

NORTHERN SANDS WISCONSIN MINE – RESPONSES TO COMMENTS FOR THE RECLAMATION PLAN SUPPLEMENT

PREPARED FOR:
NORTHERN SANDS WISCONSIN, LLC

IN SUPPORT OF THE CHIPPEWA COUNTY NONMETALIC MINING RECLAMATION
PERMIT

PREPARED BY:
WESLIE ENGINEERING GROUP

SEPTEMBER 27, 2018

COMMENTS AND RESPONSES



Table of Contents

A.	Description and Purpose	1
B.	Size and Scope	1
C.	Stream, Stream Corridor, and Wetland Protection	2
D.	Summary	7

Appendix A – Phase 1 Forest Classification Kotar Method
Appendix B – Phase 1 Hydrology and Buffer Map

Northern Sands Wisconsin Mine – Responses to Comments for the Reclamation Plan Supplement

A. DESCRIPTION AND PURPOSE

The purpose of this submittal is to provide responses and supporting information to the comments received from Chippewa County on March 13, 2018 regarding the Northern Sands Wisconsin, LLC Mine Reclamation Plan (permit number 2015-01).

The sections are broken down according to the comments received from Chippewa County. *The sections include the permit requirements in italics, County comments on the previous submittal (red), and the NSW responses (green).*

B. SIZE AND SCOPE

3. Size & Scope

d. An assessment of the existing biological resources at the mine site shall be conducted for each spatial phase of the mine development as depicted in Figure 1 of the reclamation plan.

(i) These assessments shall be conducted during the appropriate growing season and a written report of findings shall be filed with the Department before beginning the planned mining activities under each phase of the mine development.

(ii) These assessments shall be conducted using the "Wisconsin Forest Habitat Type Classification System" or an alternative system as approved the Department.

- Written report of findings is included in B. Biological Assessment (existing) – Phase 1 and Appendix A.
- Site was classified using the Wisconsin Forestry Classification System (WFCS). Areas identified include Dry, Dry-Mesic, & Mesic to Wet-Mesic.
 - **The assessment shall include documentation of existing trees and assemblages of understory plants using the Wisconsin Forest Habitat Type Classification System/KOTAR Method. See the attached documents for reference.**

- o The assessment shall document the methods used for field verification, including when & where the site investigations were conducted and data was collected.
Site investigations shall be performed to record the plant species present.

Documentation of the existing trees and assemblages of understory plants has been compiled in Appendix A. The Wisconsin Forest Habitat System (KOTAR) was used to guide the classification and was supplemented and confirmed through information from the Web Soil Survey and other sources. Thirty locations, strategically located to define reference and transitional areas, were collected, described, and characterized by Ms. Ann Key, PSS, a Professionally Assured Wetland Delineator in the State of Wisconsin.

This assessment (Appendix A) documents the field collection methods, dates when site visits occurred, and includes plant species identified in tabular form correlated to mapped locations. Ms. Key utilized the KOTAR Guidance, supplemental soils information, hydrological feature influences, and her extensive plant identification, soil characterization, and hydrologic interpretive experience to characterize and document the forest habitat types.

C. STREAM, STREAM CORRIDOR, AND WETLAND PROTECTION

4. Stream, Stream Corridor & Wetland Protection

a. A baseline hydrologic inventory shall be conducted to define the location of seeps, springs, wetlands, and surface waters located within the permitted mine boundary, and those located on adjacent properties.

(i) This inventory shall be based upon an examination of available resource maps and shall be verified through a general field assessment of the mine site, and adjacent properties if access to the adjacent properties is allowed.

- Inventory was conducted in November, 2017 within Phase 1. 10 seeps and 18 surface water drainages were identified within Phase 1.
 - o As part of the inventory, "Surficial Drainage", as identified in C.1 and shown in Appendix C, shall be clarified and mapped using flow lines to depict the areas of concentrated flow and drainageways. Areas of concentrated flow shall be depicted separately than surface waters with stream channel characteristics (continuous bed & banks) for the purpose of establishing riparian buffers (Permit Condition 4.d)
 - o As a basis for this hydrologic inventory, include the methodology that was used to determine the existing hydrologic features. Operator may propose that the full baseline hydrologic inventory be conducted in conjunction with other inventories and assessments for individual mining phases, to be conducted in the future, prior to mining a given phase.
 - o A baseline inventory was not conducted on neighboring parcels adjacent to Phase 1. This inventory shall be completed and submitted with the Follow-up Report. If the

- o operator does not see value in conducting an inventory of seeps, springs, wetlands, and surface waters on certain parcels adjacent to Phase 1, provide justification utilizing the site specific hydrologic analysis (Permit Condition 4.b).

The previous mapping for Appendix B "Preliminary Wetland Map" and Appendix C "Hydrologic Inventory" map have been compiled and updated into a new map titled "Hydrology and Buffer Map" and is located in Appendix B of this document. The map has been updated to include field verified bed and bank streams, compliant wetland delineation boundary, and flow arrows depicting the concentrated flow characteristics. These flow arrows do not depict bed and bank channels but general overland flow directions. Features identified as surficial drainage are areas of concentrated flow, but with no bed and bank.

The methodology used to assess the baseline hydrology began with a table top review of contour data, existing HUC 12 watershed boundaries, and available groundwater data. Multiple field visits were conducted to field verify the table top review and to field locate features of interest (seeps, wetlands, and surface waters). The hydrologic survey was conducted using a global positioning system (GPS), tablet-based satellite imagery (GoogleEarth) and topographic maps with a 2 foot contour interval. The Phase 1 area was systematically mapped following a grid pattern with approximate 50 meter spacing, followed by spot checks guided by topography. These data were integrated with data collected during the wetlands survey to develop a comprehensive hydrologic inventory of the property.

The county has requested that adjacent properties be evaluated in the hydrologic assessment. The need for investigation on adjacent properties was determined by whether or not the adjacent property would likely be hydrologically impacted as a result of mining. Hydrologic impacts from mining, for the purposes of this report, are defined as disruptions to surface flow. Adjacent properties that are downgradient from areas proposed to be disturbed for mining or mining related activities will have an inventory of hydrologic features conducted.

Only a portion of Phase 1 is designated for mining or construction disturbances. There are no proposed disturbances north of the existing railroad tracks and much of the southern parcels of Phase 1 are not proposed for mining. Phase 1 and adjacent properties were evaluated for offsite impact potential. No adjacent properties were identified as having potential disruption of watersheds. The reason being is that adjacent lands drain onto the mine site for Phase 1 or areas of Phase 1 that drain offsite are not proposed for land disturbing activities. At the request of landowners (Wagner, and Boland & Stahl) the parcels located west of Phase 1 were evaluated for the presence of hydrologic features. The parcels west of Phase 1 are up gradient from the proposed mining activity. These parcels were systematically mapped following a grid pattern with approximate 50 meter spacing, followed by spot checks guided by topography.

We propose that a future evaluation following the same criteria for Phases 2 and 3 will be conducted prior to mining activities in those phases.

- (ii) *This baseline hydrologic inventory shall commence by October 15, 2016, with a written report of findings to be completed and submitted to the Department by December 31, 2017.*
 - Report submitted on December 20, 2017.

b. A site specific hydrologic analysis shall be conducted by a Professional Hydrologist or Professional Geologist to evaluate and assess the potential for mining operations and reclamation activities to affect naturally occurring seeps, springs, wetlands, and surface waters as documented through the hydrologic inventory required under condition 4.a.

(i) This assessment shall be conducted for each phase of the mine site prior to beginning any mining activities in that mine phase.

(ii) This assessment shall document and describe the source of the water creating the hydrologic condition and shall assess the extent to which these features may be impacted by mining operations and reclamation activities. It shall also specify mitigation measures that can be used to reduce any potential impacts to seeps, springs, wetlands, and surface waters.

- Assessment indicates that the identified seeps will not be directly impacted by proposed mining activities. A monitoring well has been installed up gradient of the seeps near the proposed rail area.
- Assessment indicates that subsurface hydrology will be effected both during and post-mining. Restored slopes will generally be less steep than the original slopes.
- Assessment claims that post-mining surface will have similar infiltration to pre-mining surface.
 - Field studies have shown that the post-mining land surface does not regain its infiltration capacity for forested areas.
- Assessment includes multiple mitigation techniques for increasing infiltration post-construction and preserving surface drainage divides.
 - The assessment shall include a sub-watershed delineation of each hydrologic feature (or set of features) in order to determine the water source and the approximate percent contribution from each water source to the feature. The delineation shall be used to assess the extent to which each feature may be impacted by mining operations.
 - The Permit requires a Professional Hydrologist or Professional Geologist to conduct the Site Specific Hydrologic Analysis. Identify the person who has conducted the assessment and their credentials.
 - If certain wetlands will be impacted (filled or hydrologically altered), explain how these activities will be managed to limit the impact to hydrologic features (avoid, minimize, or mitigate).

See map in Appendix B for sub-watershed boundaries for identified hydrologic features meeting assessment criteria. The follow criteria were used to screen which features warrant the completion of an assessment.

1. Features located in proposed mined or disturbed areas are not assessed. Features within the disturbed and mined areas will be fully impacted and will no longer exist on the site. These features are labeled sequentially as R-1, R-2, R-3...(Removed-1, Removed-2). No assessment required.
2. Features located up gradient of any proposed mined or disturbed areas are not assessed, as the potential for impact is minimal. These features are labeled sequentially as Z-1, Z-2, Z-3...(Zero impact-1, Zero impact-2). No assessment required.
3. Features located down gradient of a proposed mined or disturbed area are assessed. These features are labeled sequentially as A-1, A-2, A-3...(Assessed-1, Assessed-2). Assessment is required.

There are no features associated with Phase 1 that meet the criteria number 3 requiring that an assessment be completed. Several features, as shown in Appendix B, were found but are either removed as part of mining or are up gradient and more than 50 feet from the disturbed areas.

J. Brian Mahoney is a licensed Professional Geologist in the state of Wisconsin (PG#1088). Mahoney specializes in sedimentology, stratigraphy, geochemistry, field geology and economic mineral deposits. He has extensive experience (25+ years) in stratigraphic, structural and economic geology field investigations in British Columbia, Washington, Idaho, Montana, New Mexico, Nevada, Wisconsin, Baja Mexico, Argentina and Honduras. Mahoney is qualified to address projects involving geologic mapping and field relations, basin analysis, economic mineral deposits, resource evaluation, environmental contamination and associated issues.

Wetland impacts will be avoided and minimized by optimizing the site layout including the detailed rail design. Permitting, as required by the ACOE and the WDNR for impacts to wetlands and waterways requires that a thorough practicable alternatives analysis (PAA) be conducted to determine the least impactful economically feasible practicable alternative be chosen and that the alternative selected address specific measures which could further reduce impacts. These include, but are not limited to modification of footprint, slope adjustments, and staging considerations which limit the duration of potential temporary impacts. The specific details defining this process will be determined as final design progresses and agency coordination is initiated. The wetland delineation performed by Ms. Ann Key and the location of regulated waterways, establishes the wetland and waterway existing condition for resource preservation and permitting. Compliance with State and Federal 401/404 requirements for wetland and waterway protection and permitting for unavoidable impacts is required prior to impacting a regulated resource.

(iii) The site specific hydrologic assessment and field work for Phase 1 of the mine shall commence by October 15, 2016, with a written report of findings to be completed and submitted to the Department by December 31, 2017.

- Report submitted on December 20, 2017.

d. A continuous riparian corridor and vegetative buffer shall be established to prevent environmental pollution and meet standards for surface water and wetland protection, as established in NR 135.07. The buffer shall be established to be 100 feet from the boundary of wetlands and centerline of watercourses with defined bed and banks. No mining or mine-related activities are permitted within this buffer. Pre-existing agricultural uses including cultivated cropland fields and agricultural pastures shall be allowed within the buffer. The wetland buffer shall be monumented with markers for the life of the mine.

A map of the riparian corridor and vegetative buffers will be prepared to prevent environmental pollution during the life of the mine. Field work shall commence by October 15, 2016, with maps and a report of findings to be completed and submitted to the Department by December 31, 2017.

- A map of the corridors and buffers was produced and included in the report, submitted on December 20, 2017.

- o The mapped buffer does not extend into railyard. Identify how Northern Sands intends to avoid, minimize, or mitigate the impacts to the USGS mapped intermittent stream.
- o The mapped riparian corridors were based on the location of intermittent streams, as shown on the USGS 7.5 minute quad maps, and were not field verified. Watercourses with defined bed & banks must be field verified and submitted to the Department. Riparian corridors and vegetative buffers shall be redrawn based on field verified watercourses with defined bed & banks and wetlands.

As noted above, wetland impacts will be avoided and minimized by optimizing the site layout including the detailed rail design. Permitting, as required by the ACOE and the WDNR for impacts to wetlands and waterways requires that a thorough practicable alternatives analysis (PAA) be conducted to determine the least impactful economically feasible practicable alternative be chosen and that the alternative selected address specific measures which could further reduce impacts. These include but are not limited to staging considerations which limit the duration of potential temporary impacts, modification of developmental footprint, and slope adjustments. The final design of the rail siding will follow the procedures outlined within the joint USACE-DNR 404/401 permitting process for wetlands and waterways which requires a thorough evaluation of alternatives which avoid and minimize impacts to aquatic resources. This will occur in conjunction with the detailed design process. Wetland buffers as proposed within this County submittal are subject to adjustment as detailed design proceeds and permitting progresses and will be coordinated with the County as necessary to ensure the documented final buffers are reflective of the influence of any permitted impacts.

See Appendix B for updated wetlands, bed and bank stream locations including buffers and typical flow patterns. It is noteworthy that since all the waterways with defined bed and bank are located within wetlands, and the required buffer for both is 100 feet, the extent of the buffer is defined exclusively by the wetland boundary and not the extent and location of the waterway with bed and bank.

f. The Operator shall determine the location of all wetlands within a mine phase using a recognized wetland delineator following procedures established in the 1987 edition of the USACOE Wetlands Delineation Manual.

g. Wetland delineations may be performed over time (in stages), to coincide with the planned phases of mining and reclamation.

h. All wetland delineations shall be completed and a written report submitted to the Department for review prior to beginning mining activities in any phase. The report shall include a map that shows the delineated boundary of the wetlands. The wetland delineation field work for Phase 1 of the mine shall commence by October 15, 2016, with a written report of findings to be completed and submitted to the Department by December 31, 2017.

- A partial wetland delineation was completed in late fall of 2016. This partial delineation identified thirteen wetlands within Phase 1.
 - o The partial wetland delineation completed for this report was not conducted during the appropriate growing season. To meet the conditions of Permit Conditions 4.f.

through 4.h., the operator shall initiate a state recognized wetland delineation for the entirety of Phase 1 no later than May 1, 2018. This report shall be completed and submitted to the Department no later than August 1, 2018.

A wetland delineation report conducted within the growing season in 2018 for Phase 1 was completed by Ms. Ann Key, PSS, a Professionally Assured Wetland Delineator in the State of Wisconsin, and submitted to Chippewa County by Northern Sands Wisconsin LLC on 7-30-18.

D. SUMMARY

This supplement provides additional information to satisfy the non-metallic mining reclamation permit conditions of Chippewa County dated August 8, 2016. This supplement is in response to comments received by Chippewa County dated March 13, 2018. This supplement address permit needs for Phase 1. Future phases will be coordinated with the County and addressed as required prior to the commencement of mining related activities.

Appendix A

Forest Classification Kotar Method



Forest Habitat Classification

Northern Sands Wisconsin, LLC

Northern Sands Wisconsin - Phase I Mine

Town of Howard

Chippewa County, Wisconsin

September 23, 2018





FOREST HABITAT CLASSIFICATION
NORTHERN SANDS WISCONSIN, LLC
NORTHERN SANDS WISCONSIN - PHASE I MINE
TOWN OF HOWARD
CHIPPEWA COUNTY, WISCONSIN

September 23, 2018

Prepared for:

Mr. Tom Gapinske
Northern Sands Wisconsin, LLC
923 South Hastings Way, #310
Eau Claire, Wisconsin 54701

Prepared By:

Wetlands and Waterways, LLC
5742 Warbonnet Lane
Hazelhurst, Wisconsin 54531
(715) 892-4211

Project Number: 378

Ann M. Key, PSS, PWS, CST
WDNR Professionally Assured Wetland Delineator

Ann Key

Table of Contents

Introduction	Page 1
Habitat Classification Methods	Page 2
Off-Site Review	Page 2
Field Evaluation	Page 4
Conclusions	Page 5
References	Page 6

Figures

Figure 1:	Site Location and Local Topography
Figure 2:	Wisconsin Wetland Inventory and Wetland Indicator Soils
Figure 3:	Delineated Wetlands and Waterways
Figure 4:	Available Water Capacity (0 to 30 Cm)
Figure 5:	Soil Organic Matter (0 to 30 Cm)
Figure 6:	Forest Habitat Classification

Tables

Table 1:	Forest Habitat Sample Plot Vegetation Summary
Table 2:	Forest Habitat Classification by Vegetation/Available Water Capacity Summary

Appendices

Appendix A: Site Photos	15 Pages
-------------------------------	----------

Introduction

On behalf of Northern Sands Wisconsin, LLC, Wetlands and Waterways, LLC, an independent WESLIE team member, conducted a Wisconsin Forest Habitat Type Classification on a parcel of land located approximately 1 mile west of Albertville, Wisconsin. The property is located near the Chippewa-Dunn County line with CTH N to the northeast and east, 90th Avenue to the northwest, 80th Avenue to the south and Frazier Road (13th Street) running through the center of the property. The Wisconsin Central LTD Railroad also runs through the property from northwest to southeast. The study area associated with this study consists of approximately 684 acres and is describe as being located in the Northeast $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, Southeast $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, Part of the Southwest $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, Part of the Southeast $\frac{1}{4}$ of the Southwest $\frac{1}{4}$ and Part of the Southwest $\frac{1}{4}$ of the Southwest $\frac{1}{4}$ of Section 19, Part of the Northwest $\frac{1}{4}$ of the Northwest $\frac{1}{4}$ and Part of the Southwest $\frac{1}{4}$ of the Northwest $\frac{1}{4}$ of Section 29 and Part of the Northeast $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, Part of the Northwest $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, the northwest $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, the Southwest $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, the Southeast $\frac{1}{4}$ of the Northeast $\frac{1}{4}$, Part of the Northwest $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, the Northeast $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, the Southwest $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, the Southeast $\frac{1}{4}$ of the Southeast $\frac{1}{4}$, the Northwest $\frac{1}{4}$ of the Northwest $\frac{1}{4}$, Part of the Northeast $\frac{1}{4}$ of the Northwest $\frac{1}{4}$, the Southwest $\frac{1}{4}$ of the Northwest $\frac{1}{4}$, Part of the Southeast $\frac{1}{4}$ of the Northwest $\frac{1}{4}$, the Northwest $\frac{1}{4}$ of the Southwest $\frac{1}{4}$ and the Southwest $\frac{1}{4}$ of the Southwest $\frac{1}{4}$ of Section 30, Township 29 North, Range 10 West, Town of Howard, Chippewa County, Wisconsin. Most of the evaluation area is comprised of upland deciduous forest and the remainder of the identified forested areas are lowland/wooded swamps. See Figure 1 for the property location and local topography.

Habitat Classification Methods

OFF-SITE SURVEY

Classification of the forest habitat types throughout the property was conducted using available resources, as well as various site visits to evaluate plant communities and other factors such as topographic position, soil moisture and nutrient content and the most indicative factor for forest habitat classification, identification of herbaceous vegetation throughout the forested areas. Several sources of information were reviewed to develop a sense of what community types may be present, as well as other factors that may affect the community types found throughout the site. Many factors determine which species thrive in certain areas including; soil texture, organic matter content, bulk density, soil structure, rock outcrops or fragments and climatic conditions. Climatic conditions may also affect herbaceous species on a short-term basis and are important to consider in such evaluations. Annual species are often more reflective of recent moisture conditions, whether it be drier or wetter than normal, but not necessarily indicative of the typical nature of the area. Therefore, it was important to take these factors into consideration and if certain annual species were observed under abnormal moisture conditions those species were not used to dictate overall forest habitat classifications for this study.

The Wisconsin Forest Habitat Type Classification System (Kotar, 1999) guidance was the most useful and relied upon guidance for the evaluation. However, this system is rather limited in species consideration and other resources were needed to more thoroughly evaluate the site. The Wetland Forest Habitat Type Classification System for Northern Wisconsin (2017), which focuses primarily on wetland communities, was also reviewed but since this specific evaluation area (Region 6) has not yet been incorporated into the system it was not necessarily applicable. Both of these systems indicate that forest habitat types are not necessarily identified by the forest cover types but rather by distinct plant assemblages of understory plants, which are more indicative of moisture-nutrient gradient and a better indicator of forest succession than overstory species.

The USGS topographical maps were evaluated with the consideration that many herbaceous and overstory species are more frequently found in the lower lying footslopes and toeslopes of landscapes and often equate to having higher moisture and nutrient regimes. Likewise, many species are more frequently found on knolls, ridges, shoulder slopes and sideslopes with better drainage, lower moisture and lower nutrient regimes. See Figure 1 for the site location and local topography.

The WDNR Wisconsin Wetland Inventory (WWI) map with Wetland Indicator Soils was evaluated to identify areas that may have soil moisture and nutrient conditions that would be more conducive to certain forest habitat types. Although wetland and wetland indicator soil areas are most often identified in lower lying areas, which would coincide with the USGS topographical maps, there are instances where soils with lower permeability and/or higher organic content may support wetland communities or species that are more likely to occur in wetter soil regimes even in higher elevations or on sloped areas. The WWI map with wetland indicator soils is included as Figure 2.

A detailed wetland delineation study was conducted on this property by Ms. Ann Key, a WDNR professionally Assured Wetland Delineator and Professional Soil Scientist, in July 2018 and identifies wetland and waterway features more specifically than the WDNR WWI map. The delineation also included evaluation of surface soils (0 to 20 inches) with moisture and organic matter content being evaluated as part of that study. However, the timing of the delineation versus occurrence of certain species within the growing season, as well as climatic conditions, was taken into consideration in this evaluation. A map identifying the delineated wetlands, as well as associated waterways that were evaluated for bed and banks, is included as Figure 3.

This particular property has known seeps, which are areas where sub-surface water reaches the earth's surface from an underground aquifer due to specific geology of the area. A detailed geologic/seep study was

conducted throughout the property by Mr. Brian Mahoney a PhD of Geology. Mr. Mahoney specializes in sedimentology and stratigraphy and he identified specific seep locations. Although these seep locations cannot necessarily be correlated to overall forest habitat, the information was taken into consideration for this evaluation.

Other off-site resources were used for evaluation of forest habitat types and these resources were most applicable in the evaluation only after the field visit was conducted. The WDNR Ecological Landscape Detailed Community Descriptions were used to help identify which herbaceous species are most likely to occur in specific forest habitats. Many species identified during the site field visits were not listed in the Wisconsin Forest Habitat Type Classification System documentation or WDNR Ecological Landscape Detailed Community Descriptions. In those cases, the WDNR Detailed Community Description from Ecological Landscapes of Wisconsin was used to better identify which species are most common in the various forest habitat types. For species that were not identified in the above mentioned documents, the Wisconsin State Herbarium website was reviewed for species community types and moisture regimes.

Many common understory species observed at the site were not referenced in any of the above referenced documents and therefore, Ms. Key used her professional experience with over 20 years of wetland delineation and vegetation identification to classify some of those species accordingly to the type of community, moisture regime and other factors that would determine the forest classification type that they would typically occur within.

Lastly, the NRCS Web Soil Survey was reviewed for soil properties that would likely affect species occurrence and succession in accordance with the WDNR Ecological Landscape Detailed Community Descriptions and the Wisconsin Forest Habitat Type Classification Systems.

The most applicable utilities within the Web Soil Survey for this study included the Available Water Capacity and Organic Matter reports. Both the WDNR Ecological Landscape Detailed Community Descriptions and the Wisconsin Forest Habitat Type Classification Systems indicate that soil moisture and nutrient regimes have strong correlations to specific forest habitat types. These systems indicate that poor nutrient levels and dry soil conditions typically equate to Very Dry to Dry habitat classifications. These systems also indicate that poor nutrient levels with very high moisture regimes typically equate to Wet Mesic to Wet habitat classifications. Soils with medium to rich nutrient levels and moderate moisture regimes are most often associated with Dry Mesic to Mesic habitat classifications.

Available water capacity is an indicator of a soil's ability to retain water and make it sufficiently available for plant use. Water held in the soil is needed to sustain plants between rainfall or irrigation events and provide a buffer against periods of water deficit. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure, with corrections for salinity and rock fragments. Available water capacity is primarily controlled by soil texture and structure. Soils with higher silt contents generally have higher available water capacities, while sandy soils have the lowest available water capacities. Rock fragments reduce a soil's available water capacity proportionate to their volume, unless the rocks are porous. Soil depth and root-restricting layers affect the total available water capacity since they can limit the volume of soil available for root growth. Since the standard root zone for herbaceous species is 0 to 12 inches, the available water capacity of soils throughout the site were evaluated for 0 to 30 cm. An evaluation of Available Water Capacity from 0 to 150 cm was also conducted since that depth would correlate more closely with rooting depths of shrub species. The results were nearly the same for the 0 to 30 cm versus 0 to 150 cm evaluation. Figure 4 shows the Available Water Capacity throughout the property for the 0 to 30 cm depth evaluation.

The other critical factor mentioned in both the WDNR Ecological Landscape Detailed Community Descriptions and the Wisconsin Forest Habitat Type Classification Systems is soil nutrient level. Although this is a more difficult factor to evaluate, typically higher silt and/or higher organic matter equates to higher nutrient levels. Therefore, the soil health with regards to organic matter content of soils throughout the site was also evaluated through the Web Soil Survey. This evaluation was also conducted for depths of 0 to 30 cm, again since that is the standard root zone for herbaceous species. In addition, the most organic matter is found

within the upper 12 inches of the soil profile. Figure 5 shows the soil Organic Matter content throughout the property for the 0 to 30 cm evaluation.

FIELD EVALUATION

Thirty forest habitat sample plots (Plots 1 through 30) were evaluated during various site visits at the site. Site visits to evaluate species composition were conducted on June 25-27 and again on September 5, 2018. Through existing knowledge of the property, review of aerial photos for forest habitat variation, as well as a random meander of the entire property, representative areas were chosen throughout the property for each sample plot. The sample plot areas were sampled using the guidelines as specified in the WDNR Ecological Landscape Detailed Community Descriptions. Each sample plot area consisted of approximately one-half to one acre (140' x 140' to 200' x 200'). A walk-over the areas was conducted while noting all species observed in both the overstory and understory, as well as their level of occurrence. Although recorded in the field notes, species that had a very low level of occurrence (ie. Less than 5% cover) were not necessarily used in classification of the associated forest habitat. Sample plot locations are shown on Figures 3, 4, 5 and 6.

The species lists have been compiled into Table 1 with each species assigned a habitat type based on available information from the following; the WDNR Ecological Landscape Detailed Community Descriptions system, the Wisconsin Forest Habitat Type Classification System, the WDNR Detailed Community Description from Ecological Landscapes of Wisconsin and the Wisconsin State Herbarium website.

In many cases the understory species vary from Very Dry Mesic species to Wet Mesic species, in which case the more dominant species within that plot were given more consideration or the species composition was averaged or given a range of classifications for that specific plot. Although the WDNR Ecological Landscape Detailed Community Descriptions, which is most applicable to forested wetlands, has not been completed for this region (Region 6), the wetland delineation and data collected during that study was utilized to help evaluate forested wetlands throughout the site.

Evaluation of the understory species along with the available soil moisture and organic matter content for soils throughout the site were then closely compared. As the forest habitat classification system guidance suggests, it was determined that the classification of the various forest habitats throughout the property based on observed understory species correlated in most cases to nearly identical classifications using the available soil moisture maps. Organic matter content was also further evaluated and in general correlates to the overall habitat classifications. Table 2 summarizes each sample plot based on habitat classification by vegetation and available moisture content. Based on this information, several of the sample plots would fall within a range of habitat classifications but that being a very narrow range such as Very Dry to Dry. This information was then used to create an overall site map that color-codes the forested areas throughout the property by forest habitat classification. See Figure 6 for the overall Forest Habitat Classifications and their boundaries throughout the property.

Conclusions

The results of the Forest Habitat Classification evaluation indicate the majority of the forested areas within this property fall within the category of Dry Mesic to Mesic with only a few select areas identified on the wetter end of the spectrum being Mesic to Wet Mesic. Of approximately 350 acres of forest habitat throughout the property, it was determined that approximately 122 acres or 35% of the forested areas consist of Dry Mesic habitat, approximately 196 acres or 55% of the forested areas consist of Mesic habitat and approximately 35 acres or 10% of the forested areas consist of Wet Mesic habitat. It should be noted that many areas may range from Very Dry to Dry Mesic, Dry Mesic to Mesic or Mesic to Wet Mesic. For the sake of mapping out the habitat classifications, areas were given one distinct classification that was most applicable based on all available information. See Figure 6 for the property layout, forested locations and habitat classification for forested areas.

The attached Table 1 summarizes the vegetation observed at each sample plot and the habitat classification for each species. Some observed species may not be included in Table 1 due to either a very low level of occurrence within a specific plot or inconclusive information on what type of community those species would typically occur within. Overstory species are included in the table but the herbaceous species were the determining factor for habitat classification. Consideration of more dominant versus less dominant species was also considered although species such as *Rubus sp.* were observed at nearly every sample plot as dominant species so more consideration was then given to the other species present at each plot. Table 2 summarizes the classification of each overall plot based both on the vegetation identified within the plots, as well as the classification based on soils and available water capacity.

Ultimately, the vegetation and available water capacity correlated quite closely at nearly every plot. The available water capacity was evaluated for a range of 0 to 30 cm since that depth correlates most closely with the root zone of most herbaceous species. However, available water capacity results were also evaluated for the 0 to 150 cm zone for consideration of deeper rooted shrub species. The results came out nearly identical with regards to how each forested area of the site would ultimately be classified.

This study has been prepared at the request of Northern Sands Wisconsin, LLC, per Chippewa County requirements for this project.

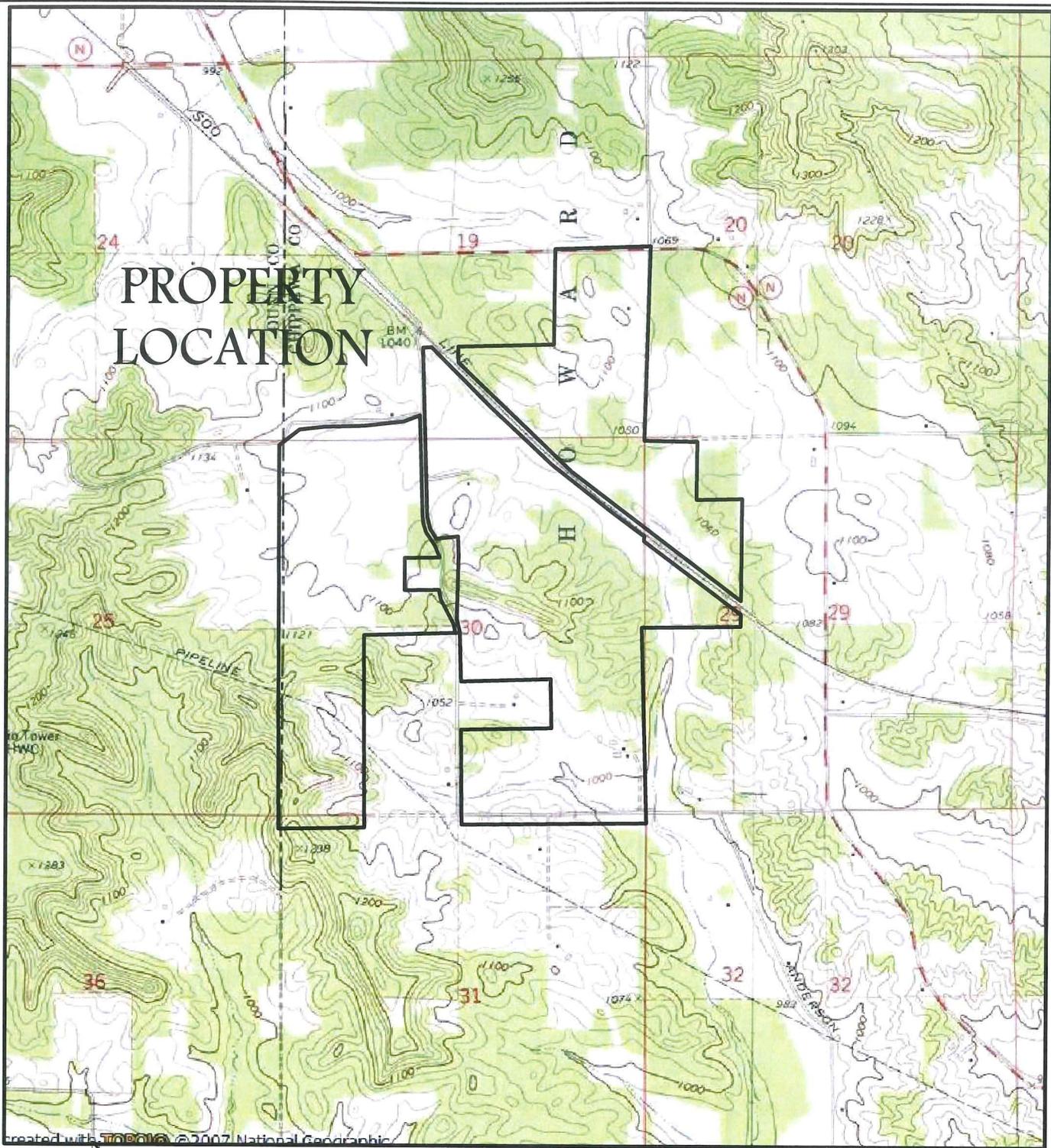
References

- Chadde, S.W., 1998. A Great Lakes Wetland Flora. Pocket Flora Press, Calumet, Michigan.
- Courtenay and Zimmerman, 1972. Wildflowers and Weeds. Toppan Printing Co., Ltd., Tokyo, Japan.
- Eggers and Reed, 2014. Wetland Plants and Plant Communities of Minnesota & Wisconsin. U.S. Army Corp of Engineers, St. Paul District.
- Kotar and Burger, 2017. Wetland Forest Habitat Type Classification System for Northern Wisconsin; A Guide for Land Managers and Landowners. Department of Natural Resources, Madison, Wisconsin.
- Kotar, Kavach and Burger, 1999. Wisconsin Forest Habitat Type Classification System. Forest Habitat Type Classification Workshop, Minneapolis, Minnesota.
- Little, E.L., 1980. The Audubon Society Field Guide to North American Trees. Chanticleer Press, Inc., New York.
- University of Wisconsin. *Wisconsin State Herbarium*. <http://wiscinfo.doit.wisc.edu/moved/herbarium.htm> (2018).
- USDA Natural Resource Conservation Service. *Official Soil Series Descriptions*. <http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi> (2018).
- USDA Natural Resources Conservation Service. NCSS Web Soil Survey, Chippewa County, Wisconsin. <http://websoilsurvey.nrcs.usda.gov/app/> (2018).



APPENDIX A – SITE PHOTOS

FIGURES



created with topo2016 © 2007 National Geographic

SCALE IN FEET

1" = 2000'



CONTOUR INTERVAL 10 FEET

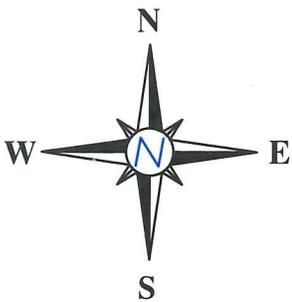
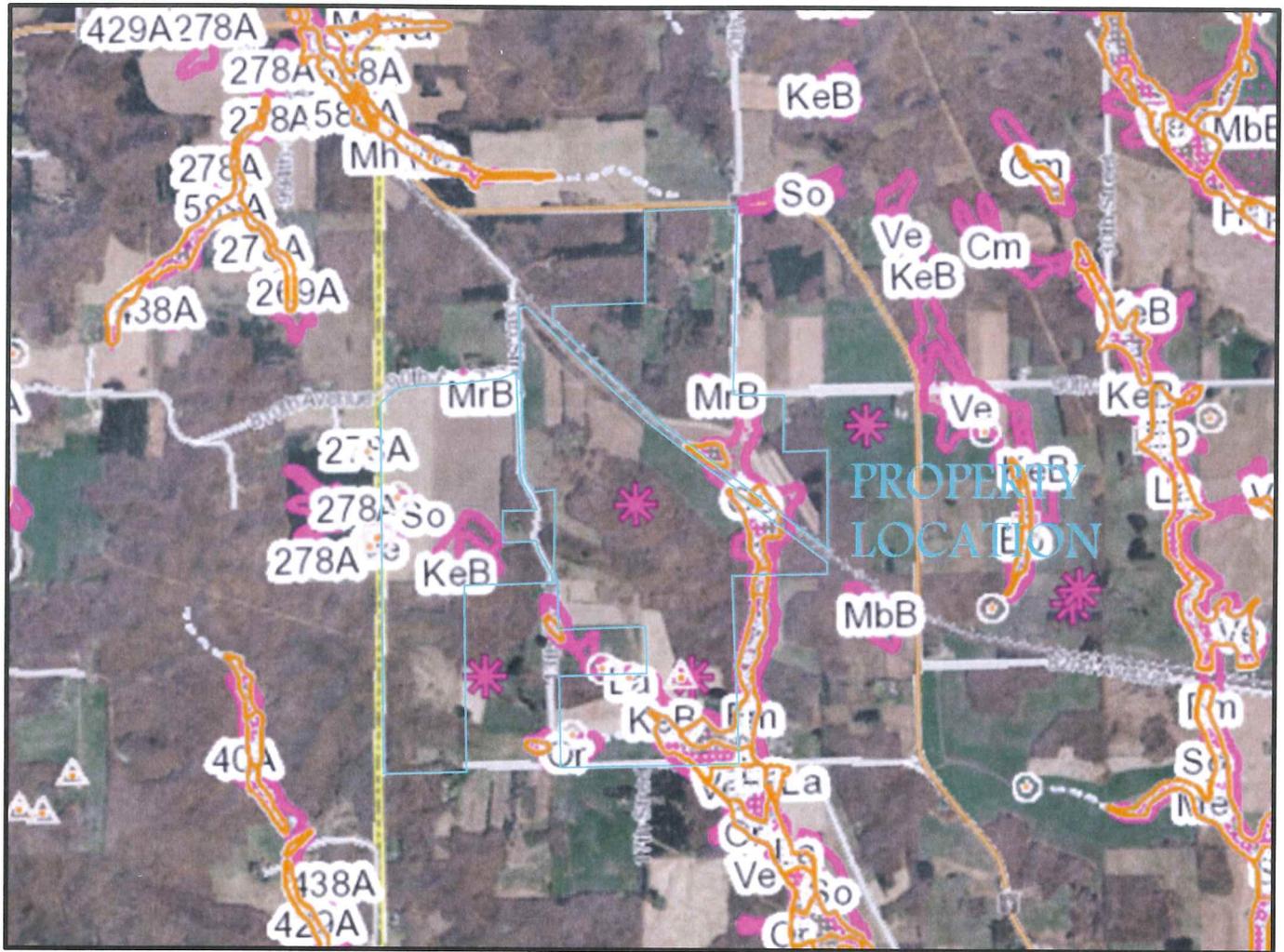
NATIONAL GEODETIC VERTICAL DATUM OF 1929



ADDRANGLE LOCATION

BASE MAP SOURCE: USGS 7.5 MINUTE ADDRANGLE, COLFAX SOUTH, WISCONSIN, 1980 NATIONAL GEOGRAPHIC HOLDINGS, INC.

<p>SITE LOCATION</p> <p>LOCAL TOPOGRAPHY</p>	<p>APPROVED BY: AMK</p> <p>DRAWN BY: NLB</p>	<p>THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF WETLANDS & WATERWAYS LLC, AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS FURNISHED.</p>	 <p>Wetlands & Waterways LLC</p>	<p>PROJECT NUMBER: 378</p> <p>FIGURE NO. 1</p>
<p>NORTHERN SANDS WISCONSIN, LLC TOWN OF HOWARD, CHIPPEWA COUNTY, WISCONSIN</p>	<p>DATE: 6-17-18</p> <p>SCALE: 1"=2000'</p>			



□ □ ADDRANGLE LOCATION

BASE MAP SOURCE □ □ SGS 7.5 MIN □ □ ADDRANGLE, WHITING, WISCONSIN, 1976 NATIONAL GEOGRAPHIC HOLDINGS, INC. □

WISCONSIN WETLAND INVENTORY AND WETLAND INDICATOR SOILS

APPROVED BY □
AMM
DRAWN BY □
NLB
DATE □
8-30-16
SCALE □
NONE

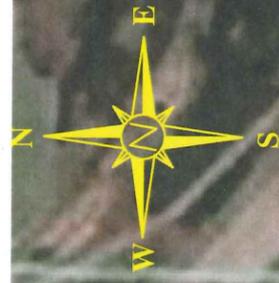
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF WETLANDS & WATERWAYS LLC, AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS FURNISHED.



PROJECT NUMBER □
378
FIGURE NO.

2

NORTHERN SANDS WISCONSIN, LLC
TOWN OF HOWARD, CHIPPEWA COUNTY
WISCONSIN



LEGEND □
 — DELINEATION LIMITS
 — DELINEATED WETLAND
 ● FOREST HABITAT SAMPLE PLOT LOCATION
 — IDENTIFIED WATERWAYS WITH DEFINED BED AND BANKS

DELINEATED WETLANDS
 □ WATERWAYS

NORTHERN SANDS WISCONSIN, LLC
 PHASE I MINE
 CHIPPEWA COUNTY, TOWN OF HOWARD,
 WISCONSIN

APPROVED BY:

AMK

DRAWN BY:

NLB

DATE:

7-2-18

SCALE:

1"=600'

THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF WETLANDS & WATERWAYS, LLC, AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS FURNISHED.



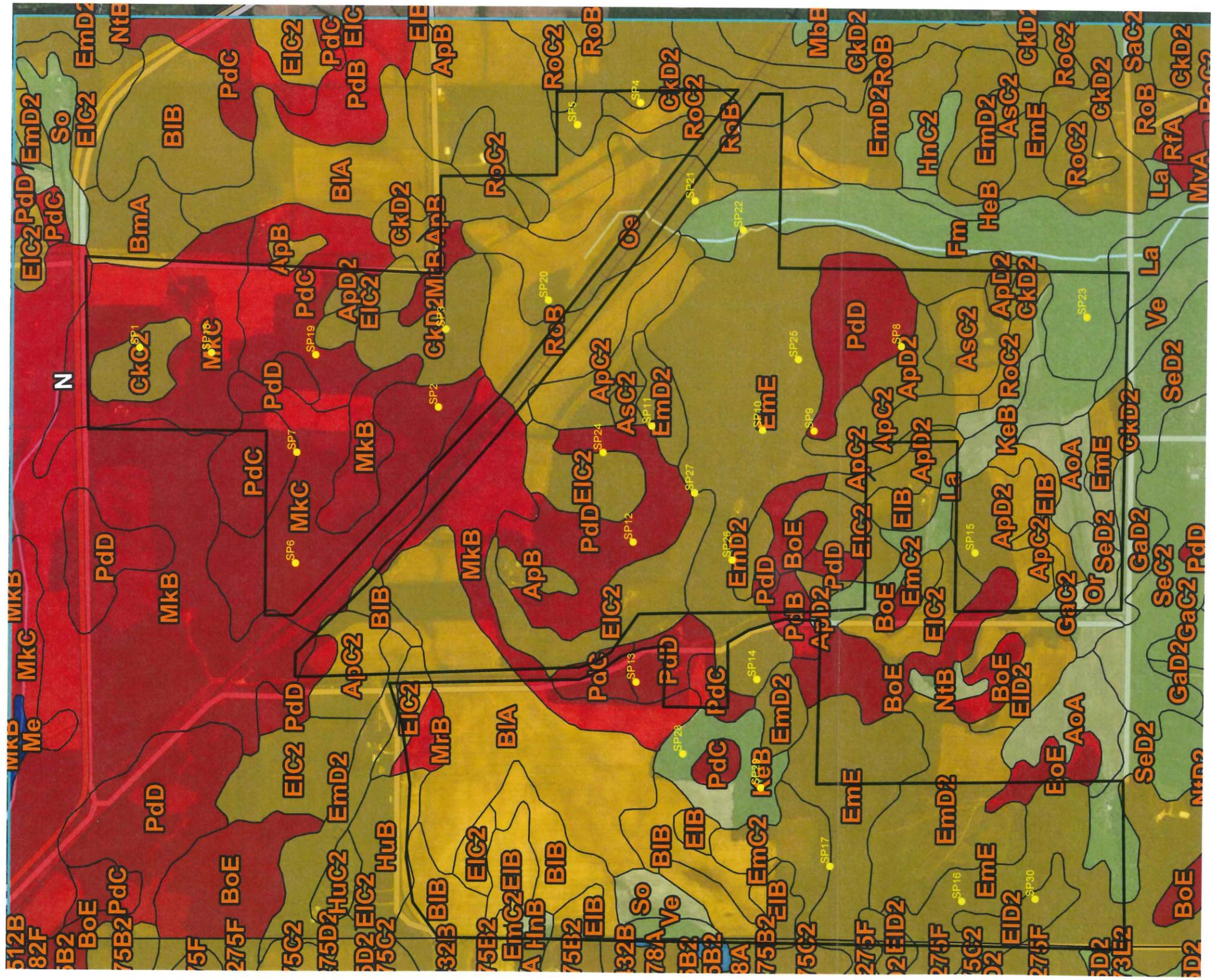
Wetlands &
 Waterways
 LLC

PROJECT NUMBER

378

FIGURE NO.

3



Soil Rating Polygons

- <= 0.12
- > 0.12 and <= 0.18
- > 0.18 and <= 0.23
- > 0.23 and <= 0.29
- > 0.29 and <= 0.40
- Not rated or not available



AVAILABLE WATER CAPACITY
0-30 CM

NORTHERN SANDS WISCONSIN, LLC
PHASE I MINE
CHIPPEWA COUNTY, TOWN OF HOWARD,
WISCONSIN

APPROVED BY: AMK
DRAWN BY: NLB
DATE: 7-2-18
SCALE: 1"=600'

THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF WETLANDS & WATERWAYS LLC. AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS FURNISHED.

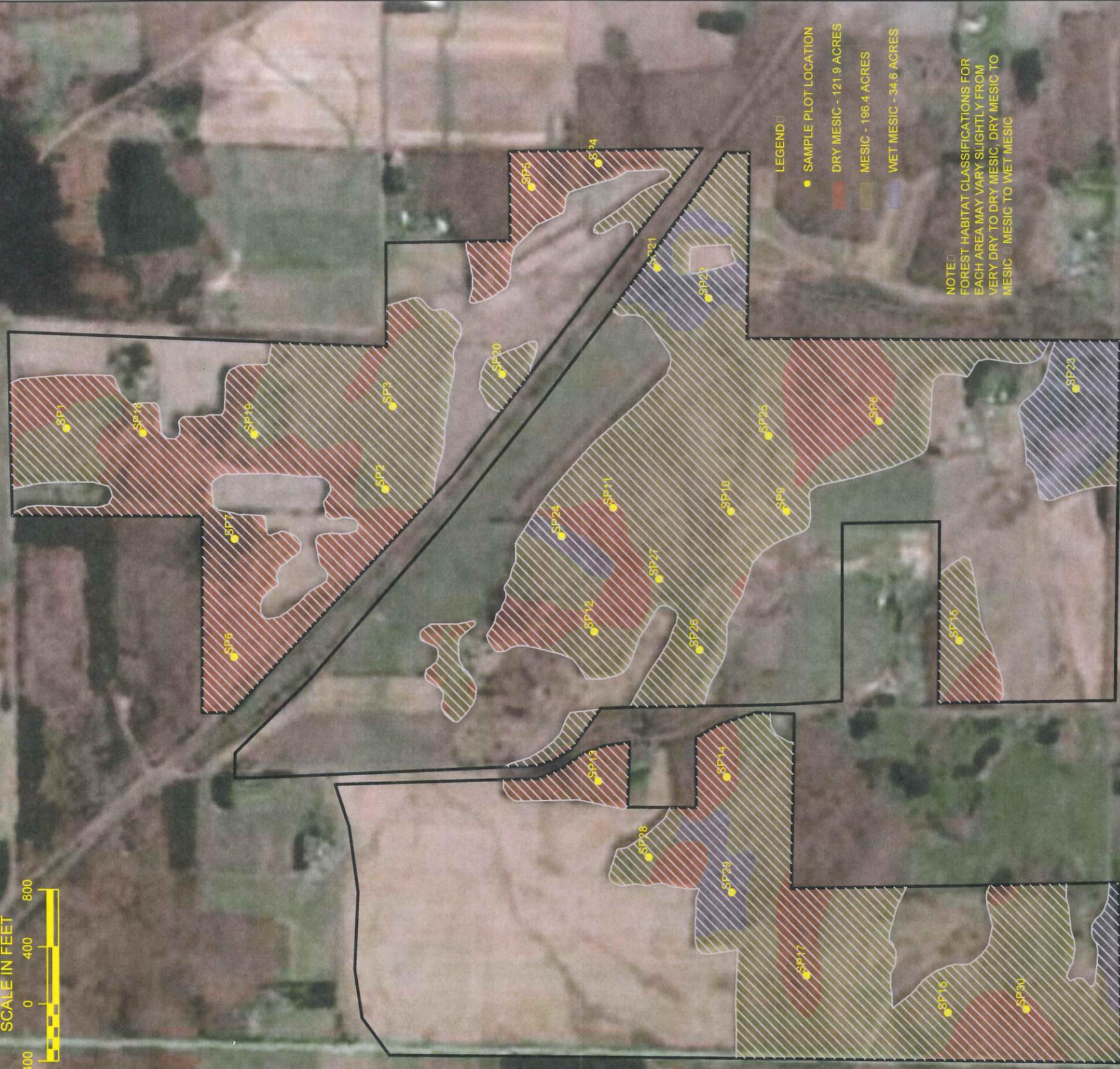


Wetlands &
Waterways
LLC

PROJECT NUMBER:
378

FIGURE NO.

4



- LEGEND**
- SAMPLE PLOT LOCATION
 - DRY MESIC - 121.9 ACRES
 - MESIC - 196.4 ACRES
 - WET MESIC - 34.6 ACRES

NOTE
 FOREST HABITAT CLASSIFICATIONS FOR EACH AREA MAY VARY SLIGHTLY FROM VERY DRY TO DRY MESIC, DRY MESIC TO MESIC, MESIC TO WET MESIC

FOREST HABITAT CLASSIFICATION

NORTHERN SANDS WISCONSIN, LLC
 PHASE I MINE
 CHIPPEWA COUNTY, TOWN OF HOWARD,
 WISCONSIN

APPROVED BY: AMK

DRAWN BY: NLB

DATE: 9-21-18

SCALE: 1"=800'

THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS THE PROPERTY OF WETLANDS & WATERWAYS LLC, AND SHALL NOT BE COPIED OR USED EXCEPT FOR THE PURPOSE FOR WHICH IT IS FURNISHED.



PROJECT NUMBER 378

FIGURE NO.

6

TABLES

Table 2 - Forest Habitat Classification by Vegetation, Available Water Capacity Summary

Sample Plot	Vegetation Survey	Soil Available Water Capacity
1	Mesic	Mesic
2	Mesic	Dry Mesic
3	Mesic	Mesic
4	Dry Mesic	Mesic
5	Dry Mesic	Mesic
6	Very Dry Mesic	Dry Mesic
7	Dry Mesic	Dry Mesic
8	Dry Mesic	Dry Mesic
9	Mesic	Dry Mesic
10	Mesic	Mesic
11	Dry Mesic	Dry Mesic
12	Mesic	Dry Mesic
13	Very Dry Mesic	Dry Mesic
14	Very Dry Mesic	Mesic
15	Mesic	Mesic
16	Mesic	Mesic
17	Dry Mesic	Mesic
18	Very Dry Mesic	Dry Mesic
19	Mesic	Dry Mesic
20	Mesic	Mesic
21	Wet Mesic	Wet Mesic
22	Wet Mesic	Wet Mesic
23	Wet Mesic	Wet Mesic
24	Wet Mesic	Mesic
25	Mesic	Mesic
26	Mesic	Mesic
27	Mesic	Mesic
28	Mesic	Wet Mesic
29	Wet Mesic	Wet Mesic
30	Dry Mesic	Mesic

xxx - Very Dry Mesic Forest

xxx - Dry Mesic Forest

xxx - Mesic Forest

xxx - Wet-Mesic Forest



APPENDIX A – SITE PHOTOS

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 1

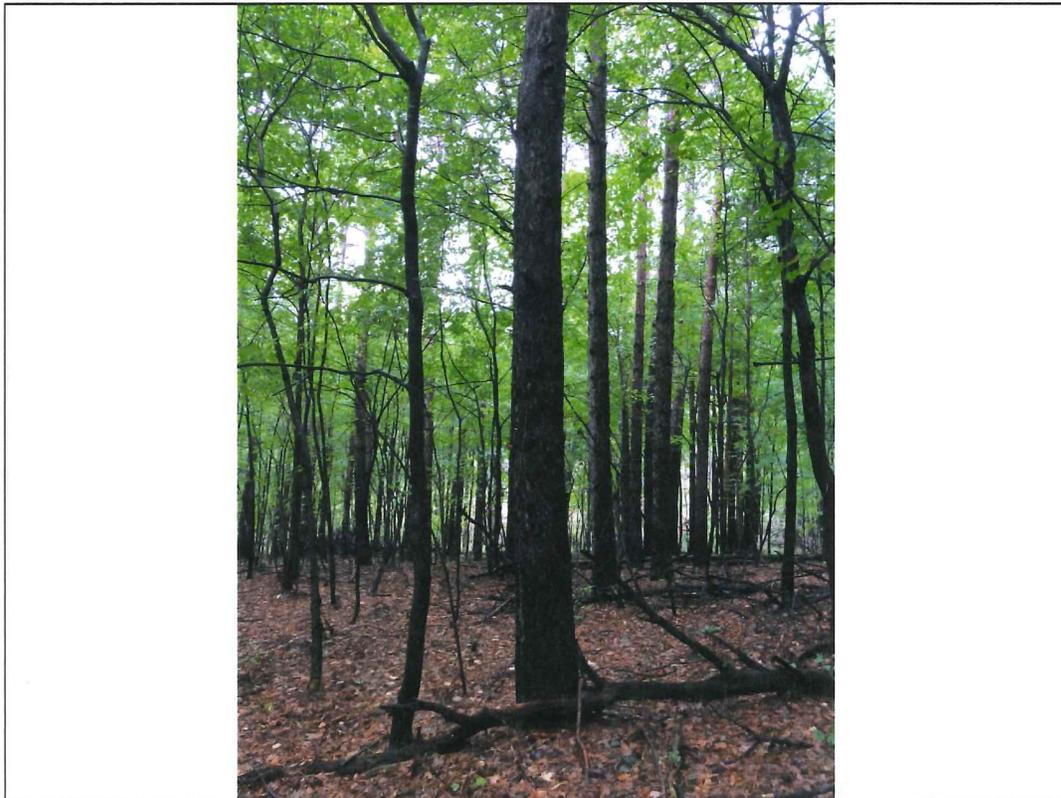


PLOT 2

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 3



PLOT 4

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 5



PLOT 6

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 7



PLOT 8

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 9



PLOT 10

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 11



PLOT 12

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 13



PLOT 14

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 15

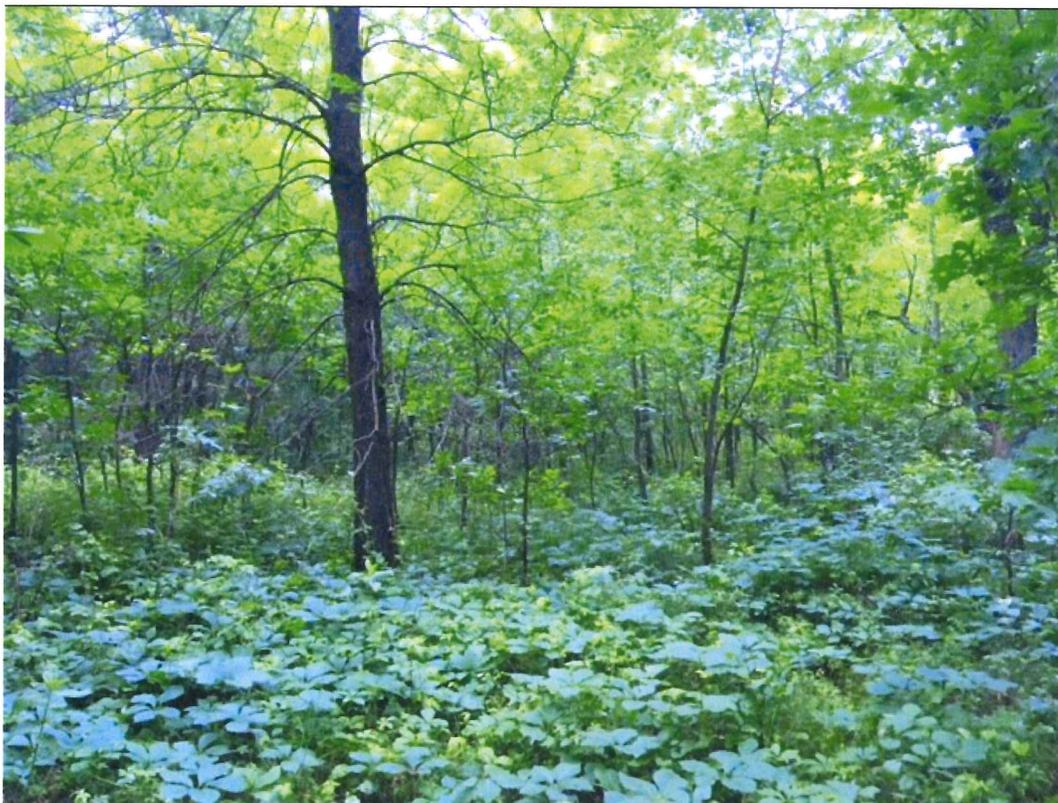


PLOT 16

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 17



PLOT 18

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 19



PLOT 20

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 21



PLOT 22

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 23

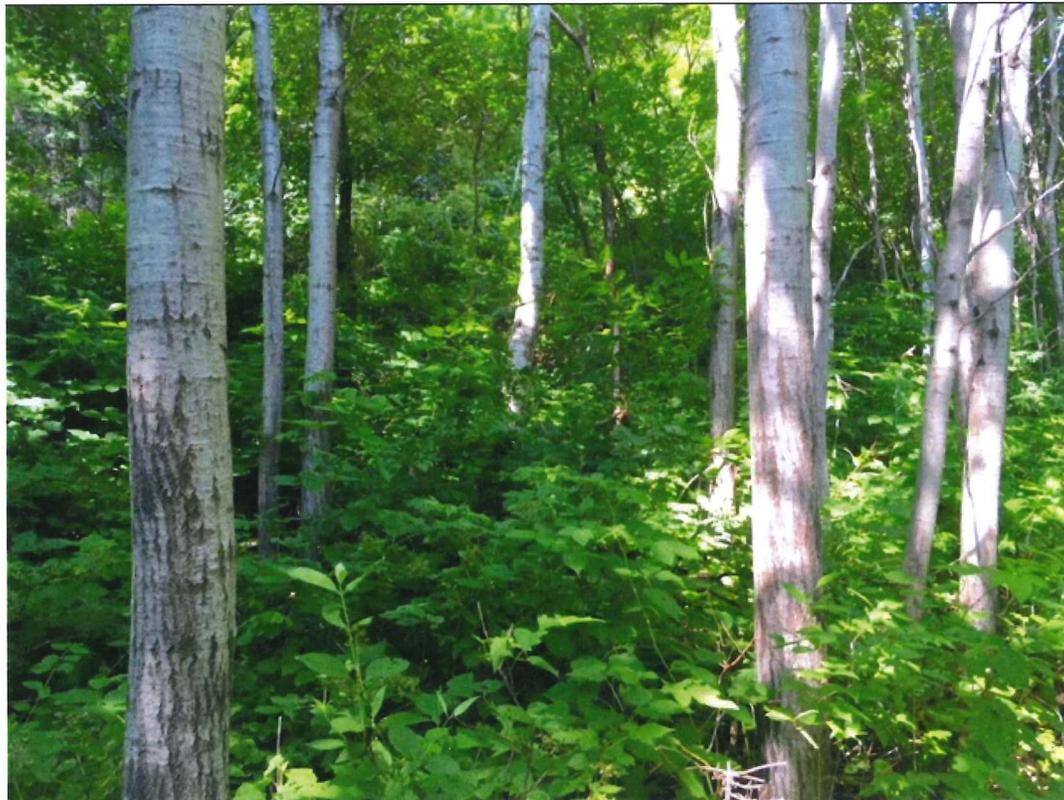


PLOT 24

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 25



PLOT 26

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



PLOT 27



PLOT 28

NORTHERN SANDS WISCONSIN, LLC - PHASE I MINE
FOREST HABITAT CLASSIFICATION SITE PHOTOS



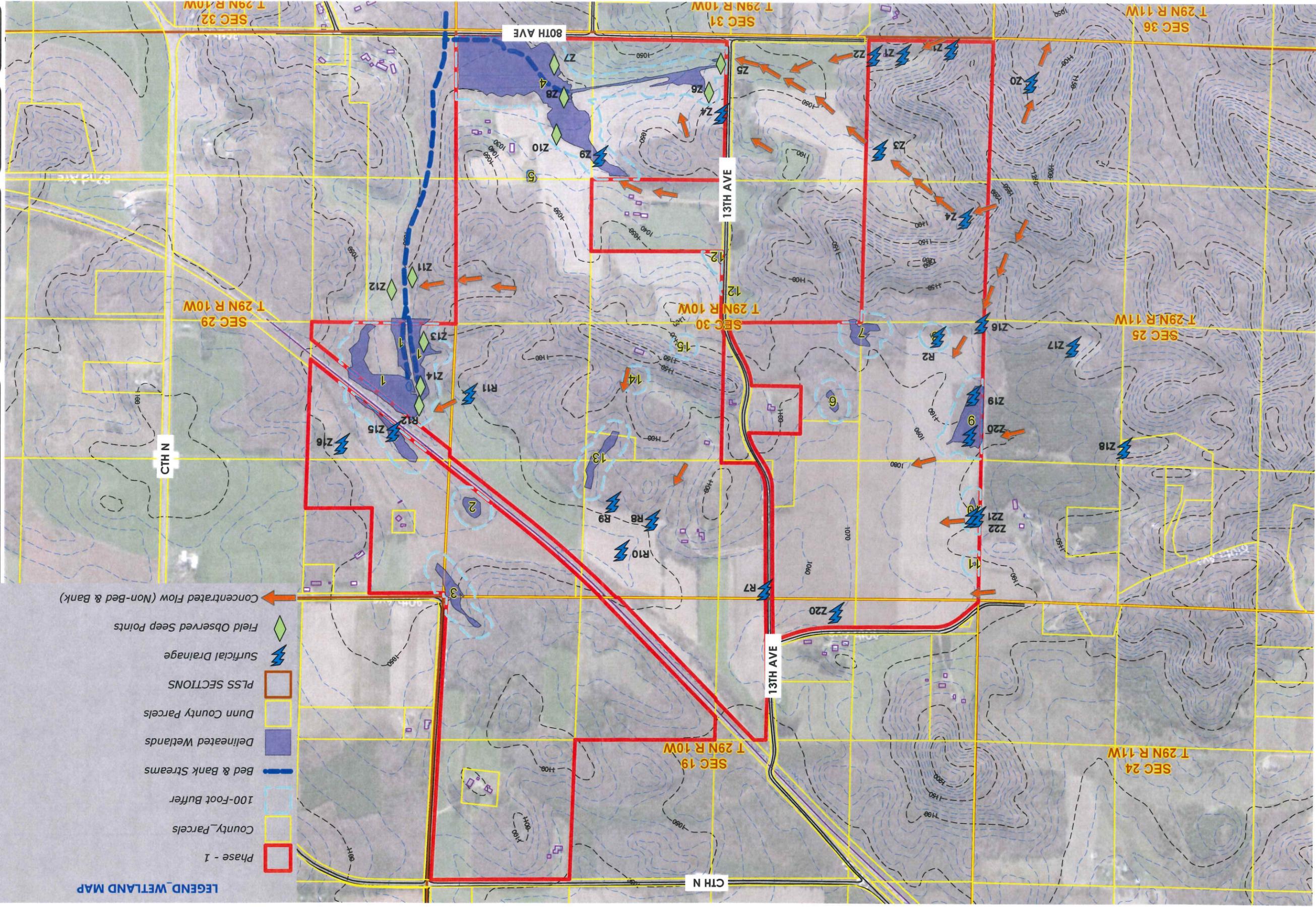
PLOT 29



PLOT 30

Appendix B

Hydrologic and Buffer Map



LEGEND WETLAND MAP

- Phase - 1
- County Parcels
- 100-Foot Buffer
- Bed & Bank Streams
- Delineated Wetlands
- Dunn County Parcels
- PLSS SECTIONS
- ⚡ Surficial Drainage
- ◆ Field Observed Seep Points
- Concentrated Flow (Non-Bed & Bank)

HYDROLOGIC & BUFFER MAP

Northern Sands Wisconsin LLC

Town of Howard
Chippewa County, WI

LONG ISLAND ENGINEERING LLC

201 Maple Ridge - Ashland, WI 54806
715-208-4747
longislandengineeringllc@outlook.com

This document contains confidential or proprietary information of Long Island Engineering, LLC. Neither the document nor the information herein is to be reproduced, distributed, used or retained other than in whole or in part except as specifically authorized by Long Island Engineering, LLC.



REVISIONS	NO	BY	DATE



DRAWN BY	SSR
DATE	9/26/18
FILE NO	01
SHEET NO.	APP-B