Data Gap Evaluation Report

Havenwoods State Forest Rehabilitation
Milwaukee County, WI

WDNR Project #MKE2007_HvnwdsPlan
Grant ID # GL00E02824

(AES/RES Project # 21-0048)

Prepared by:
RES Great Lakes, LLC
17921 Smith Road
Brodhead, WI53520
(608) 897-8641

Submitted to:
Samantha Kueffler
Project Manager
Wisconsin Department of Natural Resources
6141 North Hopkins Street
Milwaukee, WI 53209

April 19, 2021

TABLE OF CONTENTS

TABLES

APPENDICES

PREPARERS

Matthew C. Parsons, M.S., Ecologist
Michael McGraw, M.E.S., Senior Wildlife Biologist
Mark J. O'Leary, M.S., Principal Ecologist

ACRONYMS AND ABBREVIATIONS

AHI	Wisconsin Architecture and History Inventory
AOC	Area of Concern
APE	Area of Potential Effects
BUI	Beneficial Use Impairment
DGER	Data Gap Evaluation Report
DPRC	Milwaukee County Department of Parks, Recreation and Culture
EO	Element Occurrence
EPA	Environmental Protection Agency
ERMP	Ecological Restoration and Management Plan
FQA	Floristic Quality Assessment
HSF	Havenwoods State Forest
HUC	Hydrologic Unit Code
NHI	Natural Heritage Inventory
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
Project	Havenwoods State Forest Rehabilitation Project
RAP	Remedial Action Plan Update for the Milwaukee Estuary Area of Concern
RES	RES Great Lakes, LLC
SHPO	State Historic Preservation Office
USACE	U.S. Army Corps of Engineers
UWMFS	University of Wisconsin Milwaukee Field Station
WDNR	Wisconsin Department of Natural Resources
*w*FQI	Weighted Floristic Quality Index
WHPD	Wisconsin Historic Preservation Database
*w*Mean C	Weighted Mean Coefficient of Conservatism
WWI	Wisconsin Wetland Inventory

1.0 INTRODUCTION

The Havenwoods State Forest (HSF) Rehabilitation Project (Project) was selected as a management action for the Degradation of Fish and Wildlife Populations Beneficial Use Impairment (BUI) in the Remedial Action Plan (RAP) Update for the Milwaukee Estuary Area of Concern (AOC) (WDNR, 2020). An Ecological Restoration and Management Plan (ERMP) will be prepared as the final deliverable of the Project's planning phase and will provide informed habitat enhancement recommendations that directly address portions of the RAP goals and metrics. A key component of measuring success against the RAP is establishing baseline data for vegetation, habitat, and wildlife. The University of Wisconsin Milwaukee Field Station (UWMFS) and Milwaukee County Department of Park, Recreation and Culture (DPRC) conducted a comprehensive wildlife assessment of the AOC from 2014-2017 to establish baseline wildlife information; however, detailed baseline vegetation data is lacking for HSF.

This Data Gap Evaluation Report (DGER) evaluates the suitability of existing data, identifies data gaps, and provides recommendations for additional data collection in order to inform rehabilitation planning of the habitats comprising HSF.

1.1 Background and Site Description

HSF is an approximately 237-acre nature preserve in northern Milwaukee, Wisconsin. HSF has a long and well-documented history of widespread and intense disturbance dating back to the 1800's. The history of this property includes family homesteads from the mid-1800's transitioning to the Milwaukee County House of Corrections in the early 1900's. Army Disciplinary Barracks, a Nike Missile site, and Milwaukee landfill were subsequently established in 1945, 1956, and 1974, respectively (Kubicek, 2020). The land was eventually set aside as green space and in 1979, the Wisconsin Department of Natural Resources (WDNR) began ecological rehabilitation and restoration efforts. Due to the disruption of the site over the past 150 years, the landscape is scarred and subject to habitat degradation from soil disturbance and invasive species colonization.

1.2 Criteria for Measuring Success

The overall goals of the Project are to address population metrics set for the Milwaukee Estuary AOC. An AOC-wide monitoring effort will be undertaken in the future to measure and assess whether or not the following goals have been met:

1. Improve the quality of terrestrial habitat types (forest, wetland, shrubland, grassland, semiaquatic, upland/grassland) to support a better population of wildlife indicator species:
    - Species and area of exotic invasive species removed.
    - Amount (area or number) of native species planted to benefit wildlife indicator species.
    - Number and species richness of wildlife indicator species found representing breeding behavior for consecutive years.

- Amount (area) of habitat types created, enhanced, and/or protected.

2. Improve the quality of aquatic habitat to support a better population of fish indicator species:
    - Amount (length or area) of fish habitat established or enhanced for indicator and sub-indicator species.
3. Improve connectivity between fish and wildlife populations by improving size and connecting gaps or barriers of habitat types:
    - Amount (length) of corridor habitat improved or reconnected.

2.0 DATA GAP EVALUTION

Numerous sources of existing information were compiled and reviewed as part of this data gap evaluation. Sources and findings are described in the following sections.

2.1 Existing Data Review

Existing documents and data reviewed as a part of this evaluation include the following:

- Havenwoods Master Plan (WDNR, 1981)
- Restoration and Management Plan for Havenwoods State Forest Preserve (Volkert, 1986)
- Assorted bird data from 2001-2017
- Milwaukee Estuary Area of Concern Wildlife Population Assessment Report (Casper & Robson, 2018)
- Emerald Ash Borer Management Plan Havenwoods State Forest (Anderson, 2019)
- Draft Forestry Management Plan Havenwoods State Forest (Sieger, 2019)
- Remedial Action Plan for the Milwaukee Estuary Area of Concern (WDNR, 2020)
- Cultural Resources Review (Kubicek, 2020)
- Endangered Resources Review for the Proposed Milwaukee AOC Havenwoods State Forest (Dow, 2021)
- Natural Resources Conservation Service (NRCS) Soil Survey of Milwaukee and Waukesha Counties (Appendix A)
- Wisconsin Wetland Inventory (WWI) (Appendix B)
- Milwaukee County 1-foot topographical data

2.2 Summary of Existing Information

2.2.1 Topography

The topography at HSF is relatively level to gently rolling and variable, generally sloping from north to south. Elevations range from approximately 709 feet on a hillslope in the northeastern portion of the site to approximately 669 feet in the southeastern portion of the site.

2.2.2 Soils

HSF is comprised of seven soil map units (Table 1): Ashkum silty clay loam, 0-2% slopes (AsA); clayey land (Cv); Landfill (LDF); loamy land (Lu); Mequon silt loam, 1-3% slopes; Ozaukee silt loam, carbonate substratum, 2-6% slopes (OuB); and Ozaukee silt loam, high carbonate substratum, 2-6% slopes, eroded (OuB2). Due to extensive soil disturbances that have occurred throughout most of the site, the reliability of the NRCS soil survey map for an accurate representation of existing soil conditions is likely somewhat low; however, it does provide important information regarding the historical vegetation types that were present across the site as well as soil conditions that can be expected in areas that were not filled historically.

Table 1. NRCS Soils Data for Havenwoods State Forest

Soil Map Unit Symbol and Name	% of AOI	Drainage Classification*	Major/Minor Components	Map Unit % Composition	Hydric Soil Rating
AsA, Ashkum silty clay loam, 0-2% slopes	7%	Poorly drained	Ashkum, drained	92%	Yes
			Peotone, drained	5%	Yes
			Orthents, clayey	2%	No
			Urban land	1%	No
Cv, Clayey land	7%	Moderately well drained	Clayey land	90%	No
			Ashkum	10%	Yes
LDF, Landfill		Not classified	Urban land, landfill	100%	Unranked
Lu, Loamy land		Moderately well drained	Loamy land	90%	No
			Pella	10%	Yes
MtA, Mequon silt loam, 1-3% slopes		Somewhat poorly drained	Mequon	90%	No
			Ashkum	4%	Yes
			Martinton	3%	No
			Ozaukee	3%	No
OuB, Ozaukee silt loam, high carbonate substratum, 2-6% slopes		Moderately well drained	Ozaukee, high carbonate substratum	96%	No
			Ashkum, drained	2%	Yes
			Orthents, clayey	1%	No
			Urban land	1%	No
OuB2, Ozaukee silt loam, high carbonate substratum, 2-6% slopes, eroded		Moderately well drained	Ozaukee, high carbonate substratum, eroded	96%	No
			Ashkum, drained	2%	Yes
			Urban land	1%	No
			Orthents, clayey	1%	No

* Pertains to major soil component.

The dominant soil series are Mequon and Ozaukee silt loams. Both soil types form on moraine landforms under mixed hardwood forest vegetation and are not classified as hydric. Also, of note are the soil map units that indicate anthropogenic soils including Cv, Lu, and LDF.

2.2.3 Hydrology

HSF is situated in the southern portion of the Lower Milwaukee River-Frontal Lake Michigan Hydrologic Unit Code (HUC) 10 Watershed within the larger Milwaukee HUC-8 Subbasin. Lincoln Creek, a perennial headwater stream, runs north to south through the western portion of the site and is tributary to the Milwaukee River. The watershed feeding this creek is composed of a combination of residential and industrial development. Lincoln Creek appears to have undergone multiple

alignment changes throughout its history. A second intermittent waterway runs north to south through the southeastern portion of the site and is fed by surface water from the residential area to the north. This feature used to be impounded and is now free-flowing, though much of the basin has filled in with sediment or human-placed fill. These waterway features are shown on the *Wisconsin Wetland Inventory* map in Appendix B.

2.2.4 Wetlands

Nine wetlands are mapped within HSF by the WWI as follows:

- One excavated wetland is mapped along the southeast bank of Lincoln Creek. This feature represents three individual flood control basins designed and constructed to attenuate flood flows and sediment and improve downstream water quality. The wetland is classified as E1/W0Hx (emergent, persistent/open water, standing water, palustrine, excavated wetland).
- One emergent/wet meadow, narrow-leaved persistent, wet soil, palustrine, excavated wetland (E2Kx) is mapped in the south-central portion of the site.
- One emergent/wet meadow, persistent, wet soil, palustrine, excavated wetland (E1Kx) is mapped in the south-central portion of the site.
- Two scrub/shrub, broad-leaved deciduous, wet soil, palustrine wetlands (S3K) are mapped in the south-central portion of HSF.
- Two forested, broad-leaved deciduous, wet soil, palustrine wetlands (T3K) and two scrub/shrub, broad-leaved deciduous, wet soil, palustrine wetlands (S3K) are mapped in the eastern portion of the site and appear to be associated with the eastern intermittent stream described previously.

RES Great Lakes, LLC (RES) is unaware of any wetland delineation efforts that have occurred onsite in the past confirming the precise boundaries of these wetlands.

2.2.5 Vegetation

In 2019, the WDNR classified and mapped 15 stand types representing 10 general cover types onsite in support of the *Draft Forestry Management Plan* (Sieger, 2019). Plant communities described include developed use, central hardwood forest, northern hardwood forest, bottomland hardwood forest, grasslands, wetland scrub, upland shrub, the Lincoln Creek riparian corridor with created ponds, and pine plantation. Woody invasive species, especially common buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera* spp.), were found to be prevalent throughout the site. Forested areas are dominated by species such as sugar maple (*Acer saccharum*), basswood (*Tilia americana*), cottonwood (*Populus deltoides*), black cherry (*Prunus serotina*), and boxelder (*Acer negundo*). Grasslands include a restored prairie in the western portion of the site dominated by Indian grass (*Sorghastrum nutans*) as well as a grassland in the eastern portion of the site that is composed of old-field vegetation such as smooth brome (*Bromus inermis*). Portions of the emergent/wet meadow wetland areas in the east are dominated by reed canary grass (*Phalaris arundinacea*) and narrow-leaved cattail (*Typha angustifolia*) and/or hybrid cattail (*T.* x *glauca*).

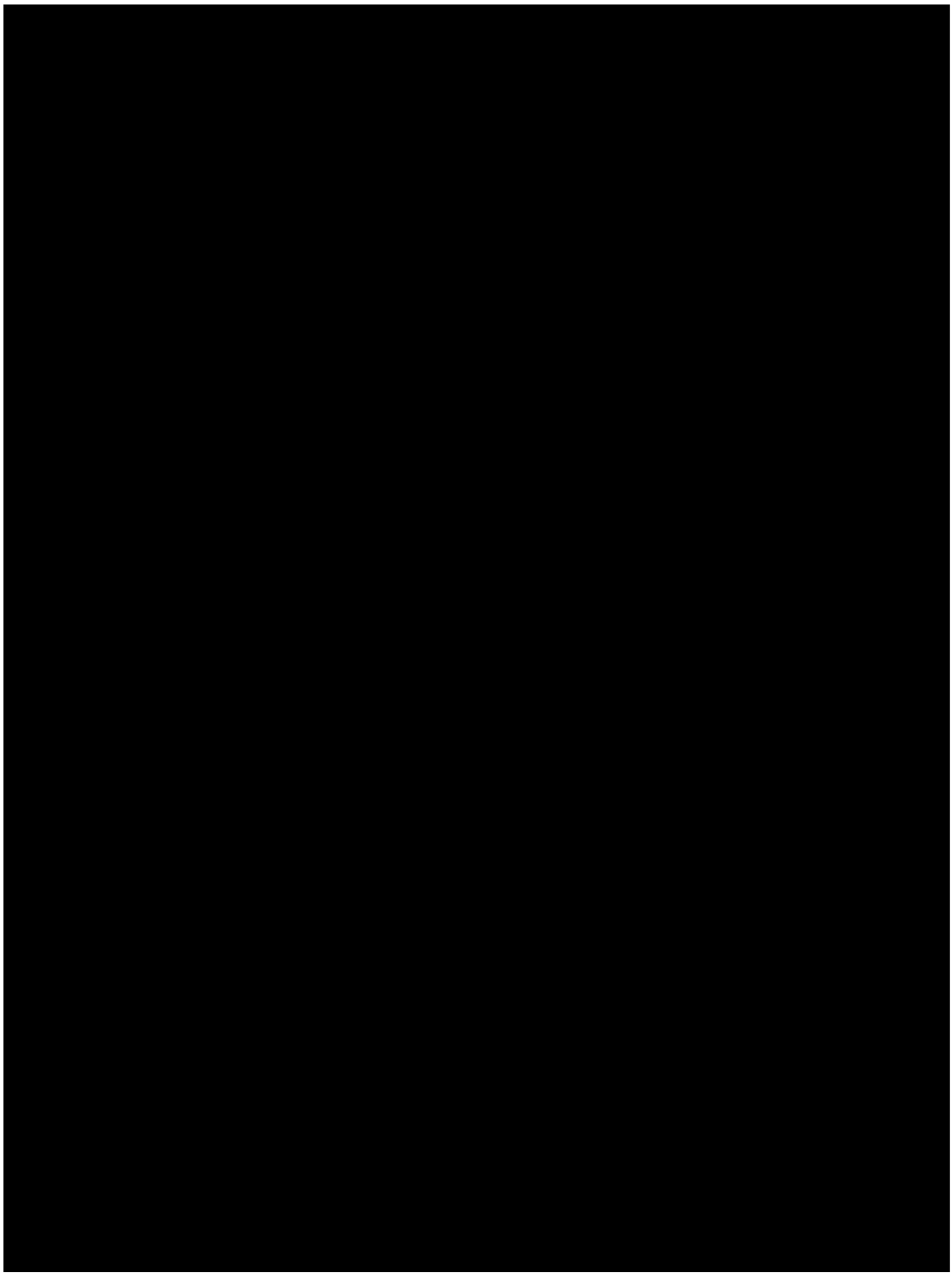
A detailed vegetation survey was conducted by Donald Vogelsang in 1983 and plant communities were also briefly described in the 1986 *Restoration and Management Plan* (Volkert, 1986). Vegetation is described and a plant list is presented in the 1981 *Master Plan* (WDNR, 1981) as well. All of this information is 35 years old or older and requires updating in order to gain an understanding of current conditions on the site.

2.2.6 Wildlife

HSF provides important habitat and serves as a migration corridor for a variety of wildlife species in an otherwise highly urbanized landscape. The UWMFS and DPRC prepared a baseline wildlife population assessment of HSF (and other portions of the Milwaukee Estuary AOC) through compilation and analysis of third party data as well as through original data collection efforts. This assessment pertained to breeding and migratory birds; insects; bats and other mammals; herptiles; fish; Odonates; primary burrowing crayfish; and mussels.

As part of this effort, the UWMFS designated Species of Local Conservation Interest (SLCI) which are defined as, "…species that are at least one of the following, and the study area has the potential to support viable populations: a) listed as either state or federally Endangered, Threatened, or Special Concern; b) listed as Species of Greatest Conservation Need in the *State Wildlife Action Plan*; c) considered to be locally rare or declining; or d) are of social value to stakeholders and considered to be desirable to the community" (Casper & Robson, 2018). A list of SLCI that have been documented in historical or contemporary records on the HSF property, excluding American mink (*Neovison vison*), is presented in Table 2.

Table 2. Havenwoods State Forest List of Species of Local Conservation Interest



A particularly rich data set exists for birds on the HSF site, though bird observation location data appear to be limited. Bird survey records obtained by RES date back to 2001. Snake surveys were conducted in HSF in 2009 and bat and crayfish surveys were conducted during the baseline wildlife assessments between 2014 and 2017. To RES' knowledge, no non-bat mammalian surveys were conducted in HSF during the baseline wildlife assessment.

A wide variety of methods were used to gather taxa-specific baseline data. Post-restoration survey methods should follow similar methods from that of the baseline assessment to the extent practical but should include monitoring for indications of breeding or breeding behaviors. Therefore, we recommend repeating all previous surveys for future assessments as well as some additional methods for certain taxa. Additional recommendations are primarily for species with lower detection probabilities, for taxa that were not studied in the baseline assessment, to document evidence of breeding, or to allow for a more comprehensive assessment of HSF as a standalone site (versus the more cursory approach as one of multiple AOC-wide sites). Table 3 highlights methods used at HSF as best understood from secondary sources and recommends survey methods to obtain near comprehensive faunal inventories.

Table 3. Summary of Baseline Survey Methods and Proposed Future Survey Effort

Taxa	Detail/ Season	Baseline Survey Methods	Proposed Additional Methods/Notes
Avifauna	Breeding Birds	Point Counts	Repeat three times (14 days apart) between May 25 and July 15 – ensure stratified random locations to cover all habitat types.
Avifauna	Migratory	Transects	Ensure baseline transects cover all habitat types adequately (if not, add transects) - Visit a minimum of 3 times in the spring passerine migration season (April 15 – May 25) and 5 times during fall migration (August 15 – October 31) spaced at least 14 days apart

Taxa	Detail/ Season	Baseline Survey Methods	Proposed Additional Methods/Notes
Avifauna	Wintering	Not Surveyed	Establish wintering point count locations (targeting open areas, such as grasslands and open water wetlands) to document overwintering species which are of local conservation concern such as short-eared owl, snowy owl, winter finches, buntings, and longspurs. Visit points at both dawn and dusk at least three times over the winter months (November through March)
Herpetofauna	Anurans	Anuran Calling Surveys, Coverboards, and Egg Mass Searches	Repeat at all baseline locations. Add new locations for new wetlands/enhanced sites. Visit at key overlap times to cover anuran phenology in the region (minimum of 4 surveys between March 15 and August 15)
Herpetofauna	Salamanders	Funnel Traps, Coverboards, and Egg Mass Searches	Repeat at all baseline locations. Add new locations for new wetlands/enhanced sites. Consider adding pitfall traps along drift fences for target Ambystomids
Herpetofauna	Snakes	Coverboards and Visual Encounter Searches	Continue to maintain and check existing coverboard array (replace any missing or deteriorated boards from baseline study. Consider adding more. Consider establishing terrestrial box trap arrays (along drift fences) in locations that bisect critical habitat areas.
Herpetofauna	Turtles	Basking Searches and Trapping	Repeat. Include new sites (basking sites and trapping locations) if restoration/enhanced area is under-represented in baseline. Consider use of basking traps in addition to hoop nets.
Mammals	Large Mammals	Camera Traps, Scat and Track Searches, and Visual Encounter Searches	Repeat. Include additional camera locations as needed to represent the site.

Taxa	Detail/ Season	Baseline Survey Methods	Proposed Additional Methods/Notes
Mammals	Bats	Audio Recordings	Uncertain about technology used. Conduct passive acoustic monitoring in at least 4 locations on the site during the summer (June 1 – September 21). Run stations as long as possible during this time (minimum of 14 consecutive days). Consider repeating during migration events as well.
Mammals	Small Mammals	Scat and Track, Sherman Live Trapping, Cameras (in nest boxes), and Visual Encounter Searches	Repeat. Include additional trapping transects if needed. Consider pitfall arrays (same as for amphibians). Can be taxing on small mammals so must be checked daily before 11am when open (and have cover and sponge in buckets).
Invertebrates	Crayfish	Funnel Traps and Visual Encounter Searches	Repeat. Consider chimney mapping as well.
Invertebrates	Odonates (adult)	Net Transects	Repeat. Add transects to represent all restored locations.
Invertebrates	Mussels	Qualitative and Quantitative Searches	Repeat in exact locations from baseline.
Invertebrates	Lepidoptera (butterflies and moths)	None	Net Transects (target Leps but document all insects via passive insect transects)
Fish	Stream-associated	None	Consider a fish shocking survey to document onsite fish species. Will require qualified surveyors and scientific collection permit (two state threatened species on site)

2.2.7 Cultural Resources

A cultural resources investigation was completed by Richard Kubicek in 2020 and one archeological burial site was found to be coincident with the Project area (Kubicek, 2020). The site is documented as an unknown prehistoric era campsite/village based on the recovery of eight pieces of lithic material. Phase I and II testing was conducted by the WDNR in the 1980's. The site is recommended as not meeting National Register of Historic Places (NRHP) criteria. No standing structures are listed in the Wisconsin Historic Preservation Database (WHPD) or Wisconsin Architecture and History Inventory (AHI).

2.2.8 Endangered Resources

[redacted]

[redacted]

2.3 Data Gaps

2.3.1 Vegetation Data

RES is unaware of any detailed vegetation surveys that have been conducted since a plant survey was directed by Donald Vogelsang in 1983 (Volkert, 1986). Vegetative information is also provided by Volkert in the 1986 *Restoration and Management Plan* (Volkert, 1986) but is of limited use due to the age and qualitative nature of the observations. WDNR forester, Mike Sieger, mapped, characterized, and briefly described cover types at HSF in 2019 (Sieger, 2019). These data are useful and still valid considering the date of the survey and will be used with some refinement for future vegetation surveys. The delineation of management stands is particularly useful for site vegetation sampling stratification. Qualitative observations of tree and shrub composition, invasive species cover, and forest quality (from a forest management perspective) is described by Sieger for the various stands, though relative cover by species and descriptions of herbaceous vegetation was not a focus of the survey.

Detailed quantitative observations of existing vegetative cover, composition, and quality by strata, including identification and extent of invasive species, are currently lacking. These data will be collected by RES in the summer of 2021. An ERMP will follow detailing restoration opportunities, methods, and costs designed to benefit target wildlife species. These data will also establish baseline vegetative conditions that can be remeasured post-restoration to document achievement of RAP goals and measures of success for fish and wildlife populations for the Milwaukee Estuary AOC.

2.3.2 Wetland Delineation

We are unaware of any wetland delineation efforts that have occurred onsite. It will be important to accurately delineate the boundaries of wetlands prior to restoration implementation in order to develop a complete plant community map and to inform avoidance measures during construction/implementation activities.

2.3.3 Ash Tree Data

The WDNR is currently conducting ash (*Fraxinus* spp.) tree removal in high priority areas throughout the Project area (Anderson, 2019). To aid in habitat management record keeping and future cost estimating, it may be useful for WDNR to conduct an ash tree survey in high priority areas that have not been managed to this point. To RES' knowledge, no such survey has been conducted.

2.3.4 Wildlife Data

Some baseline wildlife data exists for the site; however, additional wildlife surveys, especially surveys designed to document breeding behavior of wildlife indicator species, should be conducted again prior to the implementation phase of the Project to inform avoidance measures. Surveys documenting breeding behavior should also be conducted after restoration has been implemented. Additional detail is provided in Section 3.0 below.

2.3.5 Cultural Resources

The HSF cultural review states that the WDNR, in conjunction with EPA, establish the Project's Area of Potential Effect (APE) with respect to historic properties, including areas of potential ground disturbance and changes to standing structures (Kubicek, 2020). Restoration plans have not yet been developed and the area(s) of potential ground disturbance or structural alterations are therefore not known. This information will be determined during preparation of the ERMP and likely refined during the design and permitting phase. A cultural resources consultant should determine the locations and types of cultural resources within the APE during the design and permitting phase.

3.0 DATA ACQUISITION PLAN

3.1 Vegetation Surveys

In early summer, RES staff will perform a thorough baseline assessment of all native and non-native vegetative cover types to determine relative population levels and prescribe control/treatments where appropriate. As part of the baseline assessments, RES will collect canopy, sub-canopy, shrub, and herbaceous strata composition and percentages (including ash trees) using weighted Floristic Quality Assessment (FQA) methodology in accordance with the WDNR's Development of a Floristic Quality Assessment Methodology for Wisconsin (Bernthal, 2003).

The site will be stratified by vegetative cover unit and meander species search surveys will be conducted throughout the entirety of each unit. Comprehensive plant lists will be prepared for each stratum (i.e. canopy, sub-canopy, shrub, and herbaceous) within each vegetative cover unit. Once the survey within a unit is complete, surveyors will estimate the approximate percent cover of each species in each stratum. In addition to determination of relative population levels and management recommendations, these data will also allow for calculation of weighted Mean Coefficient of Conservatism (*w*Mean C) and weighted Floristic Quality Index (*w*FQI) which will provide important plant community quality information. RES will map significant populations of invasive species, especially those listed in Wisconsin Administrative Code NR 40, and other significant resources.

3.2 Wetland Delineation

RES' Assured Wetland Delineator will conduct wetland delineations in targeted areas within HSF boundaries following methodology in the U.S. Army Corps of Engineers (USACE) *Wetland Delineation Manual* (Environmental Laboratory, 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region* (Version 2.0) (USACE, 2010).

3.3 Ash Tree Survey

If the WDNR finds it useful, they may consider conducting ash tree surveys in the high priority portions of the site. This would aid in tree removal cost estimating as well as habitat management record keeping.

3.4 Wildlife Surveys

Formal wildlife surveys, especially surveys designed to document breeding behavior of wildlife indicator species, should be conducted (1) prior to commencement of restoration/rehabilitation activities to ensure avoidance of sensitive resources during these activities and (2) post-restoration/rehabilitation to document habitat rehabilitation success. At a minimum, this should include non-bat mammal, breeding bird, herptile, and crayfish surveys. RES also recommends conducting bat surveys in accordance with recommendations in the *Wildlife Population Assessment Report* (Casper & Robson, 2018). Additional considerations for future wildlife surveys are presented in Table

3. Comprehensive wildlife surveys to support development of the ERMP are outside RES' current scope of work because current wildlife baseline data already exist for the site; however, formal surveys should be conducted between the design/permitting and construction/implementation phases. Project implementation is currently planned to begin the fourth quarter of 2022.

3.5 Cultural Resources Investigation

The Project's APE should be established once restoration plans in the ERMP have been developed or early in the design and permitting phase. The WDNR should hire a cultural resources consultant to investigate the APE which typically happens during the 30% design stage. Restoration plans may need to be revised based on the consultant's findings.

4.0 DATA GAP EVALUATION SUMMARY

The following is a summary of this data gap evaluation:

- Baseline vegetation data was found to be outdated, qualitative and lacking detail, and in need of updating. Quantitative and qualitative baseline vegetation data will be collected in the summer of 2021 and summarized in the ERMP.
- The WDNR may consider conducting ash tree surveys in the high priority areas identified in the *Emerald Ash Borer Management Plan Havenwoods State Forest* (Anderson, 2019). This would be outside RES' current scope of work.
- Current baseline wildlife data were found to be adequate, though wildlife observation location and breeding indicator data were limited. We recommend repeating wildlife surveys as described in the *Wildlife Population Assessment Report* (Casper & Robson, 2018) at HSF for species listed in Table 2 to compile georeferenced wildlife data prior to restoration implementation activities and again after restoration has been implemented. For certain taxa, RES recommends additional survey methods and/or increased survey locations to adequately inventory the site during and post-restoration (Table 3). This work is outside RES' current scope of work; however, incidental wildlife observations (and critical habitat observations or opportunities for critical habitat enhancements/creation) will be documented by RES during baseline vegetation data collection.
- The Project's APE should be established once restoration plans in the ERMP have been developed or early in the design and permitting phase. The WDNR should hire a cultural resources consultant to investigate the APE which typically happens during the 30% design stage. Restoration plans may need to be revised if cultural resources are found within the APE.

5.0 REFERENCES

Anderson, C. 2019. *Emerald Ash Borer Management Plan Havenwoods State Forest*. Dated May 2019.

Bernthal, T.W. 2003. *Development of a Floristic Quality Assessment Methodology for Wisconsin. Final Report to USEPA – Region V Wetland Grant #CD975115-01-0*. Dated June 2003.

Casper, G.S., & Robson, J.L. 2018. *Milwaukee Estuary Area of Concern Wildlife Population Assessment Report.* Technical Report to Wisconsin Department of natural Resources, Office of Great Waters, 2300 N. Dr. Martin Luther King Jr. Dr., Milwaukee, WI 53212. 4 Chapters with Appendices. Dated August 5, 2018.

Dow, B. 2021. *Endangered Resources Review for the Proposed Milwaukee AOC Havenwoods State Forest*. Dated February 11, 2021.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Kubicek, R.H. 2020. *Cultural Resources Review of the Havenwoods State Forest Rehabilitation*. Dated March 23, 2020.

Sieger, M. 2019. *Draft Forestry Management Plan Havenwoods State Forest*. Dated June 2019.

Volkert, W.K. 1986. *Restoration and Management Plan for Havenwoods State Forest Preserve*. Dated February 20, 1986.

[USACE] U.S. Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0), ed. J.S. Wakeley, R. W. Lichvar, and C.V. Noble. ERDC/EL TR-10-16*. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[WDNR] Wisconsin Department of Natural Resources. 1981. *Havenwoods Master Plan*. Dated September 1981.

[WDNR] Wisconsin Department of Natural Resources. 2020. *Remedial Action Plan for the Milwaukee Estuary Area of Concern*. Dated August 2020.

Appendix A. NRCS Soil Report

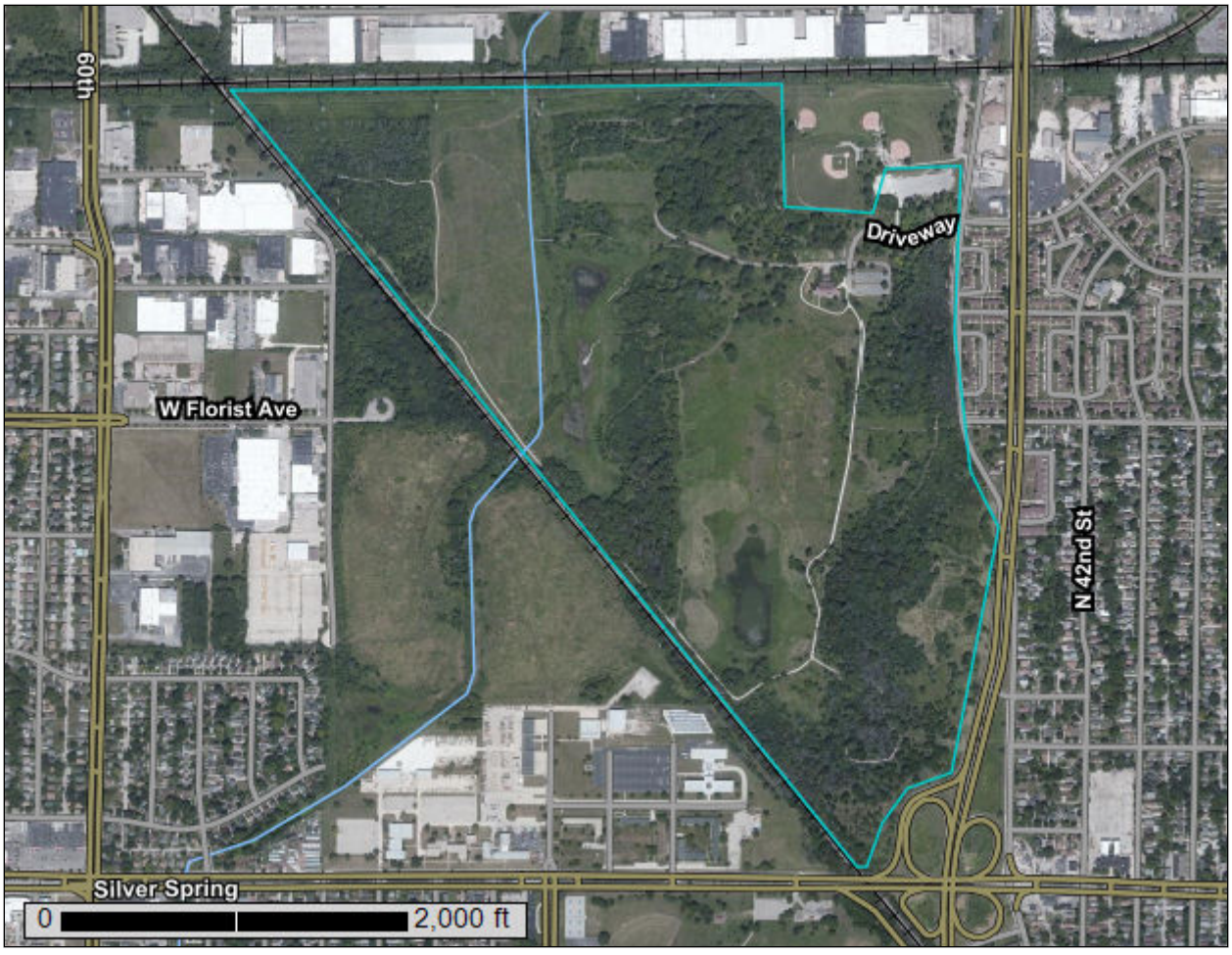
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Milwaukee and Waukesha Counties, Wisconsin



February 15, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:10,500 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 16, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 1, 2019—Oct 12, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AsA	Ashkum silty clay loam, 0 to 2 percent slopes	15.2	6.5%
Cv	Clayey land	15.9	6.8%
LDF	Landfill	1.0	0.4%
Lu	Loamy land	13.5	5.8%
MtA	Mequon silt loam, 1 to 3 percent slopes	68.3	29.2%
OuB	Ozaukee silt loam, high carbonate substratum, 2 to 6 percent slopes	64.3	27.5%
OuB2	Ozaukee silt loam, high carbonate substratum, 2 to 6 percent slopes, eroded	55.8	23.8%
Totals for Area of Interest		**234.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Milwaukee and Waukesha Counties, Wisconsin

AsA—Ashkum silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2ssrw
Elevation: 520 to 930 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 160 to 190 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Ashkum, drained, and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ashkum, Drained

Setting

Landform: Ground moraines, end moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Clayey colluvium over till

Typical profile

Ap - 0 to 12 inches: silty clay loam
Bg1 - 12 to 29 inches: silty clay
2Bg2 - 29 to 54 inches: silty clay loam
2Cg - 54 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Minor Components

Peotone, drained

Percent of map unit: 5 percent
Landform: Depressions on ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Orthents, clayey

Percent of map unit: 2 percent
Landform: Lake plains, ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Urban land

Percent of map unit: 1 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Cv—Clayey land

Map Unit Setting

National map unit symbol: g936
Elevation: 670 to 1,100 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 37 to 55 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Clayey Land

Setting

Parent material: Clayey mine spoil or earthy fill

Typical profile

H1 - 0 to 10 inches: clay loam

Properties and qualities

Slope: 1 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 12 to 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Ashkum

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

LDF—Landfill

Map Unit Setting

National map unit symbol: sjkz
Elevation: 660 to 980 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 43 to 48 degrees F
Frost-free period: 150 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, landfill: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Landfill

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Lu—Loamy land

Map Unit Setting

National map unit symbol: g94q
Elevation: 670 to 1,100 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 37 to 55 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Loamy Land

Setting

Parent material: Loamy mine spoil or earthy fill

Typical profile

H1 - 0 to 10 inches: loam

Properties and qualities

Slope: 1 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
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: About 12 to 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Pella

Percent of map unit: 10 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

MtA—Mequon silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: g953
Elevation: 670 to 1,100 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 37 to 55 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Prime farmland if drained

Map Unit Composition

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

Description of Mequon

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loess over calcareous clayey till

Typical profile

Ap - 0 to 8 inches: silt loam
BA - 8 to 12 inches: silt loam
2Bt - 12 to 19 inches: silty clay
2BC - 19 to 26 inches: silty clay loam
2C - 26 to 60 inches: silty clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water capacity: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: Mod AWC, high water table (G095BY004WI)
Other vegetative classification: Mod AWC, high water table (G095BY004WI)

Hydric soil rating: No

Minor Components

Ashkum

Percent of map unit: 4 percent
Landform: Depressions
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Martinton

Percent of map unit: 3 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Ozaukee

Percent of map unit: 3 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

OuB—Ozaukee silt loam, high carbonate substratum, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2sn09
Elevation: 650 to 1,010 feet
Mean annual precipitation: 31 to 39 inches
Mean annual air temperature: 44 to 49 degrees F
Frost-free period: 125 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ozaukee, high carbonate substratum, and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ozaukee, High Carbonate Substratum

Setting

Landform: End moraines, ground moraines

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin mantle of loess over silty and clayey till

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 10 inches: silt loam
Bt1 - 10 to 13 inches: silty clay loam
2Bt2 - 13 to 23 inches: silty clay
2Bt3 - 23 to 29 inches: silty clay loam
2Cd - 29 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 23 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F110XY012IL - Moist Glacial Drift Upland Forest
Hydric soil rating: No

Minor Components

Ashkum, drained

Percent of map unit: 2 percent
Landform: Ground moraines, end moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Orthents, clayey

Percent of map unit: 1 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Urban land

Percent of map unit: 1 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

OuB2—Ozaukee silt loam, high carbonate substratum, 2 to 6 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2sn0c
Elevation: 650 to 1,010 feet
Mean annual precipitation: 31 to 39 inches
Mean annual air temperature: 44 to 49 degrees F
Frost-free period: 125 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ozaukee, high carbonate substratum, eroded, and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ozaukee, High Carbonate Substratum, Eroded

Setting

Landform: End moraines, ground moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin mantle of loess over silty and clayey till

Typical profile

Ap - 0 to 7 inches: silt loam
Bt1 - 7 to 11 inches: silty clay loam
2Bt2 - 11 to 22 inches: silty clay
2Bt3 - 22 to 27 inches: silty clay loam
2Cd - 27 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 22 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F110XY012IL - Moist Glacial Drift Upland Forest
Hydric soil rating: No

Minor Components

Ashkum, drained

Percent of map unit: 2 percent
Landform: Ground moraines, end moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Urban land

Percent of map unit: 1 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Orthents, clayey

Percent of map unit: 1 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

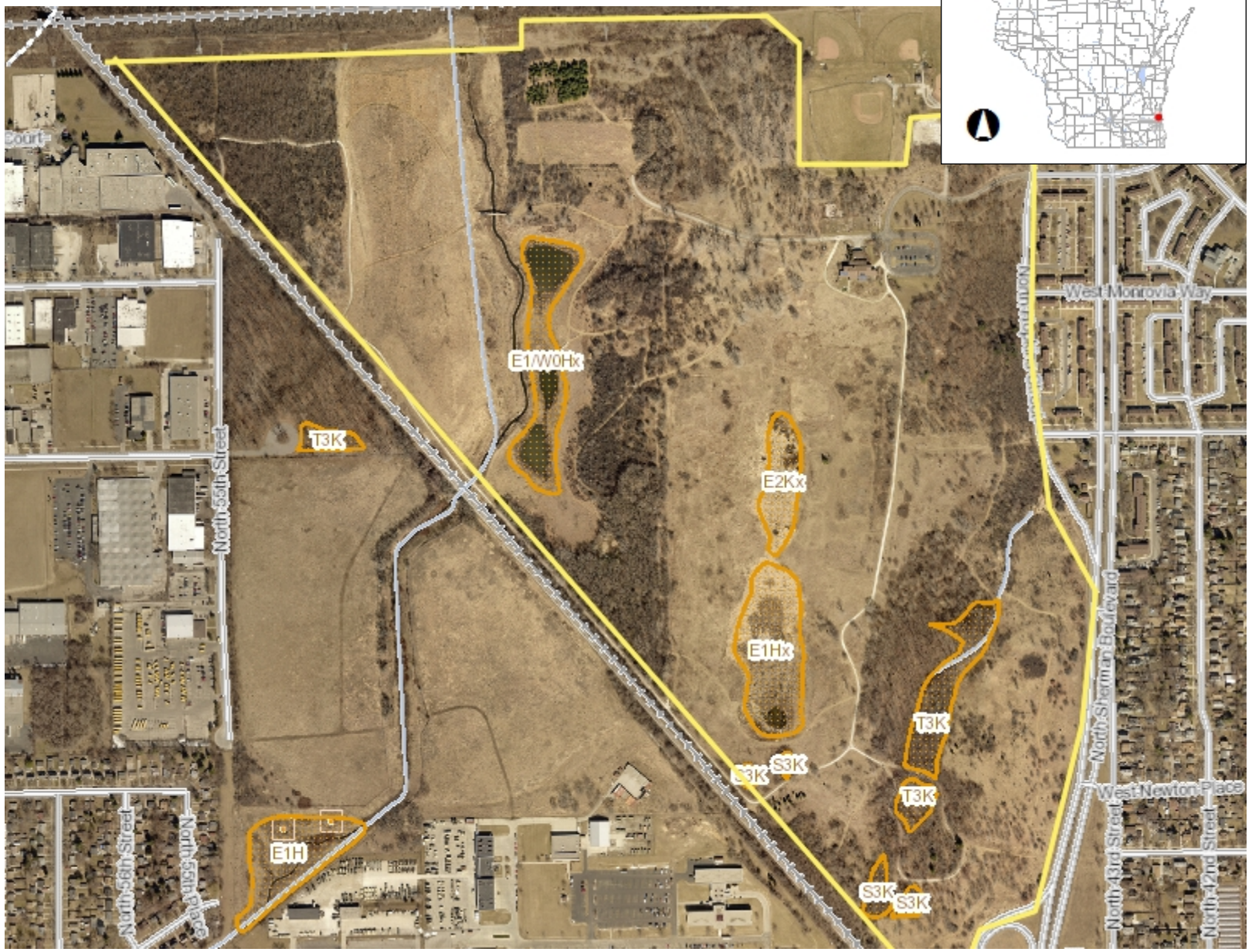
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B. Wisconsin Wetland Inventory Map

Surface Water Data Viewer Map



Legend

- Wetland Identifications and Confirmations
- Wetland Class Points
  - Dammed pond
  - Excavated pond
  - Filled excavated pond
  - Filled/drained wetland
  - Wetland too small to delineate
- Filled Points
- Wetland Class Areas
  - Wetland
  - Upland
- Filled Areas
- Wetland Class Points
  - Dammed pond
  - Excavated pond
  - Filled excavated pond
  - Filled/drained wetland
  - Wetland too small to delineate
- Filled Points
- Wetland Class Areas
  - Wetland
  - Upland
- Filled Areas
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads

Notes

0.3 0 0.13 0.3 Miles

NAD_1983_HARN_Wisconsin_TM

1: 7,920