



# Environmental Management Plan

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## Brandt Woods

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Management goals for the Brandt Woods property include allowing visitors to enjoy the property for non-motorized, passive recreational activities. The property provides excellent opportunities for hiking, birding, cross-country skiing, photography, and natural resource education.

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## **Executive Summary**

The Brandt Woods property will remain undeveloped in its predominantly natural state so as to protect the natural resource and watershed values of the premises, to maintain and enhance biodiversity, to retain quality habitat for native plants and animals, and to maintain and enhance the natural features of the premises.

The purpose of this Management Plan is to provide structure for the development and implementation of more specific plans. It is intended to be a living document, with changes being made as necessary and in accordance with the Conservation Districts Mission.

Management goals for the Brandt Woods property include allowing visitors to enjoy the property for non-motorized, passive recreational activities. The property provides excellent opportunities for hiking, birding, cross-country skiing, photography, and natural resource education.

## **Section 1: General Information**

### **1.1 Purpose**

The purpose of this Natural Resources Management Plan (NRMP) is to provide an integrated, comprehensive plan for natural resources management at Brandt Woods Conservation Area (Brandt Woods). The NRMP provides specific natural resources management goals and objectives. Considered in this process is public access to resources and multipurpose use including hunting, fishing, trapping and non-consumptive activities on the property when practical.

### **1.2 Management Intent / Philosophy**

It is the intent of the Calhoun Conservation District to manage the Brandt Woods property for conservation, resource protection and enhancement, passive recreation, environmental education, and scientific study. This NRMP will provide guidelines and assistance with management issues.

The management philosophy for the Brandt Woods Conservation Area will be one that embraces holistic management of the Brandt Woods ecosystem; this will be accomplished through strong, interdisciplinary partnerships that utilize multifaceted resource management which relies on participation of many well informed and knowledgeable partners. This multifaceted resource management will involve the management and integration of all aspects of the Brandt Woods property which includes soil, water, air, plant, animal and humans. The underpinnings of this management will be to utilize the most up to date and time proven resource management techniques that improve, protect and restore sustainability, biological diversity and ecosystem health of the aquatic and terrestrial ecosystems found on the property. Finally, the Brandt Woods ecosystem is not a static environment that will remain unchanged over time. As conditions change and the ecosystem evolves, adaptive management techniques will be identified and implemented to meet the ever changing conditions as they are identified on the ground. The adaptive management protocol will involve a feedback loop that includes: assessing resource concerns; formulating alternatives to address the resource concerns; selecting the most efficacious alternative; implementing the conservation measure; monitoring; evaluating; and adjusting as needed. This adaptive management will incorporate research and findings of fact, evaluated by competent resource professionals, into all conservation actions taken on the property.

#### **1.2.1 Land Forms, Geology and Soil Composition**

A physiographic region is classified based on common topography, morphology, soil parent materials, climate and geomorphology. The soils of the Brandt Woods Management Area in Central Calhoun County are part of the Southern Michigan and Northern Indiana Drift Plains. The soils on the property are part of the Houghton-Oshtemo-Coloma Association. These are nearly level (0 to 6 percent slope) to steep (18 to 40 percent slope), poorly to excessively drained, mucky soils on floodplains and loamy and sandy soils on outwash plains, moraines, and stream terraces and in glacial drainageways. The Granby loamy sand (43%), undrained Houghton muck (42%) and Sebewa loam (15%) soils make up 100 percent of the Brandt Woods

Management Area. Water erosion, soil blowing, loss of nutrients, and low organic matter content are the main management concerns associated with these soils.

### 1.2.2 Ecosystem Management

<b>Ecological Approach:</b>	There will be a shift from individual species management to the management of ecosystems.
<b>Partnerships:</b>	Ecosystems cross political boundaries making the need for cooperation, coordination, and partnerships essential for managing ecosystems.
<b>Participation:</b>	Public needs and desires will be recognized in management decisions and accommodated when possible.
<b>Information:</b>	The best available scientific information will be used to select technologies to be used in managing natural resources.
<b>Adaptive Management:</b>	Adaptive management techniques will be incrementally applied as they are identified.

Ecosystem management recognizes that humans are also a part of the ecosystem, and that sustainable human activity does not mutually exclude the preservation and enhancement of ecological integrity. Therefore, it is ecosystem management that provides Brandt Woods with the means to protect biological diversity.

Over the long term, Brandt Woods management philosophy shall maintain and improve the *sustainability* and biological diversity of terrestrial and aquatic ecosystems while providing for human use and enjoyment. This will occur through maintaining and improving the sustainability and native biological diversity of ecosystems with the following actions:

- Administer natural resource management with consideration of ecological units and time frames.
- Support sustainable human activities.
- Develop a vision of ecosystem health.
- Develop priorities and reconcile conflicts.
- Develop coordinated approaches to work toward ecosystem health.
- Rely on the best science and data available.
- Use benchmarks to monitor and evaluate outcomes.
- Use adaptive management.
- Implement natural resource management through property plans and programs.

## 1.3 Development Approach

In the preparation of the Brandt Woods NRMP clearly stated goals and objectives will be the

driving force to developing a comprehensive plan. Identification of existing features, resources and biota will be used to determine existing conditions. Conservation best management practices will then be identified to meet the goals and objectives of the plan.

## Section 2: Property Overview

### 2.1 Location and Area

Brandt Woods is located in in Calhoun County, in the North half of Section 7 and the West half of Section 8 in Sheridan Township. The property is located north of Winnipeg Lake. The North Branch of Rice Creek, which flows South West from Prairie Lake, defines most of the northern boundary of the property, except for its easternmost 1/4. At the East boundary of Brandt Woods, which is in Sec 8, there is a narrow (310 ft. wide) strip that extends south from the main body of the property to H Drive North. The West boundary of property borders 24-mile Road. Elevation ranges from 920 to 950 feet. There are many vernal pools and two intermittent waterways that flow in a South to North orientation, out letting into the North Branch of Rice Creek throughout the summer.

### 2.2 History

Brandt Woods was donated to the Calhoun Conservation District by Charles Brandt, whom was known as a naturalist. Brandt would not permit hunting of any kind on his property, for fear natural growth and reproduction might be injured. The Calhoun Conservation District became the owner of Brandt Woods in 1963. Brandt Woods is known by local nature enthusiasts for its spring wildflowers and warblers. The property comprises 100 acres, including approximately 70 acres of well-developed beech-maple forest.

Charles Brandt was a real naturalist and liked to roam these wooded areas. Sometime during the 1950's he decided to leave some of his farm woodland, so that it might be perpetuated as a forest. After much discussion with Michigan State University people, and with Mr. Burrell Henry, then Calhoun County Agricultural Director, he decided to deed the property to the Calhoun Conservation District. Under Mr. Henry's guidance the transfer of the property was accomplished and thus in 1963 the District became the owner of approximately 100 acres of woodland. Brandt retained a life lease of the property, and operated it as he wished as long as he lived.

He was a great naturalist, and often had heated arguments with trespassers. He would not permit hunting of any kind on his property, for fear natural growth and reproduction might be injured. He had an intense difference of opinion on some of the Department of Natural Resources laws and rulings, and as a result of this difference he stipulated that his gift property never be used or controlled by the Department. He knew the species of every tree, shrub, and plant that grew in his woods. He permitted Albion College students to use the area as an outdoor laboratory for some classes. MarLee School in Marengo Township was given permission for similar use.



Brandt harvested some of the trees for lumber during the last few years. He loved baseball, and as a result, an especially fine white ash log was cut into pieces suitable for making baseball bats. These pieces were given to many boys in the community, that they might make their own bats. The Calhoun Conservation District has been carrying out a reforestation program on the property and has planted many seedlings. The District also carries out a beneficial harvesting program.

Because of Charles Brandt's generosity, many people will be able to see and enjoy Brandt Woods with its many wonders of nature.

## **2.3 Surrounding Communities and Businesses**

The Brandt Woods property located in Calhoun County is in the southwestern portion of Michigan's Lower Peninsula. The closest developed areas to the property are Marshall with a population of 7,088 and Albion with a population of 8,616 (2010 Census data). The City of Marshall is located 9 miles west of the property, and the City of Albion is located 7 miles to the south east. Other major population centers (greater than 50,000) in the region include Battle Creek, Kalamazoo, Lansing and Grand Rapids, in Michigan and South Bend/Elkhart/Mishawaka in Indiana.

## **2.4 Regional Land Use**

Presently, regional land use is agricultural, forested, and residential in that order of significance. Land use in the area immediately surrounding Brandt Woods is primarily forested and agricultural. Adjacent parcels are privately owned forested and agricultural lands.

## **2.5 Local and Regional Natural Areas**

Located a mile east of Brandt Woods is Winnipeg Lake, which is a 40 acre lake with public access. From a regional perspective of southwestern Michigan, other large tracts of natural areas include The Hart's Lake / Fort Custer Training Center / Fort Custer Recreation Area complex, Allegan State Game Area and the Yankee Springs Recreation / Barry State Game Area complex. Maintaining forest blocks and wetlands provides a unique opportunity at Brandt Woods to protect a functioning, diverse landscape.

# **Section 3: Management Goals and Objectives**

## **3.1 Managing the Ecosystem(s) in and around Brandt Woods**

Brandt Woods will be managed in a manner to protect, maintain, and rehabilitate ecosystem processes and habitats to ensure sustainable production of desired forest, wildlife, and fishery resources.

## **3.2 Protecting the Ecosystem(s) in and around Brandt Woods**

Management activities will be protective of all attributes, keeping the health of the entire ecosystem in mind. In order to protect the ecosystem, wildlife habitats, and to ensure the safe and

appropriate use of Brandt Woods, it may be necessary to prohibit or limit public access to sensitive areas permanently or on a temporary basis.

### 3.3 Managing for Day Use Recreation

Brandt Woods shall provide for a variety of passive recreational opportunities. The property shall provide public educational programs and opportunities that help build public understanding and appreciation for the important processes linking landscapes, ecosystems, habitats, and biological assemblages, and the human values and services derived from these natural systems.

All human activities will be managed so as not to impair or interfere with the conservation values of Brandt Woods. Specifically, human presence will be actively controlled to prevent damage to the natural environment. The property will be managed so that visitors will improve their understanding and appreciation of the natural environment through active and passive interpretation and education programs. Visitor experience will be aesthetically pleasing and sensitive to the natural environment. Trails shall keep people and pets out of environmentally sensitive habitat at all times. Trails shall minimize disturbance to birds and other wildlife.

### 3.4 Monitoring and Maintaining the Area

Monitoring and maintaining the Brandt Woods area will be led by the Calhoun Conservation District and utilize volunteers, concerned citizens, and partners to accomplish goals.

## Section 4: Actual Environment

### 4.1 Yearly Climate

The average temperature in the region is 27.0°F during the winter and is 71.4° F during the summer months (Table 1). The average total precipitation is 35.15 inches with fifty-eight percent of the annual precipitation falling between April and September. During the relatively long growing season (140-150 days), most of the precipitation is associated with passing cold fronts and showers caused by air mass instability (Legge et al. 1995). The average seasonal snowfall is 71.4 inches. At mid-afternoon the average relative humidity is 62 percent. The prevailing wind in the area is from the southwest (USDA 1979).

**Table 1: Average monthly and yearly climate data for the Brandt Woods region.**

Month	Maximum Temp (F)	Minimum Temp (F)	Average Temp (F)	Average Precipitation (in)
January	30.0	14.9	22.6	1.8
February	33.3	16.3	24.8	1.6
March	44.8	26.1	35.2	2.5
April	58.5	36.1	47.3	3.3
May	70.2	46.2	58.3	3.7
June	79.2	55.6	67.5	3.9

July	83.1	60.3	71.6	3.1
August	80.8	58.1	69.4	3.3
September	73.4	51.4	62.4	3.1
October	61.2	40.6	50.9	2.8
November	47.5	31.8	39.6	2.6
December	34.3	20.5	27.5	2.1
Year Avg.	58.1	38.1	48.2	(Total) 33.9

**Source:** Data derived from National Climatic Data Center TD 9641 Clim 81 1961-1990 for Battle Creek 5 NW, Calhoun County

## 4.2 Landforms, Geology and Soil Composition

A physiographic region is classified based on terrain texture, rock type, geologic structure and similar evolutionary history. Brandt Woods is located on outwash plains that dominate much of the region. This region is largely made up of an outwash plains intermingled with morainic areas and till plains. The outwash areas are characterized by nearly level to sloping topography with some pitted areas, and are commonly at lower elevations than till deposits. Approximately 43% of Brandt Woods is covered by outwash deposits of gravel and sand. The terrain of the property is comprised of 95% in the 0 to 6 percent slope class and 5% in the 6 to 12% slope class. Scattered throughout the outwash plain are small areas of end and ground moraine.

Lakes are common on the outwash plain. The lakes are formed in abandoned channels or ice-block kettles. There are many small streams in the sub-section and two large streams, the St. Joseph River and the Kalamazoo River, both tributaries of Lake Michigan. Many of the small streams such as Rice Creek and its tributaries originate within wetlands on the outwash plain.

The bedrock geology of the area consists entirely of Mississippian age shale, overlain by glacial drift of widely varying depths. Brandt Woods lies in the southwestern outwash plain, which formed between the three major glacial lobes that occupied Lake Michigan, Lake Erie, and the Saginaw Bay basins. This plain encompasses numerous small lakes, wetlands, and small ridges of ground moraine. Slope classifications range from 0 to 6 percent, to a very steep 18 to 40 percent slope on the steeper portions of outwash moraines. The property covers a 30-foot elevation difference, ranging from 920 to 950 feet above mean sea level at the top of several hills on the property.

Soils that form from outwash plains and moraine glacial materials are principally well- or moderately well drained loamy sands (USDA 1993). The Houghton-Oshtemo-Coloma association makes up about 100 percent of the soils present at Brandt Woods (Figure 1). These are poorly to excessively drained, mucky soils on floodplains and loamy and sandy soils on outwash plains, moraines, and stream terraces and in glacial drainage ways. These soil types are considered high for erosion as determined by soil texture, rainfall and position of the soil unit on the landscape (USDA 1990 and 1993). The Granby loamy sand (43%), Houghton muck (42 %) and Sebewa Loam soils found at Brandt Woods are poorly drained. The muck soils are typically formed in glacial ice-block kettles, abandoned stream channels, floodplains, and other

depression-prone areas with poor drainage and are generally associated with wetlands.

### 4.3 Michigan Natural Features Inventory

The Michigan Natural Features Inventory indicates two species designated as threatened and one species of special concern that have been located in the area. The species identified as threatened include the Showy Orchis (*Galearis spectabilis*) and Goldenseal (*Hydrastis Canadensis*), and the species of special concern includes the Eastern Massasauga (*Sistrurus catenatus catenatus*).

### 4.4 Water Resources

Groundwater seeps and springs primarily feed the majority of wetlands at Brandt Woods. Groundwater recharge is facilitated by areas of permeable Oshtemo complex soils. These wetlands discharge towards Rice Creek. Overland flow contributes to the surface hydrology at Brandt Woods primarily in areas with less permeable silty clay loam and muck soils.

#### 4.4.1 Surface Water

The majority of surface water at Brandt Woods drains into Rice Creek through two ephemeral streams flowing mainly to the north. These streams originate in the wetland complexes located on and to the south of the property and outlet into Rice Creek. Multiple Vernal ponds and seasonal pools occur throughout the property.

#### 4.4.2 Groundwater

The regional hydrogeology of the area consists of both glacial outwash and bedrock aquifers. Deposits of unconsolidated glacial drift constitute the location of the principal aquifer in the region. The aquifer is composed of unsorted silty, bouldery gravels, as well as beds and lenses of poorly sorted stratified gravel, sand, and silt (MIARNG, Environmental Section, 1999).

This complex hydrogeology provides the water source that maintains the wetlands in the natural areas located in and around Brandt Woods. Changes in the landscape at Brandt Woods have affected the hydrology from historical conditions. Historically, the natural hydrology of the site was predominantly driven by infiltration and base flow discharge. Land use changes, and the dredging and straightening of Rice Creek have lowered and altered the hydrology and shallow groundwater aquifer at Brandt Woods. Spoil berms from historical dredging activities placed on either side of Rice Creek have further channelized the stream, disconnected the floodplains and altered the hydrology. Recent work has been completed at two locations along the berm on Rice Creek to restore floodplain connectivity and the natural hydrology in the area. The surface and subsurface hydrology are interconnected and the groundwater flow conforms roughly to surface water flow patterns. This means groundwater flow is mainly to the north, towards Rice Creek.

## Section 5: Ecosystems

### 5.1 Classification of the Ecosystems

Ecological classification schemes describe land areas along a continuum, from larger to smaller scale, according to climate, geology, topography, and soils. Accordingly, Brandt Woods exists within the Humid Temperate Domain, Hot Continental Division, Eastern Broadleaf Forest, Great Lakes moderated climate, within the Southern Lower Michigan ecological section, and the Kalamazoo Interlobate subsection (Albert et al. 1995).

The Kalamazoo Interlobate Subsection formed approximately 13,000 to 16,000 years ago between three major glacial lobes. Brandt Woods is included in the flat glacial plain 150 miles in length of what was called by Transeau (1935) the "Prairie Peninsula". This "peninsula" was a tallgrass biome, principally located in Illinois and Indiana. Here, the outwash deposits of sand and sandy loam, absent of streams or wetlands that acted as barriers to fire, supported the only extensive area of tallgrass prairie found in Michigan. These prairies graded into oak savannas along the steep narrow end moraines, and into oak-hickory dominated forests (Legge et al. 1995). Within this landscape setting, Brandt Woods is located along the edge of end moraines developed during the last glacial period.

#### 5.1.1 Vegetation

##### 5.1.1.1 Historic Vegetation

The pre-settlement landscape at Brandt Woods would be comprised mainly as a mixed hardwoods swamp surrounded by mixed oak savannas, oak-hickory forests and mixed conifer swamps. The uplands surrounding Brandt Woods were mainly a combination of oak-hickory dominated dry-mesic southern forests, and "oak openings". The oak openings had perhaps only a few white, black and bur oak per acre. The general character of the forests and openings could be quite varied, sometimes with considerable overlap in what would be termed forest and what would be called an opening. In some settings, the forest was said to have a "park-like" appearance with very little mid-story vegetation and prairie plants at the ground level, but a nearly closed canopy. The openings could range from small grassy glades in a forested matrix, to the much larger and drier oak barrens having a few scattered oaks per acre.

The higher elevation areas and soils located at Brandt Woods would have favored oak-hickory forests and oak openings. The mesic-southern forests that existed would have been dominated by beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), basswood (*Tilia americana*), tulip tree (*Liriodendron tulipifera*), and black walnut (*Juglans nigra*) which would have been found up-slope from adjoining wetlands or in pockets of moist coves.

The hardwood swamps located on the property would have historically been dominated by typically dominated by silver maple and green ash (*Fraxinus pennsylvanica*), with red maple and pin oak (*Quercus palustris*) often as important subdominants. Tree species typical of floodplain forest are often present, including hackberry (*Celtis occidentalis*), sycamore (*Platanus*

*occidentalis*), and cottonwood (*Populus deltoides*). Other associates would include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), black ash (*F. nigra*), tulip tree (*Liriodendron tulipifera*), quaking aspen (*Populus tremuloides*), swamp white oak (*Quercus bicolor*), bur oak (*Q. macrocarpa*), red oak (*Q. rubra*), basswood (*Tilia americana*), and American elm (*Ulmus americana*).

#### 5.1.1.2 Current Vegetation

The current vegetation at Brandt Woods resembles that of the historical conditions. While much of the surrounding oak savannahs have been converted to agricultural use, the lowland hardwoods complex and mesic-southern forest conditions remain on the property.

The mesic southern forests are found primarily along the southern half of the property. Current composition of the forest includes sugar maple (*Acer saccharum*), tulip tree (*Liriodendron tulipifera*), white ash (*Fraxinus americanum*), and beech (*Fagus grandifolia*), and as the dominant trees.

The hardwood swamps found along the northern half of the property are dominated by silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*). Other trees commonly found include red maple (*Acer rubrum*), cottonwood (*Populus deltoides*), white ash (*Fraxinus americana*), black ash (*Fraxinus nigra*), tulip tree (*Liriodendron tulipifera*), swamp white oak (*Quercus bicolor*), basswood (*Tilia americana*), and American elm (*Ulmus americana*).

A study of the flora conducted by Albion College has documented the following list of species at Brandt Woods.

#### LYCOPHYTES

##### LYCOPODIACEAE

*Huperzia lucidula* (Michx.) Trevis., shining fir-moss. 3466. Rare in moist woods.

#### EQUISETOPHYTES

##### EQUISETACEAE

*Equisetum arvense* L., field horsetail. 2404, 2970, 3292. Common in disturbed areas and moist woods. Fertile April-May.

*E. hyemale* L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor, common scouring rush. 2911. Occasional in field near NW entrance.

#### FERNS

##### ASPLENIACEAE

*Asplenium platyneuron* (L.) Oakes, ebony spleenwort. 2608. Uncommon in dry to moist woods.

##### DRYOPTERIDACEAE

*Athyrium felix-femina* (L.) Mertens var. *angustum* (Willd.) G. Lawson, lady-fern. 2218, 3445. Common in moist woods.

*Cystopteris protrusa* (Weatherby) Blasdell, southern bladder fern. 2300. Common in and around vernal pools near NE boundary of woods.  
*Deparia acrostichoides* (Swartz) M. Kato, silvery-spleenwort. 2600, 3446, 3463. Uncommon in wet woods. [*Athyrium thelypteroides* (Michx.) Desvaux]  
*Diplazium pycnocarpon* (Spreng.) M. Broun, glade-fern. 2297A. Uncommon in wet woods. [*Athyrium pycnocarpon* (Spreng.) Tidestrom]  
*Dryopteris carthusiana* (Villars) H. P. Fuchs, spinulose wood-fern. 2309. Occasional in wet woods.  
*Dryopteris goldiana* (Hook. ex Goldie) A. Gray, Goldie's wood-fern. 2302. Locally common in and around vernal pools near NE boundary of property.  
*Matteuccia struthiopteris* (L.) Todaro var. *pennsylvanica* (Willd.) Morton, ostrich-fern. 2303. Uncommon in swampy woods near NE boundary of property.  
*Polystichum acrostichoides* (Michx.) Schott, Christmas fern. 2199. Locally common in moist woods.  
*Onoclea sensibilis* L., sensitive fern. 2592. Locally common in wet woods.

#### OSMUNDACEAE

*O. claytoniana* L., interrupted fern. 2256. Occasional in moist woods.  
*O. regalis* L., royal fern. 2948. Occasional in wet to swampy woods.

#### PTERIDACEAE

*Adiantum pedatum* L., maidenhair fern. 3291. Occasional in moist to wet woods.

#### THELYPTERIDACEAE

*Thelypteris noveboracensis* (L.) Nieuwl., New York fern. 2217. Common in moist woods.  
*T. palustris* Schott var. *pubescens* (Lawson) Fernald

#### OPHIOGLOSSOPHYTES

##### OPHIOGLOSSACEAE

*Botrychium onidense* (Gilbert) House, blunt-lobed grapefern. 2607, 2975. Uncommon in dry to moist woods.  
*B. virginianum* (L.) Swartz, rattlesnake-fern. 2307. Occasional in dry to moist woods.

#### CONIFERS

##### CUPRESSACEAE

*Juniperus communis* L. var. *depressa* Pursh, common juniper. 2315. Rare in dry woods near SE entrance.  
*J. virginiana* L., var. *virginiana*, eastern redcedar. 3304. Rare at edge of field near NW entrance.

#### ANGIOSPERMS

Aceraceae--see SAPINDACEAE

##### ADOXACEAE

*Sambucus canadensis* L., elderberry. 2388, 2389. Common in wet open areas. Flowering May-June.

- S. racemosa* L. subsp. *pubens* (Michx.) House, red-berried elder. 2932. Occasional in wet woods and open areas. Flowering April-May.
- Viburnum acerifolium* L., mapleleaf viburnum. 2337B. Common shrub in dry to moist woods. Flowering in May.
- V. lentago* L., nannyberry. 2631, 2956, 3009, 3299. Occasional in open areas and along streams. Flowering May-June.

#### ANACARDIACEAE

- Rhus typhina* L., staghorn sumac. 2341. Common at edge of fields near NE entrance. Flowering June-July.
- Toxicodendron radicans* (L.) Kuntze, poison-ivy. 2588. Common in wet to dry habitats. Flowering May-June.

#### APIACEAE (UMBELLIFERAE)

- Cicuta maculata* L., water hemlock. 2398, 2898. Common in swampy woods just N of H Drive. Flowering July-August.
- Cryptotaenia canadensis* (L.) DC., honewort. 2311, 2642. Occasional in moist woods. Flowering May-June.
- Daucus carota* L., wild carrot. 2390. Common in disturbed areas. Flowering July-October.
- Heracleum maximum* Bartram, cow-parsnip. 2342. Occasional in disturbed area near NW entrance.
- Osmorhiza claytonii* (Michx.) C. B. Clarke, sweet-cicely. 2279, 2284. Common in moist woods. Flowering May-June.
- Sanicula canadensis* L., 2304. Occasional in moist woods. Flowering in June. Det. E.G.V. \*
- Sanicula gregaria* Bickn., 2285, 2312. Common in moist woods. Flowering in June. \*
- Sanicula trifoliata* Bickn., 2395, 2396. Occasional in moist woods. Flowering in June. \*  
(Check to see if this is really *S. canadensis* & *S. gregaria*!)
- Sium suave* Walter, water-parsnip. 2899, 2926. Uncommon in swampy woods. Flowering August-September.
- Torilis japonica* (Houtt.) DC., hedge-parsley. 2391, 2883. Locally common along trails and in other disturbed areas. Flowering July-August. \*

#### APOCYNACEAE (incl. Asclepiadaceae)

- Apocynum sibiricum* Jacq., clasping dogbane. 2347. Locally common in field near NW entrance. Flowering June-July.
- Asclepias incarnata* L., swamp milkweed. 2895, 2962. Occasional along Rice Creek and in open swampy woods. Flowering June-July.
- A. syriaca* L., common milkweed. 3004. Uncommon in disturbed areas.

#### ARACEAE

- Arisaema triphyllum* (L.) Schott, jack-in-the-pulpit. 2215, 2229. Locally common in moist to wet woods. Flowering May-June.
- Symplocarpus foetidus* (L.) Nutt., skunk-cabbage. 2236. Common in swampy areas. Flowering March-April.

#### ARALIACEAE

- Aralia nudicaulis* L., wild sarsaparilla. 2308. Occasional in dry to moist woods.



*Panax quinquefolius* L., ginseng. 2894, 2943. Uncommon in moist to dry woods. Flowering June-July. \*

*P. trifolius* L., groundnut. 2240. Common in moist woods. Flowering in May.

#### ARISTOLOCHIACEAE

*Asarum canadense* L., wild ginger. 2274. Locally common herb in moist woods. Flowering in May.

#### ASTERACEAE (COMPOSITAE)

*Achillea millefolium* L., yarrow. 2363. Common in field near NW entrance. Flowering June-July.

*Ambrosia artemisiifolia* L., ragweed. 2890. Occasional along H Drive near SE entrance. Flowering August-September.

*Antennaria neglecta* Greene, field-pussytoes. 2246A, 2629. Common in disturbed field near NW entrance.

*A. plantaginifolia* (L.) Richardson, plantain-pussytoes. 2246B. Common in disturbed field near NW entrance.

*Anthemis arvensis* L., corn-chamomile. 2333, 2885. Locally common in disturbed areas.

*Arctium minus* Schk., common burdock. 3305. Occasional in disturbed areas.

*Aster firmus* Nees., shiny aster. 3002. Locally common in sedge meadow along Rice Creek. Flowering August-September.

*A. cordifolius* L., heart-leaved or blue wood aster. 2195, 2212, 2593. Common in disturbed, open areas in wet woods.

*A. lanceolatus* Willd., eastern lined aster. 2916, 3003. Occasional in disturbed areas. Flowering August-September.

*A. lateriflorus* (L.) Britton, goblet aster. 2987--check to see if this is really *A. ontarionis*! Occasional in disturbed areas.

*A. macrophyllus* L., big-leaved aster. 2210. Locally common in wet woods.

*A. novae-angliae* L., New England aster. 2918, 3457, 3465. Occasional in open wet areas in hawthorn woods. Flowering September-October.

*A. ontarionis* Wiegand, Lake Ontario aster. 2216. Occasional in beech-maple woods. Det. E.G.V.

*Bidens connata* Muhl., purplestem beggar-tick. 3449. Locally common along H Drive. Flowering in September.

*Centaurea maculosa* Lam., spotted knapweed. 2371, 2909. Common in disturbed field near NW entrance. Flowering July-August.

*Chichorium intybus* L., chicory. Occasional along 24-mile Road. Flowering July-October.

*Chrysanthemum leucanthemum* L., ox-eye daisy. 2641. Uncommon along road at NW entrance. Flowering June-July.

*Cirsium vulgare* (Savi) Tenore, bull-thistle. 2383, 2913. Common along H Drive. Flowering July-August.

*Erigeron annuus* (L.) Pers., annual fleabane. 2408. Common in disturbed areas.

*E. philadelphicus* L., Philadelphia daisy. 2298. Common in disturbed areas.

*E. strigosus* Muhl., rough fleabane. 2345, 2372. Occasional in field near NE entrance. Flowering June-July.

- Eupatorium maculatum* L., Joe-Pye-weed. 2590, 2879, 3001. Common in moist to wet disturbed areas. Flowering July-August.
- E. perfoliatum* L., boneset. 2886. Occasional in moist woods near SE entrance. Flowering August-September.
- E. rugosum* Houttuyn, white snakeroot. 2908, 2978. Uncommon in disturbed woods. Flowering August-September.
- Euthamia graminifolia* (L.) Nutt., common flat-topped goldenrod. 2914, 2917, 2989. Common along H Drive. Flowering August-September.
- Galinsoga parviflora* Cav., lesser quickweed. 2884. Occasional along H Drive. Flowering July-August.
- Gnaphalium obtusifolium* L., fragrant cudweed. 2907. Occasional in field near NW entrance. Flowering August-September.
- Helianthus decapetalus* L., forest-sunflower. 2878, 2902. Locally common in swampy woods near N and SE entrances.
- H. giganteus* L., swamp-sunflower. 3448. Locally common in swampy woods near SE entrance. Flowering August-September.
- Hieracium aurantiacum* L., orange-red king-devil. 2349. Locally common in field near NW entrance. Flowering June-July.
- H. caespitosum* Dumort., yellow king-devil. 2301, 2354, 2630. Locally common in disturbed areas.
- Prenanthes altissima* L., tall white-lettuce. 2598, 2905. Flowering August-September.
- Rudbeckia hirta* L., black-eyed Susan. 2353, 2370. Uncommon in field near NW entrance. Flowering June-July.
- Senecio aureus* L., golden ragwort. 2625, 2283. Locally common in swampy woods and along streams. Flowering in May. Det. E.G.V.
- Solidago altissima* L. tall goldenrod. 2912. Common in field near N entrance. Det. E.G.V.
- S. caesia* L., bluestem goldenrod. 2204. Common in moist woods.
- S. canadensis* L., common goldenrod. 2903, 2990, 3006. Common along roadsides and in other disturbed areas. Flowering August-September.
- S. flexicaulis* L., zigzag goldenrod. 2200, 2601. Locally common in beech-maple woods.
- S. nemoralis* Aiton, gray goldenrod. 2906. Common in woods W of stream. Det. E.G.V.
- Sonchus arvensis* L., perennial or field sow-thistle. 2405, 2888. Occasional along H Drive. Flowering July-August. Det. E.G.V.
- Taraxacum officinale* Weber, dandelion. 2369. Occasional in field near NW entrance. Flowering April-September.

#### BALSAMINACEAE

- Impatiens capensis* Meerb., orange jewelweed. 2591, 2893. Locally common in swampy woods and open wet areas. Flowering June-August.
- I. pallida* Nutt., pale touch-me-not. 2951. Occasional in sedge meadow along Rice Creek. Flowering June-August. \*

#### BERBERIDACEAE

- Caulophyllum thalictroides* (L.) Michx., blue cohosh. 2221. Common in moist woods. Flowering in May. \*

*Podophyllum peltatum* L., may-apple. 2276. Common in dry to moist woods. Flowering in May.

#### BETULACEAE

*Betula allegheniensis*

*Carpinus caroliniana* Walter, blue-beech, muscledwood. 2196, 2252. Common, scattered in woods. Flowering April-May.

*Ostrya virginiana* (Miller) K. Koch, hop-hornbeam. 2935. Occasional in dry to moist woods. Flowering April-May.

#### BRASSICACEAE (CRUCIFERAE)

*Arabis glabra* (L.) Bernh., tower mustard. 2626. Common in open field near NW entrance. Flowering May-June.

*Barbarea vulgaris* R. Br., yellow rocket. 2624, 3306. Occasional in disturbed areas. Flowering May-June.

*Cardamine bulbosa* (Schreb.) BSP., spring cress. 2266, 2272. Common in wet woods, especially in and around vernal pools. Flowering May-June.

*C. concatenata* (Michx.) O. Schwarz, five-parted toothwort. 2244. Locally common in moist woods. Flowering April-May.

*C. douglassii* Britton, pink spring-cress. 2233. Common in moist to wet woods, especially along vernal pools. Flowering April-May.

*Hesperis matronalis* L., dame's-rocket. 2945. Rare in swampy woods along E boundary of property.

*Lepidium campestre* (L.) R. Br., field-cress. 2322. Locally common in ditch at SE entrance. \*

*Rorippa palustris* (L.) Besser, yellow cress. 2969. Uncommon along bank of Rice Creek. Flowering June-July.

Caesalpinaceae--see FABACEAE

#### CAMPANULACEAE (incl. Lobeliaceae)

*Campanula americana* L., tall bellflower. 2209, 2403. Common along trails and in disturbed areas. Flowering July-August.

*C. aparinoides* Pursh, marsh-bellflower. 2992. Occasional in sedge meadow along Rice Creek. Flowering in August.

*Lobelia siphilitica* L., blue lobelia. 2904. Locally common in disturbed areas. Flowering August-September.

Caprifoliaceae--see ADOXACEAE

#### CARYOPHYLLACEAE

*Cerastium fontanum* Baumg., mouse-ear chickweed. 2294, 2628. Occasional in disturbed areas

*Dianthus armeria* L., deptford-pink. 2348. Locally common in field near NW entrance.

*Saponaria officinalis* L., bouncing-bet. 2313. Occasional along H Drive.

#### CELASTRACEAE

*Euonymus obovatus* Nutt., running strawberry-bush. 2310, 2594. Occasional in dry to moist woods. Flowering in May.

#### CHENOPODIACEAE

*Chenopodium album* L., lambs-quarters. 2394, 2891, 2892. Common along H Drive.  
Flowering July-September.

#### CLUSIACEAE

*Hypericum perforatum* L., common St. John's-wort. 2368. Common in field near NW entrance. Flowering in July.

#### CONVOLVULACEAE

*Cuscuta pentagona* Engelm., field dodder. 2996. Locally common in sedge meadow along Rice Creek.

*Ipomoea pandurata* (L.) G. Meyer, wild potato. 2994. Common in sedge meadow along Rice Creek.

#### CORNACEAE

*Cornus alternifolia* L.f., pagoda dogwood. 2900, 2933. Occasional in moist to wet woods.  
Flowering May-June.

*C. florida* L., flowering dogwood. 2941. Uncommon in dry woods. Flowering in May.

*C. racemosa* Lam., northern swamp dogwood. 2197, 2971. Locally common along Rice Creek, and in open, wet woods.

*C. sericea* L., red-osier dogwood. 2410, 3010, 3294. Common in moist to wet open areas.  
Flowering May-August.

#### CUCURBITACEAE

*Echinocystis lobata* (Michx.) T. & G., balsam-apple. 2901, 3000. Locally common in disturbed or open areas. Flowering August-September.

Cuscutaceae--see CONVOLVULACEAE

#### CYPERACEAE

*Carex albursina* Sheldon, 2287, 2326. Occasional in wet woods, especially around vernal pools. Flowering in May. \*

*C. aquatilis* Wahl., 2953. Common in sedge meadow.

*C. blanda* Dewey, 2329. Common in moist woods. \*

*C. bromoides* Willd., 2931. Occasional in swampy woods.

*C. cephalophora* Willd., 2323. Occasional in moist woods.

*C. cristatella* Britton, 2954. Occasional in sedge meadow along Rice Creek.

*C. gracillima* Schw., 2290. Occasional in moist woods.

*C. grayi* Carey, 2328. Uncommon in swampy woods near NE boundary of property.

*C. intumescens* Rudge, 2286, 2327. Occasional in moist woods.

*C. lacustris* Willd., 3301. Common in sedge meadow along Rice Creek.

*C. laxiflora* Lam., 2265. Occasional in moist woods.

*C. pennsylvanica* Lam., sedge. 2253. Common in disturbed open area near NW entrance.  
Flowering April-May.

*C. plantaginea* L., Bowers 2, Occasional in swampy woods near SE entrance. \*

*C. radiata* (Wahlenb.) Small, 2289. Occasional in dry to wet woods. Flowering in May. *C. rosea* Willd. in Voss (1972).

*C. rosea* Willd., 2325. Locally common in dry woods W of parking area. *C. convoluta* Mack. in Voss (1972).

*C. sparganioides* Willd., 2324. Occasional in swampy woods near NE boundary of property.

*C. stricta* Wahl., 3302, 3303. Common in sedge meadow along Rice Creek.  
*Eleocharis ovata* (Roth.) Roemer & Schultes, blunt spike-rush 2966. Common along Rice Creek.

*Scirpus atrovirens* Willd., black bulrush. 2377. Occasional in field near NW entrance.  
*S. cyperinus* (L.) Kunth, wool-grass. Locally common in sedge meadow along Rice Creek.  
*S. pendulus* Muhl., 2358. Occasional in field near NW entrance. Flowering May-June.

#### DIOSCOREACEAE

*Dioscorea villosa* L., colic-root. 2596, 2985. Occasional in dry to moist woods.

#### ERICACEAE

*Monotropa uniflora* L., Indian-pipe. 2980. Occasional in dry to moist woods. Flowering July-August.

#### EUPHORBIACEAE

*Acalypha rhomboidea* Raf., three-seeded mercury. 2882. Occasional along H Drive.  
Flowering July-August. \*

*Euphorbia esula* L., leafy spurge. 2621. Uncommon along 24-mile Road at NW entrance.  
Flowering May-June. \*

*E. maculata* L., spurge. 2887. Uncommon along H Drive near SE entrance. Flowering July-September.

#### FABACEAE (LEGUMINOSAE)

*Amphicarpaea bracteata* (L.) Fern., hog-peanut. 2986, 3447. Common in dry to moist woods.  
Flowering July-August.

*Desmodium glutinosum* (Muhl.) A. Wood, cluster-leaf tick trefoil. 2380. Locally common in moist woods.

*Melilotus alba* Medikus, white sweet-clover. 2407. Locally common along H Drive.  
Flowering July-August.

*M. officinalis* (L.) Pallas, yellow sweet-clover. 2385. Common along H Drive. Flowering July-August.

*Trifolium campestre* L., pinnate hop-clover. 2352. Common in field near NW entrance.  
Flowering June-July. \*

*T. hybridum* L., Alsike clover. 2644. Common along 24 Mile Road near NW entrance.  
Flowering June-July.

*T. pratense* L., red clover. 2356. Occasional in field near NW entrance. Flowering June-July.

*T. repens* L., white clover. 2361. Common in field near NW entrance. Flowering June-July.

#### FAGACEAE

*Fagus grandifolia* Ehrh., beech. 3290. Common in dry to moist woods. Flowering in May.

*Quercus alba* L., white oak. 3464. Common in moist woods. Flowering in May.

*Q. bicolor* Willd., swamp white oak. 2270. Common in wet woods. Flowering in May.

*Q. coccinea* Muenchh., scarlet oak. 2981. Uncommon in hawthorn woods. Flowering in May.

*Q. macrocarpa* Michx., bur oak. 2967. Flowering in May. Occasional in wet woods and along streams.

*Q. rubra* L., red oak. 2910, 2947. Common in dry to moist woods. Flowering in May.

*Q. velutina*, black oak

#### GENTIANACEAE

*Gentiana andrewsii* Griseb., bottle-gentian. 3456. Rare in wet clearings in hawthorn woods.  
Flowering September-October.

#### GERANIACEAE

*Geranium maculatum* L., wild geranium. 2247, 2269. Common in moist and swampy woods.  
Flowering in May.

#### GROSSULARIACEAE

*Ribes americanum* Miller, wild black currant. 2288, 2620, 3298. Occasional in moist woods.  
Flowering May-June.

*R. cynosbati* L., prickly goosberry. 2213, 2259. Scattered in moist woods.

#### HAMAMELIDACEAE

*Hamamelis virginiana* L., witch-hazel. 2198. Common in hawthorn woods.

#### HYDROPHYLLACEAE

*Hydrophyllum appendiculatum* Michx., waterleaf. 2296. Common in moist woods. Flowering  
May-June.

#### IRIDACEAE

*Iris virginica* L., blue flag. 2636. Occasional in swampy woods and along streams. Flowering  
May-June.

#### JUGLANDACEAE

*Carya cordiformis* (Wang.) K. Koch, bitternut hickory. 2267, 2637, 2984. Common in moist  
woods.

*C. ovata*

*Juglans cinerea*

*J. nigra* L., black walnut. 3453. Common in all but wettest areas. Flowering May-June.

#### JUNCACEAE

*Juncus tenuis* Willd., path rush. 2331, 2375. Common in disturbed areas.

#### LAMIACEAE (LABIATAE)

*Collinsonia canadensis* L., Northern horse-balm. 2208. Common in moist woods. Flowering  
August-September.

*Glechoma hederacea* L., creeping-Charlie. 2262. Occasional in disturbed areas. Flowering  
April-May.

*Lycopus rubellus* Moench, 2897. Occasional in swampy woods. Flowering July-August. Det.  
E.G.V.

*Monarda fistulosa* L., wild bergamot. 2366. Uncommon in open, disturbed areas. Flowering  
July-August.

*Prunella vulgaris* L., self-heal. 3451. Occasional in disturbed areas. Flowering  
September-October.

*Scutellaria lateriflora* L., skullcap. 2896. Uncommon in moist woods. Flowering  
August-September.

#### LAURACEAE

*Lindera benzoin* (L.) Blume, spicebush. 2207, 2220. Common shrub in moist woods.  
Flowering in April.

*Sassafras albidum* (Nutt.) Nees, sassafras. 3454. Uncommon in field near NW entrance.

#### LEMNACEAE

*Lemna minor* L., duckweed. 2925. Occasional in vernal pools and streams. \*

#### LILIACEAE

*Allium tricoccum* Aiton, wild leek. 2281. Common in moist woods.

*Erythronium americanum* Ker, yellow trout-lily. 2224. Common in moist woods. Flowering April-May.

*Lilium michiganense* Farw., Michigan lily. 2384. Occasional in open disturbed areas. Flowering in July.

*Maianthemum canadense* Desf., Canada mayflower. 2271. Common herb in moist woods. Flowering May-June.

*Medeola virginiana* L., Indian cucumber-root. 2340, 2635. Locally common in moist woods. Flowering in June.

*Polygonatum pubescens* (Willd.) Pursh, Solomon's-seal. 2275. Common in moist woods.  
Flowering May-June.

*Smilacina stellata* (L.) Desf. Locally common in moist to wet woods. Flowering in May.

*Trillium grandiflorum* (Michx.) Salisb., large-flowered trillium. 2227. Common in moist woods. Flowering in May.

*Uvularia grandiflora* Sm., bellwort. 2241. Common in moist woods. Flowering in May.

Lobeliaceae--see CAMPANULACEAE

MAGNOLIACEAE

*Liriodendron tulipifera* L., tulip-poplar. 2306. Occasional in moist woods. \*

Mimosaceae--see FABACEAE

Monotropaceae--see ERICACEAE

NYMPHAEACEAE

*Nuphar advena* (Aiton) Aiton f., yellow water-lily. 2974. Occasional in Rice Creek. Flowering May-July.

OLEACEAE

*Fraxinus americana* L., white ash. 2938. Common in most to swampy woods.

*F. nigra* Marshall, black ash. 2589. Common in swampy woods N of H Drive.

*F. pennsylvanica* Marshall, red ash. 2934, 2939, 2983. Occasional in swampy woods.

ONAGRACEAE

*Circaea lutetiana* L., enchanter's-nightshade. 2334. Locally common in moist woods.  
Flowering June-July.

*Epilobium coloratum* Biehler, willow-herb. 2997. Occasional in sedge meadow along Rice Creek.

ORCHIDACEAE

*Aplectrum hyemale* (Willd.) Torrey, puttyroot. 2295, 2609. Uncommon in moist woods.  
Flowering in June. \*

*Habenaria hookeri* Torr., Hooker's orchid. 2976. Uncommon along main trail at ecotone between beech-maple woods and hawthorn woods. Flowering June-July.

*Orchis spectabilis* L., showy orchis. 3467. Rare in moist maple woods. Flowering May-June.

OROBANCHACEAE

*Conopholis americana* (L.) Wallr., squawroot. 2378. Uncommon in dry to moist woods.  
Flowering June-July.

*Epifagus virginiana* (L.) Bart., beech-drops. 2930, 2979. Uncommon in dry to moist woods.  
Flowering August-September.

OXALIDACEAE

*Oxalis fontana* Bunge, 2292, 2881. Occasional in disturbed areas. Flowering May-August.

PAPAVERACEAE

*Sanguinaria canadensis* L., bloodroot. 2238. Locally common in moist woods. Flowering in April.

PHYTOLACCACEAE

*Phytolacca americana* L., pokeweed. 2211. Locally common in open, disturbed areas.

PLANTAGINACEAE

*Plantago lanceolata* L., English plantain. 2360. Common in field near NW entrance.  
Flowering June-July.

*P. rugelii* Dcne., American plantain. 2399. Common at SE entrance. Flowering July-August.

PLATANACEAE



*Platanus occidentalis*

POACEAE (GRAMINEAE)

*Andropogon virginicus* L., broom-sedge. 3452. Common in field near NW entrance.

Flowering September-October. \*

*Cinna arundinacea* L., wood reed. 2205, 2595, 2602. Occasional along trails in beech-maple woods. \*

*Brachyelytrum erectum* (Roth) Beauv., 2337A. Occasional along trails.

*Bromus inermis* Leysser, smooth brome-grass. 2317. Common along H Drive in wet ditch.

*Calamagrostis canadensis* (Michx.) Beauv., bluejoint. 2952. Common in open sedge meadow along Rice Creek.

*Dactylis glomerata* L., orchard-grass. 2316. Common along H Drive in wet ditch. \*

*Danthonia spicata* (L.) F. Beauv., poverty grass. 2376. Locally common along trails.

*Digitaria ischaemum* (Schreber) Muhl., smooth crab-grass. Locally common along 24-mile Road. Flowering August-September. \*

*Echinochloa muricata* (P. Beauv.) Fern., barnyard-grass. Locally common along 24-mile Road. Flowering August-September. \*

*Eragrostis pectinacea* (Michx.) Nees, Carolina lovegrass. 3458. Locally common along 24-mile Road at NW entrance. Flowering September-October.

*Festuca obtusa* Biehler, fescue. 2321. Common in woods near SE entrance.

*Glyceria striata* (Lam.) Hitchc., fowl manna grass. 2950. Common in open wet glade along Rice Creek.

*Hystrix patula* Moench, bottlebrush grass. 2336. Common in moist woods, especially in disturbed areas.

*Leersia virginica* Willd., white grass. 2603. Occasional in wet woods. \*

*Panicum capillare* L., witch-grass. 3450. Common in field near NW entrance. Flowering September-October. \*

*P. dicotomiflorum* Michx., 3459. Locally common along 24-mile Road near NW entrance. Flowering September-October. \*

*P. lanuginosum* Elliott var. *implicatum* (Scribn.) Fern., 2359. Common in field near NW entrance.

*Phalaris arundinacea* L., reed canary-grass. 2314, 2949. Locally common in wet ditches and along streams.

*Phleum pratense* L., timothy. 2365. Occasional in disturbed areas.

*Poa alsodes* Gray, 2291. Occasional in wet woods. Flowering in May. \*

*P. compressa* L. Canada bluegrass. 2319. 2319. Common in dry woods near SE entrance.

*P. pratensis* L., Kentucky blue-grass. 2318. Common along H Drive.

*P. saltuensis* Fern. & Wieg. 2264. Occasional in moist woods. Det. E.G.V.\*

*Setaria glauca* (L.) Beauv., yellow foxtail. 2877. Occasional in wet woods near SE entrance.

*Sphenopholis intermedia* (Rydb.) Rydb., wedge-grass. 2320, 2338. Common in moist woods near SE entrance.

POLEMONIACEAE

*Phlox divaricata* L., blue phlox. 2223. Common in moist woods. Flowering in May.

POLYGONACEAE

*Polygonum aviculare* L., knotweed. 2392. Common along H Drive. Flowering July-August.

*P. convolvulus* L., black-bindweed. 2889. Occasional along H Drive. Flowering July-August.

*P. persicaria* L., lady's-thumb. 2387. Common along H Drive. Flowering July-August.

- P. scandens* L., false buckwheat. 2999. Occasional in sedge meadow along Rice Creek. Flowering July-August.
- P. sagittatum* L., arrow-leaved tearthumb. 2958, 2998. Occasional in sedge meadow along Rice Creek. Flowering June-July.
- Rumex acetosella* L., red sorrel. 2627. Occasional in field near NW entrance. Flowering May-June.
- R. obtusifolius* L., bitter dock. 2339. Common in disturbed areas. Flowering in June.
- R. orbiculatus* A. Gray, great water dock. 3007. Occasional in sedge meadow along Rice Creek. Flowering August-September.

#### PONTEDERIACEAE

- Heteranthera dubia* (Jacq.) MacM., water star-grass. 2973. Occasional in Rice Creek. Det. E.G.V.

#### PORTULACACEAE

- Claytonia virginica* L., spring beauty. 2232. Common in dry to wet woods. Flowering April-May.

#### PRIMULACEAE

- Lysimachia ciliata* L., fringed loosestrife. 2400. Common along edge of swampy woods at H Drive. Flowering in July.

#### RANUNCULACEAE

- Actaea alba* (L.) Miller, doll's-eyes. 2280, 2587. Common in moist woods. Flowering May-June.
- Anemone quinquefolia* L., wood anemone. 2226. Common in moist woods. Flowering April-May.
- A. virginiana* L., thimbleweed. 2915. Occasional in disturbed areas. Flowering July-August.
- Caltha palustris* L., marsh marigold. 2228. Common in wet woods around vernal pools. Flowering April-May.
- Clematis virginiana* L., virgin's-bower. 2995. Locally common at edges of wet glade along Rice Creek.
- Hepatica acutiloba* DC., liverleaf. 2230, 2249. Locally common, especially near SE entrance. Flowering April-May.
- Hydrastis canadensis* L., goldenseal. 2243. Locally common in swampy woods, especially near vernal pools. Flowering April-May.
- Isopyrum biternatum* (Raf.) T. & G., false rue anemone. 2242. Locally common along main trail at W branch of Rice Creek. Flowering in May. \*
- Ranunculus abortivus* L., small-flowered buttercup. 2222, 2245, 2282. Common along trails in moist woods. Flowering April-May.
- R. flabellaris* Raf., yellow water-crowfoot. 2940. Rare in W branch of Rice Creek. Flowering April-May.
- R. recurvatus* Poiret, hooked crowfoot. 2942. Occasional in moist woods. Flowering April-May.
- Thalictrum dasycarpum* Fisch. & Ave-Lall., purple meadow-rue. 2406, 2643, 2972. Locally common along Rice Creek and in open swampy areas. Flowering May-June.

#### ROSACEAE

- Agrimonia pubescens* Wallr., agrimony. 2379. Common in moist woods, especially along trails. Flowering July-August. Det. E.G.V.

*Amelanchier laevis* Wieg., smooth serviceberry. 2237. Occasional in disturbed area near NW entrance. Flowering April-May.

*Crataegus crus-galli* L., cockspur-thorn. 2203. Locally common in hawthorn woods.

*C. margaretta* Ashe, fireberry hawthorn. 2202, 2364, 2632, 3297. Common in disturbed areas. 2202, 2632 det. E.G.V.

*Fragaria virginiana* Duchesne, thick-leaved wild strawberry. 2248. Locally common in field near NW entrance.

*Geum aleppicum* Jacq., yellow avens. 2355. Occasional in field near NW entrance. Flowering June-July.

*G. canadense* Jacq., white avens. 2255, 2335, 2397, 2944. Occasional in moist to wet woods. Flowering May-July.

*Potentilla recta* L., cinquefoil. 2332, 2374. Common in disturbed areas.

*P. simplex* Michx., cinquefoil. 2293. Occasional in disturbed areas. Flowering May-June.

*Prunus serotina* Ehrh., black cherry. 2633. Common in woods and in disturbed areas. Flowering May-June.

*P. virginiana* L., choke-cherry. 2645. Occasional in disturbed areas near NW entrance. Flowering in May.

*Pyrus malus* L., apple. 2634, 2936. Occasional in disturbed areas. Flowering in May.

*Rosa carolina* L., pasture rose. 2343. Common in fields near NW entrance. Flowering June-July.

*R. multiflora* Murray, multiflora rose. 2201. Locally common in disturbed hawthorn woods. \*

*R. palustris* Marsh., swamp rose. 2955. Common along Rice Creek. Flowering June-July.

*Rubus allegheniensis* T. C. Porter, common blackberry. 2346. Common in field near NW entrance. Flowering May-July.

*R. idaeus* L., red raspberry. 2964. Occasional along Rice Creek. Flowering May-June.

*R. occidentalis* L., black raspberry. 2959. Occasional in disturbed areas. Flowering May-June.

*R. pubescens* Raf., dwarf raspberry. 2255 (det. E.G.V.), 3293. Occasional in sedge meadow along Rice Creek. Flowering May-June.

*Spiraea alba* Duroi, meadowsweet. 2993. Common in sedge meadow along Rice Creek. Flowering July-August.

#### RUBIACEAE

*Cephalanthus occidentalis* L., button-bush. 2638, 2963. Locally common in swampy woods and along streams. Flowering June-July.

*Galium aparine* L., cleavers. 2263, 2640. Common in moist to dry woods and disturbed areas. Flowering April-May.

*G. circaezans* Michx., forest bedstraw. 2330. Common in dry to moist woods.

*G. concinnum* T. & G., shining bedstraw. 2350, 2639. Locally common in moist disturbed areas. Flowering June-July.

*G. tinctorium* L., southern three-lobed bedstraw. 2957. Occasional in sedge meadow along Rice Creek.

#### RUTACEAE

*Zanthoxylum americanum* Miller, prickly-ash. 2305, 2351. Occasional in wet woods and along streams. \*

#### SALICACEAE

*P. grandidentata* Michx., big-toothed aspen. 2982. Common in hawthorn woods. Flowering in May.

- P. tremuloides* Michx., quaking aspen. 2991. Locally common in wet woods.
- Salix discolor* Muhl., pussy-willow. 2924. Occasional along streams. Flowering in April.
- S. exigua* Nutt., sandbar-willow. 2965, 3295, 3296. Common along Rice Creek. Flowering April-May.
- SAPINDACEAE (incl. Aceraceae)
- Acer rubrum* L., red maple. 2937. Common in moist to swampy woods. Flowering March-April.
- A. saccharum* Marsh., sugar maple. 2273. Common tree in wet to dry woods. Flowering in April.
- A. saccharinum* L., silver maple. 3289. Common in swampy woods. Flowering in April.
- SAXIFRAGACEAE
- Mitella diphylla* L., Bishop's-cap. 2225, 2239. Common in wet woods, especially around vernal pools. Flowering May-June.
- SCROPHULARIACEAE
- Mimulus ringens* L., monkey-flower. 2961. Occasional along Rice Creek. Flowering June-July.
- Verbascum blattaria* L., moth mullein. 2362, 2373, 2386. Occasional in disturbed areas. Flowering June-July.
- V. thapsus* L., common mullein. 2367. Occasional in field near NW entrance. Flowering July-August.
- Veronica peregrina* L. 2260. Occasional in disturbed areas.
- SMILICACEAE
- Smilax herbacea* L. var. *lasioneura* (Small) Rydb., carrion-flower. 2623. Occasional in woods and disturbed areas. Flowering May-June.
- SOLANACEAE
- Solanum dulcamara* L., bittersweet. 2401, 2960. Locally common in disturbed areas. Flowering July-August.
- S. nigrum* L., black nightshade. 2393. Occasional along H Drive. Flowering July-August.
- STAPHYLEACEAE
- Staphylea trifolia* L., bladdernut. 2297B. Flowering April-May.
- THYMELAEACEAE
- Dirca palustris* L., leatherwood. 2929, 2604. Occasional in wet woods. Flowering in April. \*
- TILIACEAE
- Tilia americana* L., basswood. 2597. Common in moist woods. Flowering in June.
- ULMACEAE
- Ulmus americana* L., American elm. 2923, 2968. Occasional in woods and disturbed areas. Flowering March-April.
- URTICACEAE
- Boehmeria cylindrica* (L.) Swartz, false nettle. 2402. Common in swampy woods along H Drive. Flowering July-August.
- Laportea canadensis* (L.) Wedd., stinging nettle. 2214. Common in moist to wet woods.
- Pilea pumila* (L.) A. Gray, pilea. 2206. Common in moist areas.
- Urtica dioica* L., stinging nettle. 2382. Locally common in open, wet disturbed areas. Flowering June-July.
- VERBENACEAE (including Phrymaceae)
- Phryma leptostachya* L., lopseed. 2381. Common in dry to moist woods. Flowering in July.

*Verbena hastata* L., common vervain. 2880, 3008. Occasional in open areas. Flowering August-September.

#### VIOLACEAE

*Viola canadensis* L., Canada violet. 2254. Locally common in moist woods. Flowering in May.

*V. conspersa* Reichb., dog violet. 2927. Uncommon in swampy woods. Flowering April-May. \*

*V. cucullata* Aiton, marsh violet. 3300. Occasional in sedge meadow along Rice Creek. \*

*V. palmata* L., wood violet. 2257. Uncommon in wet woods. Flowering in May. \*

*V. pubescens* Aiton, yellow violet. 2231. Common in moist woods, especially disturbed areas. Flowering April-May.

*V. rostrata* Pursh, long-spurred violet. 2234, 2250. Common in moist woods, especially in disturbed areas. Flowering April-May.

*V. sororia* Willd., common blue violet. 2235, 2251. Common in moist and disturbed areas. Flowering April-June.

#### VITACEAE

*Parthenocissus vitacea* (Knerr) A. Hitchc., grape-woodbine. 2344. Common in disturbed areas. Flowering June-July.

*Vitis aestivalis* Michx., summer grape. 2977. Locally common in disturbed areas. Flowering in June.

*Vitis riparia* Michx., river grape. 2622. Common along 24-mile Road at NW entrance. Flowering in June.

### **5.1.1.3 Future of Vegetation**

The CCD plans to actively manage the natural areas by controlling invasive exotic plants, controlling woody plant invasion in herbaceous plant communities, protecting threatened and endangered (T&E) species, conducting selective timber harvests, and monitoring the effects of resource management activities and land use activities. The intensity and success of management will depend on the availability of funding and support from partners on the team.

### **5.1.1.4 Threatened and/or Endangered Species**

Two authorities direct the management of legally protected state and federal listed (threatened or endangered), special concern, proposed and candidate species of plants and animals (termed “sensitive species”) at HL: the Michigan Endangered Species Act (Public Act 451 of 1994, Article III, Ch.1, Part 365), and the Federal Endangered Species Act of 1973, as amended.

Michigan’s Endangered Species Act prohibits the harm, taking, importation, sale, destruction, transport or possession of any state listed threatened or endangered species, except as allowed by permit. This includes all parts (e.g. roots, seeds, feathers, eggs) of both plants and animals wherever they occur. No legal protection is afforded Michigan’s special concern species. However, protection of these special concern plants and animals is recommended in this plan to prevent them from becoming more imperiled or from being listed as threatened or endangered in the future.

The Federal Endangered Species Act contains the requirement to consult with the USFWS in the event a federal listed or proposed species or their critical habitat may be affected by activities or

management decisions at Brandt Woods. Consultations are designed to avoid adverse effects to these species or to critical habitat through project modifications and implementation of conservation and protection measures. The CCD will follow the letter of the law regarding Federal or State listed species on the property.

#### **5.1.1.5 Non-Native and Invasive Species**

One of the most menacing impacts to natural areas are the impacts generated by invasive exotic plants. Often impacts from invasive exotic plants are put into motion by human activity. Introductions of species from other regions, growing in the absence of normal plant, insect or disease controls, can allow the plant to out-compete native species and cause grave ecological damage. Some plant introductions do not seem to cause ecological impacts in native plant communities and are generally excluded because no ecological niches matching their growth characteristics are available for the plants to exploit. Exotic species ecological models predict that ultimately invasive exotic species will come into stasis in the environment by insect and disease predators adapting to the introduced plant as a food source. In the modern fragmented landscape, conservative plant species have already been pushed to low population levels and exotic species can wipe out conservative species before disease and insect predators have adapted to pressure the invading exotic plant. Because of these issues management of exotic plants is a primary concern in natural areas management.

Potential threats to the ecological integrity of Brandt Woods include glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), garlic mustard (*Alliaria petiolata*), Multiflora rose (*Rosa multiflora*), autumn olive (*Oleaster elegnus*), and Russian olive (*Elaeagnus angustifolia*).

### **5.1.2 Fish and Wildlife**

#### **5.1.2.1 Mammals**

Several mammals have been documented on the property. The most notable and evident is the white-tailed deer (*Odocoileus virginianus*) which has caused damage to the understory and forest regeneration on the property. Other species commonly found include raccoon (*Procyon lotor*), virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), and Beaver (*Castor canadensis*). Several trees with cavities, snags and shagbark hickory (*Carya ovata*) exist on the property and provide shelter for local bat species including the big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and little brown bat (*M. lucifugus*).

#### **5.1.2.2 Birds**

The area around Brandt Woods provides habitats and open space for a wide variety of migratory birds that migrate annually within and beyond North America. Regardless of how these migratory birds use the area, their presence provides important ecological services and is an important indicator of ecosystem health. Primary considerations with regard to migratory bird management, are in compliance with the Migratory Bird Treaty Act (MBTA) and support, contribution and compatibility with the goals and efforts of numerous regional migratory and game bird conservation programs. Virtually all birds that occupy the area throughout the year are protected under the MBTA. The MBTA controls many actions that may negatively affect migratory birds, particularly collection and transportation of birds. Special purpose permits may

be requested and issued that allow for the relocation or transport of migratory birds for management purposes.

Local bird species that are documented or thought to occur at Brandt Woods tend to be closely associated with wetland habitats.

Species	Status	Neotropical ?
Acadian Flycatcher	summer	yes
Alder Flycatcher	summer	yes
American Crow	permanent	xxx
American Goldfinch	permanent	xxx
American Kestrel	permanent	xxx
American Redstart	summer	yes
American Robin	summer	no
American Woodcock	summer	no
Baltimore Oriole	summer	yes
Bank Swallow	summer	yes
Barn Swallow	summer	yes
Barred Owl	permanent	xxx
Belted Kingfisher	summer	no
Black-and-white Warbler	summer	yes
Black-billed Cuckoo	summer	yes
Black-capped Chickadee	permanent	xxx
Blackpoll Warbler	migrant	yes
Black-throated Green Warbler	summer	yes
Blue Jay	permanent	xxx
Blue-gray Gnatcatcher	summer	yes
Blue-headed Vireo	summer	yes
Blue-winged Warbler	summer	yes
Bobolink	summer	yes
Broad-winged Hawk	summer	yes
Brown Creeper	permanent	xxx
Brown Thrasher	summer	no
Brown-headed Cowbird	summer	no
Canada Goose	permanent	xxx
Carolina Wren	permanent	xxx
Cedar Waxwing	permanent	xxx
Cerulean Warbler	summer	yes
Chestnut-sided Warbler	summer	yes
Chimney Swift	summer	yes
Chipping Sparrow	summer	no
Clay-colored Sparrow	migrant	no
Common Grackle	summer	no
Common Yellowthroat	summer	yes
Cooper's Hawk	permanent	xxx
Dickcissel	summer	yes

Downy Woodpecker	permanent	xxx
Eastern Bluebird	summer	no
Eastern Kingbird	summer	yes
Eastern Meadowlark	summer	no
Eastern Phoebe	summer	no
Eastern Towhee	summer	no
Eastern Wood-Pewee	summer	yes
European Starling	permanent	xxx
Field Sparrow	summer	no
Golden-winged Warbler	migrant	yes
Grasshopper Sparrow	summer	no
Gray Catbird	summer	yes
Great Blue Heron	summer	no
Great Crested Flycatcher	summer	yes
Great Horned Owl	permanent	xxx
Green Heron	summer	no
Hairy Woodpecker	permanent	xxx
Henslow's Sparrow	summer	no
Hermit Thrush	summer	yes
Hooded Warbler	summer	yes
Horned Lark	permanent	xxx
House Finch	permanent	xxx
House Sparrow	permanent	xxx
House Wren	summer	no
Indigo Bunting	summer	no
Kentucky Warbler	summer	yes
Killdeer	summer	no
Least Flycatcher	summer	yes
Magnolia Warbler	migrant	yes
Mallard	permanent	xxx
Marsh Wren	summer	no
Mourning Dove	permanent	xxx
Mourning Warbler	summer	yes
Mute Swan	permanent	xxx
Northern Cardinal	permanent	xxx
Northern Flicker	permanent	xxx
Northern Rough-winged Swallow	summer	yes
Northern Waterthrush	summer	yes
Osprey	summer	no
Ovenbird	summer	yes
Pied-billed Grebe	summer	no
Pileated Woodpecker	permanent	xxx
Pine Warbler	summer	yes
Purple Martin	summer	yes
Red-bellied Woodpecker	permanent	xxx
Red-eyed Vireo	summer	yes
Red-headed Woodpecker	summer	no
Red-tailed Hawk	permanent	xxx
Red-winged Blackbird	summer	no
Ring-billed Gull	casual visitor	no



Ring-necked Pheasant	permanent	xxx
Rose-breasted Grosbeak	summer	yes
Ruby-throated Hummingbird	summer	yes
Ruffed Grouse	permanent	xxx
Sandhill Crane	summer	no
Savannah Sparrow	summer	no
Scarlet Tanager	summer	yes
Sedge Wren	summer	no
Song Sparrow	summer	no
Sora	summer	yes
Swainson's Thrush	migrant	yes
Swamp Sparrow	summer	no
Tennessee Warbler	migrant	yes
Tree Swallow	summer	yes
Trumpeter Swan	permanent	xxx
Tufted Titmouse	permanent	xxx
Turkey Vulture	summer	no
Veery	summer	yes
Vesper Sparrow	summer	no
Warbling Vireo	summer	yes
White-breasted Nuthatch	permanent	xxx
White-eyed Vireo	summer	yes
Wild Turkey	permanent	xxx
Willow Flycatcher	summer	yes
Wood Duck	summer	no
Wood Thrush	summer	yes
Worm-eating Warbler	summer	yes
Yellow Warbler	summer	yes
Yellow-billed Cuckoo	summer	yes
Yellow-breasted Chat	summer	yes
Yellow-throated Vireo	summer	yes

### **5.1.2.3 Reptiles and Amphibians**

Reptiles and amphibians are commonly located on the property and in the area. Species of special interest include the eastern box turtle (*Terrapene carolina*) and the eastern massasauga, Michigan's only venomous snake. Amphibians are commonly found in the wetlands located on or near the property, and the vernal pools that form along the northern edge provide critical reproduction habitat for salamander and frogs.

### **5.1.2.4 Threatened and/or Endangered Species**

Michigan's Endangered Species Act prohibits the harm, taking, importation, sale, destruction, transport, or possession of any state listed threatened or endangered species, except as allowed by permit. This includes all parts (e.g. roots, seeds, feathers, eggs) of both plants and animals wherever they occur. No legal protection is afforded Michigan's special concern species. However, protection of these special concern plants and animals is recommended in this plan to prevent them from becoming more imperiled or from being listed as threatened and endangered in the future.

### 5.1.2.5 Non-Native and Invasive Species

Inspection of Brandt Woods forests described in the most recent forest inventories revealed serious damage to timber stocks due to emerald ash borer (*Agrilis planipennis*) insect infestations, which have severely affected many of the ash trees located on the premises. Aside from the ash borer, the majority of damage seen during the field surveys was associated with windfalls and over browsing by deer. Over browsing by White-tailed deer has caused many successional shifts in forests from multiple stage forests into two stage or single stage forests due to over browsing.

Other diseases and tree health problems known to occur in the region, but not known to cause serious problems at Brandt Woods, include: cherry scallop shell moth, beech bark disease, and butternut canker. The cherry scallop shell moth has been known to cause defoliation of wild black cherry, but trees have been able to recover well from intermittent outbreaks and have shown no apparent residual health problems as a result. Presently, there is no evidence of beech bark disease at Brandt Woods, although it may occur regionally. It is unlikely that this disease will ever cause significant concerns at Brandt Woods, as beech represents only a slight portion of the trees present on the property.

Another tree health concern described by U.S. Forest Service in the area is oak wilt. Oak wilt is known to occur in the both Calhoun and Kalamazoo counties, but has not been seen at Brandt Woods. It is a virulent disease that can quickly cause mortality in trees of the black oak/red oak group, once attacked. However, locally it is not a common disease and its control is typically achieved through prevention. Activities at Brandt Woods should avoid any wounding or gashes to trees that may come about through trail maintenance or other activities using large equipment. Also, pruning of oaks must be curtailed entirely during the growing season to prevent the exuding of fresh sap that attracts the beetle carrying the disease fungus.

Currently there is no apparent threat of fires based on existing forest conditions. Instead, fire is termed as a natural disturbance event – much like windfall damage caused by severe weather events – it is subject to occur at some point in the future, but is not perceived to be a significant forest health concern at this time.

## Section 6: Impacts on Natural Resources

### 6.1 Land Use

The Brandt Woods property is to be used and enjoyed by the public. With the exception of some minor rules visitors are allowed and encouraged to enjoy the property for non-motorized, passive recreational activities such as hiking, birding, cross-country skiing, snow shoeing, photography, and natural resource education.

#### 6.1.1 Trails

There are trails located throughout the property with one main trail going from the entrance off of H Drive North to the entrance off of 24 Mile Road. Extending off of the main trail on the east side of the property is a loop that goes up to Rice Creek. Many trails found throughout the property were created from timber logging roads. Current trails allow visitors to walk easily

around the property and pass through multiple habitat types. As property use increases, foot traffic on such trails will help to maintain the trails with minimal work from the CCD. At the current time, minor maintenance is warranted to keep the trails free of debris and passable.

### 6.1.2 Off-Trail Use

Trails at Brandt Woods are the main areas where visitors will spend their time. This will deter vegetation and habitat loss within the property. However, visitors are not prohibited from walking off-trail and enjoying other parts of the property. While off-trail use is not prohibited, rules such as no digging, no seed or plant harvesting, no tree cutting, etc. still apply.

### 6.1.3 Boardwalks/Bridges

A boardwalk should be constructed to allow visitors to traverse the wetlands along the northwest edge of the property. This will further enhance and promote education of wetland areas. Bridges should be constructed on the main trail across the two ephemeral streams to further increase use and accessibility from one side of the property to the other, and in order to easily get to parts of the property where different habitats occur.

## 6.2 Potential Impacts of Land Use

While Brandt Woods is open to the public and has few rules, there is potential for impacts on the natural environment. Strategically placed trails throughout the property should help minimize off-trail activity that would result in impacts to native vegetation and wildlife. Allowing only passive non-motorized recreation will minimize environmental impacts. Catch and release fishing on Rice Creek, while not mandatory, will be recommended to allow for a sustainable and biologically diverse fish community.

## 6.3 Water Use

While the plan is to minimize impacts on the water environment, visitors are allowed and encouraged to enjoy recreational activities on Rice Creek. This may include fishing, boating, etc.

# Section 7: Natural Resources Management

## 7.1 Wetland Management

The wet sedge meadow is a distinct, open marsh of about two acres in size. It is located along the north branch of Rice Creek in Sec 7. Common species of this community include Carex lacustris, C. aquatilis, C. cristatella, Scirpus cyperinus, Calamagrostis canadensis, Spiraea alba, Rumex orbiculatus, Aster firmus, and Campanula aparinoides. Trees and large shrubs are mostly absent, except on the periphery, and include Salix exigua, Cornus racemosa, Viburnum lentago, and Ulmus americana.

The interspersed or the intermixing of the various wildlife habitat components is habitat diversity. A complex of diverse wetland types within the landscape is very beneficial to wetland species. A mixture of open water, mudflats, emergent, scrub shrub, forested, and riparian wetlands will attract the greatest diversity of game and non-game wetland animal species.

In managing the wetlands associated with Brandt Woods for Waterfowl, Herons, and Shorebirds favorable land use pattern consists of at least 5% in shallow open water habitats, 10% in undisturbed woody or herbaceous wetlands, 5-10% in protected herbaceous cover, and the remainder in other land uses. Key habitat needs include adequate water and safe and secure nesting and brood rearing areas.

Adequate water in wetland areas has the following general characteristics: of a maximum of 20% of the surface water area will have water depths from 3-6 feet deep; 30% of areas, 1.5-3 feet deep; and the remainder in areas less than 1.5 feet deep. Manipulation of water regimes and seasonal water levels may impact more than the target species of wildlife. These possible multiple species effects will be evaluated and taken into consideration during the planning process. This practice will be used to promote the conservation of declining species, including federal or state threatened and endangered species. Wetland vegetation that is adapted to the site that will accomplish the desired purposes will be the management goal. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Management measures shall be provided to control invasive species and noxious weeds. Biological control of undesirable plant species shall be implemented where available and feasible. Added water depth and duration may be utilized as a method to control unwanted vegetation.

With respect to nesting and brood rearing cover, a minimum of 2 acres of undisturbed nesting and brood rearing cover, which is suitable for the target species, is desirable. A ratio of undisturbed upland cover to wetland of 4:1 or greater is desired. Nesting structures, such as wood duck boxes at a rate of 1 per acre of wetland, may be installed.

With respect to Amphibians and Reptiles a maximum of 30% of the surface water area will have water depths from 3-6 feet deep and at least 40% of the area will be less than 1.5 feet deep. A complex of wetlands, of varying size and depth, including ephemeral and permanent water is desired. Basking structures such as semi submerged logs, stumps, and log piles at the rate of 4 per surface acre are desirable.

## 7.2 Forest Management

### 7.2.1 Forest Restoration, Management and Protection

Results from a study of the floral community conducted by Albion College determine Sugar maple (*Acer saccharum*) as the dominant species in the community. Silver maple (*A. saccharinum*) has the second highest importance value and is followed closely by American elm (*Ulmus americana*), basswood (*Tilia americana*), red maple (*A. rubrum*), and beech (*Fagus grandifolia*).

The area sampled is a mosaic of mesic and wet areas, the latter associated with floodplains and vernal pools, which in some years do not dry up entirely. Sugar maple and basswood are more common in mesic areas, while the wetter forests appear to be dominated by silver maple and red maple. Some of the wettest areas have yellow birch (*Betula allegheniensis*) and black ash

(Fraxinus nigra) present, especially near the SE entrance. Spicebush (Lindera benzoin) and prickly-ash (Zanthoxylum americanum) may form relatively dense thickets in some of the wetter areas.

Hawthorn forest probably represents succession from areas that were formerly fields or other open areas. Common trees in this community include Crataegus chrysocarpa, Crataegus crus-galli, Prunus serotina, Ulmus americana, Carpinus caroliniana, and Pyrus malus. In some areas this forest is almost impenetrable; in other areas it is patchy with small openings that may be dry, moist, or even have standing water during portions of the year.

Aspen stands are several rather small stands of Populus tremuloides and P. grandidentata found in wet areas in Sec 7. It is not known whether these have resulted from plantings or if they are of natural occurrence.

The plant community at Brandt Woods was found to be rich in spring wildflowers. In its swampy portions the herbaceous flowering sequence usually begins in March with Symplocarpus foetidus and during April includes as common species Cardamine douglasii, Caltha palustris, and Mitella diphylla. In its mesic portions the flowering sequence usually begins in early April with Hepatica acutiloba and includes Sanguinaria canadensis, Erythronium americanum, Anemone quinquefolia, Cardamine concatenata, Claytonia virginica, and Ranunculus spp. On into May, both mesic and wet areas have a profusion of common wildflowers including Trillium grandiflorum, Viola spp., Uvularia grandiflora, Polygonum pubescens, Smilacina spp, Geranium maculatum, Podophyllum peltatum, Hydrophyllum appendiculatum, and Panax trifolius. The orchids, Orchis spectabilis and Aplectrum hyemale, are uncommon species of mesic areas that flower in May and June respectively. Two of the most notable species in the beech-maple forest are ginseng (Panax quinquefolius) and goldenseal (Hydrastis canadensis). Both species are listed as "threatened" in Michigan. Ginseng, which flowers in June, is scattered and occasional in drier portions of the mesic woods. Goldenseal, which flowers in April and early May, is locally common in patches around some of the vernal pools.

Activities conducted at Brandt Woods will follow a forest management plan that protects the biological integrity of both flora and fauna.

### **7.2.2 Forest Management Summary**

Brandt Woods is being managed professionally by area consulting foresters. The management plan has divided the woodlot into 6 management units.

One of these units is located in the wetlands along Rice Creek. This unit of lowland hardwoods (soft maples and ash) will only receive an improvement cut when soil conditions are either dry or frozen to prevent soil damage. This is expected to occur once during a 10 year period.

The other 5 management units are upland hardwoods of very high quality sugar maple, beech, northern red oak, black cherry and basswood. An improvement cut will be carried out on one of the management units at 2 year intervals. This allows for continuous education and income opportunities for the Conservation District. After 10 years (cutting cycle) each management unit will be re-entered.

The improvement cuts concentrate on harvesting the poor quality trees first and secondly harvesting trees that need to be removed for spacing reasons. The very best high quality trees are left to grow. Additional trees will be harvested during the next cutting cycle again using the standards used on the first harvest. The next cutting cycle will yield even higher volumes of valuable high quality material.

Marking guidelines also take into account wildlife concerns. Den trees are left as are nesting trees for raptors. Songbird concerns are addressed by providing a continuous canopy of mature trees and leaving trees such as blue beech and ironwood in the understory thus providing nesting habitat throughout the forest canopy including the forest floor, mid-story and the overstory.

### **7.3 Fish and Wildlife Management**

Brandt Woods will actively be managed to provide quality habitat for both game and non-game species. Management techniques will include manipulation and management of the current vegetation to provide a diversified ecosystem community. Installation of habitat structures should include nesting boxes for waterfowl, increasing large woody debris in Rice Creek, and maintaining brush piles. Further Fish and Wildlife management plans should be developed based on species specific habitat suitability requirements.

### **7.4 Water Management**

Work will be done to protect and restore the natural hydrology along Rice Creek. Berm removals should be conducted at locations along the stream to restore lateral connectivity to the adjacent floodplains.

### **7.5 Threatened and/or Endangered Species Management**

Michigan's Endangered Species Act prohibits the harm, taking, importation, sale, destruction, transport, or possession of any state listed threatened or endangered species, except as allowed by permit. This includes all parts (e.g. roots, seeds, feathers, eggs) of both plants and animals wherever they occur. No legal protection is afforded Michigan's special concern species. However, protection of these special concern plants and animals is recommended in this plan to prevent them from becoming more imperiled or from being listed as threatened and endangered in the future. Activities on the property will be conducted in areas and during times of the year where it is known that no threatened or endangered species exist.

### **7.6 High Quality Natural Communities**

The high quality designation means that there is evidence that the ecosystem retains a high degree of native species composition and structure relative to pre-settlement conditions and that human disturbance of the site is minimal or in such condition that partial restoration of the community is possible. Protection of these designated "high quality communities" has been determined to be important for conserving biotic diversity at a regional or local scale, and most in this area are judged to be important to the state-wide survival of such natural communities. The assessment of these natural communities takes into account the global and statewide rarity of these types of ecosystems. Protection and management of high quality communities is viewed as very important to retaining the native biological diversity of the state as well as the region. Communities that exist and should be protected at Brandt Woods include mesic southern forests and southern swamp.

### **7.6.1 Keeping High Quality Natural Communities**

High quality community management requires active management. This will be done by controlling invasive exotic plants, managing the forests to provide a healthy ecosystem, controlling woody plant invasion in herbaceous plant communities, protecting threatened and endangered species, and monitoring the effects of resource management activities and land use activities when possible and fundable. The resource management activities are intended to fulfill the Calhoun Conservation District's commitment to protect the natural resources of the property.

## **7.7 Outdoor Recreation**

### **7.7.1 Outdoor Recreation Summary**

Goals of the Brandt Woods property consist of public use and environmental education. Public use of the Brandt Woods property will be encouraged in existing developed areas. Public use and activities that do not detract from protection of the natural and scenic qualities of the property are permitted and encouraged. Some of these activities include but are not limited to nature study, bird-watching, hiking, photography, cross-country skiing, etc.

### **7.7.2 Allowable Uses**

The following public uses are allowed, however, Calhoun Conservation District reserves the right to restrict or prohibit any use where such use causes unacceptable resource degradation.

- Hiking on trails designated by Calhoun Conservation District
- Fishing during authorized seasons
- Bird Watching
- Wildlife photography
- Dog walking (Dogs must be on leashes at all times)
- Natural Interpretation on-site at the property
- Additional low impact uses

### **7.7.3 Prohibited Public Uses**

Some public uses are not compatible with the scope and character of the Brandt Woods Management Plan. When done frequently or by enough visitors, these activities are expected to introduce impacts (noise, non-native plant seed dispersal, etc.) that would prevent site goals. Some examples of prohibited public uses are:

- Motorized recreation with vehicles, including boats
- Bicycles and horses
- Camping
- Hunting and Trapping
- Campfires without authorized permission
- Any activity that is determined to be unsafe, destructive, disruptive, or in conflict with the management goals of this plan
- Excavation of the grounds or removal of ordinance without written permission
- Harvesting or planting of trees, saplings, plants, seeds, etc.

### **7.7.7 Research Opportunities**

The unique and rich ecosystem found at Brandt Woods offers many opportunities for environmental research on-site. This may include Masters and Doctoral students seeking research opportunities for thesis projects and the like. This type of research is encouraged on the property with prior approval from the Conservation District Board.

### **7.7.8 Hunting/Trapping**

The Brandt Woods property is open to hunting and trapping based on a lease agreement. Hunter(s) shall have a valid hunting license and comply with all laws and regulations of the State of Michigan and the area in which the land is located. All hunting activities shall be conducted in a sportsmanlike manner. Hunter(s) shall make diligent effort to recover any wounded game and obtain permission from the owner of any neighboring property before entry upon any neighboring property in pursuit of wounded game. Hunter(s) shall respect the Calhoun Conservation District's land, property and interests at all times and abide by customary and reasonable rules of sportsmanship, firearms and weapons safety and conduct all activities upon the land in a careful, safe, and sober manner consistent with sound conservation and environmental practices.

Specialty hunts and trapping will also be arranged and utilized based upon the determination and discretion of the CCC Board. All specialty hunts and trapping will follow applicable state and federal laws and regulations and will acquire any necessary permits. Specialty hunts and trapping will be used to deal with and minimize nuisance wildlife issues as they arise at the property.

## **7.8 Cultural Resources**

No known cultural resources have been discovered at the property. Any activities occurring at the property that discover cultural resources will cease immediately and be reported to the CCD.

## **7.9 Natural Interpretation on-site at Brandt Woods**

The Brandt Woods property offers the surrounding communities a great opportunity for educating the public on such topics as wetland environments, birds/bird migrations, wildlife photography, guided hikes, plant talks, etc. This type of public programming can be done by both professionals and volunteers alike. Partnerships should be established with other local nature areas for promotion as well as using paper media, internet blog groups, and e-mails lists to advertise such programs.

## **7.10 Signage**

Signage will be crucial in educating the public on what is allowed and what is not allowed at the Brandt Woods property. Signage can also offer many more positive ways of educating the public about the area. The following signs will be essential at Brandt Woods:

- Large sign at the south entrance on H Drive displaying the name of the property and hours of use
  - A part of this sign could be an educational overview of how the District came to own the property, and property restrictions and uses.
- Large sign at the west entrance on 24 Mile Road displaying the name of the property and hours of use



- A part of this sign could be an educational overview of how the District came to own the property, and property restrictions and uses.
- Small signs indicating trail names and trail markers for specific trails to help keep the public from getting lost
- Medium-sized signs placed in key areas with educational references as to what is around that small area and what wildlife can be seen.

## Section 8- Implementation

### 8.1 General goals and Timelines

Goal	Completion Date	Accomplished ?	Comments
Review/update Brandt Woods Policy	June, 2015	√	
Update and maintain trails for public use	Annually	√	
Install boardwalk for access through wetland	As finances permit		
Install foot bridges	As finances permit		
Install signage (Entrances)	Summer 2015	√	
Install signage (Trails)	Summer 2015	√	
Install educational signage	Summer 2015	√	
Install large woody debris in Rice Creek	Summer 2016	√	
Install nesting boxes	Summer 2016	√	