invasive shrubs should be cut and their stumps treated with herbicide to prevent resprouting. The patches of reed canary grass should be monitored annually and if found to be spreading, they should be treated with herbicide. Prescribed burns conducted in the late spring may also help reduce the dominance of the reed canary grass. Prescribed fire can help maintain open conditions and species diversity and should be regularly used as a management tool in this community. For additional information on southern wet meadows see community abstract at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Nature Center Shrub-carr (Site Code: F)

A shrub-carr occurs just east of the former nature center building and south and west of the newly created pond (Figure 8). A review of aerial photographs from 1978 reveals that this area has only recently converted to shrub-carr. It is likely that prior to shrub-carr the area supported wet-

mesic prairie and sedge meadow. While shrub-carr is a diverse, native plant community, open wetlands such as sedge meadow, prairie fen, and wet-mesic prairie are much less common today. Throughout the Midwest these open wetland types have frequently converted to shrub-carr due to fire suppression, elimination of the beaver, or changes in the agricultural practice of mowing for marsh hay. Because they have become increasingly rare, it is important to protect and steward the remaining open wetland community types when feasible. In the absence of management aimed at curtailing shrub and tree colonization, the Nature Center Shrub-carr will eventually succeed to swamp forest.

Several management options for the site are possible. Allowing the site to convert to swamp forest will increase the size of the contiguous forest block to the west and north (e.g., Huron Swamp) and lessen the impacts of forest fragmentation. However, this option will likely reduce the availability of critical basking sites for the eastern massasauga, a globally rare snake, which currently utilizes the site. Another management option is to restore the wet-mesic prairie and sedge meadow that formerly occupied the site, thereby providing habitat for species that depend on open wetlands. Restoring open wetland types will require reductions in shrub and tree cover. To avoid negatively impacting the eastern massasauga reductions in shrub and tree cover should be done during the late fall and winter and consist of hand cutting woody species (e.g., using chain saws and loppers but not brush-hog or hydroax mowers) accompanied by direct application of herbicide to cut stumps (Reinartz 1998).

Crosby Lake Road Old Fields (Site Code: G)

A large cluster of old fields occurs within the eastern portion of the park (Figure 8). These old fields stretch from White Lake Road to the railroad tracks along the northern border of the metropark. In the 1800s the GLO surveyors referred to this area as “barrens” and documented widely spaced white oaks and black oaks, several of which still grace the landscape today. While few other native plant species presently occur here, the old fields do provide habitat for a variety of animal species that depend on open grasslands, most notably the Henslow’s sparrow, which is a state threatened species in Michigan and has experienced sharp declines in abundance throughout its range.

Because of their large size and close proximity, the old fields hold tremendous potential for restoration of native ecosystems such as oak barrens and prairie. In addition, the old fields encompass a variety of wetland types, which adds significantly to the diversity of wildlife that utilize the fields.

Restoration of the old fields to native community types such as oak barrens and woodland prairie will likely include the following activities. Hedgerows should be transformed from straight lines of trees and shrubs into a few widely spaced, small patches of native trees and shrubs, preferably oaks and native shrubs such as hazelnut (*Corylus americana*). Invasive trees and shrubs should be cut and their stump treated with herbicide to prevent resprouting. Prairie seeds should be reintroduced to the old fields using a seed drill. The fields should be regularly managed with prescribed fire to maintain open conditions and stimulate establishment and growth of native species. For additional information on oak barrens see community abstract at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Crosby Lake Road Swamp (Site Code: H)

A small swamp occurs just south of Crosby Lake Road in the southeast portion of the park (Figure 8). The community sits on a bed of acidic peat and in the past was likely an open bog or poor conifer swamp (forested bog). Today, the community is dominated by tall shrubs and supports only a minimal overstory of scattered tamarack, yellow birch (*Betula alleghaniensis*), black ash, American elm, and red maple (Appendix 1). Dominant shrub species include highbush blueberry (*Vaccinium corymbosum*), Michigan holly (*Ilex verticillata*), and poison sumac. A thick mat of sphagnum moss covers much of the ground layer along with royal fern (*Osmunda regalis*), cinnamon fern (*Osmunda cinnamomea*), and Canada mayflower (*Maianthemum canadense*). Similar forested bogs, which are typically dominated by tamarack and/or black spruce, occur at other locations within Oakland County and contribute a unique element to the region’s overall biodiversity. This site appears to have been heavily impacted by past land use practices and is now being invaded by aggressive, exotic plant species, which include reed canary grass, glossy buckthorn, Morrow honeysuckle (*Lonicera morrowii*), and bittersweet nightshade (*Solanum dulcamara*). In addition, red maple, an aggressive, native, swamp forest species,

is also common and if not removed will likely shade out the remaining tamarack and significantly reduce native shrub cover.

While the community is heavily impacted by invasive species, it represents a unique element of biodiversity and is thus important to protect. Management of the community should focus on removing invasive species. It may also be worth considering temporarily blocking the outflow of the community to simulate beaver flooding and setback succession. However, while this is likely to significantly reduce woody species cover such as glossy buckthorn and red maple, it may also promote invasive ground layer species like reed canary grass. Herbicide treatment of reed canary grass will likely be an important component of either management strategy.

White Lake Road Wet Meadow (Site Code: I)

A small, degraded southern wet meadow occurs along the southeastern border of the metropark adjacent to White Lake Road (Figure 8). While portions of the community are dominated by tussock sedge (*Carex stricta*) and appear in very good condition, two invasive grass species, reed canary grass and reed, have colonized other

portions and have significantly reduced species diversity (Appendix 1). These invasive grasses should be removed to prevent their further spread. Other parts of the southern wet meadow are converting to shrub-carr, a native wetland community dominated by shrubs. If left unmanaged, it is likely that shrubs will continue to colonize the sedge meadow portions of the wetland, converting the open sedge meadow to shrub-carr and eventually swamp forest. Because of the absence of fire and beaver flooding in southern Michigan and other Midwest states, conversion of sedge meadow to shrub-carr is widespread. Where possible, it is important for land managers to maintain open sedge meadows because they provide habitat for wide diversity of native plant and animal species that are not adapted to the continuously shaded conditions of shrub-carr and swamp forest. Maintaining open conditions will require reducing shrub and tree cover through cutting accompanied by herbicide application to cut stumps, and implementing prescribed burns. For additional information on southern wet meadows see community abstract at:

<http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Lower Huron Metropark

Haggerty Road Floodplain Forest (Site Code: J)

A floodplain forest of exceptional quality is located along the west bank of the Huron River in the northwest portion of Lower Huron Metropark (Figure 9). The site, approximately 45 acres in size, is comprised of active river floodplain bottoms and a narrow backswamp drained by a small ravine, and is bordered by old fields to the west and more disturbed floodplain to the east and south. A dense, multilayered canopy characterizes the site, with numerous tree species reaching impressive sizes of well over 100 cm (39 inches) in diameter including silver maple (*Acer saccharinum*), black maple (*Acer nigrum*), sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*), cottonwood (*Populus deltoides*), tulip tree (*Liriodendron tulipifera*), and red oak (*Quercus rubra*) (Appendix 2). Red ash also attains large sizes, but is suffering high mortality due to the emerald ash borer. The size of the canopy trees and

high diversity of native groundflora (over 120 total species were observed) suggest that this site was never commercially logged or subjected to sustained grazing. In addition to large trees, an abundance of large fallen logs in various stages of decomposition contribute to the old-growth characteristics of this exceptional forest. Numerous native shrubs and small trees add structural diversity, including bladdernut (*Staphylea trifolia*), spicebush (*Lindera benzoin*), pawpaw (*Asimina triloba*), redbud (*Cercis canadensis*), and prickly-ash (*Zanthoxylum americanum*). The groundflora is extremely diverse given the size of the site. A diversity of microsites provided by old river channels, backswamps, and ravines contributes to the richness of the site. Species common in the ground layer include wild ginger (*Asarum canadense*), common trillium (*Trillium grandiflorum*), blue cohosh (*Caulophyllum thalictroides*), wild garlic (*Allium canadense*), and

ostrich fern (*Matteuccia struthiopteris*). The site also supports six rare plant species including one of the state's largest populations of state-threatened goldenseal (*Hydrastis canadensis*), as well as beak grass (*Diarrhena americana*, state threatened), Virginia snakeroot (*Aristolochia serpentaria*, state threatened), cup-plant (*Silphium perfoliatum*, state-threatened), eastern wahoo (*Euonymus atropurpurea*, state special concern), and Kentucky coffee-tree (*Gymnocladus dioica*, state special concern). In addition, a small population of ginseng (*Panax quinquefolius*, state threatened) was reported in 1995.



Massive trees like this sycamore are common in the Haggerty Road Floodplain forest. While it is unfortunate that many large ash trees are currently in a state of decline due to the emerald ash borer, the resulting snags and coarse woody debris will provide important nesting cavities and wildlife habitat as they slowly decompose and release nutrients back to the soil.

Management at this site should include the protection of rare species, removal of invasive species accompanied by vigilant monitoring to prevent reestablishment, reductions in the size of the local deer herd, and allowing adjacent old fields to succeed to forest to reduce the impacts of forest fragmentation. In total, 15 invasive species were observed within the floodplain forest. The species that pose the greatest threat to ecological integrity of the site include garlic mustard and numerous exotic shrubs including common buckthorn, Amur honeysuckle, Morrow honeysuckle, multiflora rose (*Rosa multiflora*), European highbush cranberry (*Viburnum opulus*), Japanese barberry (*Berberis thunbergii*), and common privet (*Ligustrum*

vulgare). Because garlic mustard spreads very rapidly it should be removed as soon as possible. The overwintering rosettes can be treated with herbicide during the winter or flowering plants can be pulled before releasing seed in May and June. Monitoring of the area every spring should follow any treatment. Treatment to control invasive woody species should include application of herbicide to cut stumps to prevent resprouting. In addition to the invasive species mentioned above, purple loosestrife (*Lythrum salicaria*), reed canary grass, and moneywort (*Lysimachia nummularia*) all occurred within a partially shaded portion of an abandoned oxbow channel near the southwestern portion of the floodplain forest that also harbored cup-plant. While purple loosestrife and reed canary grass do not pose an immediate threat to the remainder of the site because of their lack of vigor in shaded habitats, measures should be taken to prevent their spread. Deer browse was noted throughout the site, especially on the basal shoots of red ash trees infested with emerald ash borer. The snags and large, coarse woody debris and that will eventually result from emerald ash borer infestation should be left in place to provide habitat for wildlife. For more information on floodplain forests see community abstract at:

<http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Paw Paw Trail Floodplain Forest (Site Code: K)

The Paw Paw Trail Floodplain Forest is one of several blocks of floodplain forest located along the Huron River (Figure 9). Like the other floodplain forests within Lower Huron, it contains a diverse group of species and habitats (Appendix 2). In all, 35 native tree and shrub species were recorded at the site (Appendix 2). Abundant overstory species include sycamore, silver maple, red ash, cottonwood, hackberry, swamp white oak (*Quercus bicolor*), black walnut, black maple, sugar maple, basswood (*Tilia americana*), red oak, bur oak (*Quercus macrocarpa*), bitternut hickory (*Carya cordiformis*), and shagbark hickory (*Carya ovata*). Understory and shrub species include pawpaw, redbud, bladdernut, blue-beech (*Carpinus caroliniana*), alternate-leaved dogwood (*Cornus alternifolia*), flowering dogwood (*Cornus florida*), and ironwood (*Ostrya virginiana*). Four rare species were documented from this site including Kentucky coffee-tree, red mulberry, wahoo, and beak grass.

Management of the Paw Paw Trail Floodplain Forest should focus on controlling the spread of invasive species, protecting rare species, and reducing forest fragmentation. Nine invasive species were observed at the site. The invasive species posing the greatest threat to ecological integrity include Morrow honeysuckle, multiflora rose, European highbush cranberry, common privet, autumn-olive, and Japanese barberry.

Lower Huron Floodplain Forests (Site Code: L)

Along the Huron River are many small blocks of floodplain forest that support a large number of native plant species (156 species), including 6 that are considered rare in Michigan (Figure 9) (Appendix 2). These forested, riparian ecosystems contain a variety of wetland and mesic habitats and support a broad diversity of species (Appendix 2). The forests are dominated by large trees, comprised of 32 different species. Dominant bottomland tree species include red ash, many of which are in the later stages of decline or dead as a result of infestation by emerald ash borer, sycamore, silver maple, cottonwood, hackberry, and black walnut. Located on the upper terraces of the floodplain forest are areas of mesic forest with a distinctly different flora. These former river bottoms rarely flood today and now harbor species associated with mesic conditions such as American beech, sugar maple, basswood, red oak, and white oak. For more information on floodplain forests see community abstract at:

<http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Management of the floodplain forests should focus on protecting rare species, controlling the spread of invasive species, reducing deer densities, and enhancing connectivity between isolated forest blocks. Surveys during 2003 documented the presence of 27 exotic species within the floodplain forests at Lower Huron. While many of these exotic species pose a long-term threat biodiversity, the following are of immediate concern because of their ability to rapidly colonize new habitats and outcompete native vegetation: oriental bittersweet (*Celastrus orbiculata*), Norway maple (*Acer platanoides*), common buckthorn, black locust (*Robinia pseudoacacia*), and the exotic honeysuckles (*Lonicera maackii* and *Lonicera morrowii*). These species should be removed using a treatment that includes herbicide application to prevent resprouting. Monitoring to detect

reestablishment should be undertaken following control efforts.

A well worn ORV trail was observed on the west bank of the Huron River near Robbe Road. ORV use on the floodplain should be curtailed because it can result in severe soil erosion and damage to rare species, and the associated soil disturbances facilitate establishment of invasive species.



Deer browsing was abundant throughout metropark forests, especially on shoots of red ash that had resprouted following emerald ash borer infestation.

Bobwhite Trail Forest (Site Code: M)

A mesic forest is encircled by the Bobwhite Nature Trail (Figure 9). The forest has a diverse microtopography with numerous vernal pools, low mesic rises, and an intermittent stream. Because of the diversity of wetland and mesic habitats, the site supports a rich flora comprised of both swamp forest and mesic forest species (Appendix 2). The overstory is comprised of 18 different species with the wettest portions of the forest dominated by swamp white oak, pin oak (*Quercus palustris*), red maple, silver maple, cottonwood, and sycamore. On the slightly drier, low, mesic rises grow basswood, sugar maple, shagbark hickory, bitternut hickory, and white ash (*Fraxinus americana*). Common understory and shrub species include ironwood, blue-beech, alternate-leaved dogwood, flowering dogwood, witch-hazel (*Hamamelis virginiana*), spicebush, prickly-ash, nannyberry (*Viburnum lentago*), maple-leaved arrow-wood (*Viburnum acerifolium*), elderberry (*Sambucus canadensis*) and choke cherry (*Prunus virginiana*). Like the overstory and understory, the ground flora is also

comprised of species from both forested wetlands and mesic forests. Common ground flora include royal fern, cinnamon fern, marsh marigold (*Caltha palustris*), skunk cabbage (*Symplocarpus foetidus*), richweed (*Collinsonia canadensis*), lady fern (*Athyrium filix-femina*), doll's-eyes (*Actaea pachypoda*), bloodroot (*Sanguinaria canadensis*), and common trillium.

Management of the site should focus on removing and controlling the spread of invasive species, which at present include Japanese barberry, moneywort, multiflora rose, and winged wahoo. In addition, heavy deer browse was observed indicating that the local deer herd is likely higher than the forest can sustain without compromising its ecological integrity.

Bobwhite Borrow Pit (Site Code: N)

A small lakeplain wet-mesic prairie occurs in what appears to be a borrow pit located directly south of the Bobwhite Nature Trail Parking Area (Figure 9). The wet coarse-textured sandy soils within the borrow pit are high in alkalinity and support a diverse array of native wet-mesic prairie species as well as many invasive plants (Appendix 2). Native plant species observed at the site include the following: small yellow flax (*Linum medium*), purple gerardii (*Agalinis purpurea*), autumn sedge (*Fimbristylis autumnalis*), fringed gentian (*Gentianopsis crinita*), bushy aster (*Aster dumosus*), false dragonhead (*Physostegia virginiana*), Riddell's goldenrod (*Solidago riddellii*), golden-seeded spike rush (*Eleocharis elliptica*), nodding ladies'-tresses (*Spiranthes cernua*), Loesel's twayblade (*Liparis loeselii*), and Kalm's St. John's wort (*Hypericum kalmianum*). The borrow pit is slowly being colonized by trees and shrubs.

Management for the site should include removing invasive species, reducing shrub and tree cover, and implementing prescribed fire. In all, ten invasive species were observed at the site (Appendix 2). Management efforts should first focus on controlling the most pernicious invasive species, which include reed, purple loosestrife, glossy buckthorn, common buckthorn, autumn-olive, and narrow-leaved cattail (*Typha angustifolia*).

Fox Woods Ravine (Site Code: O)

A narrow, forested ravine occurs in the central portion of the metropark and carries a small headwater stream that is dammed to form a skating pond before it enters the Huron River (Figure 9). Along the steep, upper slopes of the ravine, especially its north side, are broad zones of groundwater seepage that support a variety of wetland plants including skunk cabbage, spotted touch-me-not (*Impatiens capensis*), sensitive fern, and clearweed (*Pilea pumila*) (Appendix 2). Numerous seepage zones also occur along the bottom of the ravine and support small pockets of wet meadow and shrub-carr. The steep, north-facing slope (south of the stream) is dominated by red oak and contains many fern species and other plants indicative of a rich, mesic forest including maidenhair fern (*Adiantum pedatum*), spinulose woodfern (*Dryopteris carthusiana*), New York fern (*Thelypteris noveboracensis*), and doll's-eyes. Other common tree species occurring within the ravine or along its slopes include white oak, black oak, American beech, basswood, red ash, black walnut, and cottonwood. Bordering the ravine to the north, along the western border of the metropark is an oak woodland and a small, semi-open, level area that supports several prairie species including flowering spurge (*Euphorbia corollata*), hairy beard-tongue (*Penstemon hirsutus*), and wild bergamot (*Monarda fistulosa*).

Management for the Fox Woods Ravine should include invasive species control and prevention of leaf dumping from the Fox Woods Picnic Area. With the exception of reed canary grass, moneywort, and multiflora rose, few invasive species occur directly within the ravine. Control efforts to remove or reduce the spread of these species should be implemented and the area monitored annually. Leaf dumping from the adjacent picnic area has smothered much of the vegetation along the north side of the ravine and is contributing to increased erosion by killing plants, whose roots help stabilize the slope. The practice of leaf dumping here should be halted immediately.

The oak woodland along the north side of the ravine near the metropark's western border could be managed as a remnant oak savanna, which would entail removal of invasive species, thinning the canopy, prescribed fire, and introducing native prairie seeds.

Willow Metropark

Willow Floodplain Forests (Site Code: P)

Willow Metropark contains several blocks of floodplain forest that occur along both sides of the Huron River within the northern and central portions of the metropark (Figure 10). Like the floodplain forests at Lower Huron, these lowlands provide a wide array of habitats. Seasonally inundated depressions and old, abandoned oxbow channels support wet meadows and forested wetlands. Broad, level, mineral-rich lowlands support a diversity of forested wetland species including wahoo (state special concern) and one of the largest colonies of beak grass (state threatened) in Michigan. Low mineral-rich rises and former river terraces support both mesic forest and wetland forest. In addition to beak grass, the floodplain forests at Willow also provide habitat for wahoo, also a rare species. The forest canopy is dominated by a diverse group of tree species that includes red ash, silver maple, hackberry, black walnut, sycamore, cottonwood, and basswood (Appendix 3). Common understory and shrub species include redbud, bladdernut, prickly-ash, ninebark (*Physocarpus opulifolius*), and buttonbush (*Cephalanthus occidentalis*). The ground flora is composed predominantly of native species and includes wood nettle (*Laportea canadensis*), green dragon (*Arisaema dracontium*), jack-in-the-pulpit (*Arisaema triphyllum*), wild ginger, wingstem (*Verbesina alternifolia*), cut grass (*Leersia oryzoides*), and poison ivy (*Toxicodendron radicans*). For additional information on floodplain forests see community abstract at:

<http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Management of the floodplain should include protecting rare species, controlling the spread of invasive species, reducing deer densities, and increasing the size and connectivity of forest patches. Of the nine invasive species observed within the floodplain forests, the following pose the most serious threat to ecological integrity: purple loosestrife, dame's rocket (*Hesperis matronalis*), Amur honeysuckle, multiflora rose, and common privet. Like the other forests within Willow, Lower Huron, and Indian Springs, signs of deer browsing were abundant and efforts to reduce deer densities will be an important component of any strategy to

protect biodiversity. To increase overall connectivity between forest patches and reduce forest fragmentation, old fields and other lands adjacent to the forested floodplain corridor should be allowed to succeed to forest. An excellent opportunity to increase the size of the forested floodplain corridor occurs in the old fields south of the driving range at Willow Golf Course.

Willow Woodlands (Site Code: Q)

Willow Metropark contains several small patches of mature, seasonally wet, dry-mesic forest (Figure 10). The forests support numerous vernal pools that provide critical breeding habitat to amphibians. These woodlands occur in several locations including west of the sledding hill, near the Acorn Knoll Picnic area and north of the Pool-Activity Area, and southeast of Elder Creek Picnic Area (Figure 10). Common overstory species include red maple, pignut hickory (*Carya glabra*) shellbark hickory (*Carya laciniosa*), shagbark hickory, white ash, red ash, black walnut, silver maple, box elder (*Acer negundo*), hackberry, sycamore, cottonwood, sassafras (*Sassafras albidum*), wild black cherry (*Prunus serotina*), swamp white oak, bur oak, white oak, pin oak, red oak, black oak, and basswood (Appendix 3). Shrub and understory species include blue-beech, flowering dogwood, ironwood, rough-leaved dogwood (*Cornus drummondii*), hazelnut, witch-hazel, spicebush, prickly-ash, and nannyberry. Ground layer species include enchanter's-nightshade (*Circaea lutetiana*), cut-leaved toothwort (*Dentaria laciniata*), yellow trout-lily (*Erythronium americanum*), beggar's-lice (*Hackelia virginiana*), lopseed (*Phryma leptostachya*), may-apple (*Podophyllum peltatum*), jumpseed (*Polygonum virginianum*), black snakeroot (*Sanicula gregaria*), Virginia wild-rye (*Elymus virginicus*), and fowl manna grass (*Glyceria striata*). Abundant vines, which also dominate portions of the ground layer, include poison ivy, Virginia creeper (*Parthenocissus quinquefolia*), and riverbank grape (*Vitis riparia*).

Management objectives for these woodlots should include invasive species control, prescription burning, reductions in regional deer densities, and

reducing fragmentation. With more than a dozen invasive species observed within the upland forest blocks, control efforts are needed to protect native species diversity. Management should be directed at removing the most pernicious invasive species first, which include Oriental bittersweet, glossy buckthorn, common buckthorn, Morrow honeysuckle, multiflora rose, autumn-olive, and black locust. Signs of deer browse were frequently observed and efforts to reduce deer densities should be undertaken to protect overall species diversity. To reduce forest fragmentation, lands such as old fields that occur adjacent to forest patches should be allowed to succeed to forest. The presence of large oaks (e.g., white, black, and bur) indicates that these sites were likely much more open in past. Overtime, prescribed burning accompanied by a reduction in deer densities may help facilitate oak regeneration, which is currently lacking within the woodlands. However, stimulating oak regeneration may also require thinning the forest.

Indian Ridge Prairie (Site Code: R)

A very small, degraded, prairie remnant occurs on sandy soil near the Indian Ridge Picnic Area (Figure 10). The prairie occurs on a sandy ridge that appears to be an old, abandoned dune ridge formed when water levels in the Great Lakes were much higher than they are today. Based the ridge's height, soil composition, and proximity to the Huron River it was likely once an important location to the indigenous people of the area, which in the 1800s were predominantly members of the Huron Nation, known locally as the Wyandot Indians. Large, formerly open-grown oaks are scattered throughout the small patch of forest that occupies a portion of the dune ridge. These impressive oaks, which include an open-grown white oak measuring 100 cm (39 inches) in diameter, likely date back to the 1800s or earlier (see photo). Indeed, the GLO surveyors observed black oak on this ridge in the early 1800s. A portion of the ridge contains an old cemetery that occurs within a matrix of prairie grass. The prairie grasses are mowed throughout the summer by a private contractor employed by Huron Township, which owns the cemetery. Species observed at the site that are typically associated with sandy, well-drained lakeplain oak openings

and woodland prairies (e.g., dry-mesic prairies) include black oak, white oak, hazelnut, witch-hazel, northern dewberry (*Rubus flagellaris*), big bluestem (*Andropogon gerardii*), broom-sedge (*Andropogon virginicus*), sedge (*Carex pensylvanica*), slender sand sedge (*Cyperus filiculmis*), common spiderwort (*Tradescantia ohiensis*), old field goldenrod (*Solidago nemoralis*), and wild bergamot (Appendix 3). Small patches of prairie also occur along the west side of the ridge, within a powerline right-of-way and small borrow pit. The ridge's forested east-facing slope borders a narrow wet meadow that is slowly converting to shrub-carr. The species observed within the wet meadow, prairie openings, and adjacent woodland are listed together in Appendix 3 under Indian Ridge Prairie.

Management of the site should strive to promote native prairie vegetation by removing invasive species, reducing shrub and tree cover, conducting prescribed burns, and eliminating the practice of mowing the cemetery during the growing season. Invasive species observed at the site include spotted knapweed, smooth brome (*Bromus inermis*), autumn-olive, Morrow honeysuckle, glossy buckthorn, and common lilac (*Syringa vulgaris*). Efforts to remove or control the spread of invasive species should be undertaken to prevent further degradation of the site's native prairie flora.



An ancient, open-grown white oak measuring 100 cm in diameter (> 3 feet) graces the edge of a remnant prairie at the Smith-Fay, Huron Township cemetery in Willow Metropark.

Discussion

Rare Plants

Goldenseal is a state-threatened plant. Prior to this study, there were 70 known occurrences of goldenseal. The species has declined throughout its range due to exploitation of roots for herbal medicine and significant loss of habitat due to development and habitat modification. In Michigan, this species is concentrated in the southern three tiers of counties in the Lower Peninsula. Typical habitat for goldenseal includes rich hardwood forests with canopies dominated by beech, sugar maple, basswood, and red oak. Goldenseal is also occasionally found growing on upland rises in floodplain forests. The population at Lower Huron is exceptionally large and ranks among the top ten in the state. Goldenseal can be easily recognized in early May when it is flowering. Conservation strategies for goldenseal include the protection and restoration of rich woodland habitats, monitoring of known populations to determine if plants are being poached, and educating the public about the detrimental effects caused by poaching and use of wild-grown herbs in the herbal market. For more information see rare plant abstract on goldenseal at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.

Beak grass is a state-threatened species found primarily in southern floodplain forests. Previous to this study, it was known from 20 locations in Michigan, including several sites in southeast Michigan along the Huron and Raisin rivers (2 in Wayne County). This clump-forming species usually occurs in small, localized colonies of fewer than 100 plants. Occurrences discovered and reconfirmed in Lower Huron, Willow, and Oakwoods are unusually large (e.g., 2,000 to 10,000 plants) and make up four of the top six populations in the state. Combined, they form a metapopulation stretching 10 miles (15-20 miles of meandering river floodplain) from Belleville to Flatrock and comprise an estimated 75% of the statewide population. This species can be recognized throughout the growing season but is most easily identified in August and September by its characteristic inflated spikelets. Longer-term conservation strategies to protect beak grass include removing invasive species, protecting the hydrology of river systems and corresponding cyclical

flooding regimes, maintaining healthy, intact, mature floodplain forests, and using conservation planning and restoration to connect previously fragmented floodplain forests to create contiguous riparian corridors. For more information see the rare plant abstract on beak grass at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm>.



Beak grass grows in abundance in several floodplain forests at Lower Huron and Willow and is easily recognized by its distinctive fruiting stalks and shiny leaves.

Cup-plant is listed as a state-threatened species. Prior to this study, it was known from 23 sites in Michigan, mostly in southern Michigan (11 in Wayne and Monroe Counties combined). Cup-plant commonly occurs in openings of floodplain forests and in adjacent meadows, and is easily recognized during the latter part of the growing season (July – October) by its characteristic yellow flower and perfoliate leaves. Threats to cup-plant include loss of its floodplain forest and meadow habitats, competition from invasive species, and mowing of meadows during the growing season. These threats particularly imperil the species at Lower Huron where it was observed growing adjacent to forests with large numbers of invasive species such as Morrow honeysuckle and multiflora rose, or in meadows that may be mowed during the growing season. For example, cup-plant was observed growing in meadows that appeared to be occasionally mowed at the Group Camp and

Connector Trail areas. Conservation strategies for this species include maintaining natural forest openings and meadows, preventing mowing of its habitat during the growing season, protecting southern floodplain forests, controlling invasive species, and maintaining or restoring historical flooding regimes of rivers.

Wisteria is a state-threatened species known only from one other site in the state located in southwest Michigan. This new population comprises only the second documented occurrence statewide. The species reaches the extreme northern limit of its range in southern Michigan, and throughout its range characteristically inhabits hardwood-dominated floodplain forests. It is also cultivated and planted for ornamental purposes along with the Chinese wisteria (*Wisteria sinensis*). Though not yet definitively determined, there is a high probability that this new occurrence is of native rather than cultivated origin. Threats to wisteria include competition from exotic shrubs and habitat destruction. The population found at Lower Huron is also vulnerable to excessive pruning by park maintenance staff because of its immediate proximity to a well used trail.

Virginia snakeroot is listed as state threatened and is known from 17 sites in the Michigan, mostly in the southern two tiers of counties. Only 10 populations have been observed since 1980, and of these only one was of significant size. Virginia snakeroot inhabits southern floodplain forests and ravines, and is occasionally found in mesic and dry-mesic southern forests. It can be identified throughout the growing season by its arching habit and characteristic leaves. Threats to Virginia snakeroot include trampling, competition from exotic species, and loss of suitable habitat.

Red mulberry is listed as state threatened, and was known from 23 sites prior to this study. Of these, only 13 sites supporting 30 total trees have been observed since 1950, including 17 trees at a newly discovered site in Dexter-Huron Metropark. Surveys this year found three additional trees at two sites in Lower Huron. A dioecious species (e.g., plants having either male or female flowers, but not both), red mulberry almost always occurs as widely scattered single trees in forested river floodplains. With practice, it is recognizable throughout the growing season by its rough, unlobed leaves. Because red mulberry appears to occur in very small populations of widely scattered individuals,

successful pollination and thus, the production of viable seeds, may be problematic, as it requires the long-distance dispersal of pollen between trees of opposite sex for successful reproduction. In the absence of successful reproduction and recruitment, the long-term viability of these populations is at risk. It is worth noting that no seedling or sapling red mulberry were observed during our surveys. Red mulberry is also imperiled by a loss of floodplain habitat and excessive disturbance. Populations of the species are particularly vulnerable at Lower Huron due to ORVs use in the floodplain forest adjacent to Robbe Road, and from use of heavy equipment and pruning back the forest edge along Lower Huron Park Road, just south of the entrance to the Fox Woods Picnic Area.

Wahoo is listed as a species of special concern. Plants are given the status of special concern when the status of the species is unknown. A species remains on the special concern list until experts determine whether the species should be elevated to state threatened or endangered status or is common enough to remain untracked. Prior to this study, wahoo was known from only 10 locations in Michigan (1 in Wayne County). This study added 2 additional occurrences in the floodplain forests at Lower Huron and Willow. The species is easily identified throughout the growing season. Conservation strategies for wahoo include protecting the hydrology and water quality of the Huron River and maintaining and restoring high quality flood plain forests by minimizing fragmentation and removing invasive species. It is likely that additional sub-populations of this population may be located within the metroparks.

Kentucky coffee-tree is listed as a species of special concern and is known from 54 locations in Michigan, mostly concentrated in the southern four tiers of counties in the Lower Peninsula. This study added 2 new locations, both from Lower Huron. The species is easy to recognize throughout the growing season by its characteristic bark, fruit, and bipinnately compound leaves. Strategies to ensure the long-term viability of populations of Kentucky coffee-tree include maintaining and restoring natural flooding regimes and protecting high quality flood plain forests by minimizing fragmentation and controlling the spread of invasive species.

Squarrose sedge is listed as a species of special concern. Prior to this study squarrose sedge was known from only 15 locations in Michigan,

mostly in the southeast portion of the state (5 in Wayne and Monroe Counties combined). This sedge typically inhabits wet meadows and seasonally wet depressions within oak-hickory forests, but may also occasionally occur within floodplain forests. Threats to squarrose sedge include habitat loss, competition from invasive species, and forest fragmentation. At Lower Huron, a small population of squarrose sedge was observed growing in an old, abandoned oxbow river channel. Long-term conservation strategies to protect squarrose sedge include maintaining healthy, intact, mature forests, controlling invasive species, and using conservation planning and restoration to connect previously fragmented blocks of forest.

Two known records for state-threatened plants were not reconfirmed. **Ginseng** was last observed in Lower Huron Metropark in 2000, and a thorough survey of potential habitat failed to relocate this species. The habitat is quite extensive, however, and remains exceptionally high in quality, and it is possible that the species still persists. For more information on ginseng see rare plant abstract at: <http://web4.msue.msu.edu/mnfi/pub/abstracts.cfm> **Stiff gentian** was last observed at Lower Huron in 1991 along a steep bluff with hillside seepages. Portions of suitable habitat remain intact, and it is possible that the species may persist in the seed bank and may be found again in the future.

Fire as an Ecological Process

Many of the areas within the metroparks we surveyed once supported fire-dependent ecosystems such as wet-mesic prairie, wet meadow, prairie fen, oak barrens, and oak forest. In the past, lightning- and human-induced fires frequently spread over large areas of southern Michigan and other Midwestern states (Curtis 1959, Grimm 1984, Dorney 1981). In the absence of frequent fires, open oak barrens convert to forested communities such as oak-hickory forest or mixed oak forest. Likewise, non-forested wetlands such as wet-mesic prairie, wet meadow, and prairie fen frequently convert to shrub-carr and then tamarack swamp or hardwood swamp in the absence of fire (Curtis 1959). The reduction of wildfires in Midwestern states following the loss of indigenous cultures in the early 1800s is well documented and resulted in a loss of fire-dependent natural communities through both active conversion for farming and succession

from open barrens and wetlands to forested community types (Curtis 1959).

Plant communities, whether upland or lowland, benefit from prescribed fire in several ways. Depending on the season and intensity of a burn, prescribed fire may be used to decrease the cover of exotic, cool-season grasses and woody species, and increase the cover of warm-season grasses and native forbs (White 1983, Abrams and Hulbert 1987, Tester 1989, Anderson and Schwegman 1991, Collins and Gibson 1990, Glenn-Lewin et al. 1990). Prescribed fire helps reduce litter levels, allowing sunlight to reach the soil surface and stimulate seed germination and enhance seedling establishment (Daubenmire 1968, Hulbert 1969, Knapp 1984, Tester 1989, Anderson and Schwegman 1991, Warners 1997). Important plant nutrients (e.g., N, P, K, Ca, and Mg) are elevated following prescribed fire (Daubenmire 1968, Viro 1974, Reich et al. 1990, Schmalzer and Hinkle 1992). Prescribed fire has been shown to result in increased plant biomass, flowering, and seed production (Laubhan 1995, Abrams et al 1986, Warners 1997, Kost and De Steven 2000). Prescribed fire can also help express and rejuvenate seed banks, which may be especially important for maintaining species diversity (Leach and Givnish 1996, Kost and De Steven 2000).

Impacts to faunal communities should also be considered when planning a prescribed burn. Dividing a large area into smaller burn units that can be burned in alternate years or seasons can protect populations of many species. This allows unburned units to serve as refugia for immobile invertebrates and slow moving amphibian and reptile species. When burning larger areas it may be desirable to strive for patchy burns by igniting during times of high relative humidity. As mentioned above, the unburned patches may then serve as refugia, which facilitate recolonization of burned patches by fire-sensitive species. Burning under overcast skies and when air temperatures are cool (<55°F) can help protect reptiles, since they are less likely to be found basking above the surface when conditions are cloudy and cool. Lastly, conducting burns during the dormant season (late October through March) may also help minimize impacts to reptiles.

Forest Management

An important forest management goal at Indian Springs, Lower Huron, and Willow will be to reduce forest fragmentation. At present, a straight edge is maintained along many of the forest stands within the metroparks. Directing the succession of old fields toward oak barrens at Indian Springs and toward mesic or floodplain forests at Lower Huron and Willow will help soften these edges and eventually reduce forest fragmentation. The formation of larger blocks of forest will help improve nesting success for raptors, neotropical migrant songbirds, and ground-nesting species because their nests are less likely to be parasitized and predated in larger blocks of forest (Wilcove et al 1986). In addition, invasions by exotic species are reduced in larger blocks of contiguous habitat, since the ratio of interior habitat to edge typically increases with size.

At Indian Springs, where most upland soils are well drained and once supported oak barrens, large areas of oak barrens can be restored by allowing oaks to establish in old fields and transforming straight hedgerows into very small, widely spaced patches of oaks, hickories, hazelnuts, and other native shrubs (see site summary for Crosby Lake Old Fields). The addition of native prairie seed, in combination with prescribed fire management, will also be important components of a successful oak barrens restoration strategy. Areas within Indian Springs that are best suited for oak barrens restoration include the Crosby Lake Old Fields (G), old fields along the railroad tracks, old fields in the northwest portion of the park, old fields in the southwest corner of park, and old fields adjacent to the Indian Springs Wet-Mesic Prairie Complex (C, D, E) (Figure 8).

At Lower Huron and Willow, where poorly drained soils once supported large, contiguous blocks of forest, directing the ecological succession of old fields towards forest will help reduce fragmentation. This is especially important along the floodplain corridor of the Huron River. At Lower Huron, the succession of the old fields that border the Haggerty Road Floodplain Forest (J) can be directed towards forest, significantly increasing the overall size of the forest block and reducing the impacts of habitat fragmentation (Figure 9). Likewise, the area directly south the Haggerty Floodplain Forest, between the west side of the Huron River and metropark's western boundary,

could also be allowed to succeed to forest, thereby significantly increasing the width and acreage of the forested riparian corridor (Figure 9).

Likewise, at Willow, several smaller areas of floodplain forest and dry-mesic forest can be significantly increased in size by directing the succession of old fields towards forest. The old fields south of the driving range at Willow Metropark Golf Course present an excellent opportunity to significantly increase the size of the forested riparian corridor and reduce forest fragmentation (Figure 10). Similarly, the acreage of dry-mesic forest can be significantly increased by allowing the old fields to succeed to forest along the metropark's western and southern borders (Figure 10: Q).

Invasive Species

Invasive species also pose a major threat to species and habitat diversity within the metroparks. By outcompeting and replacing native species, invasives change species composition, alter vegetation structure, and reduce native species diversity, often causing local or even complete extinction of native species (Harty 1986). Invasive exotic species can also upset delicately balanced ecological processes such as trophic relationships, interspecific competition, nutrient cycling, soil erosion, hydrologic balance, and solar insolation (Bratton 1982). Lastly, exotic invasive species often have no natural predators and spread aggressively through rapid sexual and asexual reproduction.

While numerous invasive species occur within the metroparks, **garlic mustard**, **glossy buckthorn**, and **purple loosestrife** are likely to pose the greatest threat because of their ability to invade intact communities and quickly dominate an area. Detailed information on controlling specific invasive species can be obtained at: <http://tncweeds.ucdavis.edu/>.

Garlic mustard, in particular, is of serious concern even in very small numbers because it is self-fertile; thus, a single plant can establish an entire population and quickly result in a large infestation. While it invades all types of forested habitats, garlic mustard is especially aggressive in mesic and wet-mesic conditions like those found within the Huron Swamp at Indian Springs, and the floodplain forests and seasonally wet upland forests at Lower Huron and Willow (Meekins and

McCarthy 2001). Garlic mustard should be removed prior to seedset wherever it is encountered.

Glossy buckthorn can also severely reduce species diversity, especially in alkaline wetland habitats like wet-mesic prairie, prairie fen, and relict conifer swamp. Left untreated, it can form large, impenetrable, monotypic stands in place of open, species diverse wetlands.

Purple loosestrife is another pernicious invader of wetland habitats, often completely replacing native emergent marsh communities. Some success in controlling purple loosestrife has recently occurred with the application of biological control agents such as *Galerucella* beetles, which are native to purple loosestrife's European habitat (Hight and Drea 1991, Blossey 1992).

Several invasive species also threaten both floodplain and upland forests. Among the most problematic are **oriental bittersweet**, **common buckthorn**, and **Amur and Morrow honeysuckle**. By invading the shrub layer of forest communities, these species severely reduce the amount of light available to the ground layer, causing the elimination of many ground layer species and preventing the reproduction of overstory dominants. Oriental bittersweet is especially problematic. A twining vine, it can literally strangle large trees by tightly wrapping around the trunk and preventing new growth of cambium tissue, effectively girdling the stem. These species can be effectively controlled by stem removal, but cutting without immediate herbicide application should be strictly avoided, since resprouting typically results in the proliferation of multiple stems, thus making it even more difficult to eliminate these problematic species. Invasive species abstracts, which include detailed guidelines for controlling invasive species, can be obtained at <http://tncweeds.ucdavis.edu/>.

Prioritizing Stewardship Efforts

While invasive species occur in nearly all natural communities surveyed in this study, management priority should be given to the highest quality sites. These high quality sites typically possess the greatest species diversity and largest intact populations of native species. Therefore, maintenance of biodiversity in southeast Michigan depends on protecting and managing the remaining highest quality sites. These high quality sites will also be critical to the success of future restoration efforts because they will provide a diverse reservoir

of native species and genotypes from which to collect propagules, assemble species lists, and educate the public. Thus, their protection and maintenance is critical to any long-term conservation strategy. By concentrating management effort on a few high quality sites, limited resources of time, personnel, volunteer effort, and money can be directed to make a significant positive impact on biodiversity conservation.

How should metropark managers and naturalists determine which sites to manage? That decision is one best made by metropark resource professionals, but evaluation criteria should include the following:

- 1) A preference toward high quality sites with minimal infestations of invasive species. Biodiversity is most easily and effectively protected by preventing high quality sites from degrading.
- 2) A focus on sites that harbor high levels of native species diversity or unique elements of biodiversity (e.g., prairie fens, tamarack swamps, floodplain forests, springs, rare species, etc.). Wetlands, in particular, harbor a disproportionate number of rare species and provide critical habitat to many species.
- 3) Sites that enhance core areas of high quality habitat or act as critical corridors for wildlife. Reducing forest fragmentation at Indian Springs, Lower Huron, and Willow, or restoring oak barrens at Indian Springs will enhance many of the existing high quality sites.
- 4) High profile sites that are viewed by many visitors like those connected to well used trails or sites with scenic overlooks or picturesque views. Opportunities to educate and the public on biodiversity and stewardship are maximized by actively working to restore frequently visited sites. Restoring sites that provide scenic vistas will also promote an appreciation of both the metropark's and region's natural resources.

Accomplishing long-term protection for rare species and high quality natural areas will require an active stewardship program. While a stewardship program should be staffed by professionals, the

active participation of volunteers in stewarding natural areas will be fundamental to its success. Volunteer participation in stewardship activities will also provide many excellent opportunities to educate the public on the importance of protecting biodiversity and help build a dedicated group of metropark supporters.

A brief summary of sites with high restoration potential in each park follows below. Detailed information and management recommendations for each site appears in the Site Summaries and Management section (pages 21-30).

High Priority Sites at Indian Springs

At Indian Springs, we identified several sites with high restoration potential. 1) The **Huron Swamp** is a high quality southern swamp (Figure 8: A). Because of its large size and the diversity of habitats it encompasses, protection of this site from invasion by invasive species, an overabundance of deer, and fragmentation is extremely important to biodiversity protection in southeast Michigan. Its widespread use as an outdoor classroom and laboratory by amateur and professional naturalists and researchers further heightens the importance of protecting the ecological integrity of the Huron Swamp. 2) The **Indian Springs Wet-Mesic Prairie** and its associated prairie fen and sedge meadows are another very important group of wetlands to protect and steward (Figure 8: C, D and E). These natural communities harbor a diverse array of calcareous groundwater-dependent species that require open conditions if they are to remain viable. Reducing the extent of shrub and tree encroachment, removing invasive species, and prescription burning will all be important components of a long-term protection strategy for this diverse wetland complex. 3) The **Crosby Lake Road Old Fields** hold tremendous potential for oak barrens and prairie restoration (Figure 8: G). They harbor ancient oaks, a diversity of wetlands, and provide critical grassland habitat for a variety of species, including the Henslow's sparrow, a rare grassland-dependent bird. By carving straight hedgerows into widely spaced groupings of native trees and shrubs (preferably oaks, hickories, and hazelnuts), reintroducing native prairie species, controlling invasive species, and prescription burning, these exotic old fields can be transformed into diverse native ecosystems that provide critical habitat for declining grassland-dependent species.

4) **Timberland Lake Fen** is a small, highly visited prairie fen. Its picturesque setting alongside Timberland Lake provides an excellent opportunity to both cultivate an appreciation of the region's natural resources and educate the public on prairie fens and stewardship.

High Priority Sites at Lower Huron

Lower Huron contains several sites important to biodiversity protection in southeast Michigan. The metropark contains several large blocks of floodplain forest that harbor numerous rare plant species. While all of these blocks contribute to the ecological integrity of the forested floodplain corridor, of particular note is the 1) **Haggerty Road Floodplain Forest**, a high quality site that provides habitat for seven rare plant species (Figure 9: J). The site's varied topography supports a diversity of wetland and mesic habitats and contributes to its ecological significance. Protecting the long-term ecological integrity of the Haggerty Road Floodplain Forest will require controlling the spread of invasive species, reducing deer densities, and allowing adjacent old fields to succeed to forest to reduce impacts of forest fragmentation. 2) The **Paw Paw Trail Floodplain Forest** is another large block of floodplain forest that contains a variety of habitats and three rare plant species (Figure 9: K). The site is widely used for education and recreation and presents a prime opportunity for educating the public on the importance of forested riparian corridors to biodiversity. Management of this site should focus on controlling the spread of invasive species. 3) The **Bobwhite Nature Trail Forest** is a relatively large and diverse block of mesic forest that contains a well used hiking trail (Figure 9: M). Like the Paw Paw Trail Floodplain Forest mentioned above, this site also presents an excellent location to highlight stewardship efforts aimed at controlling the spread of invasive species.

High Priority Sites at Willow

1) The **Willow Floodplain Forests** comprise a significant forest floodplain corridor that provides habitat for a wide variety of species, including two rare plants (Figure 10: P). Directing the ecological succession of the old fields south of the driving range towards forest will substantially increase the width and acreage of the forest riparian corridor and reduce the impacts of fragmentation on songbirds. 2) The **Indian Ridge Prairie** presents an excellent

opportunity for education on prairie ecosystems and the role that cemeteries have played in harboring small remnants of this once widespread community type (Figure 10: R). In addition, volunteer participation in stewardship activities at the site can be easily accomplished because of its easy accessibility and dry condition.

Deer Densities

Many studies have shown high deer densities to adversely impact local ecosystems and vegetation (Alverson et al. 1988, Strole and Anderson. 1992, Balgooyen and Waller 1995, Waller and Alverson 1997, Ruhren and Handel 2003). Signs of heavy

deer browsing were evident throughout the metroparks we surveyed and may be partially responsible for the lack of oak reproduction within metropark forests. Through preferential grazing of native species, high deer densities are thought to contribute to the spread of invasive, exotic species such as garlic mustard (Victoria Nuzzo pers. comm. 1998). It is recommended that the Huron-Clinton Metropolitan Authority work cooperatively with the Michigan Department of Natural Resources to assess metropark deer densities and reduce deer densities if determined to be higher than recommended by the DNR

Conclusion

The Huron-Clinton Metropolitan Authority has the considerable responsibility of stewarding numerous populations of rare species and ecologically significant natural communities. As the region becomes more developed, the prominence of natural features harbored by the metroparks is substantially heightened. Both rare and common native species are threatened by the rapid pace of development in southeast Michigan. In addition, changes taking place outside metropark boundaries are having significant repercussions within their borders. For example, as new roads, subdivisions, shopping centers, and industries are built outside metroparks, invasive plants used in landscaping quickly find their way into the parks and cause severe degradation to natural communities and their associated complement of native species. Historic wildlife corridors are disrupted, and cosmopolitan edge species such as white-tailed deer increasingly seek refuge within the confines of the metroparks. The increased density of deer results in extirpation of numerous plant and animal species as their effects on ecosystems reverberate at multiple trophic levels (McShea and Rappole 1992, Waller and Alverson 1997). As rare plants and high quality natural communities are lost due to development, the regional significance of these natural features within the metroparks becomes even more important.

Conservation scientists and practitioners are more aware today than ever before that protecting rare species and ecologically significant natural communities requires far more than simply building preserves to prevent their outright destruction (Janzen 1986). Because changes occurring outside metropark boundaries result in significant impacts within the park, protection of rare species and natural communities today requires the active participation of metropark staff in stewarding the

land for ecological integrity. This formidable task requires metropark staff to identify significant natural features, develop conservation strategies, and apply their considerable expertise in resource management to the active stewardship of ecological integrity within the metroparks.

Indian Springs, Lower Huron, and Willow Metroparks all support significant natural features that are threatened by events taking place within the parks as well outside their boundaries. The metroparks have lost a considerable amount of their biodiversity as a result of fire suppression, infestation of pernicious invasive species, and unnaturally high white-tail deer populations. The loss of biodiversity caused by infestations of invasive plants can be reversed by developing monitoring and eradication programs that are focused on protecting the centers of biodiversity, namely the wet-mesic prairies, prairie fens, wet meadows, swamp forests, floodplain forests, and mesic and dry-mesic forests. Finally, active management of the local deer herd is likely to result in the recovery of many plants and ground- and shrub-nesting animal species over time.

Tremendous ecological benefits can also be gained by directing the ecological succession of old fields towards oak barrens, lakeplain oak openings, oak woodlands, or floodplain forest. Connecting isolated forest patches, enlarging current woodlands, and creating a more natural transition between open field and forest edge will help increase nesting success rates of ground-nesting birds and mammals, forest raptors, and neotropical migrant songbirds, many of which are experiencing sharp declines in their populations. The ecological benefits of reducing fragmentation will be especially great when this approach is applied to important wildlife corridors like the Huron River floodplain at Lower Huron and Willow.

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Appendix 1 . Plant species observed at **Indian Springs Metropark**. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001).

Site name	Site Abbreviation	Site Code
Huron Swamp	HS	A
Timberland Lake Fen	TLF	B
Indian Springs Wet-Mesic Prairie	IWP	C
Indian Springs Prairie Fen	IPF	D
Indian Springs Wet Meadow	IWM	E
Nature Center Shrub-carr	NCS	F
Crosby Lake Road Old Fields	CLF	G
Crosby Lake Road Swamp	CLS	H
White Lake Road Wet Meadow	WLM	I

Site Name	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
Site Code	A	B	C	D	E	F	G	H	I

Species name	Common name	Life form	C	A	B	C	D	E	F	G	H	I
Acer negundo	box elder	Nt Tree	0	-	-	-	-	-	-	x	-	-
Acer rubrum	red maple	Nt Tree	1	x	-	-	-	-	-	-	x	-
Acer saccharinum	silver maple	Nt Tree	2	x	-	-	-	-	x	-	-	-
Acer saccharum	sugar maple	Nt Tree	5	x	-	-	-	-	-	-	-	-
Actaea pachypoda	doll's-eyes	Nt P-Forb	7	x	-	-	-	-	-	-	-	-
Adiantum pedatum	maidenhair fern	Nt Fern	6	x	-	-	-	-	-	-	-	-
Agalinis purpurea	purple gerardia	Nt A-Forb	7	-	-	x	-	-	-	-	-	-
Agropyron trachycaulum	slender wheat grass	Nt P-Grass	8	-	-	-	x	x	-	-	-	-
AGROSTIS GIGANTEA	REDTOP	Ad P-Grass	0	-	-	-	x	-	-	-	-	-
Alisma plantago-aquatica	water-plantain	Nt P-Forb	1	x	-	-	-	-	-	-	-	-
Amelanchier arborea	juneberry	Nt Tree	4	x	-	-	-	-	-	-	-	-
Amphicarpaea bracteata	hog peanut	Nt A-Forb	5	x	-	-	-	-	-	-	-	-
Andropogon scoparius	little bluestem grass	Nt P-Grass	5	-	-	x	-	-	-	x	-	-
Anemone cylindrica	thimbleweed	Nt P-Forb	6	-	-	x	-	-	-	-	-	-
Anemone quinquefolia	wood anemone	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Anemone virginiana	thimbleweed	Nt P-Forb	3	-	-	x	-	-	x	-	-	-
Anemonella thalictroides	rue anemone	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Apios americana	groundnut	Nt P-Forb	3	x	-	-	-	-	x	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Site Code	A	B	C	D	E	F	G	H	I
Aquilegia canadensis	wild columbine	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Aralia nudicaulis	wild sarsaparilla	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Asclepias exaltata	poke milkweed	Nt P-Forb	6	x	-	-	-	-	-	-	-	-
Asclepias incarnata	swamp milkweed	Nt P-Forb	6	x	x	x	x	x	x	-	-	x
Asclepias syriaca	common milkweed	Nt P-Forb	1	-	-	-	x	-	-	x	-	-
Asclepias tuberosa	butterfly-weed	Nt P-Forb	5	-	-	-	-	-	-	x	-	-
Aster cordifolius	heart-leaved aster	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Aster lanceolatus	eastern-lined aster	Nt P-Forb	2	-	x	x	x	x	-	-	-	-
Aster lateriflorus	side-flowering aster	Nt P-Forb	2	x	-	-	x	x	-	-	-	-
Aster macrophyllus	big-leaved aster	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Aster novae-angliae	New England aster	Nt P-Forb	3	-	-	x	x	-	x	-	-	-
Aster pilosus	hairy aster	Nt P-Forb	1	-	-	-	-	-	-	x	-	-
Aster puniceus	swamp aster	Nt P-Forb	5	x	-	-	x	x	-	-	-	x
Aster sagittifolius	arrow-leaved aster	Nt P-Forb	2	-	-	x	-	-	-	-	-	-
Aster umbellatus	tall flat-top white aster	Nt P-Forb	5	x	-	-	x	-	x	-	-	-
Athyrium filix-femina	lady fern	Nt Fern	4	x	-	-	-	-	x	-	-	-
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	0	x	-	-	-	-	-	-	-	-
Betula alleghaniensis	yellow birch	Nt Tree	7	x	-	-	-	-	-	-	x	-
Betula pumila	bog birch	Nt Shrub	8	-	x	-	x	-	-	-	-	-
Bidens coronatus	tall swamp marigold	Nt A-Forb	7	-	x	-	x	x	-	-	x	x
Boehmeria cylindrica	false nettle	Nt P-Forb	5	x	x	-	-	-	-	-	x	-
Botrychium virginianum	rattlesnake fern	Nt Fern	5	x	-	-	-	-	-	-	-	-
Brachyelytrum erectum	long-awned wood grass	Nt P-Grass	7	x	-	-	-	-	-	-	-	-
Bromus ciliatus	fringed brome	Nt P-Grass	6	-	-	x	x	x	-	-	-	-
BROMUS INERMIS	SMOOTH BROME	Ad P-Grass	0	-	-	-	-	-	-	x	-	-
Bromus pubescens	Canada brome	Nt P-Grass	5	x	-	-	-	-	-	-	-	-
Calamagrostis canadensis	blue-joint grass	Nt P-Grass	3	-	x	-	x	x	-	-	-	x
Caltha palustris	marsh marigold	Nt P-Forb	6	x	x	-	-	-	x	-	-	-
Campanula aparinoides	marsh bellflower	Nt P-Forb	7	-	x	-	-	x	-	-	-	-
Cardamine bulbosa	spring cress	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Carex albursina	sedge	Nt P-Sedge	5	x	-	-	-	-	-	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Code	A	B	C	D	E	F	G	H	I
Carex amphibola	sedge	Nt P-Sedge	8	x	-	-	-	-	-	-	-	-
Carex aquatilis	sedge	Nt P-Sedge	7	-	x	-	-	-	-	-	-	-
Carex blanda	sedge	Nt P-Sedge	1	x	-	-	x	-	-	-	-	-
Carex bromoides	sedge	Nt P-Sedge	6	x	-	-	-	-	-	-	-	-
Carex crinita	sedge	Nt P-Sedge	4	x	-	-	-	-	-	-	-	-
Carex cryptolepis	sedge	Nt P-Sedge	10	-	x	x	-	-	-	-	-	-
Carex diandra	sedge	Nt P-Sedge	8	-	x	-	-	-	-	-	-	-
Carex flava	sedge	Nt P-Sedge	4	-	x	x	x	-	-	-	-	-
Carex gracillima	sedge	Nt P-Sedge	4	x	-	-	-	-	-	-	-	-
Carex grayi	sedge	Nt P-Sedge	6	x	-	-	-	-	-	-	-	-
Carex hystericina	sedge	Nt P-Sedge	2	-	-	-	x	-	-	-	-	-
Carex interior	sedge	Nt P-Sedge	3	x	x	-	-	-	-	-	-	-
Carex intumescens	sedge	Nt P-Sedge	3	x	-	-	-	-	-	-	-	-
Carex lacustris	sedge	Nt P-Sedge	6	x	-	-	-	x	x	-	-	-
Carex lasiocarpa	sedge	Nt P-Sedge	8	-	x	x	-	-	-	-	-	-
Carex leptalea	sedge	Nt P-Sedge	5	-	-	x	x	-	-	-	-	-
Carex pedunculata	sedge	Nt P-Sedge	5	x	-	-	-	-	-	-	-	-
Carex pensylvanica	sedge	Nt P-Sedge	4	x	-	x	-	-	-	-	-	-
Carex plantaginea	sedge	Nt P-Sedge	8	x	-	-	-	-	-	-	-	-
Carex prairea	sedge	Nt P-Sedge	10	-	x	-	-	-	-	-	-	-
Carex rosea	curly-styled wood sedge	Nt P-Sedge	2	x	-	-	-	-	-	-	-	-
Carex rostrata	sedge	Nt P-Sedge	10	-	-	-	-	-	x	-	-	-
Carex sartwellii	sedge	Nt P-Sedge	5	-	x	-	-	-	-	-	-	-
Carex sterilis	sedge	Nt P-Sedge	10	-	x	x	x	-	-	-	-	-
Carex stipata	sedge	Nt P-Sedge	1	x	-	-	-	-	x	-	-	-
Carex stricta	sedge	Nt P-Sedge	4	x	x	x	x	x	x	-	-	x
Carex tetanica	sedge	Nt P-Sedge	9	-	x	-	-	-	-	-	-	-
Carex tuckermanii	sedge	Nt P-Sedge	8	x	-	-	-	-	-	-	-	-
Carex vulpinoidea	sedge	Nt P-Sedge	1	-	-	-	x	-	-	-	-	-
Carpinus caroliniana	blue-beech	Nt Tree	6	x	-	-	-	-	-	-	-	-
Carya cordiformis	bitternut hickory	Nt Tree	5	x	-	-	-	-	-	-	-	-
Carya glabra	pignut hickory	Nt Tree	5	-	-	-	-	-	-	x	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name	A	B	C	D	E	F	G	H	I
			Code									
Carya ovata	shagbark hickory	Nt Tree	5	x	-	-	-	-	-	-	-	-
Caulophyllum thalictroides	blue cohosh	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
CENTAUREA MACULOSA	SPOTTED KNAPWEED	Ad B-Forb	0	-	-	x	-	-	-	x	-	-
Chelone glabra	turtlehead	Nt P-Forb	7	x	-	-	-	x	-	-	-	-
Cicuta bulbifera	water-hemlock	Nt P-Forb	5	-	x	-	-	-	-	-	-	-
Cicuta maculata	water-hemlock	Nt B-Forb	4	x	-	-	-	x	x	-	-	-
Cinna arundinacea	wood reedgrass	Nt P-Grass	7	x	-	-	-	-	-	-	-	-
Circaea lutetiana	enchanter's-nightshade	Nt P-Forb	2	x	-	-	-	-	-	-	-	-
Cirsium muticum	swamp thistle	Nt B-Forb	6	x	-	-	-	-	x	-	-	-
CIRSIUM PALUSTRE	MARSH THISTLE	Ad B-Forb	0	-	-	x	-	-	-	-	-	-
Cladium mariscoides	Twig-rush	Nt P-Sedge	10	-	x	-	-	-	-	-	-	-
Comandra umbellata	bastard toadflax	Nt P-Forb	5	-	-	-	-	-	x	-	-	-
Corallorhiza maculata	spotted coral-root	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Cornus alternifolia	alternate-leaved dogwood	Nt Tree	5	x	-	-	-	-	-	-	-	-
Cornus amomum	silky dogwood	Nt Shrub	2	-	-	x	x	x	-	-	-	-
Cornus florida	flowering dogwood	Nt Tree	8	x	-	-	-	-	-	-	-	-
Cornus foemina	gray dogwood	Nt Shrub	1	x	x	x	x	x	x	-	-	-
Cornus stolonifera	red-osier dogwood	Nt Shrub	2	x	x	x	x	x	x	-	-	x
Corylus americana	hazelnut	Nt Shrub	5	x	-	-	-	-	-	-	-	-
Crataegus sp.	hawthorn	Nt Tree		x	-	-	-	-	-	-	-	-
Cryptotaenia canadensis	honewort	Nt P-Forb	2	x	-	-	-	-	-	-	-	-
Cuscuta groenovii	common dodder	Nt A-Forb	3	x	-	-	-	-	-	-	-	-
Cypripedium calceolus var. pubescens	large yellow lady's-slipper	Nt P-Forb	5	x	-	-	-	-	x	-	-	-
Danthonia spicata	poverty grass; oatgrass	Nt P-Grass	4	-	-	x	-	-	-	-	-	-
DAUCUS CAROTA	QUEEN-ANNE'S-LACE	Ad B-Forb	0	-	-	x	x	-	-	-	-	-
Decodon verticillatus	whorled or swamp loosestrife	Nt Shrub	7	-	x	-	-	-	-	-	-	-
Dentaria diphylla	two-leaved toothwort	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Dirca palustris	leatherwood	Nt Shrub	8	x	-	-	-	-	-	-	-	-
Drosera rotundifolia	round-leaved sundew	Nt P-Forb	6	-	x	-	-	-	-	-	-	-
Dryopteris carthusiana	spinulose woodfern	Nt Fern	5	x	-	-	-	-	-	-	-	-
Dryopteris cristata	crested shield fern	Nt Fern	6	x	-	-	-	-	-	-	-	-
Dryopteris intermedia	evergreen woodfern	Nt Fern	5	x	-	-	-	-	-	-	-	-

Appendix 1 Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name	A	B	C	D	E	F	G	H	I
			Code									
Echinocystis lobata	wild cucumber	Nt A-Forb	2	-	-	-	-	x	-	-	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	0	x	-	x	-	x	-	x	-	-
Eleocharis elliptica	golden-seeded spike-rush	Nt P-Sedge	6	-	x	-	-	-	-	-	-	-
Eleocharis rostellata	spike-rush	Nt P-Sedge	10	-	x	-	-	-	-	-	-	-
Elymus canadensis	Canada wild-rye	Nt P-Grass	7	x	-	-	-	x	-	-	-	-
Epilobium leptophyllum	fen willow-herb	Nt P-Forb	6	-	-	-	x	x	-	-	-	-
		Nt Fern										
Equisetum arvense	common horsetail	Ally	0	x	-	x	x	-	x	-	-	-
		Nt Fern										
Equisetum fluviatile	water horsetail	Ally	7	x	-	-	-	-	-	-	-	-
		Nt Fern										
Equisetum hyemale	scouring rush	Ally	2	-	-	-	x	-	-	-	-	-
		Nt Fern										
Equisetum palustre	marsh horsetail	Ally	10	x	-	-	-	-	-	-	-	-
Erigeron philadelphicus	marsh fleabane	Nt P-Forb	2	x	-	-	-	-	-	-	-	-
Eriophorum viridi-carinatum	green-keeled cotton-grass	Nt P-Sedge	8	-	x	-	-	-	-	-	-	-
Erythronium americanum	yellow trout-lily	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Euonymus obovata	running strawberry-bush	Nt Shrub	5	x	-	-	-	-	-	-	-	-
Eupatorium maculatum	joe-pye-weed	Nt P-Forb	4	x	-	x	x	x	x	-	-	x
Eupatorium perfoliatum	common boneset	Nt P-Forb	4	x	x	x	x	x	-	-	-	x
Euphorbia maculata	nodding spurge	Nt A-Forb	0	-	x	-	-	-	-	-	-	-
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	3	-	-	x	x	x	x	-	-	-
Fagus grandifolia	American beech	Nt Tree	6	x	-	-	-	-	-	-	-	-
Festuca subverticillata	nodding fescue	Nt P-Grass	5	x	-	-	-	-	-	-	-	-
Floerkea proserpinacoides	false mermaid	Nt A-Forb	7	x	-	-	-	-	-	-	-	-
Fragaria virginiana	wild strawberry	Nt P-Forb	2	x	-	x	x	-	-	-	-	-
Fraxinus americana	white ash	Nt Tree	5	x	-	-	-	-	-	-	-	-
Fraxinus nigra	black ash	Nt Tree	6	x	-	-	-	-	-	-	x	-
Fraxinus pennsylvanica	red ash	Nt Tree	2	x	-	-	-	x	-	-	-	-
Galium aparine	annual bedstraw	Nt A-Forb	0	x	-	-	-	-	-	-	-	-
Galium asprellum	rough bedstraw	Nt P-Forb	5	x	-	-	-	x	x	-	-	-
Galium boreale	northern bedstraw	Nt P-Forb	3	-	-	x	-	-	-	-	-	-
Galium circaezans	white wild-licorice	Nt P-Forb	4	x	-	-	-	-	-	-	-	-

Appendix 1. Plant species observed at Indian Springs Metropark (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Site Name	A	B	C	D	E	F	G	H	I
			Site Code									
Lobelia kalmii	bog lobelia	Nt P-Forb	10	-	x	x	x	-	-	-	-	-
Lobelia siphilitica	great blue lobelia	Nt P-Forb	4	x	-	x	x	-	-	-	-	-
Lobelia spicata	pale spiked lobelia	Nt P-Forb	4	-	-	-	x	-	-	-	-	-
Lonicera dioica	red honeysuckle	Nt W-Vine	5	x	-	-	-	-	-	-	-	-
LONICERA MORROWII	MORROW HONEYSUCKLE	Ad Shrub	0	x	-	-	-	-	-	x	x	-
Luzula multiflora	common wood rush	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Lycopus americanus	common water-horehound	Nt P-Forb	2	-	-	x	x	-	-	-	-	-
Lycopus uniflorus	northern bugleweed	Nt P-Forb	2	-	x	-	x	x	-	-	x	-
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	4	-	-	-	x	-	-	-	-	-
Lysimachia quadriflora	whorled loosestrife	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Lysimachia thyrsoflora	tufted loosestrife	Nt P-Forb	6	x	x	-	-	-	-	-	x	-
Maianthemum canadense	Canada mayflower	Nt P-Forb	4	x	-	-	-	-	-	-	x	-
Medeola virginiana	Indian cucumber-root	Nt P-Forb	10	x	-	-	-	-	-	-	-	-
Mentha arvensis	wild mint	Nt P-Forb	3	-	-	-	x	x	-	-	-	-
Mitchella repens	partridge berry	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Mitella diphylla	bishop's-cap	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Mitella nuda	naked miterwort	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Monarda fistulosa	wild bergamot	Nt P-Forb	2	-	-	x	-	-	-	-	-	-
Muhlenbergia glomerata	marsh wild timothy	Nt P-Grass	10	-	x	x	x	x	-	-	-	-
Muhlenbergia mexicana	leafy satin grass	Nt P-Grass	3	-	-	x	x	x	-	-	-	-
MYOSOTIS SCORPIOIDES	FORGET-ME-NOT	Ad P-Forb	0	x	-	-	-	-	-	-	-	-
Onoclea sensibilis	sensitive fern	Nt Fern	2	x	-	-	-	x	x	-	x	-
Oryzopsis asperifolia	rough-leaved rice grass	Nt P-Grass	6	x	-	-	-	-	-	-	-	-
Osmunda cinnamomea	cinnamon fern	Nt Fern	5	x	-	-	-	-	-	-	x	-
Osmunda claytoniana	interrupted fern	Nt Fern	6	x	-	-	-	-	-	-	-	-
Osmunda regalis	royal fern	Nt Fern	5	x	-	-	-	-	-	-	x	-
Ostrya virginiana	ironwood; hop-hornbeam	Nt Tree	5	x	-	-	-	-	-	-	-	-
Panax trifolius	dwarf ginseng	Nt P-Forb	8	x	-	-	-	-	-	-	-	-
Panicum implicatum	panic grass	Nt P-Grass	3	-	-	x	x	-	-	-	-	-
Parnassia glauca	grass-of-Parnassus	Nt P-Forb	8	-	x	x	x	-	-	-	-	-
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	5	x	-	-	-	x	x	-	-	-
Pedicularis lanceolata	swamp betony	Nt P-Forb	8	x	x	x	x	x	x	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name									
			Code	A	B	C	D	E	F	G	H	I
Phalaris arundinacea	reed canary grass	Nt P-Grass	0	x	x	x	-	x	x	-	x	x
PHLEUM PRATENSE	TIMOTHY	Ad P-Grass	0	-	-	x	-	-	x	x	-	-
Phlox divaricata	woodland phlox	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Phragmites australis	reed	Nt P-Grass	0	-	x	-	-	x	-	-	-	x
Physocarpus opulifolius	ninebark	Nt Shrub	4	x	-	x	-	-	-	-	-	-
Pilea fontana	bog clearweed	Nt A-Forb	5	x	-	-	-	x	-	-	-	-
Pilea pumila	clearweed	Nt A-Forb	5	x	-	-	-	-	-	-	-	-
POA COMPRESSA	CANADA BLUEGRASS	Ad P-Grass	0	-	-	-	-	-	-	x	-	-
Poa palustris	fowl meadow grass	Nt P-Grass	3	x	-	-	-	-	-	-	-	-
POA PRATENSIS	KENTUCKY BLUEGRASS	Ad P-Grass	0	-	-	x	-	-	x	x	-	-
Podophyllum peltatum	may-apple	Nt P-Forb	3	x	-	x	-	-	-	-	-	-
Polygonatum pubescens	downy Solomon-seal	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Polygonum amphibium	water smartweed	Nt P-Forb	6	x	-	-	-	x	-	-	x	-
Polygonum virginianum	jumpseed	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Polystichum acrostichoides	Christmas fern	Nt Fern	6	x	-	-	-	-	-	-	-	-
Populus deltoides	cottonwood	Nt Tree	1	x	-	-	-	-	-	-	-	-
Populus grandidentata	big-toothed aspen	Nt Tree	4	x	-	-	-	-	-	-	-	-
Populus tremuloides	quaking aspen	Nt Tree	1	x	-	x	x	-	x	-	-	-
Potentilla fruticosa	shrubby cinquefoil	Nt Shrub	10	-	x	x	x	-	-	-	-	-
Potentilla simplex	old field cinquefoil	Nt P-Forb	2	x	-	-	-	-	-	-	-	-
Prenanthes alba	white lettuce	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
PRUNELLA VULGARIS	lawn prunella	Nt P-Forb	0	x	-	x	x	-	-	-	-	-
PRUNUS AVIUM	SWEET CHERRY	Ad Tree	0	x	-	-	-	-	-	-	-	-
Prunus serotina	wild black cherry	Nt Tree	2	x	-	x	-	-	-	x	-	-
Prunus virginiana	choke cherry	Nt Shrub	2	x	-	-	-	-	-	-	-	-
Pteridium aquilinum	bracken fern	Nt Fern	0	x	-	-	-	-	-	-	-	-
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	5	-	-	x	x	x	-	-	-	-
Quercus alba	white oak	Nt Tree	5	x	-	-	-	-	-	x	-	-
Quercus bicolor	swamp white oak	Nt Tree	8	x	-	-	-	-	-	-	x	-
Quercus macrocarpa	bur oak	Nt Tree	5	x	-	-	-	-	-	-	-	-
Quercus rubra	red oak	Nt Tree	5	x	-	-	-	-	-	-	-	-
Quercus velutina	black oak	Nt Tree	6	x	-	-	-	-	-	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name									
			Site	A	B	C	D	E	F	G	H	I
			Code									
Ranunculus abortivus	small-flowered buttercup	Nt A-Forb	0	x	-	-	-	-	-	-	-	-
Ranunculus recurvatus	hooked crowfoot	Nt A-Forb	5	x	-	-	-	-	-	-	-	-
Rhamnus alnifolia	alder-leaved buckthorn	Nt Shrub	8	-	x	-	-	-	x	-	-	-
RHAMNUS CATHARTICA	COMMON BUCKTHORN	Ad Tree	0	x	-	x	-	-	-	x	-	-
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	0	x	x	x	-	x	-	-	-	-
Rhynchospora alba	Beak-rush	Nt P-Sedge	6	-	x	-	-	-	-	-	-	-
Rhynchospora capillacea	Beak-rush	Nt P-Sedge	10	-	-	-	x	-	-	-	-	-
Ribes americanum	wild black currant	Nt Shrub	6	x	-	-	-	-	-	-	-	-
Ribes cynosbati	prickly or wild gooseberry	Nt Shrub	4	x	-	-	-	x	-	-	-	-
Ribes hirtellum	swamp gooseberry	Nt Shrub	6	-	-	x	x	x	x	-	-	-
Ribes triste	swamp red currant	Nt Shrub	6	x	-	-	-	-	-	-	-	-
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	0	x	-	-	-	-	-	-	-	-
Rosa palustris	swamp rose	Nt Shrub	5	x	x	-	-	-	x	-	-	-
Rubus allegheniensis	common blackberry	Nt Shrub	1	x	-	x	-	-	-	-	-	-
Rubus hispidus	swamp dewberry	Nt Shrub	4	x	-	-	-	-	-	-	-	-
Rubus pubescens	dwarf raspberry	Nt P-Forb	4	x	x	-	x	x	x	-	-	-
Rudbeckia hirta	black-eyed susan	Nt P-Forb	1	-	-	x	-	-	x	-	-	-
Rudbeckia laciniata	cut-leaved coneflower	Nt P-Forb	6	x	-	-	-	-	-	-	-	-
Rumex orbiculatus	great water dock	Nt P-Forb	9	-	x	-	x	-	x	-	-	x
Salix bebbiana	Bebb's willow	Nt Shrub	1	-	-	x	x	-	x	-	-	-
Salix candida	hoary willow	Nt Shrub	9	-	x	-	x	-	-	-	-	-
Salix discolor	pussy willow	Nt Shrub	1	-	-	x	x	x	-	-	-	-
Salix exigua	sandbar willow	Nt Shrub	1	-	-	-	-	-	x	-	-	x
Salix lucida	shining willow	Nt Shrub	3	-	x	-	x	-	x	-	-	-
Salix nigra	black willow	Nt Tree	5	x	-	-	-	-	-	-	-	-
Salix petiolaris	slender willow	Nt Shrub	1	-	-	x	-	x	x	-	-	-
Sambucus canadensis	elderberry	Nt Shrub	3	x	-	-	-	-	-	-	-	-
Sanicula gregaria	black snakeroot	Nt P-Forb	2	x	-	x	-	-	-	-	-	-
Sarracenia purpurea	pitcher-plant	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Saxifraga pensylvanica	swamp saxifrage	Nt P-Forb	10	-	x	-	-	-	x	-	-	-
Schoenoplectus acutus	hardstem bulrush	Nt P-Sedge	5	-	x	-	x	-	-	-	-	-
Schoenoplectus pungens	three-square	Nt P-Sedge	5	-	x	-	-	-	-	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name	A	B	C	D	E	F	G	H	I
			Code	A	B	C	D	E	F	G	H	I
Schoenoplectus tabernaemontani	softstem bulrush	Nt P-Sedge	4	-	-	-	-	-	-	-	-	x
Scirpus atrovirens	bulrush	Nt P-Sedge	3	-	-	-	x	-	-	-	-	x
Scirpus cyperinus	wool-grass	Nt P-Sedge	5	-	-	-	-	-	-	-	-	x
Scutellaria galericulata	common skullcap	Nt P-Forb	5	-	-	-	-	x	-	-	-	-
Senecio aureus	golden ragwort	Nt P-Forb	5	x	-	x	x	-	-	-	-	-
Sium suave	water parsnip	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Smilacina racemosa	false spikenard	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Smilacina stellata	starry false solomon-seal	Nt P-Forb	5	x	-	-	-	-	x	-	-	-
Smilacina trifolia	false mayflower	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Smilax tamnoides	bristly greenbrier	Nt W-Vine	5	x	-	-	-	-	-	-	-	-
SOLANUM DULCAMARA	NIGHTSHADE	Ad P-Forb	0	x	-	-	-	-	-	-	x	-
Solidago altissima	tall goldenrod	Nt P-Forb	1	-	-	x	x	x	x	x	-	-
Solidago caesia	blue-stemmed goldenrod	Nt P-Forb	7	x	-	-	-	-	-	-	-	-
Solidago canadensis	Canada goldenrod	Nt P-Forb	1	-	-	-	-	-	-	x	-	-
Solidago flexicaulis	broad-leaved goldenrod	Nt P-Forb	6	x	-	-	-	-	-	-	-	-
Solidago gigantea	late goldenrod	Nt P-Forb	3	-	-	-	-	x	-	-	-	-
Solidago nemoralis	old field goldenrod	Nt P-Forb	2	-	-	x	-	-	x	x	-	-
Solidago ohioensis	Ohio goldenrod	Nt P-Forb	8	-	x	-	x	x	-	-	-	-
Solidago patula	swamp goldenrod	Nt P-Forb	6	x	-	-	-	x	-	-	-	-
Solidago riddellii	Riddell's goldenrod	Nt P-Forb	6	-	x	x	x	x	x	-	-	-
Solidago rigida	stiff goldenrod	Nt P-Forb	5	-	x	-	-	-	-	-	-	-
Solidago rugosa	rough goldenrod	Nt P-Forb	3	x	-	x	x	-	x	-	-	-
Solidago speciosa	showy goldenrod	Nt P-Forb	5	-	-	-	-	-	-	x	-	-
Solidago uliginosa	bog goldenrod	Nt P-Forb	4	x	x	-	x	-	-	-	-	-
Spiraea alba	meadowsweet	Nt Shrub	4	x	-	x	-	x	x	-	-	-
Spiranthes cernua	nodding ladies'-tresses	Nt P-Forb	4	-	-	x	-	-	x	-	-	-
Symplocarpus foetidus	skunk cabbage	Nt P-Forb	6	x	x	-	-	-	x	-	x	-
Thalictrum dasycarpum	purple meadow-rue	Nt P-Forb	3	x	x	-	x	x	-	-	-	-
Thalictrum dioicum	early meadow-rue	Nt P-Forb	6	x	-	-	-	-	-	-	-	-
Thelypteris palustris	marsh fern	Nt Fern	2	x	x	x	x	x	x	-	x	x
Tiarella cordifolia	foamflower	Nt P-Forb	9	x	-	-	-	-	-	-	-	-
Tilia americana	basswood	Nt Tree	5	x	-	-	-	-	-	-	-	-

Appendix 1. Plant species observed at **Indian Springs Metropark** (continued).

Species name	Common name	Life form	Site	HS	TLF	IWP	IPF	IWM	NCS	CLF	CLS	WLM
			Name	A	B	C	D	E	F	G	H	I
			Code									
Tofieldia glutinosa	false asphodel	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Toxicodendron radicans	poison ivy	Nt W-Vine	2	x	-	-	-	-	x	-	-	-
Toxicodendron vernix	poison sumac	Nt Shrub	6	x	x	-	x	x	-	-	x	x
Triadenum fraseri	marsh St. John's-wort	Nt P-Forb	6	-	x	-	-	-	-	-	-	-
Trientalis borealis	starflower	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Trillium grandiflorum	common trillium	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
	NARROW-LEAVED											
TYPHA ANGUSTIFOLIA	CATTAIL	Ad P-Forb	0	x	x	-	-	-	-	-	-	x
Typha latifolia	broad-leaved cattail	Nt P-Forb	1	-	-	-	x	x	x	-	-	x
Ulmus americana	American elm	Nt Tree	1	x	x	-	-	x	x	-	x	x
Urtica dioica	nettle	Nt P-Forb	1	x	-	-	-	x	-	-	-	-
Utricularia minor	small bladderwort	Nt P-Forb	10	-	x	-	-	-	-	-	-	-
Uvularia grandiflora	bellwort	Nt P-Forb	5	x	-	-	-	-	-	-	-	-
Vaccinium corymbosum	smooth highbush blueberry	Nt Shrub	6	-	-	-	-	-	-	-	x	-
Valeriana uliginosa	bog valerian	Nt P-Forb	10	-	x	-	x	-	-	-	-	-
Verbena hastata	blue vervain	Nt P-Forb	4	-	-	-	-	x	-	-	-	-
Viburnum acerifolium	maple-leaved arrow-wood	Nt Shrub	6	x	-	-	-	-	-	-	-	-
Viburnum dentatum	smooth arrow-wood	Nt Shrub	6	x	-	-	-	-	-	-	-	-
Viburnum lentago	nannyberry	Nt Shrub	4	x	x	-	x	x	-	-	-	x
Viburnum opulus var. americanum	highbush cranberry	Nt Shrub	5	x	-	-	-	-	-	-	-	-
Viola nephrophylla	northern bog violet	Nt P-Forb	8	-	x	-	-	-	-	-	-	-
Viola pubescens	yellow violet	Nt P-Forb	4	x	-	-	-	-	-	-	-	-
Vitis riparia	riverbank grape	Nt W-Vine	3	x	-	-	-	x	-	-	-	-
Zanthoxylum americanum	prickly-ash	Nt Shrub	3	x	-	-	-	-	-	-	-	-
Zigadenus glaucus	white camas	Nt P-Forb	10	-	-	-	x	-	-	-	-	-
Zizia aurea	golden alexanders	Nt P-Forb	6	-	-	x	-	-	-	-	-	-
Total number of species observed in survey site				209	77	79	79	64	56	22	24	21
Total number of species observed in Indian Springs: 330												

Appendix 2. Plant species observed at **Lower Huron Metropark**. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001).

Site name	Site Abbreviation	Site Code								
Haggerty Road Floodplain Forest	HRF	J								
Paw Paw Trail Floodplain Forest	PTF	K								
Lower Huron Floodplain Forests	LHF	L								
Bobwhite Trail Forest	BTF	M								
Bobwhite Borrow Pit	BBP	N								
Fox Woods Ravine	FWR	O								
				Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
Species Name	Common Name	Life Form	C							
ACER GINNALA	AMUR MAPLE	Ad Tree	0	-	-	x	-	-	-	
Acer negundo	box elder	Nt Tree	0	x	x	x	-	-	-	
Acer nigrum	black maple	Nt Tree	4	x	x	x	-	-	-	
ACER PLATANOIDES	NORWAY MAPLE	Ad Tree	0	-	-	x	-	-	-	
Acer rubrum	red maple	Nt Tree	1	-	-	x	x	x	x	
Acer saccharinum	silver maple	Nt Tree	2	x	x	x	x	-	-	
Acer saccharum	sugar maple	Nt Tree	5	x	x	x	x	-	-	
Achillea millefolium	yarrow	Nt P-Forb	1	-	-	-	-	-	x	
Actaea pachypoda	doll's-eyes	Nt P-Forb	7	x	-	x	x	-	x	
Adiantum pedatum	maidenhair fern	Nt Fern	6	-	-	-	-	-	x	
Agalinis purpurea	purple gerardia	Nt A-Forb	7	-	-	-	-	x	-	
Agrimonia gryposepala	tall agrimony	Nt P-Forb	2	-	-	x	x	-	x	
AGROPYRON REPENS	QUACK GRASS	Ad P-Grass	0	-	-	-	-	-	x	
AILANTHUS ALTISSIMA	TREE-OF-HEAVEN	Ad Tree	0	-	-	x	-	-	-	
Alisma plantago-aquatica	water-plantain	Nt P-Forb	1	-	-	-	-	-	x	
ALLIARIA PETIOLATA	GARLIC MUSTARD	Ad B-Forb	0	x	-	-	-	-	-	
Allium canadense	wild garlic	Nt P-Forb	4	x	x	x	-	-	-	
Allium tricoccum	wild leek	Nt P-Forb	5	x	-	-	-	-	-	
Alnus rugosa	tag alder	Nt Shrub	5	-	-	-	-	x	-	

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

		Site Name	HRF	PTF	LHF	BTF	BBP	FWR
		Site Code	J	K	L	M	N	O
Species Name	Common Name	Life Form	C					
Amelanchier arborea	juneberry	Nt Tree	4	-	-	x	-	-
Amphicarpaea bracteata	hog-peanut	Nt A-Forb	5	-	-	-	-	x
Andropogon virginicus	broom-sedge	Nt P-Grass	4	-	-	-	-	x
Anemone canadensis	Canada anemone	Nt P-Forb	4	-	-	x	-	-
Anemone quinquefolia	wood anemone	Nt P-Forb	5	x	x	-	x	-
Anemone virginiana	thimbleweed	Nt P-Forb	3	-	-	x	-	-
Anemonella thalictroides	rue anemone	Nt P-Forb	8	x	-	-	x	-
Apios americana	groundnut	Nt P-Forb	3	-	-	-	-	x
Apocynum cannabinum	Indian-hemp	Nt P-Forb	3	-	-	x	-	x
Aquilegia canadensis	wild columbine	Nt P-Forb	5	x	-	-	-	-
Arabis laevigata	smooth bank cress	Nt B-Forb	5	x	-	x	-	-
Aralia nudicaulis	wild sarsaparilla	Nt P-Forb	5	-	-	x	-	-
ARCTIUM MINUS	COMMON BURDOCK	Ad B-Forb	0	-	-	x	-	-
Arisaema dracontium	green dragon	Nt P-Forb	8	x	-	x	-	-
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	5	x	x	x	x	-
Aristolochia serpentaria	Virginia snakeroot	Nt P-Forb	10	x	-	-	-	-
Asarum canadense	wild-ginger	Nt P-Forb	5	x	x	x	-	x
Asclepias incarnata	swamp milkweed	Nt P-Forb	6	-	-	-	-	x
Asclepias syriaca	common milkweed	Nt P-Forb	1	-	-	x	-	-
Asimina triloba	pawpaw	Nt Tree	9	x	x	x	-	-
ASPARAGUS OFFICINALIS	ASPARAGUS	Ad P-Forb	0	-	-	-	-	x
Asplenium platyneuron	ebony spleenwort	Nt Fern	2	-	-	-	-	x
Aster cordifolius	heart-leaved aster	Nt P-Forb	4	-	-	-	-	x
Aster dumosus	bushy aster	Nt P-Forb	7	-	-	-	-	x
Aster firmus	smooth swamp aster	Nt P-Forb	4	-	-	-	-	x
Aster lateriflorus	side-flowering aster	Nt P-Forb	2	-	-	x	-	-
Aster macrophyllus	big-leaved aster	Nt P-Forb	4	x	-	x	-	x
Aster novae-angliae	New England aster	Nt P-Forb	3	-	-	-	-	x
Aster pilosus	hairy aster	Nt P-Forb	1	-	-	-	-	x
Aster umbellatus	tall flat-top white aster	Nt P-Forb	5	-	-	-	-	x
Athyrium filix-femina	lady fern	Nt Fern	4	-	-	-	x	-
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	0	x	x	x	x	-
Bidens coronatus	tall swamp marigold	Nt A-Forb	7	-	-	-	-	x
Bidens frondosus	common beggar-ticks	Nt A-Forb	1	-	-	x	-	-

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

Species Name	Common Name	Life Form	C	Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
Boehmeria cylindrica	false nettle	Nt P-Forb	5	-	-	x	-	-	-	x
Botrychium virginianum	rattlesnake fern	Nt Fern	5	x	-	x	-	-	-	-
Brachyelytrum erectum	long-awned wood grass	Nt P-Grass	7	x	-	-	-	-	-	-
Bromus latiglumis	ear-leaved brome	Nt P-Grass	6	x	-	-	-	-	-	-
Bromus pubescens	Canada brome	Nt P-Grass	5	-	-	x	-	-	-	x
Calamagrostis canadensis	blue-joint grass	Nt P-Grass	3	-	-	-	-	-	-	x
Caltha palustris	marsh marigold	Nt P-Forb	6	-	-	-	x	-	-	-
Cardamine douglassii	pink spring cress	Nt P-Forb	6	x	-	-	-	-	-	-
Carex albursina	sedge	Nt P-Sedge	5	-	-	x	-	-	-	-
Carex amphibola	sedge	Nt P-Sedge	8	-	-	x	-	-	-	-
Carex blanda	sedge	Nt P-Sedge	1	x	x	x	x	-	-	-
Carex careyana	sedge	Nt P-Sedge	10	x	-	-	-	-	-	-
Carex cephaloidea	sedge	Nt P-Sedge	5	x	-	-	-	-	-	-
Carex cephalophora	sedge	Nt P-Sedge	3	x	-	-	-	-	-	-
Carex communis	sedge	Nt P-Sedge	2	x	-	-	-	-	-	-
Carex emoryi	sedge	Nt P-Sedge	7	x	-	-	-	-	-	-
Carex formosa	sedge	Nt P-Sedge	10	x	-	-	-	-	-	-
Carex grayi	sedge	Nt P-Sedge	6	-	-	x	-	-	-	-
Carex hirtifolia	sedge	Nt P-Sedge	5	-	-	x	x	-	-	-
Carex hitchcockiana	sedge	Nt P-Sedge	5	x	-	-	-	-	-	-
Carex jamesii	James' sedge	Nt P-Sedge	8	x	-	-	-	-	-	-
Carex lacustris	sedge	Nt P-Sedge	6	-	-	-	-	-	-	x
Carex laxiculmis	sedge	Nt P-Sedge	8	-	-	x	-	-	-	-
Carex lurida	sedge	Nt P-Sedge	3	-	-	-	-	-	-	x
Carex muskingumensis	sedge	Nt P-Sedge	6	x	-	-	-	-	-	-
Carex pensylvanica	sedge	Nt P-Sedge	4	x	-	x	x	-	-	x
Carex radiata	straight-styled wood sedge	Nt P-Sedge	2	x	x	x	-	-	-	x
Carex rosea	curly-styled wood sedge	Nt P-Sedge	2	x	-	-	-	-	-	-
Carex sparganioides	sedge	Nt P-Sedge	5	x	-	-	-	-	-	-
Carex squarrosa	sedge	Nt P-Sedge	9	-	-	x	-	-	-	-
Carex stipata	sedge	Nt P-Sedge	1	x	-	-	-	-	-	x
Carex vulpinoidea	sedge	Nt P-Sedge	1	-	-	x	-	-	-	-
Carex woodii	sedge	Nt P-Sedge	8	x	-	-	-	-	-	-
Carpinus caroliniana	blue-beech	Nt Tree	6	x	x	x	x	-	-	x

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

		<table border="1"> <thead> <tr> <th>Site Name</th> <th>HRF</th> <th>PTF</th> <th>LHF</th> <th>BTF</th> <th>BBP</th> <th>FWR</th> </tr> <tr> <th>Site Code</th> <th>J</th> <th>K</th> <th>L</th> <th>M</th> <th>N</th> <th>O</th> </tr> </thead> </table>								Site Name	HRF	PTF	LHF	BTF	BBP	FWR	Site Code	J	K	L	M	N	O
Site Name	HRF	PTF	LHF	BTF	BBP	FWR																	
Site Code	J	K	L	M	N	O																	
Species Name	Common Name	Life Form	C																				
Carya cordiformis	bitternut hickory	Nt Tree	5	x	x	-	x	-	x														
Carya ovata	shagbark hickory	Nt Tree	5	-	x	x	x	-	x														
CATALPA SPECIOSA	NORTHERN CATALPA	Ad Tree	0	x	-	x	-	-	-														
Caulophyllum thalictroides	blue cohosh	Nt P-Forb	5	x	x	-	x	-	-														
CELASTRUS ORBICULATA	ORIENTAL BITTERSWEET	Ad W-Vine	0	-	-	x	-	-	-														
Celastrus scandens	American bittersweet	Nt W-Vine	3	-	x	-	-	-	-														
Celtis occidentalis	hackberry	Nt Tree	5	x	x	x	-	-	-														
Cercis canadensis	redbud	Nt Tree	8	x	x	x	-	-	x														
Chelone glabra	turtlehead	Nt P-Forb	7	-	-	-	-	-	x														
Cicuta bulbifera	water-hemlock	Nt P-Forb	5	-	-	-	-	-	x														
Cicuta maculata	water hemlock	Nt B-Forb	4	x	-	x	-	-	-														
Cinna arundinacea	wood reedgrass	Nt P-Grass	7	-	-	x	-	-	-														
Circaea lutetiana	enchanter's-nightshade	Nt P-Forb	2	x	x	x	x	-	-														
CIRSIUM VULGARE	BULL THISTLE	Ad B-Forb	0	-	-	x	-	x	-														
Claytonia virginica	spring beauty	Nt P-Forb	4	x	x	-	x	-	-														
Clematis virginiana	virgin's bower	Nt W-Vine	4	x	-	-	-	-	-														
Collinsonia canadensis	richweed	Nt P-Forb	8	-	-	-	x	-	-														
Comandra umbellata	bastard toadflax	Nt P-Forb	5	-	-	x	-	-	-														
CONVALLARIA MAJALIS	LILY-OF-THE-VALLEY	Ad P-Forb	0	x	x	x	-	-	-														
Coreopsis tripteris	tall coreopsis	Nt P-Forb	7	-	-	x	-	-	-														
Cornus alternifolia	alternate-leaved dogwood	Nt Tree	5	x	x	x	x	-	x														
Cornus amomum	silky dogwood	Nt Shrub	2	x	-	x	-	-	-														
Cornus drummondii	rough-leaved dogwood	Nt Shrub	6	-	-	x	-	-	-														
Cornus florida	flowering dogwood	Nt Tree	8	-	x	x	x	-	x														
Cornus foemina	gray dogwood	Nt Shrub	1	-	-	x	-	x	x														
Cornus stolonifera	red-osier dogwood	Nt Shrub	2	-	x	-	-	x	x														
Crataegus sp.	hawthorn	Nt Tree		-	x	x	-	-	-														
Cryptotaenia canadensis	honewort	Nt P-Forb	2	x	-	x	-	-	x														
DACTYLIS GLOMERATA	ORCHARD GRASS	Ad P-Grass	0	x	-	-	-	-	-														
DAUCUS CAROTA	QUEEN-ANNE'S-LACE	Ad B-Forb	0	-	-	x	-	x	-														
Dentaria laciniata	cut-leaved toothwort	Nt P-Forb	5	x	x	x	x	-	-														
Desmodium canadense	showy tick-trefoil	Nt P-Forb	3	-	-	-	-	-	x														
Desmodium glutinosum	clustered-leaved tick-trefoil	Nt P-Forb	5	-	-	x	-	-	x														
Diarrhena americana	beak grass	Nt P-Grass	9	x	x	x	-	-	-														

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

Species Name	Common Name	Life Form	C	Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
DIPSACUS LACINIATUS	CUT-LEAVED TEASEL	Ad B-Forb	0	-	-	-	x	-	-	-
Dirca palustris	leatherwood	Nt Shrub	8	x	-	-	-	-	-	-
Dryopteris carthusiana	spinulose woodfern	Nt Fern	5	-	-	-	-	x	-	x
Echinocystis lobata	wild-cucumber	Nt A-Forb	2	-	-	-	x	-	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	0	-	-	x	x	-	x	x
Eleocharis elliptica	golden-seeded spike-rush	Nt P-Sedge	6	-	-	-	-	-	x	-
Elymus canadensis	Canada wild-rye	Nt P-Grass	7	-	-	-	x	-	-	-
Elymus virginicus	Virginia wild-rye	Nt P-Grass	4	-	-	-	-	-	-	x
Epilobium coloratum	cinnamon willow-herb	Nt P-Forb	3	-	-	-	-	-	-	x
Equisetum arvense	common horsetail	Nt Fern Ally	0	x	-	-	x	-	x	x
Equisetum fluviatile	water horsetail	Nt Fern Ally	7	-	-	-	x	x	-	-
Equisetum hyemale	scouring rush	Nt Fern Ally	2	x	-	-	x	-	x	-
Equisetum laevigatum	smooth scouring rush	Nt Fern Ally	2	-	-	-	-	-	x	-
Erigeron philadelphicus	marsh fleabane	Nt P-Forb	2	-	-	-	x	-	-	-
Erythronium albidum	white trout-lily	Nt P-Forb	7	-	-	x	-	-	-	-
Erythronium americanum	yellow trout-lily	Nt P-Forb	5	x	-	x	-	x	-	-
EUONYMUS ALATA	WINGED WAHOO	Ad Shrub	0	-	-	-	x	x	-	-
Euonymus atropurpurea	wahoo; burning-bush	Nt Shrub	8	x	-	x	x	-	-	-
EUONYMUS EUROPAEA	SPINDLE TREE	Ad Shrub	0	x	-	-	-	-	-	-
Euonymus obovata	running strawberry-bush	Nt Shrub	5	x	-	x	x	x	-	x
Eupatorium maculatum	joe-pye-weed	Nt P-Forb	4	-	-	-	x	-	x	x
Eupatorium perfoliatum	common boneset	Nt P-Forb	4	-	-	-	-	-	x	x
Eupatorium purpureum	purple joe-pye-weed	Nt P-Forb	5	-	-	x	x	-	-	x
Eupatorium rugosum	white snakeroot	Nt P-Forb	4	x	-	x	x	-	-	-
Euphorbia corollata	flowering spurge	Nt P-Forb	4	-	-	-	-	-	-	x
Euphorbia maculata	nodding spurge	Nt A-Forb	0	-	-	-	x	-	-	-
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	3	-	-	-	-	-	x	x
Fagus grandifolia	American beech	Nt Tree	6	x	-	-	x	-	-	x
FESTUCA ARUNDINACEA	TALL FESCUE	Ad P-Grass	0	-	-	-	x	-	-	-
Fimbristylis autumnalis	autumn sedge	Nt A-Sedge	6	-	-	-	-	-	x	-
Fragaria virginiana	wild strawberry	Nt P-Forb	2	-	-	-	-	x	-	x
Fraxinus americana	white ash	Nt Tree	5	-	-	-	-	x	-	-
Fraxinus nigra	black ash	Nt Tree	6	x	-	-	-	-	-	-
Fraxinus pennsylvanica	red ash	Nt Tree	2	x	-	x	x	-	x	x

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

		Site Name	HRF	PTF	LHF	BTF	BBP	FWR
		Site Code	J	K	L	M	N	O
Species Name	Common Name	Life Form	C					
Fraxinus quadrangulata	blue ash	Nt Tree	8	x	-	x	-	-
Galium aparine	annual bedstraw	Nt A-Forb	0	x	x	-	-	-
Galium asprellum	rough bedstraw	Nt P-Forb	5	-	-	-	-	x
Galium concinnum	shining bedstraw	Nt P-Forb	5	x	-	-	-	-
Gentiana andrewsii	bottle gentian	Nt P-Forb	5	-	-	-	x	-
Gentianopsis crinita	fringed gentian	Nt A-Forb	8	-	-	-	x	-
Geranium maculatum	wild geranium	Nt P-Forb	4	x	x	x	x	-
Geum canadense	white avens	Nt P-Forb	1	-	-	x	-	-
Glyceria striata	fowl manna grass	Nt P-Grass	4	-	-	x	-	-
Gymnocladus dioicus	Kentucky coffee-tree	Nt Tree	9	x	x	x	-	-
Hackelia virginiana	beggar's-lice	Nt P-Forb	1	-	-	x	-	-
Hamamelis virginiana	witch-hazel	Nt Shrub	5	-	-	x	x	-
Helenium autumnale	sneezeweed	Nt P-Forb	5	-	-	-	-	x
Helianthus giganteus	tall sunflower	Nt P-Forb	5	-	-	x	-	-
Hepatica americana	round-lobed hepatica	Nt P-Forb	6	-	x	x	-	-
Hydrastis canadensis	goldenseal	Nt P-Forb	10	x	-	-	-	-
Hydrophyllum virginianum	Virginia waterleaf	Nt P-Forb	4	-	-	-	x	-
Hypericum kalmianum	Kalm's St. John's-wort	Nt Shrub	10	-	-	-	-	x
Hystrix patula	bottlebrush grass	Nt P-Grass	5	-	-	x	-	-
Impatiens capensis	spotted touch-me-not	Nt A-Forb	2	-	-	x	x	-
Iris virginica	southern blue flag	Nt P-Forb	5	-	-	x	-	-
Juglans nigra	black walnut	Nt Tree	5	x	x	x	-	-
Juncus effusus	soft-stemmed rush	Nt P-Forb	3	-	-	-	-	-
Juncus tenuis	path rush	Nt P-Forb	1	-	-	-	-	x
Juncus torreyi	Torrey's rush	Nt P-Forb	4	-	-	-	-	x
Juniperus virginiana	red-cedar	Nt Tree	3	x	-	-	-	x
Laportea canadensis	wood nettle	Nt P-Forb	4	x	x	x	-	-
Leersia oryzoides	cut grass	Nt P-Grass	3	-	-	-	-	-
Leersia virginica	white grass	Nt P-Grass	5	-	-	x	-	-
LIGUSTRUM VULGARE	COMMON PRIVET	Ad Shrub	0	x	x	x	-	-
Lilium michiganense	Michigan lily	Nt P-Forb	5	x	-	x	-	-
Lindera benzoin	spicebush	Nt Shrub	7	x	x	x	x	-
Linum medium	small yellow flax	Nt P-Forb	7	-	-	-	-	x
Liparis loeselii	Loesel's twayblade	Nt P-Forb	5	-	-	-	-	x

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

Species Name	Common Name	Life Form	C	Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
Liriodendron tulipifera	tulip-tree	Nt Tree	9	x	x	x	x	-	-	-
Lobelia siphilitica	great blue lobelia	Nt P-Forb	4	-	-	x	-	-	-	x
Lonicera dioica	red honeysuckle	Nt W-Vine	5	-	x	-	x	-	-	-
LONICERA MAACKII	AMUR HONEYSUCKLE	Ad Shrub	0	x	-	x	-	-	-	-
LONICERA MORROWII	MORROW HONEYSUCKLE	Ad Shrub	0	x	x	x	-	-	-	-
Lycopus americanus	common water-horehound	Nt P-Forb	2	-	-	-	-	-	x	-
Lycopus rubellus	stalked water-horehound	Nt P-Forb	8	x	-	-	-	-	-	-
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	4	x	x	x	-	-	-	-
LYSIMACHIA										
NUMMULARIA	MONEYWORT	Ad P-Forb	0	x	x	x	x	x	x	x
LYTHRUM SALICARIA	PURPLE LOOSESTRIFE	Ad P-Forb	0	x	-	-	-	-	x	-
Maianthemum canadense	Canada mayflower	Nt P-Forb	4	-	-	-	x	-	-	-
MALUS PUMILA	APPLE	Ad Tree	0	-	-	x	-	-	-	-
Matteuccia struthiopteris	ostrich fern	Nt Fern	3	x	-	x	-	-	-	-
Menispermum canadense	moonseed	Nt W-Vine	5	x	x	x	-	-	-	-
Mitella diphylla	bishop's-cap	Nt P-Forb	8	x	-	-	-	-	-	-
Monarda fistulosa	wild bergamot	Nt P-Forb	2	-	-	x	-	-	-	x
Monotropa uniflora	Indian pipe	Nt P-Forb	5	-	-	-	-	-	-	x
MORUS ALBA	WHITE MULBERRY	Ad Tree	0	x	-	x	-	-	-	-
Morus rubra	red mulberry	Nt Tree	9	-	x	x	-	-	-	-
Oenothera biennis	common evening primrose	Nt B-Forb	2	-	-	x	-	-	x	-
Onoclea sensibilis	sensitive fern	Nt Fern	2	x	x	-	x	-	-	x
Osmunda cinnamomea	cinnamon fern	Nt Fern	5	-	-	-	x	-	-	x
Osmunda regalis	royal fern	Nt Fern	5	-	-	-	x	-	-	-
Ostrya virginiana	ironwood; hop-hornbeam	Nt Tree	5	x	x	x	x	-	-	-
Oxalis stricta	common yellow wood-sorrel	Nt P-Forb	0	-	-	x	-	-	-	-
Oxypolis rigidior	cowbane	Nt P-Forb	6	-	-	-	-	-	-	x
Panicum clandestinum	panic grass	Nt P-Grass	3	-	-	-	-	-	-	x
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	5	x	x	x	x	-	-	x
Penstemon hirsutus	hairy beard-tongue	Nt P-Forb	5	-	-	-	-	-	-	x
Phalaris arundinacea	reed canary grass	Nt P-Grass	0	x	-	x	-	-	-	x
PHLEUM PRATENSE	TIMOTHY	Ad P-Grass	0	-	-	-	-	-	-	x

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

		Site Name	HRF	PTF	LHF	BTF	BBP	FWR
		Site Code	J	K	L	M	N	O
Species Name	Common Name	Life Form	C					
Phlox divaricata	woodland phlox	Nt P-Forb	5	x	-	-	-	-
Phragmites australis	reed	Nt P-Grass	0	-	-	-	x	-
Phryma leptostachya	lopseed	Nt P-Forb	4	-	-	x	-	-
Phyla lanceolata	fogfruit	Nt P-Forb	6	-	-	x	-	-
Physocarpus opulifolius	ninebark	Nt Shrub	4	-	-	x	-	-
Physostegia virginiana	false dragonhead	Nt P-Forb	8	-	-	-	x	-
Pilea pumila	clearweed	Nt A-Forb	5	-	-	x	-	x
Pinus strobus	white pine	Nt Tree	3	-	-	-	-	x
Platanus occidentalis	sycamore	Nt Tree	7	x	x	x	x	-
POA COMPRESSA	CANADA BLUEGRASS	Ad P-Grass	0	-	-	x	-	-
POA PRATENSIS	KENTUCKY BLUEGRASS	Ad P-Grass	0	-	-	-	-	x
Podophyllum peltatum	may-apple	Nt P-Forb	3	x	x	x	x	-
Polygonatum pubescens	downy solomon-seal	Nt P-Forb	5	x	-	x	x	-
Polygonum sagittatum	arrow-leaved tear-thumb	Nt A-Forb	5	-	-	-	-	x
Polygonum virginianum	jumpseed	Nt P-Forb	4	x	-	x	x	x
Polystichum acrostichoides	Christmas fern	Nt Fern	6	-	-	-	x	x
Populus deltoides	cottonwood	Nt Tree	1	x	x	x	x	x
Populus grandidentata	big-toothed aspen	Nt Tree	4	-	-	-	-	x
Potentilla anserina	silverweed	Nt P-Forb	5	x	-	-	-	-
Prenanthes alba	white lettuce	Nt P-Forb	5	-	-	x	x	-
PRUNELLA VULGARIS	lawn prunella	Nt P-Forb	0	-	-	-	-	x
Prunus serotina	wild black cherry	Nt Tree	2	x	x	-	x	x
Prunus virginiana	choke cherry	Nt Shrub	2	x	x	x	x	x
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	5	-	-	-	-	x
Quercus alba	white oak	Nt Tree	5	-	-	x	x	x
Quercus bicolor	swamp white oak	Nt Tree	8	x	x	x	x	-
Quercus macrocarpa	bur oak	Nt Tree	5	x	x	-	-	-
Quercus muehlenbergii	chinquapin oak	Nt Tree	5	x	-	-	-	-
Quercus palustris	pin oak	Nt Tree	8	-	-	x	x	x
Quercus rubra	red oak	Nt Tree	5	x	x	x	x	x
Quercus velutina	black oak	Nt Tree	6	-	-	x	x	x
Ranunculus abortivus	small-flowered buttercup	Nt A-Forb	0	x	-	x	-	-
Ranunculus hispidus	swamp buttercup	Nt P-Forb	5	x	-	x	x	-
Ratibida pinnata	yellow coneflower	Nt P-Forb	4	-	-	-	-	x

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

		<table border="1"> <thead> <tr> <th>Site Name</th> <th>HRF</th> <th>PTF</th> <th>LHF</th> <th>BTF</th> <th>BBP</th> <th>FWR</th> </tr> <tr> <th>Site Code</th> <th>J</th> <th>K</th> <th>L</th> <th>M</th> <th>N</th> <th>O</th> </tr> </thead> </table>								Site Name	HRF	PTF	LHF	BTF	BBP	FWR	Site Code	J	K	L	M	N	O
Site Name	HRF	PTF	LHF	BTF	BBP	FWR																	
Site Code	J	K	L	M	N	O																	
Species Name	Common Name	Life Form	C																				
RHAMNUS CATHARTICA	COMMON BUCKTHORN	Ad Tree	0	x	-	x	-	x	-														
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	0	-	-	-	-	x	-														
Rhus glabra	smooth sumac	Nt Tree	2	-	-	-	-	-	x														
Ribes americanum	wild black currant	Nt Shrub	6	-	x	x	-	-	-														
Ribes cynosbati	prickly or wild gooseberry	Nt Shrub	4	x	-	x	-	-	x														
ROBINIA PSEUDOACACIA	BLACK LOCUST	Ad Tree	0	-	-	x	-	-	-														
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	0	x	x	x	x	-	x														
Rosa palustris	swamp rose	Nt Shrub	5	-	-	-	-	x	x														
Rubus allegheniensis	common blackberry	Nt Shrub	1	-	-	x	-	-	-														
Rubus flagellaris	northern dewberry	Nt Shrub	1	-	-	-	-	-	x														
Rubus occidentalis	black raspberry	Nt Shrub	1	x	-	x	-	-	-														
Rudbeckia hirta	black-eyed susan	Nt P-Forb	1	-	-	-	-	x	-														
Rudbeckia laciniata	cut-leaved coneflower	Nt P-Forb	6	x	x	x	-	-	x														
Salix bebbiana	Bebb's willow	Nt Shrub	1	-	-	-	-	x	-														
Salix lucida	shining willow	Nt Shrub	3	-	-	-	-	x	-														
Salix nigra	black willow	Nt Tree	5	-	-	x	-	-	-														
Sambucus canadensis	elderberry	Nt Shrub	3	-	-	x	x	-	x														
Sanguinaria canadensis	bloodroot	Nt P-Forb	5	x	x	x	x	-	x														
Sanicula gregaria	black snakeroot	Nt P-Forb	2	x	-	x	-	-	-														
Sassafras albidum	sassafras	Nt Tree	5	-	-	x	x	-	x														
Scirpus cyperinus	wool-grass	Nt P-Sedge	5	-	-	-	-	x	-														
Scrophularia lanceolata	early figwort	Nt P-Forb	5	-	-	x	-	-	-														
Scrophularia marilandica	late figwort	Nt P-Forb	5	-	x	-	-	-	-														
Scutellaria lateriflora	mad-dog skullcap	Nt P-Forb	5	-	-	-	-	-	x														
Senecio aureus	golden ragwort	Nt P-Forb	5	x	-	x	x	-	x														
Silphium perfoliatum	cup-plant	Nt P-Forb	10	x	-	x	-	-	-														
Smilacina racemosa	false spikenard	Nt P-Forb	5	x	x	x	x	-	x														
Smilacina stellata	starry false solomon-seal	Nt P-Forb	5	x	x	-	-	-	-														
Smilax ecirrhata	upright carrion-flower	Nt P-Forb	6	x	x	x	-	-	-														
Smilax lasioneura	carrion-flower	Nt P-Vine	5	x	-	-	-	-	-														
Smilax tamnoides	bristly greenbrier	Nt W-Vine	5	-	x	x	-	-	-														
Solidago altissima	tall goldenrod	Nt P-Forb	1	-	-	-	-	x	-														
Solidago caesia	blue-stemmed goldenrod	Nt P-Forb	7	-	x	x	x	-	x														
Solidago canadensis	Canada goldenrod	Nt P-Forb	1	-	-	x	-	-	-														

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

Species Name	Common Name	Life Form	C	Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
Solidago flexicaulis	broad-leaved goldenrod	Nt P-Forb	6	-	-	x	-	-	x	
Solidago gigantea	late goldenrod	Nt P-Forb	3	-	-	x	-	-	x	
Solidago juncea	early goldenrod	Nt P-Forb	3	-	-	-	-	-	x	
Solidago patula	swamp goldenrod	Nt P-Forb	6	-	-	-	-	x	x	
Solidago riddellii	Riddell's goldenrod	Nt P-Forb	6	-	-	-	-	x	-	
Solidago rugosa	rough goldenrod	Nt P-Forb	3	-	-	-	x	x	x	
SONCHUS ARVENSIS	PERENNIAL SOW-THISTLE	Ad P-Forb	0	-	-	-	-	x	-	
Spiranthes cernua	nodding ladies'-tresses	Nt P-Forb	4	-	-	-	-	x	-	
Staphylea trifolia	bladdernut	Nt Shrub	9	x	x	x	-	-	-	
Symplocarpus foetidus	skunk-cabbage	Nt P-Forb	6	-	-	x	x	-	x	
Taenidia integerrima	yellow pimpernel	Nt P-Forb	8	-	-	x	-	-	-	
TARAXACUM OFFICINALE	COMMON DANDELION	Ad P-Forb	0	x	x	x	-	-	-	
Teucrium canadense	wood-sage	Nt P-Forb	4	-	-	-	-	-	x	
Thalictrum dasycarpum	purple meadow-rue	Nt P-Forb	3	x	-	x	-	-	-	
Thalictrum dioicum	early meadow-rue	Nt P-Forb	6	x	x	x	-	-	x	
Thelypteris noveboracensis	New York fern	Nt Fern	5	-	-	-	x	-	x	
Thelypteris palustris	marsh fern	Nt Fern	2	-	-	-	x	-	-	
Tilia americana	basswood	Nt Tree	5	x	x	x	x	-	x	
Toxicodendron radicans	poison ivy	Nt W-Vine	2	x	x	x	x	-	x	
Toxicodendron vernix	poison sumac	Nt Shrub	6	-	-	x	-	-	-	
Trillium grandiflorum	common trillium	Nt P-Forb	5	x	x	-	x	-	-	
Triosteum aurantiacum	horse gentian	Nt P-Forb	5	-	-	x	-	-	-	
TYPHA ANGUSTIFOLIA	NARROW-LEAVED CATTAIL	Ad P-Forb	0	-	-	-	-	x	-	
Ulmus americana	American elm	Nt Tree	1	x	x	x	x	-	x	
Urtica dioica	nettle	Nt P-Forb	1	-	-	x	-	-	-	
Uvularia grandiflora	bellwort	Nt P-Forb	5	x	-	-	-	-	-	
Vaccinium angustifolium	blueberry	Nt Shrub	4	-	-	x	-	-	x	
Verbena urticifolia	white vervain	Nt P-Forb	4	-	-	x	-	-	-	
Verbesina alternifolia	wingstem	Nt P-Forb	4	x	x	x	-	-	-	
Vernonia missurica	Missouri ironweed	Nt P-Forb	4	-	-	-	-	x	-	
Veronicastrum virginicum	Culver's-root	Nt P-Forb	8	x	-	-	-	-	-	
Viburnum acerifolium	maple-leaved arrow-wood	Nt Shrub	6	-	-	x	x	-	x	
Viburnum dentatum	smooth arrow-wood	Nt Shrub	6	-	-	x	-	-	x	
Viburnum lentago	nannyberry	Nt Shrub	4	x	x	x	x	-	x	

Appendix 2. Plant species observed at **Lower Huron Metropark** (continued).

Species Name	Common Name	Life Form	C	Site Name	HRF	PTF	LHF	BTF	BBP	FWR
				Site Code	J	K	L	M	N	O
VIBURNUM OPULUS	EUROPEAN Highbush- CRANBERRY	Ad Shrub	0		x	x	x	-	-	-
Viola canadensis	Canada violet	Nt P-Forb	5		-	x	-	-	-	-
Viola pubescens	yellow violet	Nt P-Forb	4		x	x	x	-	-	-
Viola sororia	common blue violet	Nt P-Forb	1		x	x	x	-	-	-
Viola striata	cream violet	Nt P-Forb	5		x	-	-	-	-	-
Vitis riparia	riverbank grape	Nt W-Vine	3		x	x	x	x	-	x
Wisteria frutescens	wisteria	Nt P-Forb	9		-	-	x	-	-	-
Zanthoxylum americanum	prickly-ash	Nt Shrub	3		x	x	x	x	-	x
Total number of species observed in survey site					140	87	183	79	59	120
Total number of species observed in Lower Huron: 330										

Appendix 3. Plant species observed at **Willow Metropark**. "X" indicates the species occurred within the site. "-" indicates species was not observed at the site. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species (Herman et al. 2001).

Scientific Name	Common Name	Life Form	C	Willow	Willow	Indian Ridge	
				Floodplain	Woodlands	Prairie	
Site Name	Site Code	P	Q	R			
Acer negundo	box elder	Nt Tree	0	x	x	x	
Acer rubrum	red maple	Nt Tree	1	-	x	x	
Acer saccharinum	silver maple	Nt Tree	2	x	x	-	
Acer saccharum	sugar maple	Nt Tree	5	-	-	x	
Achillea millefolium	yarrow	Nt P-Forb	1	-	-	x	
Agalinis purpurea	purple gerardia	Nt A-Forb	7	-	-	x	
Agrimonia gryposepala	tall agrimony	Nt P-Forb	2	x	x	-	
Alisma plantago-aquatica	water-plantain	Nt P-Forb	1	x	x	-	
Ambrosia artemisiifolia	common ragweed	Nt A-Forb	0	-	-	x	
Andropogon gerardii	big bluestem	Nt P-Grass	5	-	-	x	
Andropogon virginicus	broom-sedge	Nt P-Grass	4	-	-	x	
Anemone cylindrica	thimbleweed	Nt P-Forb	6	-	-	x	
Apocynum cannabinum	Indian-hemp	Nt P-Forb	3	-	-	x	
Arisaema dracontium	green dragon	Nt P-Forb	8	x	-	-	
Arisaema triphyllum	jack-in-the-pulpit	Nt P-Forb	5	x	x	-	
Asarum canadense	wild-ginger	Nt P-Forb	5	x	-	-	
Asclepias incarnata	swamp milkweed	Nt P-Forb	6	x	-	x	
Asclepias syriaca	common milkweed	Nt P-Forb	1	-	-	x	
Aster lateriflorus	side-flowering aster	Nt P-Forb	2	x	x	-	
Aster pilosus	hairy aster	Nt P-Forb	1	-	-	x	
Athyrium filix-femina	lady fern	Nt Fern	4	-	-	x	
BERBERIS THUNBERGII	JAPANESE BARBERRY	Ad Shrub	0	-	x	x	
Bidens frondosus	common beggar-ticks	Nt A-Forb	1	x	-	-	
Boehmeria cylindrica	false nettle	Nt P-Forb	5	x	-	-	
BROMUS INERMIS	SMOOTH BROME	Ad P-Grass	0	-	-	x	
Bromus pubescens	Canada brome	Nt P-Grass	5	x	-	-	
Caltha palustris	marsh marigold	Nt P-Forb	6	-	-	x	

Appendix 3. Plant species observed at **Willow Metropark** (continued).

Scientific Name	Common Name	Life Form	C	Willow	Willow	Indian Ridge
				Floodplain	Woodlands	Prairie
Site Name	Site Code	P	Q	R		
Cardamine bulbosa	spring cress	Nt P-Forb	4	x	-	-
Carex blanda	sedge	Nt P-Sedge	1	-	x	-
Carex grayi	sedge	Nt P-Sedge	6	x	x	-
Carex hirtifolia	sedge	Nt P-Sedge	5	-	x	-
Carex intumescens	sedge	Nt P-Sedge	3	x	-	-
Carex laxiculmis	sedge	Nt P-Sedge	8	-	x	-
Carex pensylvanica	sedge	Nt P-Sedge	4	-	x	x
Carex radiata	straight-styled wood sedge	Nt P-Sedge	2	-	x	-
Carex rosea	curly-styled wood sedge	Nt P-Sedge	2	-	x	-
Carex stipata	sedge	Nt P-Sedge	1	-	x	x
Carpinus caroliniana	blue-beech	Nt Tree	6	-	x	-
Carya cordiformis	bitternut hickory	Nt Tree	5	x	-	-
Carya glabra	pignut hickory	Nt Tree	5	-	x	-
Carya laciniosa	shellbark hickory	Nt Tree	9	-	x	-
Carya ovata	shagbark hickory	Nt Tree	5	x	x	-
CELASTRUS ORBICULATA	ORIENTAL BITTERSWEET	Ad W-Vine	0	-	x	x-
Celtis occidentalis	hackberry	Nt Tree	5	x	x	-
Cenchrus longispinus	sandbur	Nt A-Grass	0	-	-	x
CENTAUREA MACULOSA	SPOTTED KNAPWEED	Ad B-Forb	0	-	-	x
Cephalanthus occidentalis	buttonbush	Nt Shrub	7	x	-	-
Cercis canadensis	redbud	Nt Tree	8	x	-	-
Cinna arundinacea	wood reedgrass	Nt P-Grass	7	x	-	-
Circaea lutetiana	enchanter's-nightshade	Nt P-Forb	2	x	x	-
CIRSIIUM PALUSTRE	MARSH THISTLE	Ad B-Forb	0	-	x	-
Coreopsis tripteris	tall coreopsis	Nt P-Forb	7	-	x	-
Cornus amomum	silky dogwood	Nt Shrub	2	x	-	x
Cornus drummondii	rough-leaved dogwood	Nt Shrub	6	-	x	-
Cornus florida	flowering dogwood	Nt Tree	8	-	x	-
Cornus foemina	gray dogwood	Nt Shrub	1	x	-	x
Corylus americana	hazelnut	Nt Shrub	5	-	x	x
Crataegus sp.	hawthorn	Nt Tree		x	x	x
Cyperus filiculmis	slender sand sedge	Nt P-Sedge	2	-	-	x

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Appendix 3. Plant species observed at **Willow Metropark** (continued).

Scientific Name	Common Name	Life Form	C	Willow	Willow	Indian Ridge
				Floodplain	Woodlands	Prairie
Site Name	Site Code	P	Q	R		
Cyperus strigosus	long-scaled nut sedge	Nt P-Sedge	3	-	-	x
Dentaria laciniata	cut-leaved toothwort	Nt P-Forb	5	-	x	-
Diarrhena americana	beak grass	Nt P-Grass	9	x	-	-
ECHINOCHLOA CRUSGALLI	BARNYARD GRASS	Ad A-Grass	0	x	-	-
ELAEAGNUS UMBELLATA	AUTUMN-OLIVE	Ad Shrub	0	-	x	x
Elymus canadensis	Canada wild-rye	Nt P-Grass	7	x	-	-
Elymus virginicus	Virginia wild-rye	Nt P-Grass	4	-	x	-
		Nt Fern				
Equisetum arvense	common horsetail	Ally	0	-	-	x
		Nt Fern				
Equisetum hyemale	scouring rush	Ally	2	-	-	x
Erythronium americanum	yellow trout-lily	Nt P-Forb	5	-	x	x
Euonymus atropurpurea	wahoo; burning-bush	Nt Shrub	8	x	-	-
EUONYMUS EUROPAEA	SPINDLE TREE	Ad Shrub	0	-	x	-
Euonymus obovata	running strawberry-bush	Nt Shrub	5	-	x	-
Eupatorium maculatum	joe-pye-weed	Nt P-Forb	4	-	-	x
Eupatorium perfoliatum	common boneset	Nt P-Forb	4	x	x	-
Eupatorium rugosum	white snakeroot	Nt P-Forb	4	x	x	-
Euthamia graminifolia	grass-leaved goldenrod	Nt P-Forb	3	-	x	x
Fragaria virginiana	wild strawberry	Nt P-Forb	2	-	x	x
Fraxinus americana	white ash	Nt Tree	5	-	x	x
Fraxinus nigra	black ash	Nt Tree	6	x	-	-
Fraxinus pennsylvanica	red ash	Nt Tree	2	x	x	-
Galium aparine	annual bedstraw	Nt A-Forb	0	-	x	-
Geranium maculatum	wild geranium	Nt P-Forb	4	-	x	x
Geum canadense	white avens	Nt P-Forb	1	x	x	-
Glyceria striata	fowl manna grass	Nt P-Grass	4	-	x	-
Hackelia virginiana	beggar's-lice	Nt P-Forb	1	x	x	-
Hamamelis virginiana	witch-hazel	Nt Shrub	5	-	x	x
HESPERIS MATRONALIS	DAME'S ROCKET	Ad P-Forb	0	x	-	-
Hystrix patula	bottlebrush grass	Nt P-Grass	5	-	x	-
Impatiens capensis	spotted touch-me-not	Nt A-Forb	2	-	-	x

Appendix 3. Plant species observed at **Willow Metropark** (continued).

Scientific Name	Common Name	Life Form	C	Willow	Willow	Indian Ridge
				Floodplain	Woodlands	Prairie
Site Name	Site Code	P	Q	R		
Iris virginica	southern blue flag	Nt P-Forb	5	x	-	-
Juglans nigra	black walnut	Nt Tree	5	x	x	x
Juncus dudleyi	Dudley's rush	Nt P-Forb	1	-	-	x
Juniperus virginiana	red-cedar	Nt Tree	3	-	-	x
Laportea canadensis	wood nettle	Nt P-Forb	4	x	-	-
Leersia oryzoides	cut grass	Nt P-Grass	3	x	x	-
Leersia virginica	white grass	Nt P-Grass	5	x	x	-
Lespedeza capitata	round-headed bush-clover	Nt P-Forb	5	-	-	x
LIGUSTRUM VULGARE	COMMON PRIVET	Ad Shrub	0	x	x	-
Lindera benzoin	spicebush	Nt Shrub	7	-	x	-
Lobelia siphilitica	great blue lobelia	Nt P-Forb	4	-	x	-
67 LONICERA MAACKII	AMUR HONEYSUCKLE	Ad Shrub	0	x	-	-
LONICERA MORROWII	MORROW HONEYSUCKLE	Ad Shrub	0	-	x	x
Lycopus uniflorus	northern bugleweed	Nt P-Forb	2	-	x	-
Lysimachia ciliata	fringed loosestrife	Nt P-Forb	4	-	x	-
LYSIMACHIA NUMMULARIA	MONEYWORT	Ad P-Forb	0	x	-	-
Lysimachia quadriflora	whorled loosestrife	Nt P-Forb	10	-	x	-
LYTHRUM SALICARIA	PURPLE LOOSESTRIFE	Ad P-Forb	0	x	-	-
Monarda fistulosa	wild bergamot	Nt P-Forb	2	-	x	x
MORUS ALBA	WHITE MULBERRY	Ad Tree	0	x	-	-
Onoclea sensibilis	sensitive fern	Nt Fern	2	-	x	x
Osmunda claytoniana	interrupted fern	Nt Fern	6	-	-	x
Osmunda regalis	royal fern	Nt Fern	5	-	-	x
Ostrya virginiana	ironwood; hop-hornbeam	Nt Tree	5	-	x	-
Oxalis stricta	common yellow wood-sorrel	Nt P-Forb	0	-	x	-
Panicum clandestinum	panic grass	Nt P-Grass	3	-	x	-
Panicum oligosanthos	panic grass	Nt P-Grass	5	-	-	x
Parthenocissus quinquefolia	Virginia creeper	Nt W-Vine	5	x	x	-
Phryma leptostachya	lopseed	Nt P-Forb	4	-	x	-
Physocarpus opulifolius	ninebark	Nt Shrub	4	x	-	-
Pilea pumila	clearweed	Nt A-Forb	5	x	-	-
Platanus occidentalis	sycamore	Nt Tree	7	x	x	-

Appendix 3. Plant species observed at **Willow Metropark** (continued).

Scientific Name	Common Name	Life Form	C	Willow	Willow	Indian Ridge
				Floodplain	Woodlands	Prairie
Site Name	Site Code	P	Q	R		
Podophyllum peltatum	may-apple	Nt P-Forb	3	-	x	x
Polygonum amphibium	water smartweed	Nt P-Forb	6	x	-	-
Polygonum virginianum	jumpseed	Nt P-Forb	4	x	x	-
Populus deltoides	cottonwood	Nt Tree	1	x	x	-
Populus tremuloides	quaking aspen	Nt Tree	1	-	-	x
Prenanthes alba	white lettuce	Nt P-Forb	5	-	x	-
PRUNELLA VULGARIS	lawn prunella	Nt P-Forb	0	-	-	x
Prunus serotina	wild black cherry	Nt Tree	2	x	x	x
Prunus virginiana	choke cherry	Nt Shrub	2	x	-	-
Pteridium aquilinum	bracken fern	Nt Fern	0	-	-	x
Pycnanthemum virginianum	common mountain mint	Nt P-Forb	5	-	x	-
Quercus alba	white oak	Nt Tree	5	-	x	x
Quercus bicolor	swamp white oak	Nt Tree	8	-	x	-
Quercus macrocarpa	bur oak	Nt Tree	5	x	x	-
Quercus palustris	pin oak	Nt Tree	8	-	x	-
Quercus rubra	red oak	Nt Tree	5	x	x	x
Quercus velutina	black oak	Nt Tree	6	-	x	x
Ranunculus hispidus	swamp buttercup	Nt P-Forb	5	x	-	-
RHAMNUS CATHARTICA	COMMON BUCKTHORN	Ad Tree	0	-	x	-
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	Ad Shrub	0	-	x	x
Ribes cynosbati	prickly or wild gooseberry	Nt Shrub	4	-	x	-
ROBINIA PSEUDOACACIA	BLACK LOCUST	Ad Tree	0	-	x	-
ROSA MULTIFLORA	MULTIFLORA ROSE	Ad Shrub	0	x	x	-
Rubus allegheniensis	common blackberry	Nt Shrub	1	-	-	x
Rubus flagellaris	northern dewberry	Nt Shrub	1	-	x	x
Rubus occidentalis	black raspberry	Nt Shrub	1	x	-	x
Rubus strigosus	wild red raspberry	Nt Shrub	2	x	-	-
Rudbeckia laciniata	cut-leaved coneflower	Nt P-Forb	6	x	-	-
Salix bebbiana	Bebb's willow	Nt Shrub	1	-	-	x
Salix exigua	sandbar willow	Nt Shrub	1	-	-	x
Salix nigra	black willow	Nt Tree	5	x	-	-
Salix sericea	silky willow	Nt Shrub	6	-	-	x

Appendix 3. Plant species observed at **Willow Metropark** (continued).

Scientific Name	Common Name	Life Form	C	Site Name	Willow Floodplain Forests	Willow Woodlands	Indian Ridge Prairie
				Site Code	P	Q	R
<i>Sambucus canadensis</i>	elderberry	Nt Shrub	3	-	-	x	
<i>Sanicula gregaria</i>	black snakeroot	Nt P-Forb	2	-	x	-	
<i>Sassafras albidum</i>	sassafras	Nt Tree	5	-	x	x	
<i>Scrophularia marilandica</i>	late figwort	Nt P-Forb	5	x	-	-	
<i>Smilacina racemosa</i>	false spikenard	Nt P-Forb	5	x	x	x	
<i>Solidago altissima</i>	tall goldenrod	Nt P-Forb	1	-	-	x	
<i>Solidago canadensis</i>	Canada goldenrod	Nt P-Forb	1	x	-	-	
<i>Solidago nemoralis</i>	old field goldenrod	Nt P-Forb	2	-	-	x	
<i>Solidago rugosa</i>	rough goldenrod	Nt P-Forb	3	-	x	x	
<i>Spiranthes cernua</i>	nodding ladies'-tresses	Nt P-Forb	4	-	-	x	
<i>Staphylea trifolia</i>	bladdernut	Nt Shrub	9	x	-	-	
<i>Symplocarpus foetidus</i>	skunk-cabbage	Nt P-Forb	6	-	-	x	
SYRINGA VULGARIS	COMMON LILAC	Ad Shrub	0	-	-	x	
TARAXACUM OFFICINALE	COMMON DANDELION	Ad P-Forb	0	x	x	-	
<i>Teucrium canadense</i>	wood-sage	Nt P-Forb	4	x	-	x	
<i>Thalictrum dasycarpum</i>	purple meadow-rue	Nt P-Forb	3	x	-	-	
<i>Tilia americana</i>	basswood	Nt Tree	5	x	x	-	
<i>Toxicodendron radicans</i>	poison ivy	Nt W-Vine	2	x	x	-	
<i>Tradescantia ohiensis</i>	common spiderwort	Nt P-Forb	5	-	-	x	
<i>Trillium grandiflorum</i>	common trillium	Nt P-Forb	5	-	-	x	
<i>Triosteum perfoliatum</i>	horse gentian	Nt P-Forb	5	-	x	-	
<i>Ulmus americana</i>	American elm	Nt Tree	1	x	x	x	
<i>Urtica dioica</i>	nettle	Nt P-Forb	1	-	-	x	
<i>Verbena urticifolia</i>	white vervain	Nt P-Forb	4	x	x	-	
<i>Verbesina alternifolia</i>	wingstem	Nt P-Forb	4	x	-	-	
<i>Vernonia missurica</i>	Missouri ironweed	Nt P-Forb	4	-	x	x	
<i>Viburnum dentatum</i>	smooth arrow-wood	Nt Shrub	6	-	-	x	
<i>Viburnum lentago</i>	nannyberry	Nt Shrub	4	-	x	x	
VIBURNUM OPULUS	EUROPEAN Highbush-Cranberry	Ad Shrub	0	-	x	-	
<i>Viola sororia</i>	common blue violet	Nt P-Forb	1	x	-	-	
<i>Vitis riparia</i>	riverbank grape	Nt W-Vine	3	x	x	-	
<i>Zanthoxylum americanum</i>	prickly-ash	Nt Shrub	3	x	x	x	

Appendix 3. Plant species observed at **Willow Metropark** (continued).

				Willow Floodplain Forests	Willow Woodlands	Indian Ridge Prairie
		Site Name	Site Code	P	Q	R
Scientific Name	Common Name	Life Form	C			
Zizia aurea	golden alexanders	Nt P-Forb	6	-	x	-
Total number of species observed in survey site				78	100	82
Total number of species observed in Willow Metropark: 186						