

NORTHERN SANDS WISCONSIN MINE – RECLAMATION PLAN SUPPLEMENT

PREPARED FOR:
NORTHERN SANDS WISCONSIN, LLC

IN SUPPORT OF THE CHIPPEWA COUNTY NONMETALIC MINING RECLAMATION
PERMIT

PREPARED BY:
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DECEMBER 14, 2017



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Northern Sands Wisconsin Mine – Reclamation Plan Supplement

A. DESCRIPTION AND PURPOSE

The purpose of this supplement is to provide additional information to fulfill the non-metallic mining reclamation permit conditions of Chippewa County dated August 8, 2016. The permit conditions required additional information be provided regarding the biological assessment, hydrologic and wetland information, and site restoration and vegetative management plan for Phase 1 of the mine. A nutrient management plan for all current phases as required by the County has been previously submitted.

B. BIOLOGICAL ASSESSMENT (EXISTING) – PHASE 1

Several site visits were completed to assess the existing biological communities within Phase 1. Biological communities consist of various types of forested habitat and agricultural uses. The existing forested areas were broadly classified within the Wisconsin Forestry Classification System (WFCS).

Areas classified as Dry per the WFCS classification system represent the driest areas of Phase I. Most Dry areas identified northeast of the railroad are dominated primarily by *Pinus strobus* (Eastern White Pine), while most Dry areas to the southwest of the railroad are dominated primarily by *Quercus rubra* (Northern Red Oak) with some *Pinus strobus*, *Betula papyrifera* (Paper Birch), *Populus grandidentata* (Bigtooth Aspen), and *Acer rubrum* (Red Maple) intermixed. Most of these areas are located on ridges with moderately steep slopes and minimal opportunity for retention of runoff.

Areas classified as Dry-Mesic represent better growth conditions with slightly wetter moisture regimes and are dominated primarily by *Acer rubrum*, *Populus tremula* (Quaking Aspen) and *Betula papyrifera*. Many of these areas appear to have been disturbed by former agricultural or silvicultural activities in the past 20 years but also coincide with topographic positions (swales and foot slopes) which would tend to receive more runoff and therefore, a wetter moisture regime.

Areas classified as Wet Mesic represent the wooded swamps identified during the preliminary wetland evaluation of Phase I. These areas are primarily dominated by *Fraxinus pennsylvanica* (Green Ash), *Fraxinus nigra* (Black Ash) and *Ulmus americana* (American Elm) and are located in the lowest lying positions of the property where significant runoff

accumulates and/or within seepage areas along the side slopes of ridges and swales throughout the property.

A map illustrating the location of general WFCS classifications and areas of agricultural use within Phase 1, are included in this report as **Appendix A**.

C. STREAM, STREAM CORRIDOR, AND WETLAND PROTECTION

C.1 Baseline Hydrologic Inventory - Phase 1

A hydrologic inventory was conducted within Phase I in November, 2017 to determine the pre-mining baseline hydrologic conditions within the property. The inventory was conducted by aerial photo analysis followed by a series of traverses across the property that identified seeps, springs, and surface water drainages as well as an initial assessment of the distribution of geologic features within the property. Each of these features were mapped using a Global Positioning System using the 1983 North American Datum (NAD83).

The following hydrologic features were identified (see figures in Appendix C):

Seeps: a moist or wet place where groundwater reaches the earth's surface from an underground aquifer. In the Phase 1 area, these seeps are interpreted to represent to Wonewoc/Eau Claire Formation boundary.

Springs: defined as places where groundwater is exposed at the earth's surface, flowing naturally from bedrock or soil onto the land surface or into a body of surface water. The key term here is 'flowing'. Springs commonly produce geomorphic artifacts such as rills and gullies. There were no springs encountered in Phase 1.

Surface water drainages: defined as rills and gullies that show evidence of intermittent surface water flow, most commonly during precipitation events or during spring snowmelt runoff.

The following geologic features were identified (see figures in Appendix C):

Quaternary River Falls (CRF) Formation: unconsolidated, poorly sorted clay, silt, sand, gravel and boulders. Occurs at elevations between 1020 to 1080 feet amsl along the margins of modern drainages. Tends to occupy distinct terraces with an average elevation of 1060-1080 feet amsl. The formation forms irregular topography, and its clay-rich nature tends to restrict drainage, leading to intermittent water pondage.

Cambrian Wonewoc (CW) Formation: Tan, fine to medium grained, well sorted quartz arenite. Forms hills and ridges in the project area. Well-drained, and does not pond water. This is the target formation for mining activities.

C.2 Hydrologic Analysis of Impacts – Phase 1

C.2.1 Seeps and Springs

Seeps within the Phase 1 project area are confined to the southern and southeastern portion of the project area, and are hydrologically linked to Wetland 1 (described below, Figure C1). The southernmost seeps (stations 11142-11146) will not be impacted by proposed mining activities. The southeastern seeps (stations 11072-11076) are downgradient from the proposed rail loading area, and are hydrologically linked to Wetland 3 (described below). These seeps will not be directly impacted by construction, and a monitoring well has been installed immediately upgradient from these seeps. These seeps do not directly feed any wetland areas that are not being unavoidably impacted by mining activities, thus there are no secondary wetland impacts resulting from impacts to seeps.

C.2.2 Impacts to Surface Waters

The east end of the proposed rail spur crosses a USGS intermittent stream. A navigability review has not been conducted at this time. A site visit and navigability review with Wisconsin DNR and/or USACE regulators will be completed in 2018. Unavoidable wetland impacts are estimated to total approximately 1.8 acres. Permitting with the USACE and Wisconsin DNR will be required for any proposed wetland impacts pending jurisdictional determinations.

C.2.3 Impacts to Subsurface Hydrology from Mining and Reclamation

During the mining and post-mining phases of the project, the landscape and surfaces will be temporarily and permanently altered. Restoration slopes will generally be less steep across the site and soils will retain their infiltration capacity thus continuing to feed the underlying aquifers and the high-quality resources they ultimately feed. During mining, runoff will be managed within the mine to minimize any temporary hydrologic effects.

C.2.4 Mitigation Recommendations for Hydrologic Impacts

A number of elements essential to preserve and enhance the existing hydrologic condition of the Phase 1 project area are being incorporated into the plans. These include decompaction of reclaimed areas to enhance infiltration, the selection of deep rooted prairie species which tends to develop infiltration capacity in large segments of the restoration, the preservation of surface drainage patterns and divides, and the reduction of average slope on which allows for greater infiltration. In addition, buffers are being established for wetlands and waterways with defined bed and bank outside of areas planned for mining to ensure they are not disturbed and that stable long term vegetation can develop.

Maps and associated spreadsheet identifying seeps, springs, wetlands, and other surface waters is included in this report as **Appendix C**.

C.3 – Wetland and Riparian Corridor Buffers – Phase 1

Wetland and Riparian Corridor Buffers have been added to wetlands and USGS intermittent waterways that are not part of the mine impact area as defined within the mine reclamation plan. Buffers have been established along two USGS waterways. A navigability review has not been conducted at this time. A site visit and navigability review with Wisconsin DNR and/or USACE regulators will be completed in 2018. Buffers for wetlands are 100 feet from the edge of the wetland and 100 feet from stream centerline for waterways with bed and bank. These resource buffer maps are shown along with the wetland characterization locations in **Appendix B**.

C.4 Wetland Inventory – Phase 1

A preliminary assessment of the wetlands located in Phase 1 was completed in late Fall 2016. Available topographic maps, survey maps, WWI maps, Chippewa County Soil Survey maps, Hydric Soil maps and available aerial photos were reviewed prior to visiting the property to identify potential wetland areas. In addition, antecedent precipitation information was evaluated through use of available local WETS data for the three months prior to the evaluation to determine if conditions were within normal, wetter than normal or drier than normal at the time of the site visit.

The field visit consisted of a thorough meander walk-over of the property over the course of several days. Particular attention was given to areas identified as wetlands or wetland indicator soils on the WWI map, as well as topographical areas that would be more likely to support wetland hydrology such as lower-lying areas, swales and seepage areas. The determination of potential wetlands and boundaries was based on observations of vegetation, surficial hydrology indicators and topographic position. Areas with a dominance of Obligate (OBL), Facultative Wet (FACW) and Facultative (FAC) vegetation species, which are indicators of wetland conditions, along with surficial hydrology indicators such as standing water, saturated soil, water-stained leaves, drainage patterns, geomorphic position and/or microtopographic relief, were in most cases identified as wetlands. In addition, identification of wetness signatures in cropped areas through review of aerial photos were also identified as wetlands if wetness signatures occurred at least 50% of normal precipitation years. All available information along with best professional judgment was used to identify suspected wetlands and approximate wetland boundaries.

Identified wetland boundaries were mapped with a Geo7X Series sub-meter Global Positioning System and maps illustrating wetland overview assessment are located in **Appendix C**. In addition, wetland community types were documented during the preliminary evaluation.

Results of the preliminary wetland evaluation are discussed below but it should be noted this study was conducted outside of the growing season and was limited in scope, data collection and detail in comparison to official wetland delineation. An official wetland delineation study will be conducted within the 2018 growing season and results may vary slightly from those of the preliminary evaluation. The official study will be conducted per requirements outlined in the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987) and the Northcentral and Northeast Regional Supplement. During the official wetland delineation study, vegetation, hydrology and soils will be thoroughly evaluated and the hydric soil component will be evaluated based on the Natural Resources Conservation Service (NRCS) Field Indicators of Hydric Soils in the United States Guide.

Preliminary Wetland Evaluation Results

Thirteen wetlands were identified and mapped during the preliminary assessment. Wetland community types, topographic position, quality, acreage and other features are discussed below;

Wetland 1 – This wetland community is approximately 17 acres and is the largest wetland community identified during the preliminary assessment of Phase I. This wetland is located on the far southern portion of the property in a low-lying swale with an extension of the

wetland to the west consisting of a man-made ditch, likely intended to drain the larger wetland complex to the east.

Wetland 1 is identified on the WWI maps with the eastern portion identified as a large (> 2 acres) wetland complex, the western portion of the wetland identified as an intermittent, unnamed waterway and a small (< 2 acres) wetland identified in the widest portion of Wetland 1 along the north side of the swale. The entire eastern portion of Wetland 1, as well as the far western portion of the west swale, are identified as having wetland indicator soils. Based on information provided on the WWI map, this wetland is connected to Wetlands 3 and 4 to the north.

Based on observations made during the site visit, Wetland 1 is classified as the following wetland communities or a combination thereof per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

S3K – Scrub/Shrub, Broad-Leaved Deciduous, Wet Soil, Palustrine

The forested and shrub-scrub portions of this wetland in the southeast are of moderately high quality although with a high density of the invasive species Reed Canary Grass in the understory. Other portions of this wetland comprised of wet meadow communities are of low to medium quality due to the dominance of invasive species and agricultural activities that have in the past or continue to degrade these communities.

The southeastern forested portion of this wetland had standing water at the time of the site visit. However, the climatic conditions were considered to be exceptionally wet at the time of the site visit so this may not be the typical hydrology of this wetland complex. Areas further north and west displayed other hydrology indicators such as saturation and geomorphic position but did not have standing water present at the time of the site visit.

The 1938 aerial photo indicates this wetland and surrounding areas were of similar condition and land use at that time although a portion of the aerial was not available for the southernmost portion of this wetland.

Wetland 2 – This wetland community is approximately 0.16 acres and is comprised of a man-made open-water pond in the southern portion of the property. This wetland is mostly comprised of open water but with hydrophytic vegetation along the shallower outside edges. This wetland is located on the far southern portion of the property on the footslope of a ridge that rises abruptly to the east/northeast.

Wetland 2 is identified on the WWI maps as a small (< 2 acres) wetland and also as having wetland indicator soils.

Based on observations made during the site visit, Wetland 2 is classified as the following wetland community per the WDNR WWI Classification System:

E2H – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Standing Water, Palustrine

This wetland is of low quality although with the dominant vegetation being Cattail, an invasive species. This wetland may also qualify for a WDNR exemption if documentation can be provided to confirm the pond was constructed in upland.

Wetland 3 – This wetland community is approximately 4.5 acres and is located in a low-lying swale at the toeslope of a large forested ridge to the west. This wetland is located along the eastern portion of the property, just south/southwest of the existing rail. This wetland community is in relatively undisturbed condition today but several indications of historic alterations were observed. A historic fill road runs down the center of this wetland and can be seen clearly on the 1938 aerial photo. Other fill areas and culverts were also observed within and adjacent to this wetland.

Wetland 3 is identified on the WWI maps as a large (> 2 acres) forested wetland complex with an unnamed intermittent stream identified as running north-south through the wetland. Wetland 3, as well as a larger surrounding area is also identified as having wetland indicator soils. Based on the WWI maps, this wetland is connected to Wetland 1 to the south and Wetland 4 to the north.

Based on observations made during the site visit, Wetland 3 is classified as the following wetland communities or a combination thereof per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

S3K – Scrub/Shrub, Broad-Leaved Deciduous, Wet Soil, Palustrine

The forested and shrub-scrub portions of this wetland in the southeast are of moderately high to high quality although an evaluation during growing season may identify invasive species that result in a lower quality classification. This wetland community had standing water in lower lying areas that appear to have been ditched at one time. The western edge is evidently a seep location with wet, mucky soils identified along the base of a steep ridge. Areas to the north were dry at the time of the site visit but with evident scouring and drainage patterns from recent precipitation events.

The 1938 aerial photo indicates this area consisted of a combination of cropland (to the north and east) and forested lands to the west with some recent timber harvest at that time.

Wetland 4 – This wetland community is approximately 0.9 acres and is located on the north/northeast side of the existing rail in the eastern portion of the property. A culvert was observed between Wetland 3 and 4, indicating that prior to construction of the railroad these areas were likely one larger wetland complex.

Wetland 4 is identified on the WWI maps as a large (> 2 acres) forested wetland complex with an unnamed intermittent stream identified as running north-south through the wetland and appearing to be connected to Wetland 3 to the south, and ultimately to Wetland 1 on the far south end of the property. Wetland 3, as well as a larger surrounding area is also identified as having wetland indicator soils.

Based on observations made during the site visit, Wetland 4 is classified as the following wetland communities or a combination thereof per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

S3K – Scrub/Shrub, Broad-Leaved Deciduous, Wet Soil, Palustrine

The forested and shrub-scrub portions of this wetland are of moderately high quality although an evaluation during growing season may identify invasive species that result in a lower quality classification.

No standing water or flow between wetlands was observed and the culvert appears to be elevated above the wetland bed, thereby indicating these wetlands may no longer be hydrologically connected. Therefore, this wetland was considered a separate community from Wetland 3. This community was rather dry at the time of the site visit but hydrology indicators observed included water-stained leaves and geomorphic position. The 1938 aerial photo indicates this area was farmed at that time and what appear to be wetness signatures are present in this area on that aerial photo.

Wetland 5 – This wetland community is approximately 0.7 acres and is located on the north/northeast side of the existing rail in the eastern portion of the property. This wetland is located in a shallow depression with a very gradual transition from upland to wetland.

Wetland 5 is identified on the WWI maps as a large (> 2 acres) forested wetland complex with wetland indicator soils coinciding with the mapped wetland as well as a larger area of indicator soils to the north and south.

Based on observations made during the site visit, Wetland 5 is classified as the following wetland community per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

The forested and shrub-scrub portions of this wetland are of moderately high quality although an evaluation during growing season may identify invasive species that result in a lower quality classification.

This wetland community was very dry and minimal hydrology indicators were observed although tufts of hydrophytic sedge species were observed throughout, indicating wetland hydrology is present for at least part of the growing season. Hydrology indicators observed included water-stained leaves and geomorphic position. The 1938 aerial photo indicates this area was farmed at that time and what appear to be wetness signatures are present in this area on that aerial photo.

Wetland 6 – This wetland community is approximately 0.6 acres and is located in a sloping forested swale along the far eastern portion of the property. This wetland receives concentrated runoff from adjacent ridges and retains perched water in clay rich soils.

Wetland 6 is not identified on the WWI map but is identified as having wetland indicator soils.

Based on observations made during the site visit, Wetland 6 is classified as the following wetland community per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

This wetland is of high quality with virtually no disturbances observed. A 4-wheeler trail passes through the central portion of the two mapped wetland areas but it is assumed that the areas are hydrologically connected and due to proximity were considered to be one community.

Hydrology indicators in this wetland community varied but consisted primarily of water-stained leaves and saturated, mucky soils where perching of runoff and precipitation occurs. The 1938 aerial photo indicates this area is in the same forested state and land use as it was at that point in time.

Wetland 7 – This wetland community is approximately 0.4 acres and is located in a sloping forested swale in the central portion of the property. This wetland receives concentrated runoff from adjacent ridges and retains perched water in clay rich soils.

Wetland 7 is identified on the WWI map as a small (< 2 acres) wetland and also as having wetland indicator soils.

Based on observations made during the site visit, Wetland 7 is classified as the following wetland communities, or a combination thereof, per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

S3K – Scrub/Shrub, Broad-Leaved Deciduous, Wet Soil, Palustrine

This wetland is of moderate quality with a dominance of Aspen, which is not invasive but also not considered to have high floristic quality. Although virtually no disturbances were observed, the presence of aspen as the dominant species indicates the area was likely logged in the past 10 to 20 years.

This wetland is mapped as a series of 3 wetlands but observations of flow patterns and soil scouring were observed throughout, indicating the 3 areas are hydrologically connected. Therefore, the 3 areas are considered to be the same community. Hydrology indicators in this wetland community consisted primarily of water-stained leaves, drainage patterns and geomorphic position. This wetland likely receives hydrology from runoff of the adjacent surrounding ridges and retains surface water due to less permeable clay soils. The 1938 aerial photo indicates this area was not as heavily forested at that time and was likely used for grazing of livestock.

Wetland 8 – This wetland community is approximately 0.1 acres and is located in a low-lying swale on the east side of and immediately adjacent to Frazier Road. This wetland appears to be a man-made ditch.

Wetland 8 is not identified on the WWI map and no wetland indicator soils are identified in this area. However, the WWI map and soil survey do not typically map areas this small and rather consider them as minor inclusions.

Based on observations made during the site visit, Wetland 8 is classified as the following wetland community per the WDNR WWI Classification System:

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

This wetland is of low to moderate quality with limited functional value and/or connectivity to other wetland communities.

Hydrology indicators in this wetland community consisted primarily of geomorphic position. Further evaluation of soils during the growing season may determine this area does not fully meet the requirements of a wetland community. This wetland likely receives minimal hydrology from runoff since it appears to be separated from the adjacent slopes and ridges to the west by the current road. The 1938 aerial photo indicates this area was cleared and farmed at that time.

Wetland 9 – This wetland community is approximately 0.1 acres and is located in a low-lying depression on the west side of and immediately adjacent to Frazier Road. This wetland appears to be a natural wetland community at the footslope of a large forested ridge.

Wetland 9 is not identified on the WWI map and no wetland indicator soils are identified in this area. However, the WWI map and soil survey do not typically map areas this small and rather consider them as minor inclusions.

Based on observations made during the site visit, Wetland 9 is classified as the following wetland community per the WDNR WWI Classification System:

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

This wetland is of moderate quality. Although connectivity to other wetland communities was not observed, this wetland was likely connected to Wetland 8 at one time and Wetland 8 may have been specifically excavated to drain Wetland 9 at one time. Vegetation within Wetland 9 seems to be of moderate floristic quality.

Hydrology indicators in this wetland community consisted primarily of geomorphic position and saturated soils. The 1938 aerial photo indicates this area was cleared and farmed at that time although the area is too small to be evaluated for possible wetness signatures.

Wetland 10 – This wetland community is approximately 1.2 acres and is located in the western portion of the property at the toe of slope of a large forested ridge located to the south.

Wetland 10 is not identified on the WWI map but is identified as having wetland indicator soils.

Based on observations made during the site visit, Wetland 10 is classified as the following wetland communities, or a combination thereof, per the WDNR WWI Classification System:

T3K – Forested, Broad-Leaved Deciduous, Wet Soil, Palustrine

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

This wetland community is of moderate quality. Although invasive species were not specifically noted, the species that are present are of lower floristic quality than many wetland species.

The hydrology throughout this wetland community was quite variable with dryer areas displaying hydrology indicators and then saturation, mucky soils in other areas. An area of standing water, possibly an attempt at a man-made pond, had standing water and may result in lateral effect drainage of adjacent areas to some extent. The southern edges of the wetland located along the base of a large ridge appear to be seepage areas with saturated mucky soils observed in those areas.

This wetland and surrounding areas displayed some historic disturbances including ditches and other excavation areas, berms and/or forest roads. The 1938 aerial photo indicates this area was forested and in a relatively undisturbed state at that time. However, aerial photos from the early 1990's indicate the area may have been partially cleared with possible intentions of farming it at one time.

Wetland 11 – This wetland community is approximately 2.4 acres and is located on the far west side of the property. This wetland is located in a shallow, sloped swale with corn crops surrounding it at the time of the visit.

Wetland 11 is identified on the WWI map as two small (< 2 acres) wetlands with a larger area surrounding both wetlands identified as having wetland indicator soils.

Based on observations made during the site visit, Wetland 11 is classified as the following wetland communities, or a combination thereof, per the WDNR WWI Classification System:

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

S3K – Scrub/Shrub, Broad-Leaved Deciduous, Wet Soil, Palustrine

This wetland is of low to medium quality with degradation having occurred from many years of agricultural activities in this area.

This area appears to have some soil compaction and/or clay or silt lenses that likely perch water from runoff and precipitation, thereby contributing to the hydrology of the wetland. Saturated soils and geomorphic position were the most evident hydrology indicators observed but the lack of crops along with rutting from farm equipment around the wetland edges are also good indicators of wet conditions. The 1938 aerial photo indicates this area was farmed at that time and what appears to be a small uncropped patch of field or crop stress is identified on that aerial photo.

Wetland 12 – This wetland community is approximately 0.3 acres and is located on the far west side of the property. This wetland is located in a shallow, swale with corn crops surrounding it at the time of the visit.

Wetland 12 is not identified on the WWI map as a wetland but a small (< 2 acres) wetland is mapped immediately to the west. Areas immediately west are mapped as having wetland indicator soils with an abrupt boundary located along the property line. This is typically an indication of a prior converted wetland community. For any purpose other than agriculture, this area would be considered wetland if it meets wetland criteria.

Based on observations made during the site visit, Wetland 12 is classified as the following wetland community per the WDNR WWI Classification System:

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

This wetland is of low to medium quality with degradation having occurred from many years of agricultural activities in this area.

This area appears to have some soil compaction and/or clay or silt lenses that likely perch water from runoff and precipitation, thereby contributing to the hydrology of the wetland. Saturated soils and geomorphic position were the most evident hydrology indicators observed but the lack of crops along with rutting from farm equipment in this area are also good indicators of wet conditions. The 1938 aerial photo indicates this area was farmed at that time and what appears to be a small uncropped patch of field or crop stress is identified on that aerial photo.

Wetland 13 – This wetland community is approximately 0.2 acres and is located in the northern portion of the property on the on the west side of Frazier Road. This wetland is located in a shallow, depression with corn crops planted within and surrounding it at the time of the visit.

Wetland 13 is not identified as a wetland on the WWI map, nor is it identified as having wetland indicator soils. However, the WWI map and soil survey do not typically map areas this small and rather consider them as minor inclusions.

Based on observations made during the site visit, Wetland 13 is classified as the following wetland communities, or a combination thereof, per the WDNR WWI Classification System:

E2K – Emergent/Wet-Meadow, Narrow-Leaved Persistent, Wet Soil, Palustrine

This wetland is of low quality with degradation having occurred from many years of agricultural activities in this area.

This area appears to have some soil compaction and/or clay or silt lenses that likely perch water from runoff and precipitation, thereby contributing to the hydrology of the wetland. Standing water, saturated soils and geomorphic position were the most evident hydrology indicators observed but the crop stress along with rutting from farm equipment in this area are also good indicators of wet conditions. The 1938 aerial photo does not indicate any wetness

indicators or crop stress in this area although the area is relatively small and difficult to evaluate through aerial photo review.

Maps illustrating wetland overview assessment are located in **Appendix B**.

D. SITE RESTORATION AND VEGETATIVE MANAGEMENT PLAN

Two major plant communities have been selected for reclamation revegetation within the reclamation area. The primary plant community is prairie grassland and accounts for 85% of the mine area. The second major community is woodland. Within the entire mine site, there are three plant communities that are proposed to make up the different woodlands. They are jack pine, oak savanna, and dry mesic woodlands.

For Phase 1, the woodland community is entirely dry mesic woodlands with the remainder being dry to dry mesic prairie. Vegetation management plans the Phase 1 plant communities have been completed as standalone documents. The documents provide instruction on how prepare the site, when and how to install the seed, and management recommendations for the long-term success of the plant communities. The documents also contain alternate seed mixes that may be used during planting. Since availability of specific seeds can vary from year to year, the precise mix will be determined immediately prior to restoration.

The standalone revegetation plans for Phase 1 are included as **Appendix D**.

E. SUMMARY

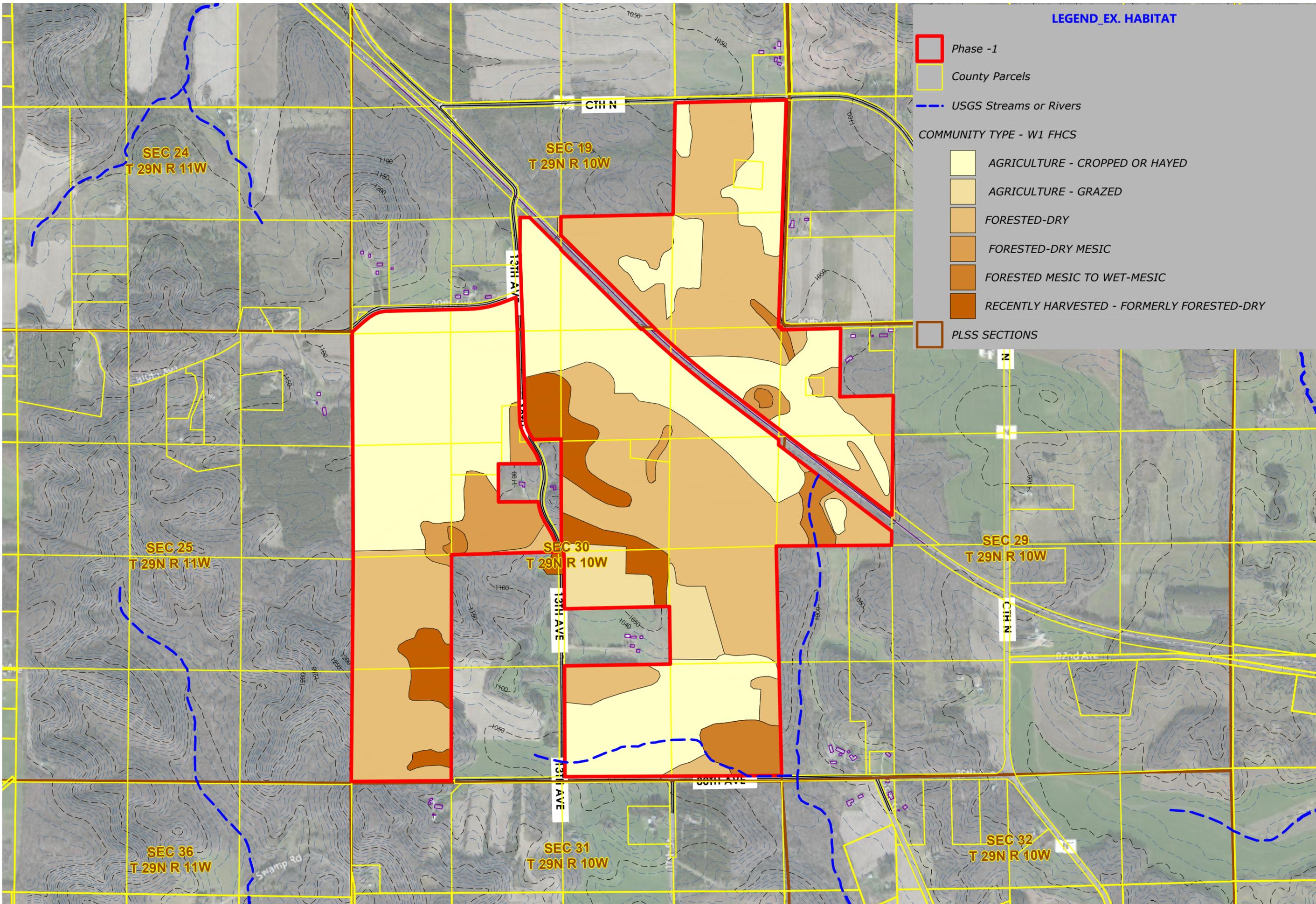
This supplement provides additional information to satisfy the non-metallic mining reclamation permit conditions of Chippewa County dated August 8, 2016.

Future work includes the in-season wetland delineations, stream navigability determinations, and monitoring well data collection. Once in-season wetland delineations have been completed during the 2018 growing season, this information will be submitted to supplement the 2017 Phase 1 wetland characterizations and mapping contained in this report.

As more data becomes available from the installed monitoring wells updated ground water figures and analysis information will be provided to the County for their records.

Appendix A

Existing Habitat Classification Map



LEGEND_EX. HABITAT

- Phase -1
 - County Parcels
 - USGS Streams or Rivers
- COMMUNITY TYPE - W1 FHCS
- AGRICULTURE - CROPPED OR HAYED
 - AGRICULTURE - GRAZED
 - FORESTED-DRY
 - FORESTED-DRY MESIC
 - FORESTED MESIC TO WET-MESIC
 - RECENTLY HARVESTED - FORMERLY FORESTED-DRY
- PLSS SECTIONS



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EXISTING HABITAT CLASSIFICATION MAP
Northern Sands Wisconsin LLC
 Town of Howard
 Chippewa County, WI

REVISIONS	NO.	BY	DATE



DRAWN BY: SSR
 DATE: 12/14/17
 FILE NO.: Q1
 SHEET NO.: **APP-A**

Appendix B

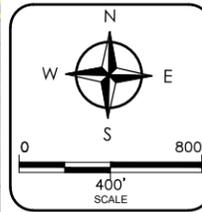
Preliminary Wetland Mapping & Wetland and Waterway Buffers



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

PRELIMINARY WETLAND MAP
 Northern Sands Wisconsin LLC
 Town of Howard
 Chippewa County, WI

REVISONS	NO.	BY	DATE



DRAWN BY: SSR
 DATE: 12/14/17
 FILE NO.: Q1
 SHEET NO.:

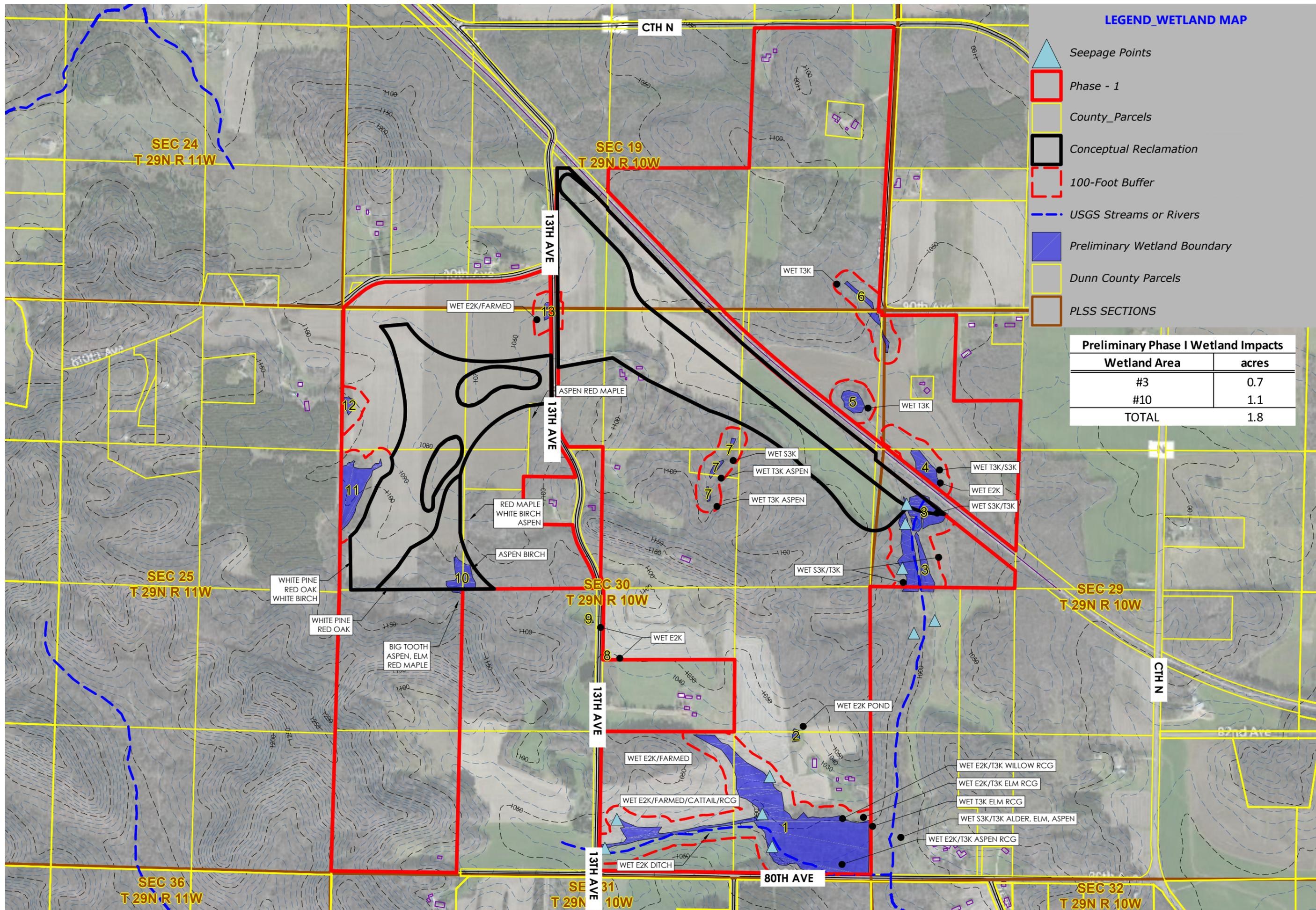
APP-B

LEGEND_WETLAND MAP

- Seepage Points
- Phase - 1
- County_Parcels
- Conceptual Reclamation
- 100-Foot Buffer
- USGS Streams or Rivers
- Preliminary Wetland Boundary
- Dunn County Parcels
- PLSS SECTIONS

Preliminary Phase I Wetland Impacts

Wetland Area	acres
#3	0.7
#10	1.1
TOTAL	1.8



SEC 24
T 29N R 11W

SEC 19
T 29N R 10W

SEC 25
T 29N R 11W

SEC 30
T 29N R 10W

SEC 29
T 29N R 10W

SEC 36
T 29N R 11W

SEC 31
T 29N R 10W

SEC 32
T 29N R 10W

WET E2K/FARMED

ASPEN RED MAPLE

RED MAPLE
WHITE BIRCH
ASPEN

ASPEN BIRCH

WHITE PINE
RED OAK
WHITE BIRCH

WHITE PINE
RED OAK

BIG TOOTH
ASPEN, ELM
RED MAPLE

WET E2K

WET E2K/FARMED

WET E2K/FARMED/CATTAIL/RCG

WET E2K DITCH

WET S3K

WET T3K ASPEN

WET T3K ASPEN

WET S3K/T3K

WET E2K POND

WET E2K/T3K WILLOW RCG

WET E2K/T3K ELM RCG

WET T3K ELM RCG

WET S3K/T3K ALDER, ELM, ASPEN

WET E2K/T3K ASPEN RCG

WET T3K

WET T3K

WET T3K/S3K

WET E2K

WET S3K/T3K

13TH AVE

13TH AVE

13TH AVE

13TH AVE

CTH N

CTH N

80TH AVE

82nd Ave

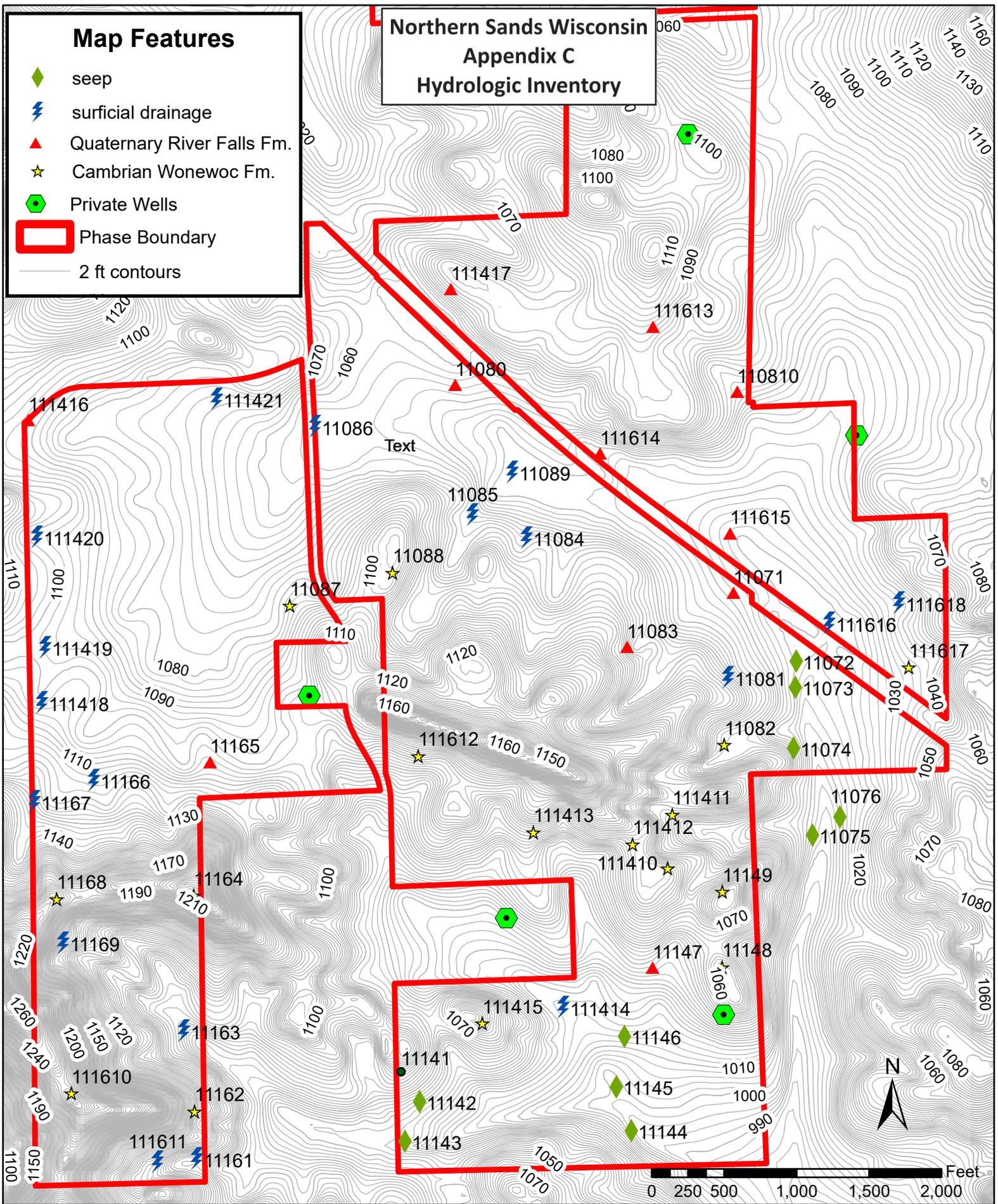
Appendix C

Hydrologic Mapping and Spreadsheet

Northern Sands Wisconsin Appendix C Hydrologic Inventory

Map Features

-  seep
-  surficial drainage
-  Quaternary River Falls Fm.
-  Cambrian Wonewoc Fm.
-  Private Wells
-  Phase Boundary
-  2 ft contours



11165	Qrf	44.9654218977089	-91.6460577172131		
11166	surf_drainage	44.9651068979646	-91.6491627163522		
11167	surf_drainage	44.9647248981285	-91.6507527159407		
11168	Cw	44.9628788983671	-91.6502077163454		
11169	surf_drainage	44.9620398984818	-91.6500527165024		
110810	Qrf	44.9722518957343	-91.6318327204394		
111410	Cw	44.9632638972138	-91.633902721036		
111411	Cw	44.9642788970523	-91.6337527209443		
111412	Cw	44.9637318972061	-91.6348267207048		
111413	Cw	44.9639888973452	-91.6374667199027		
111414	surf_drainage	44.9606658977921	-91.6367427205563		
111415	Cw	44.9603878979795	-91.6389127199623		
111416	Qrf	44.9719418970525	-91.6507527149778		
111417	Qrf	44.9742848959417	-91.6394277179589		
111418	surf_drainage	44.9665922460001	-91.650513439		
111419	surf_drainage	44.9676351370001	-91.650400217		
111420	surf_drainage	44.9697255620001	-91.6505667659999		
111421	surf_drainage	44.97227867	-91.6457131769999		
111610	Cw	44.9591978988956	-91.649902716925		
111611	surf_drainage	44.9578718989408	-91.6476327177619		
111612	Cw	44.9654648973291	-91.6405027188229		
111613	Qrf	44.9735118956956	-91.6340527196255		
111614	Qrf	44.9711258961502	-91.6355227195163		
111615	Qrf	44.9695768961503	-91.632087720722		
111616	surf_drainage	44.9678488962326	-91.6294787217114		
111617	Cw	44.9669798962214	-91.627382722437		
111618	surf_drainage	44.9682078960537	-91.6276127222063		

Appendix D

Grass Prairie Revegetation Plan

Dry to Dry Mesic Woodland Revegetation Plan

NORTHERN SANDS WISCONSIN MINE – GRASS PRAIRIE REVEGETATION PLAN – PHASE 1

PREPARED FOR:
NORTHERN SANDS WISCONSIN, LLC

IN SUPPORT OF THE CHIPPEWA COUNTY NONMETALIC MINING RECLAMATION
PERMIT

PREPARED BY:
WESLIE ENGINEERING GROUP

DECEMBER 14, 2017



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Appendix A – Alternate Grass Prairie Seed Mixes

Northern Sands Wisconsin Mine – Grass Prairie Revegetation Plan – Phase 1

1. PURPOSE

The purpose of this plan is to provide detailed information in preparing, establishing, maintaining, and monitoring the creation of a grass prairie following reclamation of the Northern Sands Wisconsin Mine site. This standalone plan was produced utilizing information from the Applied Ecological Services report dated 11-10-2015 (revised 11-17-2015) which was previously submitted as a supplement to the mine reclamation plan.

2. SITE PREPARATION AND INSTALLATION

Ensure subsoil and topsoil replacement is distributed in a quantity sufficient to meet standards and criteria set forth in this document. The area will be ripped to a depth of 24 inches to alleviate compaction and the potential for shearing. In areas designated for native seed and tree mixes the finished graded surface will be disked with an agricultural disc to at least 4 inches and dragged.

If conditions are such that, by reason of drought, excessive moisture, or other factors, satisfactory results are not likely to be obtained, stop work and resume when directed. Excess undulation or irregularities in the surface will interfere with operations or maintenance. If such areas are observed these will be leveled before the next specified operation. In areas with a slope greater than 10:1, ensure that disc tracks run parallel to the dominate grade; minimize rilling.

3. SEED CERTIFICATION AND SOURCE

Each grass-seed mono-stand or mixture list will be provided stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

All grass species will be supplied as pure live seed. Submit Lab germination test results for all grass species. For species that are not typically tested, submit an affidavit that describes estimated purity.

Seed will be native to northern Wisconsin regime, preferably from within a 150-mile radius of the project site unless approved otherwise. Inert material, such as sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed is recommended.

Provide a fresh clean crop of the species and proportions as specified. All legumes will be inoculated with proper rhizobia at the appropriate time for planting. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence.

4. SEED MIX, INSTALLATION, AND DATES

Seed and woody material should be installed during one of the following periods:

1. Spring Planting: Between February 15 and June 15.
2. Fall Planting: Between September 15 and December 15.

After soil replacement in mined areas to be restored to prairie, there may be a need for an herbicide application to prepare the site for seeding. A non-selective herbicide such as roundup can be applied at a rate specified on the label. Wait two weeks (14 days) before conducting seeding after a site preparation herbicide application.

Prairie sites will be seeded with a minimum of 25 native species, of which a minimum of 4 will be native grasses (Table 3). Install seed at a rate of 15 lbs of grasses/acre and 4 lbs of forbs/acre. In the event that seed is unavailable, reasonable approved ecologically sound substitutes will be accepted.

Install all seed with a rangeland type grain drill or no-till planter, such as by Truax, or equivalent where conditions allow. In all other areas broadcast seed into a lightly tilled soil surface. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Roll seeded areas with a cultipack roller.

If soil is too wet or grade is too steep to install seed, seed using a mechanical broadcast seeder, such as by Cyclone seeder. Hand broadcasting of seed may also be employed. Roll or drag broadcast seeded areas will be perpendicular to the slope within 24 hours, or as soon as site conditions allow.

A cover crop of winter rye (*Secale cereal*) will be applied in all native seed mix areas during seeding application at a rate of 30 lbs/acre during dormant seeding in fall. Spring seeding cover crop will consist of 30 lbs/acre of oats (*Avena sativa*) and/or annual rye (*Lolium multiflorum*).

Acceptable species for seeding in prairie restoration areas at the Northern Sands Wisconsin nonmetallic mine site are shown below.

C	SCIENTIFIC NAME	COMMON NAME	PHYSIOG.
7	<i>Amorpha canescens</i>	Leadplant	Nt SHRUB
4	<i>Andropogon gerardii</i>	Big Bluestem grass	Nt P-GRASS
4	<i>Andropogon scoparius</i>	Little bluestem grass	Nt P-GRASS
3	<i>Aremesia ludoviciana</i>	Prairie sage	NT-P-FORB
1	<i>Asclepias syriaca</i>	Common milkweed	Nt P-FORB

6	<i>Asclepias tuberosa</i>	Butterfly weed	Nt P-FORB
2	<i>Asclepias verticillata</i>	Whorled milkweed	Nt P-FORB
8	<i>Aster azureus</i>	Sky-blue aster	Nt P-FORB
6	<i>Aster laevis</i>	Smooth blue aster	Nt P-FORB
6	<i>Bouteloua curtipendula</i>	Side-oats grama	Nt P-GRASS
6	<i>Carex bicknellii</i>	Bicknell's sedge	Nt-P-SEDGE
3	<i>Carex gravida</i>	Heavy sedge	Nt-P-SEDGE
5	<i>Cassia fasciculata</i>	Partridge pea	Nt A-FORB
4	<i>Danthonia spicata</i>	Poverty oat grass	Nt P-GRASS
4	<i>Desmodium canadense</i>	Showy tick trefoil	Nt P-FORB
4	<i>Elymus Canadensis</i>	Canada wild rye	Nt P-GRASS
3	<i>Gnaphalium obtusifolium</i>	Old-field balsam	Nt A-FORB
4	<i>Euphorbia corollata</i>	Flowering spurge	Nt-P-FORB
5	<i>Heliopsis helianthoides</i>	False sunflower	Nt P-FORB
6	<i>Helianthus occidentalis</i>	Western sunflower	Nt P-FORB
7	<i>Heuchera richardsonii</i>	Alum root	Nt-P-FORB
7	<i>Koeleria cristata</i>	June grass	Nt-P-GRASS
5	<i>Lespedeza capitata</i>	Round-headed bush clover	Nt P-FORB
5	<i>Liatris aspera</i>	Rough blazing star	Nt-P-FORB
6	<i>Lupinus perennis</i>	Wild lupine	Nt P-FORB
3	<i>Monarda fistulosa</i>	Wild bergamot	Nt P-FORB
3	<i>Monarda Punctata</i>	Spotted bergamot	Nt-B-FORB
1	<i>Oenothera biennis</i>	Common evening primrose	Nt B-FORB
10	<i>Panicum leibergii</i>	Prairie panic grass	Nt P-GRASS
9	<i>Petalostemum candidum</i>	White prairie clover	Nt P-FORB
9	<i>Petalostemum purpureum</i>	Purple prairie clover	Nt P-FORB
4	<i>Ratibida pinnata</i>	Yellow coneflower	Nt P-FORB

4	<i>Rudbeckia hirta</i>	Black-eyed Susan	Nt P-FORB
5	<i>Solidago rigida</i>	Stiff goldenrod	Nt P-FORB
5	<i>Solidago speciose</i>	Showy goldenrod	Nt P-FORB
4	<i>Solidago nemoralis</i>	Old field goldenrod	Nt P-FORB
5	<i>Sorghastrum nutans</i>	Indian grass	Nt P-GRASS
5	<i>Tradescantia ohiensis</i>	Spiderwort	Nt-P-FORB
3	<i>Verbena stricta</i>	Hoary vervain	Nt P-FORB

C- Coefficient of Conservation. Assigned values range from 0-10 and represent how likely a plant is to found in a remnant versus disturbed community. 1 is for natives that are very tolerable of disturbance and 10 is for a native that is typically only found in remnant communities.

Included in Appendix A are dry and mesic seed mixes which meet the above criteria, and are currently available through Shooting Star Native Seeds. This will cover the anticipated range of soil moisture conditions expected during the prairie restoration in Phase 1 areas at the Northern Sands Wisconsin Mine.

5. MULCH

Depending on slope, mulch 2,000 lbs/acre of clean straw over seeded areas and crimp. Slopes 3:1 or greater will likely require erosion control blanket such as SC 75 to stabilize slopes once native seed and cover crop has been applied. Straw or hay for erosion control will be clean, seed-free hay or threshed straw of wheat, rye, oats, or barley.

6. MANAGEMENT RECOMMENDATIONS

First Year:

- Mow reclamation grass areas, 2-4 times during the early growing season. Avoid mowing tree copses.
- Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.
- If necessary, herbicide must be appropriate for target species and applied by a licensed applicator, trained in plant identification.

Second Year:

- Undesirable species will be controlled as necessary by mowing, hand pulling, and selective herbicide application.
- Evaluate fuel loads and develop prescribed burn plan for Year 3 implementation.

Third Year:

- Undesirable species will be controlled as necessary by hand pulling and selective herbicide application.
- Initiate prescribed burn if fuel loads are sufficient and be careful to avoid woody species copes.

Fourth Year:

- Conduct prescribed burn and selective herbicide application as necessary.

Fifth Year:

- Conduct prescribed burn and selective herbicide application as necessary.

Sixth and Seventh Year:

- Selective herbicide application as necessary. Assess fuel loads.

Eighth Year:

- Conduct prescribed burn and selective herbicide application as necessary.

Ninth Year:

- Selective herbicide application as necessary.

Tenth Year:

- Conduct prescribed burn and selective herbicide application as necessary.

7. VEGETATIVE PERFORMANCE STANDARDS

As part of this reclamation plan, a set of quantitative vegetation performance standards have been proposed to assess the success of native prairie reclamation. The set of criteria proposed are modifications of those that have been accepted by other regulatory agencies on projects of similar size and complexity. Quantitative vegetation monitoring and data analysis from Years 1, 2, 3, 5, 8 and 10 will be used to measure performance and determine compliance according to the following performance standards.

8. PERFORMANCE STANDARD – PLANT SPECIES COMPOSITION

Species selected for the planting will be appropriate for the community to be planted. A minimum number of native perennial species must be present within five years after seeding and planting in each plant community to meet the total community species diversity performance standard and are as follows:

- Native Prairie: minimum of fifteen (15) native perennial species

Also, after 5 years in areas restored to Prairie, each plant community will have at least a native Mean C value of 3.0 and a native FQI of 15.0 using the Wisconsin Floristic Quality Assessment methodology (Bernthal 2003).

Appendix A

Alternate Grass Prairie Seed Mixes



SHOOTING STAR

NATIVE SEEDS

20740 County Road 33 • Spring Grove, MN 55974
 (507) 498-3944 Phone • (507) 498-3953 Fax • www.ssns.co

Description: SSNS Dry Prairie Mix

Seeding Rate: 10 lb/acre (59.4 seeds/square foot)

Notes: Soil - Dry Mesic to Dry, Sun - Full

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Lb/acre
Grasses				
Big Bluestem	Andropogon gerardii	10.00%	3.7	1.00 PLS lb
Sideoats Grama	Bouteloua curtipendula	18.00%	4.0	1.80 PLS lb
Blue Grama	Bouteloua gracilis	4.00%	5.9	0.40 PLS lb
Prairie Brome	Bromus kalmii	10.00%	2.9	1.00 PLS lb
Canada Wild Rye	Elymus canadensis	6.00%	1.1	0.60 PLS lb
June Grass	Koeleria cristata	1.00%	7.3	0.10 PLS lb
Switchgrass	Panicum virgatum	1.00%	0.5	0.10 PLS lb
Little Bluestem	Schizachyrium scoparium	20.00%	11.0	2.00 PLS lb
Indiangrass	Sorghastrum nutans	8.00%	3.5	0.80 PLS lb
Rough Dropseed	Sporobolus aspera	2.00%	2.2	0.20 PLS lb
Forbs				
Anise Hyssop	Agastache foeniculum	0.20%	0.7	0.02 PLS lb
Lead Plant	Amorpha canescens	0.60%	0.4	0.06 PLS lb
Butterfly Milkweed	Asclepias tuberosa	1.60%	0.3	0.16 PLS lb
Sky-Blue Aster	Aster azureus	0.00%	0.0	0.00 PLS lb
Arrow-leaved Aster (sub)	Aster sagittifolius	0.20%	1.0	0.02 PLS lb
Smooth Blue Aster	Aster laevis	0.40%	0.8	0.04 PLS lb
Canada Milk Vetch	Astragalus canadensis	0.60%	0.4	0.06 PLS lb
White Wild Indigo	Baptisia alba	1.60%	0.1	0.16 PLS lb
Sand Coreopsis	Coreopsis lanceolata	0.40%	0.3	0.04 PLS lb
White Prairie Clover	Dalea candidum	1.00%	0.7	0.10 PLS lb
Purple Prairie Clover	Dalea purpurea	1.00%	0.7	0.10 PLS lb
Rattlesnake Master	Eryngium yuccifolium	1.80%	0.5	0.18 PLS lb
Ox-eye Sunflower	Heliopsis helianthoides	0.80%	0.2	0.08 PLS lb
Round-headed Bush Clover	Lespedeza capitata	0.60%	0.2	0.06 PLS lb
Button-Blazingstar	Liatis aspera	0.00%	0.0	0.00 PLS lb
Dotted Blazingstar (sub)	Liatis punctata	1.20%	0.3	0.12 PLS lb
Wild Bergamot	Monarda fistulosa	0.40%	1.0	0.04 PLS lb
Spotted Bee Balm	Monarda punctata	0.40%	1.3	0.04 PLS lb
Foxglove Beardtongue	Penstemon digitalis	0.20%	1.0	0.02 PLS lb
Large-flowered Beardtongue	Penstemon grandiflorus	0.40%	0.2	0.04 PLS lb
Prairie Cinquefoil	Potentilla arguta	0.20%	1.7	0.02 PLS lb
Yellow Coneflower	Ratibida pinnata	0.60%	0.7	0.06 PLS lb
Black-eyed Susan	Rudbeckia hirta	0.60%	2.0	0.06 PLS lb
Compass Plant	Silphium laciniatum	0.00%	0.0	0.00 PLS lb
Rosin Weed (sub)	Silphium integrifolium	1.60%	0.1	0.16 PLS lb
Stiff Goldenrod	Solidago rigida	0.40%	0.6	0.04 PLS lb
Showy Goldenrod	Solidago speciosa	0.20%	0.7	0.02 PLS lb
Prairie Spiderwort	Tradescantia bracteata	0.00%	0.0	0.00 PLS lb
Ohio Spiderwort (sub)	Tradescantia ohiensis	1.20%	0.4	0.12 PLS lb
Hoary Vervain	Verbena stricta	0.80%	0.8	0.08 PLS lb
Heartleaf Alexanders	Zizia aptera	0.00%	0.0	0.00 PLS lb

Golden Alexanders (sub)	Zizia aurea	1.00%	0.4	0.10 PLS lb
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Request a price quote for this mix by contacting info@ssns.co or (507) 498-3944. Substitutions may be necessary based on availability at the time of order.



SHOOTING STAR

NATIVE SEEDS

20740 County Road 33 • Spring Grove, MN 55974
 (507) 498-3944 Phone • (507) 498-3953 Fax • www.ssns.co

Description: SSNS Mesic Prairie Mix

Seeding Rate: 10 lb/acre (46.7 seeds/square foot)

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Lb/acre
Grasses				
Big Bluestem	Andropogon gerardii	15.00%	5.5	1.50 PLS lb
Sideoats Grama	Bouteloua curtipendula	12.00%	2.6	1.20 PLS lb
Prairie Brome	Bromus kalmii	8.00%	2.4	0.80 PLS lb
Canada Wild Rye	Elymus canadensis	10.00%	1.9	1.00 PLS lb
Switchgrass	Panicum virgatum	2.00%	1.0	0.20 PLS lb
Little Bluestem	Schizachyrium scoparium	12.00%	6.6	1.20 PLS lb
Indiangrass	Sorghastrum nutans	20.00%	8.8	2.00 PLS lb
Prairie Dropseed	Sporobolus heterolepis	1.00%	0.6	0.10 PLS lb
Forbs				
Anise Hyssop	Agastache foeniculum	0.20%	0.7	0.02 PLS lb
Common Milkweed	Asclepias syriaca	0.80%	0.1	0.08 PLS lb
Smooth Blue Aster	Aster laevis	0.40%	0.8	0.04 PLS lb
New England Aster	Aster novae-angliae	0.20%	0.5	0.02 PLS lb
Canada Milk Vetch	Astragalus canadensis	0.40%	0.2	0.04 PLS lb
White Wild Indigo	Baptisia alba	0.80%	0.0	0.08 PLS lb
Partridge Pea	Chamaecrista fasciculata	2.40%	0.2	0.24 PLS lb
Tall Coreopsis	Coreopsis tripteris	0.40%	0.2	0.04 PLS lb
White Prairie Clover	Dalea candidum	0.80%	0.6	0.08 PLS lb
Purple Prairie Clover	Dalea purpurea	0.80%	0.5	0.08 PLS lb
Showy Tick Trefoil	Desmodium canadense	0.60%	0.1	0.06 PLS lb
Purple Coneflower	Echinacea purpurea	2.00%	0.5	0.20 PLS lb
Rattlesnake Master	Eryngium yuccifolium	1.20%	0.3	0.12 PLS lb
Ox-eye Sunflower	Heliopsis helianthoides	0.80%	0.2	0.08 PLS lb
Meadow Blazingstar	Liatris ligulistylis	0.60%	0.2	0.06 PLS lb
Prairie Blazingstar	Liatris pycnostachya	1.60%	0.6	0.16 PLS lb
Wild Bergamot	Monarda fistulosa	0.40%	1.0	0.04 PLS lb
Wild Quinine	Parthenium integrifolium	1.00%	0.3	0.10 PLS lb
Foxglove Beardtongue	Penstemon digitalis	0.30%	1.4	0.03 PLS lb
Yellow Coneflower	Ratibida pinnata	0.80%	0.9	0.08 PLS lb
Black-eyed Susan	Rudbeckia hirta	0.80%	2.7	0.08 PLS lb
Compass Plant	Silphium laciniatum	0.00%	0.0	0.00 PLS lb
Rosin Weed (sub)	Silphium integrifolium	1.00%	0.0	0.10 PLS lb
Stiff Goldenrod	Solidago rigida	0.20%	0.3	0.02 PLS lb
Purple Meadow Rue	Thalictrum dasycarpum	0.20%	0.1	0.02 PLS lb
Blue Vervain	Verbena hastata	0.40%	1.4	0.04 PLS lb
Culver's Root	Veronicastrum virginicum	0.10%	2.9	0.01 PLS lb
Golden Alexanders	Zizia aurea	0.80%	0.3	0.08 PLS lb

Request a price quote for this mix by contacting info@ssns.co or (507) 498-3944. Substitutions may be necessary based on availability at the time of order.

NORTHERN SANDS WISCONSIN MINE – DRY OR DRY MESIC WOODLAND REVEGETATION PLAN

PREPARED FOR:
NORTHERN SANDS WISCONSIN, LLC

IN SUPPORT OF THE CHIPPEWA COUNTY NONMETALIC MINING RECLAMATION
PERMIT

PREPARED BY:
WESLIE ENGINEERING GROUP

DECEMBER 14, 2017



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Appendix A – Alternate Seed Mix

Northern Sands Wisconsin Mine – Dry or Dry Mesic Woodland Revegetation Plan

1. Purpose

The purpose of this plan is to provide detailed information in preparing, establishing, maintaining, and monitoring the creation of a dry or dry mesic woodland following reclamation of the Northern Sands Wisconsin Mine site. This standalone plan was produced utilizing information from the Applied Ecological Services report dated 11-10-2015 (revised 11-17-2015) which was previously submitted as a supplement to the mine reclamation plan.

2. Dry or Dry Mesic Woodland Reclamation

Phase I woodland reclamation areas (i.e. those areas not planted to prairie, or Jack Pine barrens and oak savanna (opening) will be restored to dry or dry mesic woodland (Figure 17 in the Reclamation Plan). In the Upper Midwest, northern red oak, white oak, and black oak dominate early seral to midseral stages but are ultimately replaced by sugar maple in the absence of natural perturbations such as fire. The oaks assume prominence after early succession in which bigtooth aspen (*Populus grandidentata*) dominates. Bigtooth aspen, usually growing in even-aged mixed stands, is a codominant tree in hardwood forests on the drier upland sites. With frequent fires, sugar maple forests are replaced by oak stands. The oaks grow in a range of habitats and moisture regimes – from prairies to valley floors and upland woods.

3. Site Preparation

Ensure subsoil and topsoil replacement is distributed in a quantity sufficient to meet standards and criteria set forth in this document. The area will be ripped to a depth of 24 inches to alleviate compaction and the potential for shearing. In areas designated for native seed and tree mixes the finished graded surface will be rough disked.

If conditions are such that, by reason of drought, excessive moisture, or other factors, satisfactory results are not likely to be obtained, we will stop work and resume when directed. Excess undulation or irregularities in the surface will interfere with operations or maintenance. If such areas are observed these will be leveled before the next specified operation. In areas with a slope greater than 10:1, disk tracks shall run parallel to the dominate grade to minimize rilling.

Pre-emergent herbicides may likely be needed to ensure the absence of dense ground cover or highly competitive species. Successful establishment of oak, in terms of fast growth and good

quality may be seriously hampered on minelands by harsh environmental conditions, which lead to shoot die-back. While good survival of oak seedlings requires ripping of soils and avoidance of frost pockets or high winds, fertilization is not critical to the early establishment of oak. Eventually the application of phosphate fertilizer may be required on certain sites if the trees are to continue to grow for economic timber. However, the application of nitrogen fertilizer does not appear to stimulate the growth of black oak, white oak, or northern red oak.

In any case, the best survival seems to occur where oak is underplanted in a shelter wood setting such as under bigtooth aspen. In a shelter wood cover situation such as is recommended here, understory control (cutting or spraying non-oak stems to control the understory density so that it does not become overly competitive) results in an increase survival of black oak, white oak (*Quercus alba*), and northern red oak. Oak seedlings in afforested areas without an overplanting require a modicum of herbaceous vegetation in order to survive beyond the first several years.

4. Plant Material Certification and Provenance

Each tree, shrub, forb, grass, and sedge plant or seed mixture listed will be provided and will state the botanical and common name and number or percentage by weight of each species and variety, and percentage of purity, germination, and weed seed as appropriate. The year of production and date of packaging or age and caliper of tree seedlings will be included.

All grass species will be supplied as pure live seed. Submit Lab germination test results for all grass species. For species that are not typically tested, submit an affidavit that describes estimated purity.

Plant materials will be native to western Wisconsin, preferably within a 150-mile radius of the project site unless approved otherwise. Inert material, such as sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed is recommended.

A fresh clean crop of the species and proportions as specified will be provided. All legumes will be inoculated with proper rhizobia at the appropriate time for planting. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence. We will ensure woody plant materials are inoculated with appropriate mycorrhizae and that tree seedlings (or seed) are properly stored and planted. Tree roots will be kept moist at all times.

5. Planting Dates

Seed and woody material will typically be installed during the spring planting period as soon as frost is out of the ground and conditions are suitable, but not beyond June 15. Some grass, forb, shrub, and tree species seeds, especially those requiring stratification/scarification may be planted in the fall between September 15 and December 15. Under natural conditions, acorns generally germinate in the spring after dormancy is broken by over-wintering. Some germination occurs during the fall (directly after maturation) and unless germination is rapid, few seeds survive predation by insects, small birds, and mammals.

6. Seeding

Dry or Dry Mesic Forest sites will be seeded with a minimum of 8 native understory species including the sedges and ferns. Three native grasses Canada wild rye (*Elymus Canadensis*), little bluestem (*Andropogon scoparius*), and side oats grama (*Bouteloua curtipendula*) from Table 3 below, seeded at a rate of 4lbs/acre, will be part of the initial seeding for establishment purposes. The forbs, ferns, and sedge mixture will be seeded at 2 lbs/acre. Herbaceous seeding for the ground story will include Partridgeberry (*Mitchella repens*), Bracken fern (*Pteridium aquilinum*), large-leaved aster (*Aster macrophyllus*), Wood strawberry (*Fragaria vesca*), meadow-rue (*Thalictrum* spp.), false Solomon's-seal (*Smilacina racemose*), and Pennsylvania sedge (*Carex pensylvanica*). In the event that seed is unavailable, reasonable approved ecologically sound substitutes will be accepted.

Seed will be installed with a rangeland type grain drill or no-till planter, such as by Truax, or equivalent where conditions allow. In all other areas broadcast seed into a roughened soil surface. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

If soil is too wet or grade is too steep to install seed, seed using a mechanical broadcast seeder, such as by Cyclone seeder. Hand broadcasting of seed may also be employed. Drag broadcast seeded areas perpendicular to the slope immediately or as soon as site conditions allow.

A cover crop of winter rye (*Secale cereal*) will be applied in all native seed mix areas during seeding application at a rate of 5-6 lbs/acre during dormant seeding in fall. Spring seeding cover crop will consist of 5-6 lbs/acre of oats (*Avena sativa*).

Table 3. Potential species for seeding in dry or dry mesic woodland areas.

C	SCIENTIFIC NAME	COMMON NAME	PHYSIOG.
7	<i>Amorpha canescens</i>	Leadplant	Nt SHRUB
4	<i>Andropogon gerardii</i>	Big Bluestem grass	Nt P-GRASS
4	<i>Andropogon scoparius</i>	Little bluestem grass	Nt P-GRASS
3	<i>Aremesia ludoviciana</i>	Prairie sage	NT-P-FORB
1	<i>Asclepias syriaca</i>	Common milkweed	Nt P-FORB
6	<i>Asclepias tuberosa</i>	Butterfly weed	Nt P-FORB

2	<i>Asclepias verticillata</i>	Whorled milkweed	Nt P-FORB
8	<i>Aster azureus</i>	Sky-blue aster	Nt P-FORB
6	<i>Aster laevis</i>	Smooth blue aster	Nt P-FORB
6	<i>Bouteloua curtipendula</i>	Side-oats grama	Nt P-GRASS
6	<i>Carex bicknellii</i>	Bicknell's sedge	Nt-P-SEDGE
3	<i>Carex gravida</i>	Heavy sedge	Nt-P-SEDGE
5	<i>Cassia fasciculata</i>	Partridge pea	Nt A-FORB
4	<i>Danthonia spicata</i>	Poverty oat grass	Nt P-GRASS
4	<i>Desmodium canadense</i>	Showy tick trefoil	Nt P-FORB
4	<i>Elymus Canadensis</i>	Canada wild rye	Nt P-GRASS
3	<i>Gnaphalium obtusifolium</i>	Old-field balsam	Nt A-FORB
4	<i>Euphorbia corollata</i>	Flowering spurge	Nt-P-FORB
5	<i>Heliopsis helianthoides</i>	False sunflower	Nt P-FORB
6	<i>Helianthus occidentalis</i>	Western sunflower	Nt P-FORB
7	<i>Heuchera richardsonii</i>	Alum root	Nt-P-FORB
7	<i>Koeleria cristata</i>	June grass	Nt-P-GRASS
5	<i>Lespedeza capitata</i>	Round-headed bush clover	Nt P-FORB
5	<i>Liatris aspera</i>	Rough blazing star	Nt-P-FORB
6	<i>Lupinus perennis</i>	Wild lupine	Nt P-FORB
3	<i>Monarda fistulosa</i>	Wild bergamot	Nt P-FORB
3	<i>Monarda Punctata</i>	Spotted bergamot	Nt-B-FORB
1	<i>Oenothera biennis</i>	Common evening primrose	Nt B-FORB
10	<i>Panicum leibergii</i>	Prairie panic grass	Nt P-GRASS
9	<i>Petalostemum candidum</i>	White prairie clover	Nt P-FORB
9	<i>Petalostemum purpureum</i>	Purple prairie clover	Nt P-FORB
4	<i>Ratibida pinnata</i>	Yellow coneflower	Nt P-FORB

4	<i>Rudbeckia hirta</i>	Black-eyed Susan	Nt P-FORB
5	<i>Solidago rigida</i>	Stiff goldenrod	Nt P-FORB
5	<i>Solidago speciose</i>	Showy goldenrod	Nt P-FORB
4	<i>Solidago nemoralis</i>	Old field goldenrod	Nt P-FORB
5	<i>Sorghastrum nutans</i>	Indian grass	Nt P-GRASS
5	<i>Tradescantia ohiensis</i>	Spiderwort	Nt-P-FORB
3	<i>Verbena stricta</i>	Hoary vervain	Nt P-FORB

C- Coefficient of Conservation. Assigned values range from 0-10 and represent how likely a plant is to found in a remnant versus disturbed community. 1 is for natives that are very tolerable of disturbance and 10 is for a native that is typically only found in remnant communities.

7. Tree and Shrub Planting

After seeding ground story species follow up with woody species installation in the oak woodland communities. Plants can be propagated by several methods, including transplanting bareroot stock and direct seeding of acorns. Direct seeding is the fastest and cheapest propagation method and can be effective if few seed predators are present. Though herbaceous vegetation appears important to the survival, excessive competition will reduce growth. Therefore, general guidelines for propagation are to control competing vegetation in the understory, ensure adequate propagules, and remove any competing overstory as seedlings become established.

Seed and install seedlings of a combination of red, white, and black oak with a lesser amount of bigtooth aspen. Best survival of bareroot stock is after spring planting. Since survival is generally good with one-year old, bare root seedlings, 12 to 18 inches tall, they are recommended in plantings. Initial growth is centered on root development. Two to three years after planting, top growth should average 8 to 12 inches annually with control of competing vegetation. Tree seedling protection from weather and predation is recommended.

Shrub associates planted in copses will include blueberries (*Vaccinium* spp.), huckleberries (*Gaylussacia* spp.), chokecherry (*Prunus virginiana*), dogwood (*Cornus* spp.), beaked hazel (*Corylus cornuta*), American hazel (*Corylus Americana*), and dwarf bush-honeysuckle (*Diervilla lonicera*). Trees and shrubs may be heavily browsed by deer when young. Use of temporary deer fencing or other effective deterrents to prevent intense mammal herbivory during the first 5-10 years of growth may be needed. Install oak seedlings at a density of 250 stems per acre, aspen at 50 stems per acre, and shrub associates at a density of 100 stems per acre. Control of

competition will likely be necessary if survivor ship of all propagules is high. Tree shelters are recommended.

8. Mulch

Acorns germinate best in soil which is covered by a layer of leaf litter though litter-covered acorns are likely more vulnerable to rodents, insects, and fungus. Depending on slope, mulch 2,000 lbs/acre of clean leaf litter, or composted equivalent. Salvaged composted woodchips are acceptable so long as attention is paid to maintaining a favorable C/N ratio in the material. Livestock manure should be used only if it is composted. Otherwise it is a definite source of weed seeds. Substitutes could include clean straw. Slopes 3:1 or greater will likely require erosion control blanket such as SC 75 to stabilize slopes once the seed and cover crop has been applied. All mulch materials will be clean and weed-free.

9. Dry or Dry Mesic Woodland Management

First Year:

Mow those patchy areas where no woody species will be impacted once or twice during the early growing season.

Selectively control mechanically or chemically herbaceous competition around all woody stems and in particular around oak stems.

Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a license applicator, trained in plant identification.

Second Year through Year Eight:

Selectively control herbaceous competition around and over woody stems and in particular around oak stems. Avoid excessive shading of oak stems. Selectively reduce the stem density of aspen.

Control undesirable plant species by hand pulling prior to the development and maturity of the plant.

Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a licensed applicator, trained in plant identification.

Ninth and Tenth Year:

Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a licensed applicator, trained in plant identification. Aggressively remove invasive native and non-native shrubs and small trees in the understory (e.g. blackberry, black cherry).

Attempt limited prescribed burn: Back burn through the forested understory to remove accumulation of organic material and fire-kill non-adapted tree species. This is dependent on size of woody species growth.

10. Plant Species Composition

Species selected for the planting will be appropriate for the community to be planted. A minimum number of native perennial species must be present within five years after seeding and planting in each plant community to meet the total community species diversity performance standard and are as follows:

- Dry or Dry Mesic Woodland: minimum of eight (8) native perennial species

Also, after 5 years in areas restored to Oak savanna, each plant community will have at least a native Mean C value of 3.0 and a native FQI of 15.0 using the Wisconsin Floristic Quality Assessment methodology (Bernthal 2003).

11. Native Woody Species Cover and Density

As individual trees and shrubs, as well as the different species, grow at variable rates, the native woody canopy cover (trees and shrubs) in areas restored to dry or dry mesic woodland will be 8% or greater by year 10 as measured as line intercept along transects established to collect herbaceous cover data.

Dry or Dry Mesic woodland will have a woody live stem density of saplings greater than 0.5 meter in height \geq 100 woody stems/acre.

Appendix A

Alternate Seed Mix



SHOOTING STAR

NATIVE SEEDS

20740 County Road 33 • Spring Grove, MN 55974
(507) 498-3944 Phone • (507) 498-3953 Fax • www.ssns.co

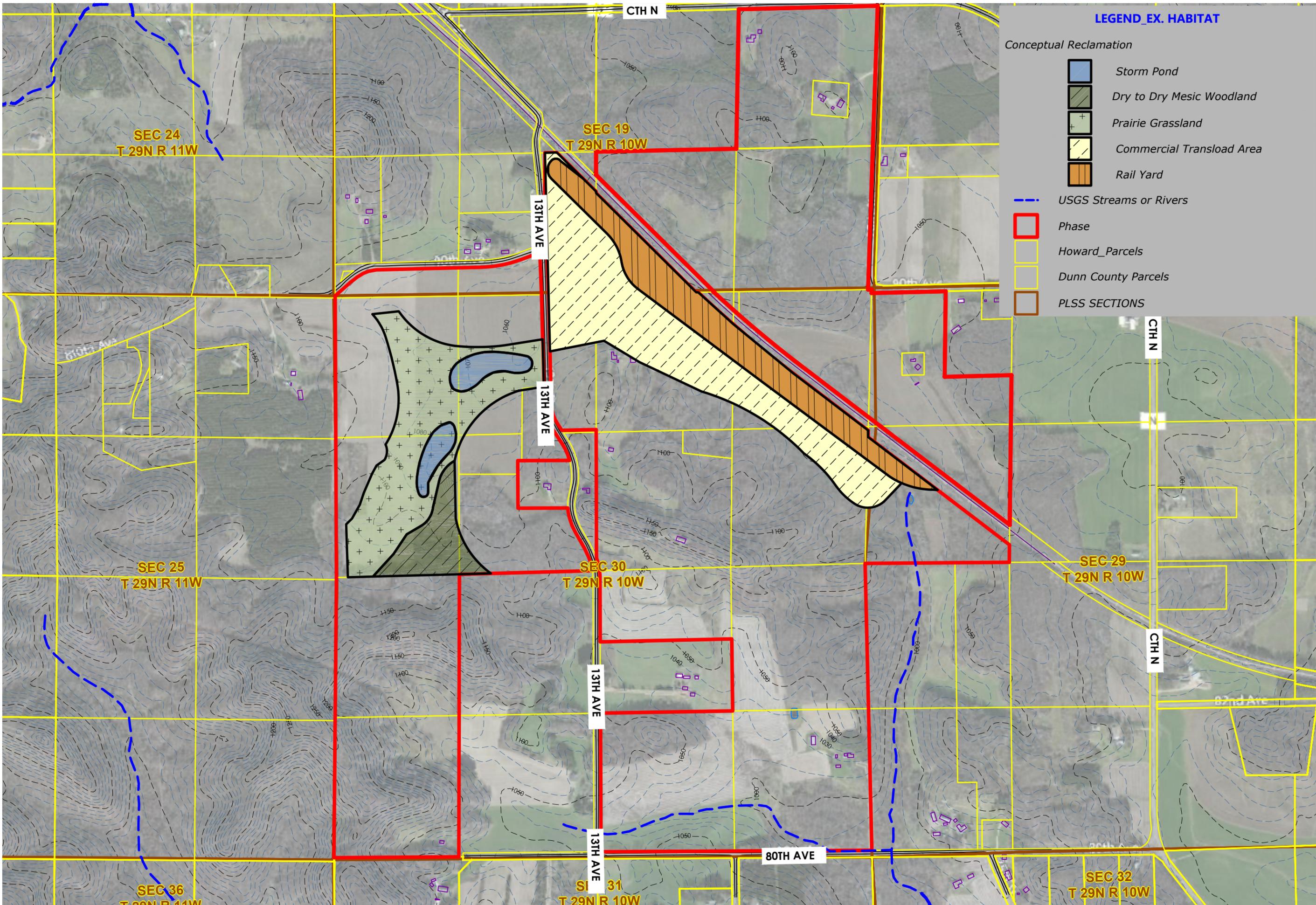
Description: SSNS Savanna & Woodland Edge Mix
Seeding Rate: 10 lb/acre (53.5 seeds/square foot)
Notes: Soil - Wet Mesic to Dry Mesic, Sun - Partial to Shade

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Lb/acre
Grasses				
Big Bluestem	Andropogon gerardii	8.00%	2.9	0.80 PLS lb
Prairie Brome	Bromus kalmii	10.00%	2.9	1.00 PLS lb
Hairy Wood Chess	Bromus purgans	12.00%	3.3	1.20 PLS lb
Canada Wild Rye	Elymus canadensis	6.00%	1.1	0.60 PLS lb
Silky Wild Rye	Elymus villosus	12.00%	2.4	1.20 PLS lb
Virginia Wild Rye	Elymus virginicus	16.00%	2.5	1.60 PLS lb
Bottlebrush Grass	Hystrix patula	8.00%	2.2	0.80 PLS lb
Little Bluestem	Schizachyrium scoparium	6.00%	3.3	0.60 PLS lb
Sedges & Rushes				
Plains Oval Sedge	Carex brevior	0.60%	0.6	0.06 PLS lb
Field Oval Sedge	Carex molesta	0.60%	0.6	0.06 PLS lb
Long-beaked Sedge	Carex spengelii	0.80%	0.3	0.08 PLS lb
Forbs				
Anise Hyssop	Agastache foeniculum	0.60%	2.0	0.06 PLS lb
Tall Thimbleweed	Anemone virginiana	0.20%	0.2	0.02 PLS lb
Columbine	Aquilegia canadensis	1.00%	1.4	0.10 PLS lb
Smooth Blue Aster	Aster laevis	0.80%	1.6	0.08 PLS lb
Arrow-leaved Aster	Aster sagittifolius	0.60%	3.0	0.06 PLS lb
Tall Bellflower	Campanula americana	0.10%	0.6	0.01 PLS lb
Tall Coreopsis	Coreopsis tripteris	0.80%	0.4	0.08 PLS lb
Purple Coneflower	Echinacea purpurea	3.20%	0.8	0.32 PLS lb
Sweet Joe Pye Weed	Eupatorium purpureum	0.80%	1.2	0.08 PLS lb
Biennial Gaura	Gaura biennis	1.40%	0.1	0.14 PLS lb
Cream-Gentian	Gentiana flavida	0.00%	0.0	0.00 PLS lb
Showy Goldenrod (sub)	Solidago speciosa	0.50%	1.7	0.05 PLS lb
Ox-eye Sunflower	Heliopsis helianthoides	1.60%	0.4	0.16 PLS lb
False Boneset	Kuhnia eupatorioides	0.40%	0.5	0.04 PLS lb
Wild Bergamot	Monarda fistulosa	0.40%	1.0	0.04 PLS lb
Sweet Cicely	Osmorhiza claytoni	0.00%	0.0	0.00 PLS lb
Nodding Onion (sub)	Allium cernuum	0.60%	0.2	0.06 PLS lb
Foxglove Beardtongue	Penstemon digitalis	0.60%	2.9	0.06 PLS lb
Solomon's Seal	Polygonatum canaliculatum	0.40%	0.0	0.04 PLS lb
Black-eyed Susan	Rudbeckia hirta	0.80%	2.7	0.08 PLS lb
Brown-eyed Susan	Rudbeckia triloba	0.80%	1.0	0.08 PLS lb
Early Figwort	Scrophularia lanceolata	0.20%	1.4	0.02 PLS lb
Late Figwort	Scrophularia marilandica	0.20%	1.2	0.02 PLS lb
Solomon's Plume	Smilacina racemosa	1.20%	0.0	0.12 PLS lb
Early Meadow Rue	Thalictrum dioicum	0.40%	0.1	0.04 PLS lb
Ohio Spiderwort	Tradescantia ohiensis	0.40%	0.1	0.04 PLS lb
Culver's Root	Veronicastrum virginicum	0.20%	5.9	0.02 PLS lb
Golden Alexanders	Zizia aurea	1.80%	0.7	0.18 PLS lb

Request a price quote for this mix by contacting info@ssns.co or (507) 498-3944. Substitutions may be necessary based on availability at the time of order.

Appendix E

Revegetation Plan Map



LEGEND_EX. HABITAT

- Conceptual Reclamation*
-  Storm Pond
 -  Dry to Dry Mesic Woodland
 -  Prairie Grassland
 -  Commercial Transload Area
 -  Rail Yard
-  USGS Streams or Rivers
-  Phase
-  Howard_Parcels
-  Dunn County Parcels
-  PLSS SECTIONS

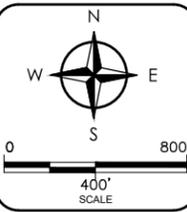


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REVEGETATION PLAN - PHASE 1
 Northern Sands Wisconsin LLC
 Town of Howard
 Chippewa County, WI

REVISIONS	NO.	BY	DATE



DRAWN BY: SSR
 DATE: 12/14/17
 FILE NO.: Q1
 SHEET NO.:

APP-E