Forest Stewardship Plan for Graham Greene Park

Prepared for Suttons Bay Township by:

Linda Thomasma, Ph.D.
Two by Two Wildlife Consulting, LLC
(twobytwowildlife@gmail.com)

Plan Start Date: July 2017
Plan Duration: 20 years (July, 2037)

Landowner Contact Information			Plan Writer Contact Information	
Name: Suttons Bay Township Parks and Recreation William Drozdalski (contact)			Name: Linda Thomasma, Ph.D. Two by Two Wildlife Consulting LLC	
Address: 95 W. Fourth St. P.O. Box 457 Suttons Bay, MI 49682			Address: P.O. Box 155 Honor, MI 49640	
Phone: 231.271.2722			Phone: 906.361.0260	
Email: sbaytwp@suttonsbaytwp.com			Email: twobytwowildife@gmail.com	
Property Information				
Total Acres: Approximately 32	Forested Acres: Approximately 31		Acres in Plan: Approximately 31	Tax ID:
Town: 31N	Range: 11W	Section: 2	Township: Suttons Bay	County: Leelanau
Property Legal Description: SE1/4 of the NW1/4 of Section 2; T31N R11W; Suttons Bay Township; Leelanau County				
How to Find Property from Nearest Town: The parking area for Graham Greene Park is located slightly less than a mile north of Peshawbestown on M22.				
Participation in Related Forestry Programs				
__ I intend to enroll this parcel in the Qualified Forest Program (QF). [www.Michigan.gov/QFP] __ I intend to enroll this parcel in the Commercial Forest Program (CF). [www.Michigan.gov/Commercial Forest] __ I intend to enroll this parcel in the American Tree Farm System. [www.TreeFarmSystem.org] __ I intend to apply to the NRCS for financial assistance. [www.nrcs.usda.gov]				
Michigan's Stewardship Ethic				
Stewardship is an ethic recognizing that the land and its natural inhabitants have an inherent worth and that we have a responsibility to consider the land as we protect, manage, utilize, and enjoy the forest. Stewardship guides us to conduct our activities to the utmost of our abilities, to insure the future health, productivity, diversity, and well-being of the land, its natural communities and species, and to provide opportunities to our successors that are at least equal to ours to use and enjoy the land and its resources.				
Signatures of Approval from the Landowner, Plan Writer, and DNR Service Forester				
Landowner: William Drozdalski Suttons Bay Township Parks and Recreation				Date: 6/21/2017
Plan Writer:				Date: 6/21/2017
DNR Service Forester: Mike Smallegan				Date: 6/21/2017

After review and approval by the Landowner, the Plan Writer will submit the entire Plan to the nearest DNR Service Forester for their review. Electronic submission of the Plan is encouraged by emailing a Word document or pdf file to the Service Forester. The DNR Service Forester will return a hard copy or pdf of the final signature page to the Plan Writer after approval.

Table of Contents

Introduction

Goals for Graham Greene Park

The Township has four primary goals for Graham Greene Park; 1) determine if revenue could be generated through active timber management 2), increase recreational opportunities, 3) evaluate potential threats associated with hazard trees, and 4) retain/enhance local biodiversity, including the promotion of wildlife corridors within the landscape.

Specifically, the township would like to determine if logging is a viable financial option and would it conflict with recreational objectives. Road biking is a popular activity along M-22, yet camping sites are limited. The township would like to consider placing tent camping sites within the Park for bikers. Emerald Ash Borer, Beech-Bark Disease, and Oak Wilt have left dead and dying trees throughout the region. Standing dead trees pose potential safety threats to park visitors. This threat will need to be addressed as recreational opportunities increase within the Park. The land use/land cover of the neighborhood encompassing the park is diverse. Do the habitats that comprise the Park contribute to the local diversity and are these habitats well connected? This report will address the Township's objectives and the management recommendations required to meet those objectives.

General Property Description

Graham Greene Park is approximately 32 acres in size with 31 acres of diverse, predominantly coniferous forest and 1 acre of developed area including a picnic ground. The Park is located in Leelanau County just north of Peshawbestown on M22 (Figure 1). The watershed that incorporates the Park drains directly into West Branch of Grand Traverse Bay (Lake Michigan Watershed, 04060200) (Figure 2).

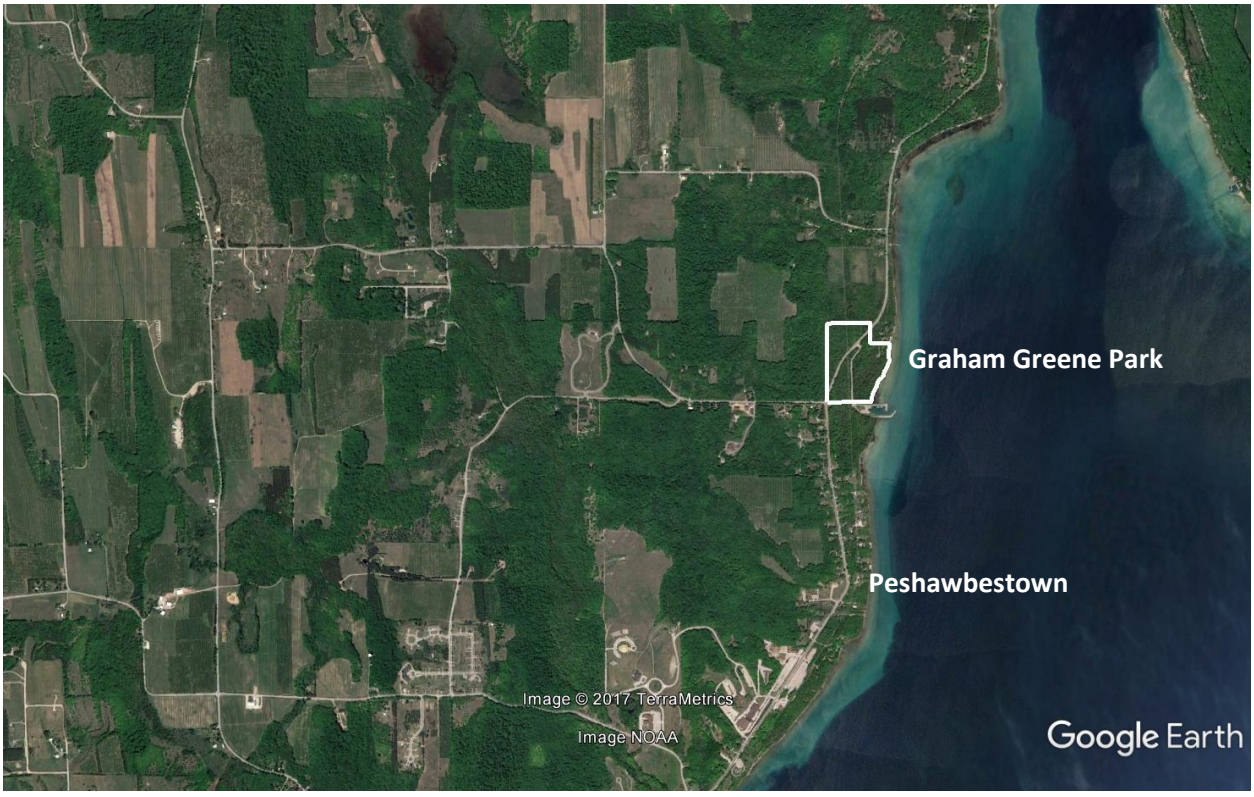

Figure 1. Graham Greene Park is located north of Peshawbestown, MI.

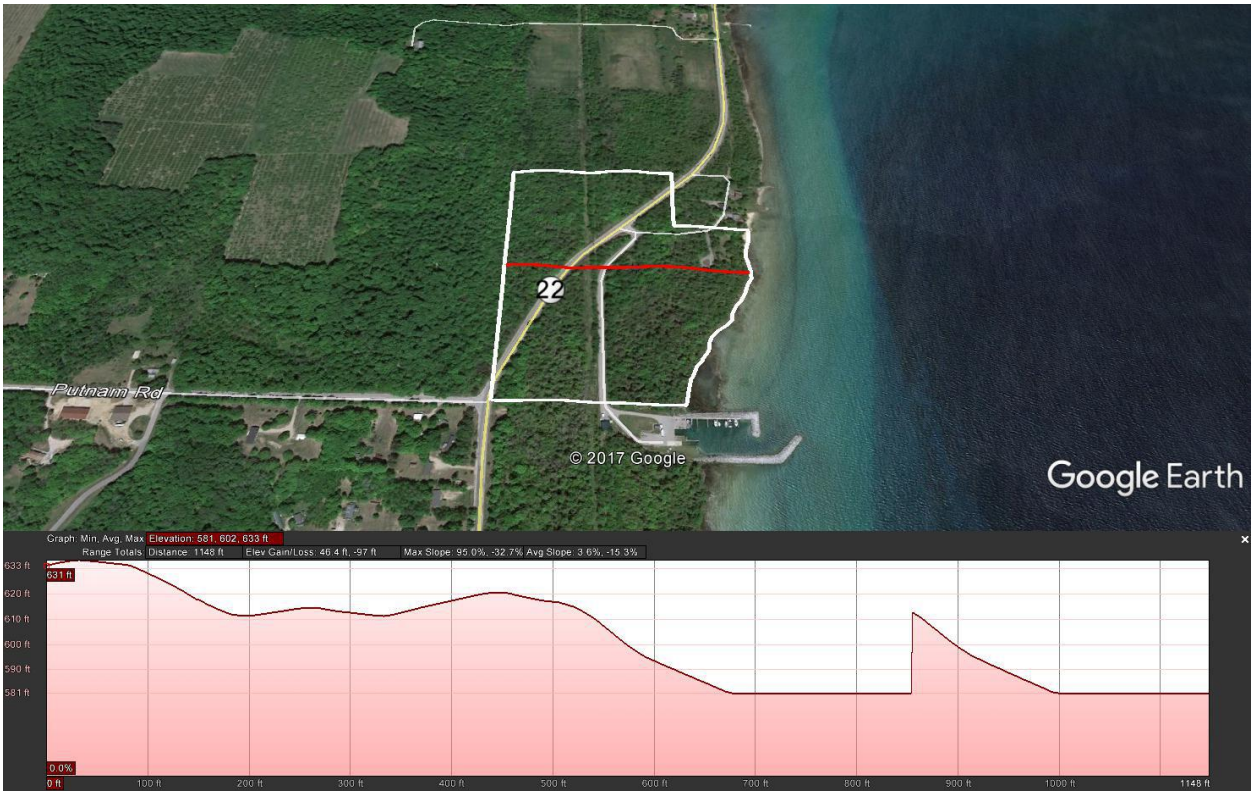

Figure 2. Elevation change on a west to east transect through Graham Greene Park.

Planning Process

Representatives of the Township met with the Plan Writer during the winter of 2016-2017. A proposal, including a schedule, was submitted and accepted in late winter 2017. Multiple field visits in late winter and spring were conducted by the Plan Writer. A draft plan was submitted to the Township for their review prior to submission to the MDNR. Upon the Township's approval, the plan was then submitted to the MDNR for their review and approval.

Stand Assessment Method

The Plan Writer first compiled information on property boundaries, soil types, and vegetative cover types. Basic field assessment data was collected by visual and quantitative surveys on multiple occasions in the winter and spring. Winter sampling was necessary to address the presence or absence of winter deer yards. Winter sampling had the additional advantage of allowing the Plan Writer to determine if other wildlife species were present based upon tracks left in the snow. Vegetative sampling was conducted during the spring to sample both over and understory species. In addition, other wildlife such as songbirds were identified in the spring. Point and fixed area plots were used to gain a rough estimate of forest density, vegetative species composition, diameter distribution, and dead down woody debris. Other observational data included: insect and disease issues, presence or absence of invasive species, and occurrence of wildlife trees. These sampling efforts were not a formal forest inventory as this entails more expensive data collection and analysis and should be completed in preparation for a timber sale.

Resource Descriptions

Geology

Graham Greene Park is located on the West Arm of Grand Traverse Bay on the glaciolacustrine plain. The topography is relatively flat consisting of lake plain, depressions in the lake plain and glacial lake terraces and beach terraces.

Soils

The three primary soil types found within Graham Greene Park are Alpena gravelly sandy loam on 0-12% slopes, Bach loam, and the Lupton-Markey mucks (Table 1, Figure 3). For a complete description of each Soil Type see Appendix 1. The Alpena gravelly sandy loam parent material is derived from glacial fluvial deposits and is associated with beach ridges and lake terraces. The Bach loam and Lupton Markey Mucks are hydric soils associated with depressions in lake plains or terraces. The existing picnic area, homes, and access road are located on the well-drained Alpena gravelly sandy loam while much of the forest cover is on the hydric, poorly drained soils of the Bach Loam and Lupton-Markey mucks.

Table 1. Soil types found in the Area of Interest (AOI) which includes Graham Greene Park, Suttons Bay Township (Soil Survey Staff, Natural Resources Conservation Service, and United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.sc.egov.usda.gov/).

Map Unit Symbol	Map Unit Name	Percent Slope	Acres in AOI*	Percent of AOI*
AsC	Alpena gravelly sandy loam	0-12%	6.1	17.5%
Ba	Bach loam	-----	9.6	27.5%
EoD	Emmet-Mancelona gravelly sandy loams	12-18%	0.1	0.4%
Lm	Lupton-Markey mucks	-----	16.6	47.5%
MlB	Mancelona-East Lake loamy sands	0-6%	2.0	5.8%
Totals for Area of Interest			**34.9**	**100.0%**

*AOI = Area of Interest

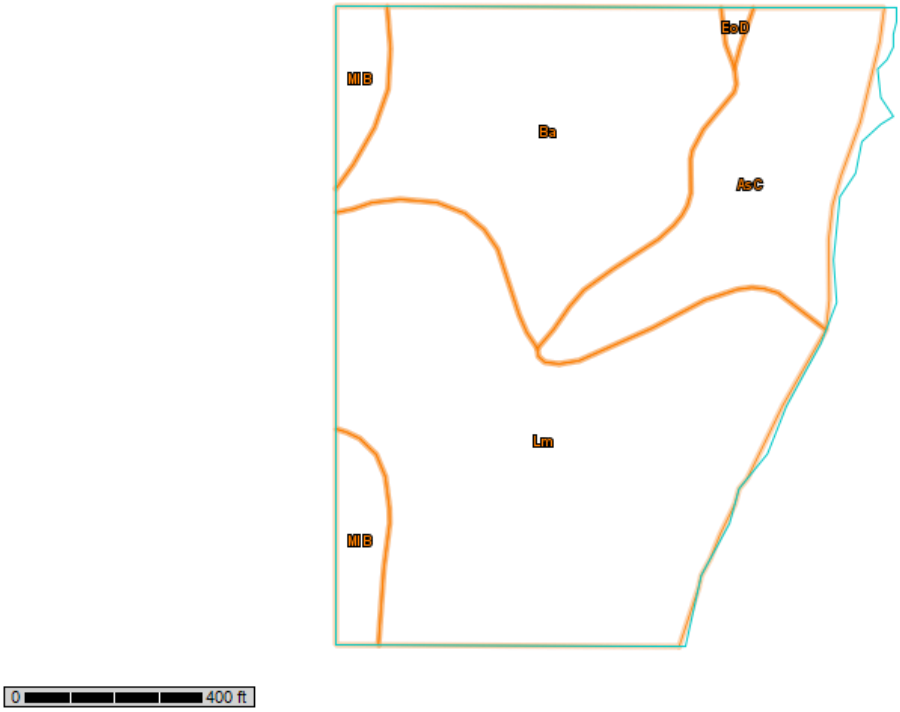

Figure 3. Soils map of the Area of Interest which encompasses Graham Greene Park, Suttons Bay Township (Soil Survey Staff, Natural Resources Conservation Service, and United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.sc.egov.usda.gov/).

Forest Cover Types

The forest comprising Graham Greene Park is inherently diverse and difficult to classify. This diversity is the result of site factors and natural disturbance regimes. The change in vegetation and stand structure is on such a fine scale that it was not possible to construct a typical forest cover type map. In an attempt to capture that diversity, vegetation samples and point counts for birds were taken along a transect that ran roughly from the southeast to the northwest, covering each soil type found within the Park (Figure 4).

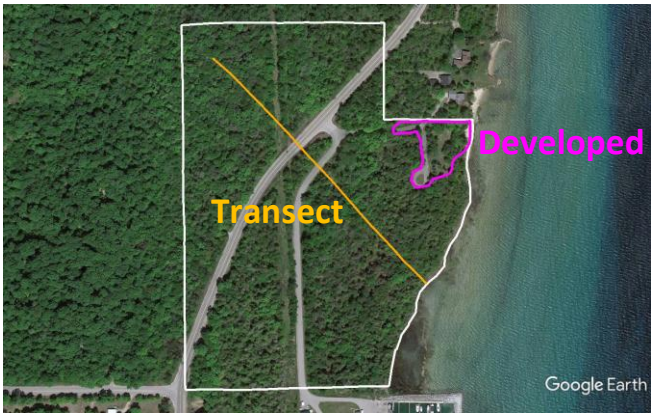

Figure 4. Relative transect location through Graham Greene Park, Suttons Bay Township.

The transect stepped-up from the shoreline onto an old lake terrace (Figure 5). The terrace was somewhat rocky and the predominant tree was Northern White Cedar with scattered Eastern Hemlock, White and Yellow Birch, and Aspen. Balsam Fir, Eastern Hemlock, and Maple comprised the understory. The trees tended to grow in patches of the same size/age, most likely the result of wind-throw events. From there, the transect dropped slightly into a mucky depression. In this low area, tree species composition was exceedingly diverse, consisting of; Northern White Cedar, Trembling Aspen, Red Maple, Ash, Yellow Birch, and Eastern Hemlock. There was considerable wind-throw in the low area. The numerous downed trees left significant openings in the canopy. Depending on how long since the event, the disturbed areas were filled with water; forbs, grasses, or sedges; or regenerating trees (mostly Aspen, Ash, and Northern White Cedar). This Bottomland Mixed cover type is the most predominant type in the Park. From the lowland area, the ground rose and the site was drier. This change corresponded to a change in soil from Lupton-Markey muck to the Alpena sandy gravelly loam. The predominant tree species was Sugar Maple with scattered American Basswood, American Beech, Yellow Birch, Aspen, White Birch, Eastern Hemlock, and Northern White Cedar. With a slight decrease in elevation and possibly soil type, the stand then changed to Eastern Hemlock.

Figure 5. The inherent fine-scale diversity of the forest at Graham Greene Park, Suttons Bay Township. Sketch is not to scale.

Of note, multiple large diameter trees (possibly remnant), were found on and near the transect. This includes a Northern White Cedar (28 inches dbh), Yellow Birch (26 inches dbh), American Basswood (>40 inches dbh), and an Eastern Hemlock (>30 inches dbh).

Water

No springs were located within the Park. There was standing water associated with uprooted trees and evidence of an intermittent watercourse near the shoreline (Figure 6).

Figure 6. An intermittent watercourse near the shoreline, Graham Greene Park, Suttons Bay Township.

Wetlands

The Michigan Department of Environmental Quality (DEQ) Wetlands Map Viewer (www.mcgi.stte.mi.us/wetlands), indicates that the forested stands east of M-22 and most of the area to the west are designated wetland according to state and federal definitions (Figure 7). A permit is not required for typical forest management activities in a wetland, but a permit is required for filling, dredging, draining or development. See www.Michigan.gov/DEQWetlands for more information about wetlands. Any management activity in the Park should follow the "Sustainable Soil and Water Quality Practices on Forest Land" (Best Management Practices – www.michgan.gov/dnr).

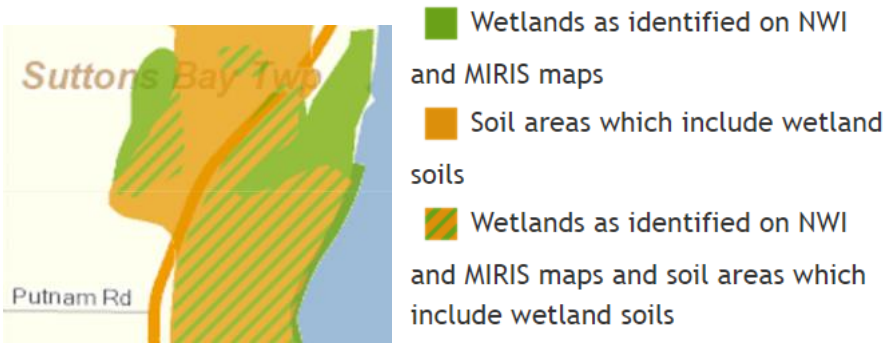

Figure 7. Wetland designation for Graham Greene Park as determined from Michigan DEQ Wetlands Map Viewer (www.mcgi.stte.mi.us/wetlands

Threatened and Endangered Species

The Michigan Department of Natural Resources (MDNR) and the Michigan Natural Features Inventory (MNFI) report that no Threatened or Endangered Species were found within the general vicinity of the park.

Wildlife Habitat

Of the 399 vertebrate wildlife species found in Michigan, 300 are found in Leelanau County. Of this, the Park provides forested habitat for 157 species (MIWILD analysis, Appendix 2). The forests of Graham Green Park are inherently diverse both in vegetative species composition and structure. This vegetative diversity correlates with high wildlife habitat diversity. In addition, the Park contains a variety of structural habitat features which contribute to the overall quality of the habitat for wildlife. These include; vernal pools, intermittent watercourses, significant dead down woody debris, snags, living cavity trees, a large tree component, canopy gap openings, and mast producing species (e.g. American Beech). Graham Greene Park also has significant undeveloped footage on the West Arm of Grand Traverse Bay. The substrate along the shore is rocky with some sandy areas. These beaches provide habitat for an additional 34 species (MIWILD Analysis, Appendix 3). Shoreline adjacent to forest is excellent wildlife habitat (Figure 8).

Bird species observed within the Park include: Scarlet Tanager, Winter Wren, Yellow-bellied Sapsucker, Red-bellied Woodpecker, Black-capped Chickadee, Song Sparrow, Spotted Sandpiper, Great-crested Flycatcher, Blue Jay, American Crow, Red-eyed Vireo, Blue-headed Vireo, Common Grackle, Red-breasted Nuthatch, Blackburnian Warbler, Oven Bird, and Black-throated Green Warbler. A likely Northern River Otter latrine was located just in the forest, near the shoreline.

Figure 8. The shoreline along Graham Greene Park, Suttons Bay Township. The shoreline is predominantly rock with scattered sandy beaches.

Archeological, Cultural, or Unique Natural Sites

The MDNR reports that the archeological database does not show any concerns for historical sites in this section of the Township. Standard Seven of the American Tree Farm System is Protect Special Sites – "Special sites are managed in ways that recognized their unique historical, archeological, cultural, geological, biological or ecological characteristics." The high inherent diversity found within Graham Greene Park makes it truly ecologically unique. In addition, the Park is located within a Forest of Recognized Importance (FORI). The FORI in Michigan include Great Lakes coastline, riparian corridors along Wild and Scenic or Natural Rivers, rare forest types, or forests that provide required habitat for threatened or endangered species. Forests within a mile of the Great Lakes are globally rare and should be managed to maintain forest cover near Great Lakes shorelines.

Aspen Northern Hardwoods Forest type within the Park falls within the Michigan Natural Features Inventory definition of Mesic Northern Forest while portions of the Bottomland Mixed Forest type fall within the Rich Conifer Swamp and Hardwood Conifer Swamp classifications. The state element ranking for Mesic Northern Forest, Rich Conifer Swamp, and Hardwood Conifer Swamp is S3. The S3 ranking is defined as "Vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation."

Landscape Considerations

In general, the remaining forested habitats in much of Leelanau County are reduced and fragmented (Figure 9). However, Graham Greene Park resides in a neighborhood that is still relatively forested and well connected with other forested stands in the area. However, much of the coniferous cover has been reduced (Figure 10). The reduction of forest cover within this landscape would result in a loss of biodiversity. The Park plays an important role in sustaining the biodiversity of the neighborhood.

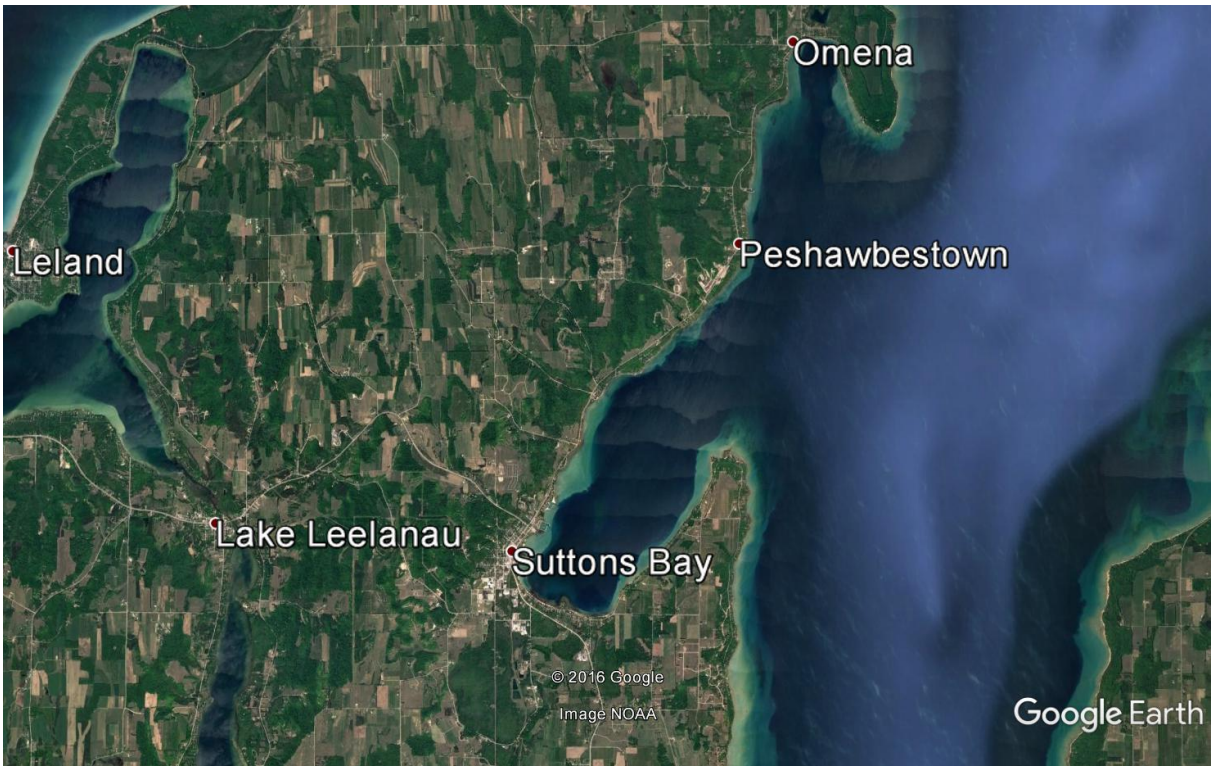

Figure 9. Land cover of portions of Leelanau County. The remaining forests in (dark green) tend to be fragmented. Some of the most contiguous forested cover tends to be along the shorelines of Suttons Bay and Grand Traverse Bay.

Figure 11. The neighborhood containing Graham Greene Park. Note the amount of forests available within this landscape and their connectivity with other forested stands. The Park is unique in that it is still forested and connected. The lowland conifer forests, like the Bottomland Mixed Forest within the Park are more highly fragmented and detached from similar stands.

Invasive Species

Populations of non-native invasive species were found at Graham Greene Park. They include; Autumn Olive, Chinese Forget-me-nots, and Bull Thistle (Figure 12). The Autumn Olive was found in proximity to the roads, parking area, and on the lakeshore. Basically, anywhere there was anthropogenic disturbance. The Chinese Forget-me-nots were mostly near the shoreline. Only one Bull Thistle plant was found and it was in a wind-throw area. The Invasive Species Specialist from the Leelanau Conservation District should be contacted and directed to the sites. Population control of these invasive species should be conducted as soon as possible to prevent the spread and encroachment on native species.


Figure 12. Invasive species found to occur in Graham Greene Park. Autumn Olive, Chinese Forget-me-nots, and Bull Thistle.

Hazard Trees

The two most predominant soil types in the park are rated as having "Severe" wind-throw potential. This is due in part to saturated (lowland sites) or shallow (lake terrace) soil conditions. Wind-throw is the natural disturbance regime in these forests and there is significant evidence in most every stand (Figure 13). Complicating the matter is Emerald Ash Borer and the presence of numerous dead and dying ash trees in both upland and lowland situations (Figure 14).

Figure 13. Wind-throw in the Park.

Figure 14. Dead ash in the Park.

Aesthetic Quality

People respond positively to trees and other vegetation. Research indicates a direct link between visual quality and human health. Enhancing the visual quality of forested land for recreational users may result in a healthier community and local economy. People respond positively to natural versus urban landscapes. Within forested landscapes, they tend to prefer more open forest conditions with scattered large trees. Negative features include; many small trees, large amounts of dead and down woody debris, and a thick shrub understory. At times, human perceptions of visual quality may be at odds with the ecological value of the stand. For instance, dead down woody debris is of significant value to wildlife and important in carbon retention and nutrient cycling. Once people are made aware of the positive ecological benefits of those "undesirable" features they may modify their opinion. The same is true for timber harvesting. Initially, harvesting may result in a negative visual perception, yet in the long term produce a more visibly desirable stand. Efforts should be made to educate the public on the differences between visual and ecological quality of their forests as well as the transitory effects of timber management.

Graham Greene Park is as diverse in visual quality elements as it is in stand structure and habitat types. This diversity is represented in a variety of forms, colors, and textures across a relatively short distance, which lends to high visual quality. Within stand features which contribute to high visual quality include: tree species diversity, canopy breaks, some open stand conditions, and a large tree component. The considerable dead and down woody debris has low visual value but high ecological value. M-22 and an access road to a marina bisect the Park. Much of the Park is visible from these two roads and the sound of traffic is ever-present. This does distract from the aesthetic quality of the Park. However, the expansive forested shoreline on the bay has high visual quality.

Management Recommendations

Site Considerations

In general, meeting the goals and objectives of the Township for Graham Greene Park are dependent on site factors. For instance, soil type will determine management options and potential expense associated with activities and development (Table 2).

Table 2. Potential limitations associated with the soil types found within Graham Greene Park and the Township's goals (Soil Survey Staff, Natural Resources Conservation Service, and United States Department of Agriculture. Web Soil Survey. Available online at https://websoilsurvey.sc.egov.usda.gov/).

Township's Goals	AsC 0-12% slope	Ba	Lm
Timber Production			
Erosion Hazard (Road and Trail)[a]	Moderate	Slight	Slight
Suitability for Haul Roads[b]	Well Suited	Poorly Suited	Poorly Suited
Suitability for Log Landings[c]	Moderately Suited	Poorly Suited	Poorly Suited
Harvest Equipment Operability[d]	Well Suited	Moderately Suited	Poorly Suited
Potential for Wind-throw[e]	Slight	Severe	Severe
Recreation Development			
Erosion Hazard (Off Road and Off Trail)[f]	Slight	Slight	Slight
Paths and Trails[g]	Not Limited	Very Limited	Very Limited
Camp and Picnic Areas[h]	Somewhat Limited	Very Limited	Very Limited

[a] "Slight" indicates that little or no erosion is likely. "Moderate" indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed.

[b] "Well suited" indicates that few or no restrictions affect construction activities. "Poorly suited" indicates that one or more limitations make the construction of haul roads very difficult or costly.

[c] "Moderately suited" indicates that one or more restrictions reduce the suitability of the site. "Poorly suited" indicates that one or more restrictions generally make using the soil as a site for a log landing very difficult or unsafe.

[d] "Well suited" indicates that the soil has features that are favorable and there are no limitations. Good performance can be expected, and little or no maintenance is needed. "Moderately suited" indicates that the soil has features that are moderately favorable for the specified management aspect. "Poorly suited" indicates that the soil has one or more properties that are unfavorable and that overcoming them requires special design, extra maintenance, and costly alteration.

[e] Wind-throw hazard is the likelihood that trees will be uprooted (tipped over) by the wind. It can occur if the soil is not deep enough to provide adequate root anchorage. "Severe" alerts the forestland manager to the possibility of wind-throw. Special care is needed in planning cutting areas to minimize the danger of wind-throw.

[f] "Slight" indicates that erosion is unlikely under ordinary climatic conditions. "Severe" indicates that erosion is very likely and that erosion-control measures, including re-vegetation of bare areas, are advised.

[g and h] "Not Limited" indicates that the soil features are very favorable for the specified use. "Somewhat limited" indicates that the soil has features that are moderately favorable. Limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or

more features that are unfavorable. Limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Best Management Practices

Poor land management practices can degrade surface and ground water quality by increasing sedimentation, nutrient and chemical input, heat, and debris. Forest landowners and their agents and contractors are responsible for any damage to streams, lakes, and wetlands. Any land management activity in the Park should follow "Sustainable Soil and Water Quality Practices on Forest Land" (Best Management Practices – http://www.michigan.gov/dnr/0,4570,7-153-31154_31261---,00.html). The purpose of the manual is to provide specific guidance to the forest landowner on how to protect water quality, critical habitat, and aquatic resources when conducting forest management activities. Following these practices results in healthy forests and watersheds by preventing erosion, sedimentation, and soil compaction.

Timber Management

Due to the overall ecological importance of the forest, the preponderance of saturated soils with severe wind-throw potential, and low merchantable timber volume, there are no timber harvest recommendations for Graham Greene Park.

Recreation Management

Camping Area – The placement of camp sites needs to consider the potential for wind-throw and the subsequent safety of park visitors. The only soil type that was rated as "Slight" is the Alpena gravelly sandy loam. The current picnic area and housing development have been constructed on that soil type. The other soils have "Severe" wind-throw ratings and should be avoided for camp site placement. Any dead or dying trees in the vicinity of the Picnic Area and potential camp sites should be felled.

Nature Observation and Trails – Due to the high inherent biodiversity of the Park, it would be a great location for a Birding Trail. Park visitors would be exposed to a variety of habitat conditions (from lake shore to upland forest) and have the opportunity to see and hear a variety of bird species not frequently seen or heard elsewhere (e.g. Blackburnian Warbler). As most observations of invasive species within the Park were associated with roads and trails, the treatment of invasive species should be incorporated into any recreational development plan.

Hunting – Deer blinds were found around the margins of the Park. Even though the Park has deer, there is still White Cedar, Aspen, Eastern Hemlock, and Balsam Fir regeneration within the Forest. By keeping the deer population in check, hunting may help with the perpetuation of White Cedar as well as Eastern Hemlock, Aspen, and Sugar Maple within the stands.

Biodiversity and Wildlife Corridors

With a mix of forested habitat types, variable stand structure, upland, lowland, and lakeshore sites, Graham Greene Park makes an important contribution to local biodiversity. At a large spatial scale, the Park provides forested habitat and is still well-connected with adjoining stands. At a fine within stand scale, there is significant structural complexity due to the numerous wind-throw events. At both the large and small spatial scales Graham Greene Park plays a significant role in sustaining the local biodiversity.

Summary of Management Recommendations

Invasive Species Inventory
Contact Rebecca S. Koteskey (Communication Specialist, NW Michigan Invasive Species Network at 231.941.0960 x17) to discuss funding sources as well as a formal inventory and evaluation of invasive species within the Park. Invasive species inventories should be conducted on an annual basis at the floristically appropriate time of the year.

Recreational Development
Investigate potential sources of funding including, but not limited to:
Mark Mandenberg
MDNR Parks & Recreation Division
517.284.6114
mandenbergm@michigan.gov

Grand Traverse Band of Ottawa and Chippewa Indians 2% Grant http://www.grandtraverse.org/218/2-Percent-Applications---GT-Band

American Trails http://www.americantrails.org/resources/funding/

Federal Highway Administration https://www.fhwa.dot.gov/Environment/recreational_trails/

People for Bikes http://www.peopleforbikes.org/pages/community-grants

Michigan Trails and Greenway Alliance http://michigantrails.org/resources/trail-toolkit/funding/

Once funding is secured, work with the appropriate agencies to insure compliance and follow Best Management Practices in recreational development http://www.michigan.gov/dnr/0,4570,7-153-31154_31261---,00.html

Join the American Tree Farm System
Consider joining the American Tree Farm System. Information can be found at:
https://www.treefarmsystem.org/get-started-american-tree-farm

Forest Health
Forest health is an issue of concern with Emerald Ash Borer already present within the stands. The stands should be monitored annually (during different seasons) for changes that may indicate additional insect or disease problems. The "Forest Health Highlights" publication on forest insects and diseases is updated annually and available at www.Michigan.gov/ForestHealth. An additional source of information is www.Michigan.gov/ExoticPests.

Summary Chart

Stand	Activity	Dates		Cost Share	Cost/Income
		Planned	Completed		
Entire Park	Invasive Species Inventory	Annual* Beginning in 2017			
Entire Park	Invasive Species Removal	Annual* Beginning in 2017			
Entire Park	Recreational Development	Beginning in 2017			
Entire Park	Consider Joining the American Tree Farm System	2017			
Entire Park	Monitor Forest Health	Annual* Beginning in 2018			

* Funding dependent

Monitoring

The successful implementation of this Forest Stewardship Plan is dependent upon frequent monitoring by the Township. The Township (or their agent) should walk the entire Park at least annually to inspect the forests for changes and to evaluate the success of earlier management activities. All Forest Stewardship Plans should be adaptable and flexible enough to accommodate changes in landowner goals or forest resources over the 20 year planning period. Please use the following table to record notes and make modifications to this plan as needed.

Updates and Modifications

Appendix 1. Soil Map Unit descriptions for soils found in Graham Greene Park, Suttons Bay Township, Leelanau County.

AsC—Alpena gravelly sandy loam, 0 to 12 percent slopes

Map Unit Setting

- *National map unit symbol:* 6dj5
- *Elevation:* 600 to 1,000 feet
- *Mean annual precipitation:* 27 to 32 inches
- *Mean annual air temperature:* 41 to 46 degrees F
- *Frost-free period:* 100 to 150 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Alpena and similar soils:* 90 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Alpena

Setting

- *Landform:* Beach ridges, lake terraces, moraines
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, nose slope, side slope, base slope, crest
- *Down-slope shape:* Linear
- *Across-slope shape:* Convex, linear
- *Parent material:* 4 to 10 inches of sandy and loamy material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

- *H1 - 0 to 4 inches:* gravelly sandy loam
- *H2 - 4 to 60 inches:* cobbly coarse sand

Properties and qualities

- *Slope:* 0 to 12 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Excessively drained
- *Runoff class:* Very low
- *Capacity of the most limiting layer to transmit water (Ksat):* High to very high (1.98 to 19.98 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 25 percent
- *Available water storage in profile:* Very low (about 2.1 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 6s
- *Hydrologic Soil Group:* A

- *Hydric soil rating:* No

Minor Components

Mancelona

- *Percent of map unit:* 5 percent
- *Landform:* Beach ridges, outwash plains, valley trains, lake plains, moraines
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, nose slope, side slope, base slope, crest
- *Down-slope shape:* Linear
- *Across-slope shape:* Convex, linear
- *Hydric soil rating:* No

Kiva

- *Percent of map unit:* 5 percent
- *Landform:* Lake plains, moraines, outwash plains
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, nose slope, side slope, base slope, crest
- *Down-slope shape:* Linear
- *Across-slope shape:* Convex, linear
- *Hydric soil rating:* No

Ba—Bach loam

Map Unit Setting

- *National map unit symbol:* 6dj7
- *Elevation:* 600 to 1,400 feet
- *Mean annual precipitation:* 19 to 34 inches
- *Mean annual air temperature:* 36 to 46 degrees F
- *Frost-free period:* 70 to 172 days
- *Farmland classification:* Prime farmland if drained

Map Unit Composition

- *Bach and similar soils:* 90 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Bach

Setting

- *Landform:* Depressions, lake plains
- *Landform position (three-dimensional):* Talf
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Calcareous silty lacustrine deposits

Typical profile

- *H1 - 0 to 8 inches:* loam
- *H2 - 8 to 19 inches:* silt loam
- *H3 - 19 to 60 inches:* stratified fine sand to silt

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Poorly drained
- *Runoff class:* Medium
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high (0.20 to 0.57 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* Frequent
- *Calcium carbonate, maximum in profile:* 25 percent
- *Available water storage in profile:* High (about 9.7 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* C/D
- *Hydric soil rating:* Yes

Minor Components

Sanilac

- *Percent of map unit:* 5 percent
- *Landform:* Drainageways, lake plains
- *Landform position (three-dimensional):* Rise

- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Edwards

- *Percent of map unit:* 5 percent
- *Landform:* Depressions on moraines, depressions on outwash plains
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

EoD—Emmet-Mancelona gravelly sandy loams, 12 to 18 percent slopes

Map Unit Setting

- *National map unit symbol:* 6djx
- *Elevation:* 600 to 1,400 feet
- *Mean annual precipitation:* 22 to 44 inches
- *Mean annual air temperature:* 39 to 46 degrees F
- *Frost-free period:* 60 to 150 days
- *Farmland classification:* Farmland of local importance

Map Unit Composition

- *Emmet and similar soils:* 60 percent
- *Mancelona and similar soils:* 30 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Emmet

Setting

- *Landform:* Moraines, till plains, drumlins
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, side slope, base slope, nose slope, crest
- *Down-slope shape:* Linear, convex
- *Across-slope shape:* Convex, concave
- *Parent material:* 24 to 50 inches of loamy material over calcareous loamy till

Typical profile

- *H1 - 0 to 8 inches:* gravelly sandy loam
- *H2 - 8 to 26 inches:* sandy loam
- *H3 - 26 to 32 inches:* sandy clay loam
- *H4 - 32 to 60 inches:* sandy loam

Properties and qualities

- *Slope:* 12 to 18 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Well drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.57 to 1.98 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 30 percent
- *Available water storage in profile:* Moderate (about 7.4 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4e
- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

Description of Mancelona

Setting

- *Landform:* Moraines, beach ridges, outwash plains, valley trains, lake plains
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, nose slope, side slope, base slope, crest
- *Down-slope shape:* Convex, linear
- *Across-slope shape:* Concave, convex
- *Parent material:* 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

- *H1 - 0 to 8 inches:* gravelly sandy loam
- *H2 - 8 to 25 inches:* loamy sand
- *H3 - 25 to 30 inches:* gravelly sandy loam
- *H4 - 30 to 60 inches:* very gravelly coarse sand

Properties and qualities

- *Slope:* 12 to 18 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Somewhat excessively drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 25 percent
- *Available water storage in profile:* Low (about 3.8 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4e
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

Minor Components

Kiva

- *Percent of map unit:* 4 percent
- *Landform:* Outwash plains, lake plains, moraines
- *Landform position (two-dimensional):* Summit, shoulder, backslope, footslope, toeslope
- *Landform position (three-dimensional):* Interfluve, head slope, nose slope, side slope, base slope, crest
- *Down-slope shape:* Linear
- *Across-slope shape:* Concave, convex
- *Hydric soil rating:* No

Markey

- *Percent of map unit:* 2 percent
- *Landform:* Depressions on lake plains, depressions on moraines, depressions on outwash plains

- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

Lupton

- *Percent of map unit:* 2 percent
- *Landform:* Moraines, till plains, depressions, depressions, depressions, lake terraces
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

Hettinger

- *Percent of map unit:* 2 percent
- *Landform:* Depressions on lake plains
- *Landform position (three-dimensional):* Talf
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

Lm—Lupton-Markey mucks

Map Unit Setting

- *National map unit symbol:* 6dkv
- *Elevation:* 600 to 1,500 feet
- *Mean annual precipitation:* 19 to 44 inches
- *Mean annual air temperature:* 36 to 46 degrees F
- *Frost-free period:* 60 to 172 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Lupton and similar soils:* 60 percent
- *Markey and similar soils:* 30 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Lupton

Setting

- *Landform:* Depressions, depressions, depressions, lake terraces, moraines, till plains
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Greater than 51 inches of organic material

Typical profile

- *Oa1 - 0 to 10 inches:* muck
- *Oa2 - 10 to 60 inches:* muck

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Very poorly drained
- *Runoff class:* Very low
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.20 to 5.95 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* Frequent
- *Available water storage in profile:* Very high (about 23.9 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 6w
- *Hydrologic Soil Group:* A/D
- *Hydric soil rating:* Yes

Description of Markey

Setting

- *Landform:* Depressions on moraines, depressions on outwash plains, depressions on lake plains
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear

- *Across-slope shape:* Linear
- *Parent material:* 16 to 51 inches of organic material over sandy glaciofluvial deposits

Typical profile

- *Oa - 0 to 20 inches:* muck
- *2C - 20 to 60 inches:* sand

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Very poorly drained
- *Runoff class:* Very low
- *Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.20 to 5.95 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* Frequent
- *Calcium carbonate, maximum in profile:* 5 percent
- *Available water storage in profile:* High (about 10.4 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* A/D
- *Hydric soil rating:* Yes

Minor Components

Edwards

- *Percent of map unit:* 5 percent
- *Landform:* Depressions on outwash plains, depressions on moraines
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

Roscommon

- *Percent of map unit:* 5 percent
- *Landform:* Depressions on lake plains, depressions on outwash plains
- *Landform position (three-dimensional):* Talf
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* Yes

MlB—Mancelona-East Lake loamy sands, 0 to 6 percent slopes

Map Unit Setting

- *National map unit symbol:* 6dky
- *Elevation:* 600 to 1,900 feet
- *Mean annual precipitation:* 27 to 34 inches
- *Mean annual air temperature:* 39 to 46 degrees F
- *Frost-free period:* 70 to 150 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Mancelona and similar soils:* 60 percent
- *East lake and similar soils:* 30 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Mancelona

Setting

- *Landform:* Lake plains, moraines, beach ridges, outwash plains, valley trains
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* 18 to 40 inches of sandy and/or gravelly material over calcareous sandy and gravelly glaciofluvial deposits

Typical profile

- *H1 - 0 to 8 inches:* loamy sand
- *H2 - 8 to 25 inches:* loamy sand
- *H3 - 25 to 30 inches:* gravelly sandy loam
- *H4 - 30 to 60 inches:* very gravelly coarse sand

Properties and qualities

- *Slope:* 0 to 6 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Somewhat excessively drained
- *Runoff class:* Very low
- *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 25 percent
- *Available water storage in profile:* Low (about 3.8 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 3s
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

Description of East Lake

Setting

- *Landform:* Outwash plains, moraines
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

- *H1 - 0 to 8 inches:* loamy sand
- *H2 - 8 to 26 inches:* loamy sand
- *H3 - 26 to 60 inches:* gravelly coarse sand

Properties and qualities

- *Slope:* 0 to 6 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Somewhat excessively drained
- *Runoff class:* Negligible
- *Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 25 percent
- *Available water storage in profile:* Low (about 3.9 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4s
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

Minor Components

Kalkaska

- *Percent of map unit:* 3 percent
- *Landform:* Outwash plains, moraines
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Kiva

- *Percent of map unit:* 3 percent
- *Landform:* Outwash plains, lake plains, moraines
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Sanilac

- *Percent of map unit:* 2 percent

- *Landform:* Drainageways, lake plains
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Leelanau

- *Percent of map unit:* 2 percent
- *Landform:* Drumlins, moraines, till plains
- *Landform position (three-dimensional):* Rise
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Appendix 2. Wildlife species associated with the various size classes of Cedar, Hemlock, Aspen Northern Hardwood, and Bottomland Mixed Forests in Leelanau County, MI.

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
Blue-spotted Salamander	*Ambystoma laterale*	-	-	LX	LX
Spotted Salamander	*Ambystoma maculatum*	-	-	LX	-
Tiger Salamander	*Ambystoma tigrinum*	-	-	SPLX	SPLX
Four-toed Salamander	*Hemidactylium scutatum*	-	-	LX	LX
Eastern Redback Salamander	*Plethodon cinereus*	-	-	PLX	PLX
Eastern Newt	*Notophthalmus viridescens*	LX	LX	LX	LX
American Toad	*Bufo americanus*	SPLX	SPLX	SPLX	SPLX
Gray Treefrog	*Hyla versicolor*	LX	LX	LX	LX
Western Chorus Frog	*Pseudacris triseriata*	PLX	PLX	-	PLX
Spring Peeper	*Pseudacris crucifer*	PLX	PLX	PLX	PLX
Green Frog	*Rana clamitans*	SPLX	SPLX	-	SPLX
Wood Frog	*Rana sylvatica*	LX	LX	LX	LX
Double-crested Cormorant	*Phalacrocorax auritus*	-	-	-	LX
Great Blue Heron	*Ardea herodias*	-	-	-	PLX
Green Heron	*Butorides virescens*	-	-	-	SPLX
Wood Duck	*Aix sponsa*	-	-	-	LX
American Black Duck	*Anas rubripes*	-	-	-	RSPLX
Mallard	*Anas platyrhynchos*	-	-	-	RSPLX
Hooded Merganser	*Lophodytes cucullatus*	-	-	-	LX
Common Merganser	*Mergus merganser*	LX	LX	-	LX
Turkey Vulture	*Cathartes aura*	-	-	LX	-
Osprey	*Pandion haliaetus*	LX	LX	-	LX
Bald Eagle	*Haliaeetus leucocephalus*	-	-	-	LX
Sharp-shinned Hawk	*Accipiter striatus*	PLX	PLX	PLX	-
Cooper's Hawk	*Accipiter cooperii*	-	-	LX	-
Red-shouldered Hawk*	*Buteo lineatus*	-	-	LX	LX
Broad-winged Hawk	*Buteo platypterus*	-	-	LX	LX
Red-tailed Hawk	*Buteo jamaicensis*	-	-	RLX	-

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
Ruffed Grouse	*Bonasa umbellus*	-	-	SPLX	-
Solitary Sandpiper	*Tringa solitaria*	PLX	PLX	-	PLX
American Woodcock	*Scolopax minor*	-	-	RS	-
Mourning Dove	*Zenaida macroura*	RPLX	RPLX	-	-
Yellow-billed Cuckoo	*Coccyzus americanus*	-	-	R	R
Great Horned Owl	*Bubo virginianus*	RLX	RLX	RLX	RLX
Northern Hawk Owl	*Surnia ulula*	RPLX	RPLX	-	RPLX
Barred Owl	*Strix varia*	-	LX	LX	LX
Northern Saw-whet Owl	*Aegolius acadicus*	PLX	PLX	-	PLX
Whip-poor-will	*Caprimulgus vociferus*	-	-	PLX	-
Ruby-throated Hummingbird	*Archilochus colubris*	-	-	LX	LX
Red-bellied Woodpecker	*Melanerpes carolinus*	-	-	LX	-
Yellow-bellied Sapsucker	*Sphyrapicus varius*	-	-	LX	-
Downy Woodpecker	*Picoides pubescens*	-	-	PLX	PLX
Hairy Woodpecker	*Picoides villosus*	-	-	LX	LX
Northern Flicker	*Colaptes auratus*	LX	LX	RLX	-
Pileated Woodpecker	*Dryocopus pileatus*	-	-	LX	-
Olive-sided Flycatcher	*Contopus cooperi*	PLX	PLX	-	PLX
Eastern Wood-pewee	*Contopus virens*	-	-	LX	-
Least Flycatcher	*Empidonax minimus*	-	-	PLX	-
Eastern Phoebe	*Sayornis phoebe*	-	-	PLX	-
Great Crested Flycatcher	*Myiarchus crinitus*	-	-	PLX	-
Blue Jay	*Cyanocitta cristata*	-	-	PLX	-
American Crow	*Corvus brachyrhynchos*	RPLX	RPLX	RPLX	-
Common Raven	*Corvus corax*	RLX	RLX	RLX	RLX
Black-capped Chickadee	*Poecile atricapillus*	PLX	PLX	PLX	PLX
Tufted Titmouse	*Baeolophus bicolor*	-	-	PLX	PLX
Red-breasted Nuthatch	*Sitta canadensis*	PLX	PLX	-	PLX
White-breasted Nuthatch	*Sitta carolinensis*	-	-	PLX	-
Brown Creeper	*Certhia americana*	LX	LX	LX	LX

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
House Wren	*Troglodytes aedon*	-	-	-	SPLX
Winter Wren	*Troglodytes troglodytes*	LX	LX	-	LX
Ruby-crowned Kinglet	*Regulus calendula*	PLX	PLX	-	PLX
Blue-gray Gnatcatcher	*Polioptila caerulea*	-	-	LX	-
Veery	*Catharus fuscescens*	-	-	SPLX	SPLX
Gray-cheeked Thrush	*Catharus minimus*	PLX	PLX	LX	LX
Swainson's Thrush	*Catharus ustulatus*	PLX	PLX	-	PLX
Hermit Thrush	*Catharus guttatus*	PLX	PLX	-	PLX
Wood Thrush	*Hylocichla mustelina*	-	-	LX	LX
American Robin	*Turdus migratorius*	-	-	RSPLX	RSPLX
Cedar Waxwing	*Bombycilla cedrorum*	RSPLX	RSPLX	RSPLX	RSPLX
Blue-headed Vireo	*Vireo solitarius*	LX	LX	-	LX
Yellow-throated Vireo	*Vireo flavifrons*	-	-	LX	-
Warbling Vireo	*Vireo gilvus*	-	-	PLX	PLX
Red-eyed Vireo	*Vireo olivaceus*	-	-	PLX	-
Golden-winged Warbler	*Vermivora chrysoptera*	-	-	S	-
Nashville Warbler	*Vermivora ruficapilla*	SLX	SLX	SLX	SLX
Northern Parula	*Parula americana*	LX	LX	-	LX
Chestnut-sided Warbler	*Dendroica pensylvanica*	-	-	S	S
Magnolia Warbler	*Dendroica magnolia*	-	SLX	-	SLX
Yellow-rumped Warbler	*Dendroica coronata*	-	PLX	-	PLX
Black-throated Blue Warbler	*Dendroica caerulescens*	-	-	LX	-
Black-throated Green Warbler	*Dendroica virens*	PLX	PLX	-	PLX
Blackburnian Warbler	*Dendroica fusca*	-	PLX	-	PLX
Blackpoll Warbler	*Dendroica striata*	-	PLX	-	PLX
Black-and-white Warbler	*Mniotilta varia*	-	-	LX	LX
American Redstart	*Setophaga ruticilla*	-	-	LX	S
Ovenbird	*Seiurus aurocapillus*	-	-	PLX	-
Northern Waterthrush	*Seiurus noveboracensis*	LX	LX	-	LX

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
Mourning Warbler	*Oporornis philadelphia*	S	S	S	S
Canada Warbler	*Wilsonia canadensis*	-	-	LX	-
Scarlet Tanager	*Piranga olivacea*	-	-	LX	-
Northern Cardinal	*Cardinalis cardinalis*	-	-	SPLX	SPLX
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	-	-	PLX	PLX
Indigo Bunting	*Passerina cyanea*	-	-	RSPLX	RSPLX
White-throated Sparrow	*Zonotrichia albicollis*	S	S	-	S
Common Grackle	*Quiscalus quiscula*	-	-	-	SPLX
Clay-colored Sparrow	*Spizella pallida*	-	-	R	-
Brown-headed Cowbird	*Molothrus ater*	RSPLX	RSPLX	RSPLX	-
Baltimore Oriole	*Icterus galbula*	-	-	LX	LX
Pine Grosbeak	*Pinicola enucleator*	PLX	PLX	-	PLX
Purple Finch	*Carpodacus purpureus*	PLX	PLX	-	PLX
Pine Siskin	*Carduelis pinus*	PLX	PLX	-	PLX
American Goldfinch	*Carduelis tristis*	-	-	RS	-
Evening Grosbeak	*Coccothraustes vespertinus*	PLX	PLX	-	-
Virginia Opossum	*Didelphis virginiana*	-	-	PLX	PLX
Masked Shrew	*Sorex cinereus*	RSPLX	RSPLX	RSPLX	RSPLX
Water Shrew	*Sorex palustris*	PLX	PLX	-	PLX
Northern Short-tailed Shrew	*Blarina brevicauda*	RSPLX	RSPLX	RSPLX	RSPLX
Eastern Mole	*Scalopus aquaticus*	-	-	SPLX	-
Star-nosed Mole	*Condylura cristata*	PLX	PLX	-	PLX
Little Brown Myotis	*Myotis lucifugus*	LX	LX	LX	LX
Northern Myotis	*Myotis septentrionalis*	LX	LX	LX	LX
Silver-haired Bat	*Lasionycteris noctivagans*	-	-	LX	LX
Big Brown Bat	*Eptesicus fuscus*	-	-	RSPLX	RSPLX
Eastern Red Bat	*Lasiurus borealis*	-	-	LX	LX
Hoary Bat	*Lasiurus cinereus*	LX	LX	LX	LX
Eastern Cottontail	*Sylvilagus floridanus*	R	R	R	-
Snowshoe Hare	*Lepus americanus*	SPLX	SPLX	S	SPLX
Eastern Chipmunk	*Tamias striatus*	-	-	SPLX	-
Eastern Gray Squirrel	*Sciurus carolinensis*	-	-	LX	-
Eastern Fox Squirrel	*Sciurus niger*	-	-	LX	-

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
Red Squirrel	*Tamiasciurus hudsonicus*	PLX	PLX	LX	PLX
Southern Flying Squirrel	*Glaucomys volans*	-	-	LX	-
Northern Flying Squirrel	*Glaucomys sabrinus*	LX	LX	-	LX
American Beaver	*Castor canadensis*	-	-	SPLX	-
Deer Mouse	*Peromyscus maniculatus*	SPLX	SPLX	SPLX	SPLX
White-footed Mouse	*Peromyscus leucopus*	SPLX	SPLX	SPLX	-
Southern Red-backed Vole	*Clethrionomys gapperi*	SPLX	SPLX	SPLX	SPLX
Woodland Vole	*Microtus pinetorum*	-	-	LX	-
Southern Bog Lemming	*Synaptomys cooperi*	LX	LX	LX	LX
Woodland Jumping Mouse	*Napaeozapus insignis*	-	SPLX	-	SPLX
Common Porcupine	*Erethizon dorsatum*	-	PLX	PLX	PLX
Coyote	*Canis latrans*	RPLX	RPLX	RPLX	PLX
Red Fox	*Vulpes vulpes*	PLX	PLX	PLX	PLX
Common Gray Fox	*Urocyon cinereoargenteus*	-	-	LX	-
Black Bear	*Ursus americanus*	RSPLX	RSPLX	RSPLX	PLX
Common Raccoon	*Procyon lotor*	LX	LX	LX	LX
American Marten	*Martes americana*	PLX	PLX	-	PLX
Ermine	*Mustela erminea*	SPLX	SPLX	SPLX	SPLX
Long-tailed Weasel	*Mustela frenata*	SPLX	SPLX	SPLX	SPLX
Mink	*Mustela vison*	-	-	-	SPLX
Striped Skunk	*Mephitis mephitis*	SPLX	SPLX	SPLX	SPLX
Northern River Otter	*Lutra canadensis*	SPLX	SPLX	-	SPLX
Bobcat	*Lynx rufus*	SPLX	SPLX	SPLX	SPLX
White-tailed Deer	*Odocoileus virginianus*	RSPLX	RSPLX	RS	S
Spotted Turtle	*Clemmys guttata*	SPLX	SPLX	-	SPLX
Wood Turtle	*Clemmys insculpta*	SPLX	SPLX	SPLX	SPLX
Blanding's Turtle	*Emydoidea blandingii*	SPLX	SPLX	-	SPLX
Common Box Turtle	*Terrapene carolina*	-	-	LX	LX
Five-lined Skink	*Eumeces fasciatus*	-	-	LX	-
Ringneck Snake	*Diadophis punctatus*	-	-	LX	LX
Eastern Hognose Snake	*Heterodon platirhinos*	-	-	SPLX	-

Species	Latin	Cedar	Hemlock	Aspen Northern Hardwood Forest	Bottomland Mixed Forest
Milk Snake	*Lampropeltis triangulum*	-	-	SPLX	-
Northern Water Snake	*Nerodia sipedon*	SPLX	SPLX	-	SPLX
Brown Snake	*Storeria dekayi*	SPLX	SPLX	SPLX	SPLX
Redbelly Snake	*Storeria occipitomaculata*	-	-	SPLX	-
Common Garter Snake	*Thamnophis sirtalis*	SPLX	-	SPLX	SPLX
Eastern Massasauga	*Sistrurus catenatus*	SPLX	SPLX	-	SPLX

R – Regeneration
S – Sapling
P – Pole
L – Small Saw
X – Large Saw
* Michigan State Threatened Species

Appendix 3. Wildlife species associated with Beaches in Leelanau County, MI.

Species	Latin
Red-breasted Merganser	*Mergus serrator*
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover	*Pluvialis dominica*
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover	*Charadrius melodus*
Killdeer	*Charadrius vociferus*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Willet	*Catoptrophorus semipalmatus*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Purple Sandpiper	*Calidris maritima*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Bonaparte's Gull	*Larus philadelphia*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Great Black-backed Gull	*Larus marinus*
Snowy Owl	*Nyctea scandiaca*
Common Nighthawk	*Chordeiles minor*
Belted Kingfisher	*Ceryle alcyon*
American Crow	*Corvus brachyrhynchos*
American Pipit	*Anthus rubescens*
Lapland Longspur	*Calcarius lapponicus*
Snow Bunting	*Plectrophenax nivalis*
Eastern Hognose Snake	*Heterodon platirhinos*