Appendix F – Tier 3 Wildlife Studies

Native Prairie Evaluation

Freeborn Wind Energy Project Expansion Area

Freeborn County, Minnesota and Worth County, Iowa

Final Report

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1 INTRODUCTION

Freeborn Wind Energy LLC (Freeborn) is considering the development of the Freeborn Wind Energy Project (Project) and Expansion Area (Project Expansion Area) in Freeborn County, Minnesota and Worth County, Iowa (Figure 1). To support development of the Project Expansion Area, Freeborn requested Western EcoSystems Technology, Inc. (WEST) conduct a preliminary desktop evaluation and field evaluation of potential native prairie habitats found within the Project Expansion Area, summarized in this report. A similar native prairie evaluation was conducted for the original Project area and described in a previous report (Simon and Mattson 2016a). The primary objective of this assessment was to identify grassland areas within the Project Expansion Area, define grassland types, and provide information on which of the grasslands would likely be considered native prairie by the Minnesota Department of Commerce (MNDOC) and Minnesota Department of Natural Resources (MNDNR).

2 STUDY AREA

The Project Expansion Area encompasses 22,482 hectares (ha; 55,553 acres [ac]) in Freeborn County, Minnesota and Worth County, Iowa, and is contiguous with the original Project area (Figure 1). The Project Expansion Area in Minnesota is located southeast of the city of Albert Lea and southwest of the city of Austin; the Project Expansion Area in Iowa is located east and northeast of the city of Northwood.

The Project Expansion Area is located in the Eastern Iowa and Minnesota Drift Plains Level IV Ecoregion, within the Western Corn Belt Plains Level III Ecoregion (United States [U.S.] Environmental Protection Agency [USEPA] 2017a, 2017b), which covers much of Iowa and portions of southern Minnesota and eastern Nebraska. The Western Corn Belt Plains Ecoregion is composed of glaciated till plains and undulating loess plains. Much of the region was originally dominated by tallgrass prairie, riparian forest, oak- (*Quercus* spp.) prairie savannas, and woody and herbaceous wetlands. As described in detail in the Site Characterization Study (SCS) report for the original Project area (Simon and Mattson 2016b) and confirmed in an SCS report specific to the Project Expansion Area (Simon et al. in review), most of the area has been cleared for agricultural production, with the predominant land cover type being cultivated crops (e.g., corn [*Zea mays*], soybeans [*Glycine max*]).

Many smaller streams in the Project Expansion Area (USGS National Hydrography Dataset [NHD] 2016) have been tilled, ditched, and tied into existing drainage systems, which has caused a reduction in wetland and aquatic habitats (USEPA 2017a, 2017b). Topography in the region is nearly flat to gently rolling, with elevations ranging from 337-412 meters (m; 1,106-1,352 feet [ft]).

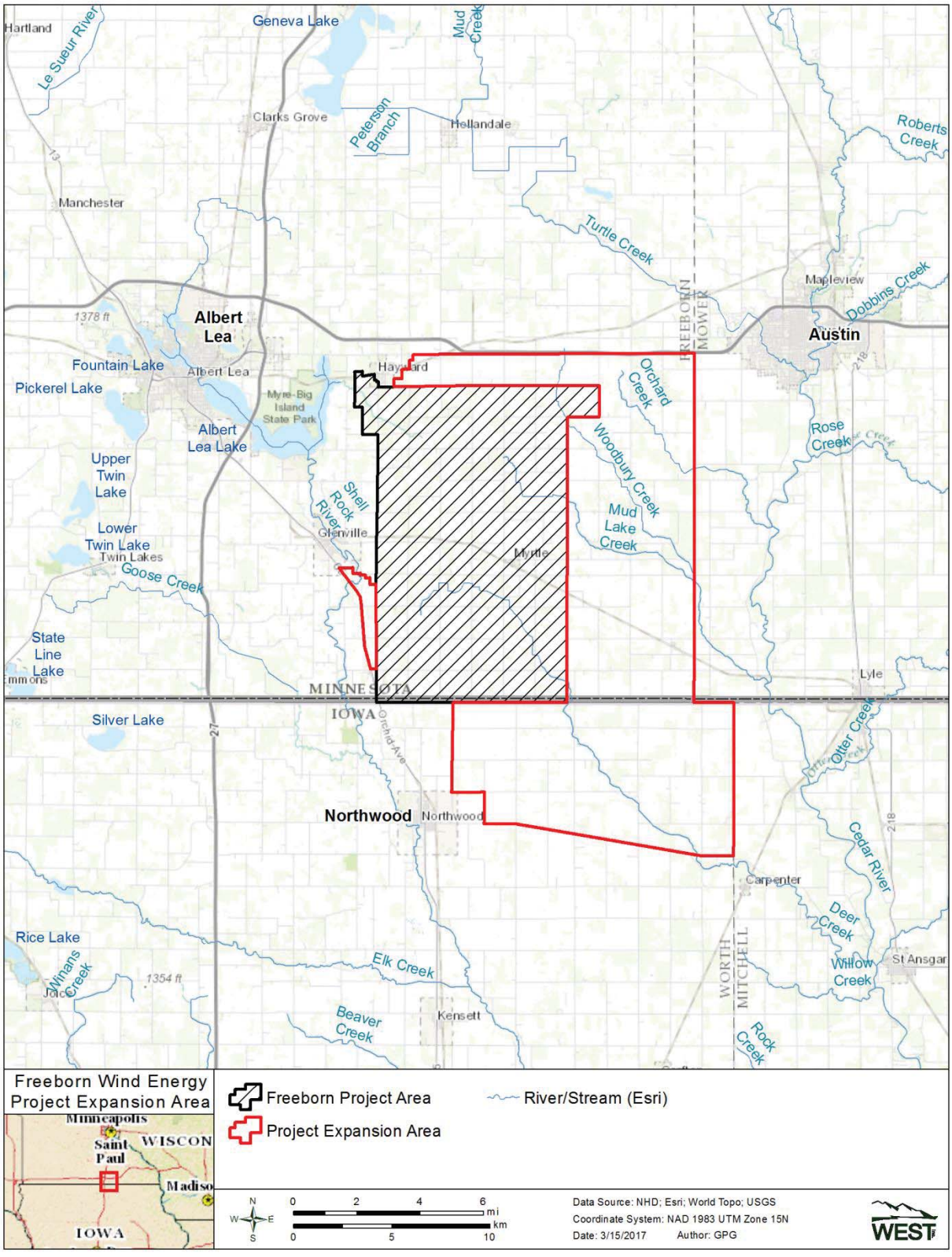

Figure 1. Location of the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota and Worth County, Iowa.

3 METHODS

3.1 Study Design Background

MNDOC (2010) and MNDNR (2011) define native prairie as grasslands that have never been tilled (i.e., plowed) and contain floristic qualities representative of prairie habitat. Therefore, planted grasslands, such as Conservation Reserve Program parcels that are typically planted in previously tilled fields, are not considered native prairie. However, agricultural grasslands, such as pasture and hayfields, may be considered native prairie if the land has not previously been tilled. MNDNR's guidance, therefore, recommends that all grassland types, including hayfields, pastures, and fallow lands, be evaluated as potentially harboring native prairie vegetation (MNDNR 2011).

Tilling land modifies the soil structure (e.g., potential soil compaction, erosion), while non-tilled land generally contains well aggregated soils, with characteristics such as crumbly soil structure capable of greater water infiltration, porous air exchange, and microbial activity, all of which enhance root development (Culman et al. 2010). As such, non-tilled soils provide a more suitable environment for native grasses and forbs to establish, as compared to actively tilled soils. Although a non-tilled hayfield or pasture may not currently contain floristic qualities associated with native prairie habitats (e.g., big bluestem [*Andropogon gerardi*], Indian grass [*Sorghastrum nutans*]), there is potential for native prairie species to exist within a seedbank in these areas (i.e., within the soil profile) and/or to germinate within these soils from a nearby seed source.

3.2 Desktop Evaluation

Data resources reviewed to assess the Project Expansion Area for potential native prairie habitats, as defined above included the U.S. Geological Survey (USGS) LANDFIRE maps; USGS Gap Analysis maps; U.S. Department of Agriculture crop mapping; USGS National Land Cover Database (NLCD; USGS NLCD 2011, Homer et al. 2015); MNDNR Minnesota County Biological Survey maps of Sites of Biodiversity Significance; and aerial photographs of the Project Expansion Area, including current and historic imagery (i.e., 1991, 2003, 2004, 2006, 2008, 2009, 2011, 2012, 2015). Based on this review of public data, potential grasslands (e.g., pastures, hayfields) were identified and mapped within the Project Expansion Area using Google Earth and Geographic Information System mapping software (e.g., ArcGIS).

3.3 Field Evaluation

During the field evaluation, completed from November 29 – 30, 2016, grasslands and potential native prairie features were ground-truthed and verified to the extent possible, using the areas mapped during the desktop evaluation. Grasslands were assessed to the extent possible from public roads by driving through the Project Expansion Area, and the types of grassland (e.g., fallow field, grass-lined waterway, hayfield, pasture, railroad verge, ungrazed prairie/grassland) and general species composition were documented. Criteria were recorded to further assess

whether the grasslands have been previously tilled (i.e., to assess whether they would potentially be considered native prairie by the MNDOC and MNDNR).

During both the desktop and field evaluations, grasslands were categorized as potential native prairie if there were no obvious characteristics of previous tilling (see criteria outlined below) and/or if plant species associated with native prairie habitats were observed during the field evaluation (e.g., sawtooth sunflower [*Helianthus grosseserratus*], phlox [*Phlox* spp.], Indian grass).

Several criteria were used to determine whether grasslands had previously been tilled, including assessing land cover and soil characteristics. For the purpose of this assessment, the criteria used to identify previously tilled grasslands (either through the desktop evaluation or during the field evaluation) included:

- Trace remnants of planted row crop (e.g., corn or soybeans) intermixed with grassland vegetation that included weedy species typical of disturbed areas (e.g., ragweed [*Ambrosia* spp.], Canada thistle [*Cirsium arvense*], waterhemp [*Amaranthus* spp.], horseweed [*Conyza canadensis*)
- A decline in soil structure (i.e., soil characteristics including top soil crusting, compaction, erosion) representative of impacted soils
- Aerial imagery reviewed on Google Earth (i.e., historic aerials from as early as 1991) that showed obvious furrows
- Pastures that had not had soil completely smoothed over and still had slight furrows and appeared to be left fallow

It should be noted that grasslands that did not appear to have been previously tilled (i.e., did not meet any of the above criteria) may still have been historically tilled, but it was not currently apparent through visual assessment in the field or examination of more recent aerial imagery.

4 RESULTS

Based on the desktop evaluation and the field evaluation, approximately 621 ha (1,535 ac) of grasslands occur in the Project Expansion Area, which is about 3% of the total area. Figure 2 shows the grassland areas and types that were mapped, while Table 1 reports the areas of each type. Appendix A photo documents the various grassland types. Note in Figure 2 the Developed Land cover type (USGS NLCD 2011, Homer et al. 2015) is included because it largely represents homesteads with manicured grass (i.e., lawn), although these would not be considered native prairie.

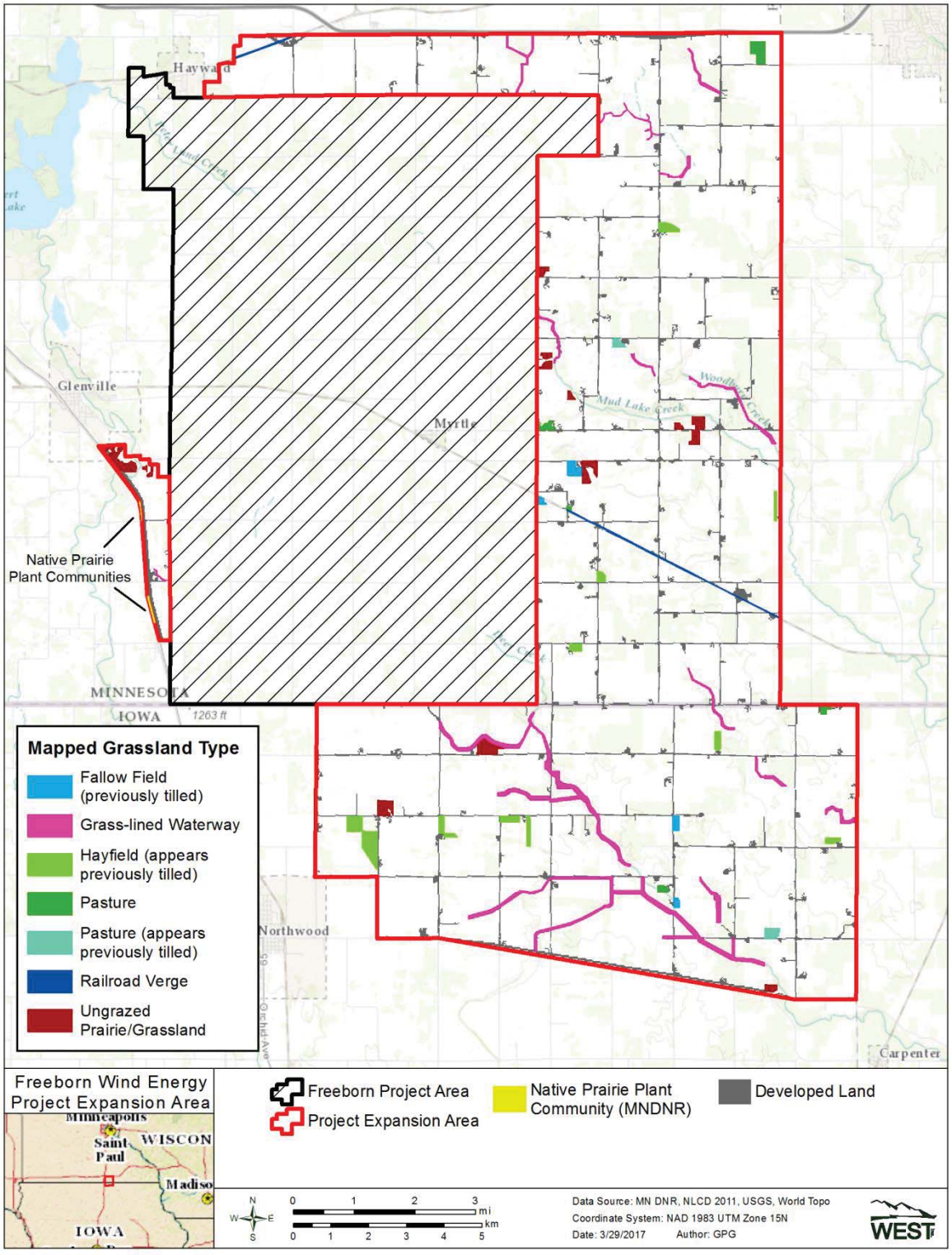

Figure 2. Desktop and field evaluations of grassland types within the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota and Worth County, Iowa.

Table 1. Grassland types present within the Freeborn Wind Energy Project Expansion Area based on the desktop evaluation and field evaluation from November 29 – 30, 2016.

Grassland Type[1]	Hectares	Acres	Percent
Grass-lined waterway	296	731	48
Ungrazed prairie/grassland	119	294	19
Hayfield (appears previously tilled)	105	259	17
Pasture	36	89	6
Fallow field (previously tilled)	26	64	4
Railroad verge	23	57	4
Pasture (appears previously tilled)	14	35	2
MNDNR native prairie plant community	2	5	<1
Total[2]	**621**	**1,535**	**100**

[1] All grassland categories not followed with "appears previously tilled" or "previously tilled," were considered potential native prairie, as defined by MNDOC and MNDNR, at this level of assessment
[2] Sums of values may not add to total value shown, due to rounding

The majority of the grassland areas (48%; 296 ha [731 ac]) documented in the Project Expansion Area consisted of grass-lined waterways along the various streams and ditches. The stream banks and ditches were grass covered and many had grass buffer strips along each bank (see Photo 3 in Appendix A). These grass-lined waterways and the associated grass buffer strips were generally located in agricultural lands, typically not tilled, and may have been previously mowed or hayed. Although grass-lined waterways constituted 62% of all grasslands that appeared to be untilled, many of these waterways have been disturbed by past ditching and tiling activities. Grass species observed included smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), and orchard grass (*Dactylis glomerata*).

The second most abundant grassland type was ungrazed prairie/grassland (19%; 119 ha [294 ac]). Most of the ungrazed prairies/grasslands were located near Mud Lake Creek in Freeborn County, Minnesota (east of the original Project area in the center portion of the Project Expansion Area) (Figure 2). The Mud Lake Creek area contained several designated Sites of Biodiversity Significance (classified as low quality) by the MNDNR County Biological Survey (MNDNR 2016). This area also contained wetland complexes along the creek corridor. Another area of interspersed ungrazed prairie/grassland occurred along the western section of the Project Expansion Area, encompassing wetland complexes associated with the Shell Rock River (Figure 1 and Figure 2).

Previously tilled hayfield (17%; 105 ha [259 ac]) was the third most abundant grassland type in the Project Expansion Area. Hayfields typically consisted of alfalfa (*Medicago sativa*) and various grasses.

The desktop evaluation identified two MNDNR native prairie plant communities (<1%; 2 ha [5 ac]) along the railroad verge (i.e., corridor abutting railroad tracks) labeled in Figure 2 along the western section of the Project Expansion Area, west of the original project area. These prairies were identified by the MNDNR as part of their railroad native prairie survey program. A floristic inventory of these prairies was not completed during this field evaluation.

Based on species composition, soil characteristics, and other attributes, as described in Section 3.3, 23% (145 ha [359 ac]) of grasslands in the Project Expansion Area appeared to have been previously tilled and were recorded in hayfields, fallow fields, and pasture (Table 1). Therefore, these grasslands (Figure 3) would not be considered native prairie, as defined by MNDOC (2010) and MNDNR (2011). Conversely, an estimated 77% (476 ha [1,176 ac]) of grasslands in the Project Expansion Areas were identified and mapped as grassland areas that may not have been previously tilled and could contain remnant prairie plant communities (Figure 3).

5 DISCUSSION

This assessment of grassland resources in the Freeborn Project Expansion Area provided information on the potential for native and non-native prairies to occur within this area, based on MNDOC (2010) and MNDNR (2011) guidelines. Potential native prairie land cover (i.e., grassland that does not appear to have been previously tilled) totaled 476 ha (1,176 ac) or 2% of the Project Expansion Area. Of these 476 ha (1,176 ac) of untilled grasslands, 62% consisted of grass-lined waterways. However, past management activities have previously ditched, tiled, and planted cool season, non-native grasses along many of the grass-lined waterways.

Although no MNDNR native plant communites were identified in the ungrazed prairie/grasslands and pastures during the project evaluations, there is the potential for native plant communities to occur in these grassland types. Ungrazed prairie/grasslands, as well as wetland complexes and MNDNR Sites of Biodiversity Significance, were located along or near Mud Lake Creek.

Railroad verges were known to contain remnant native prairies because they have not been disturbed (except for occasional mowing activities) for many decades, and they may provide suitable habitat for native prairie vegetation. Therefore, the two native prairie remnants along the railroad verge along the western section of the Project Expansion Area (Figure 2) identified by MNDNR and the two other railroad rights-of-way may support native prairie vegetation.

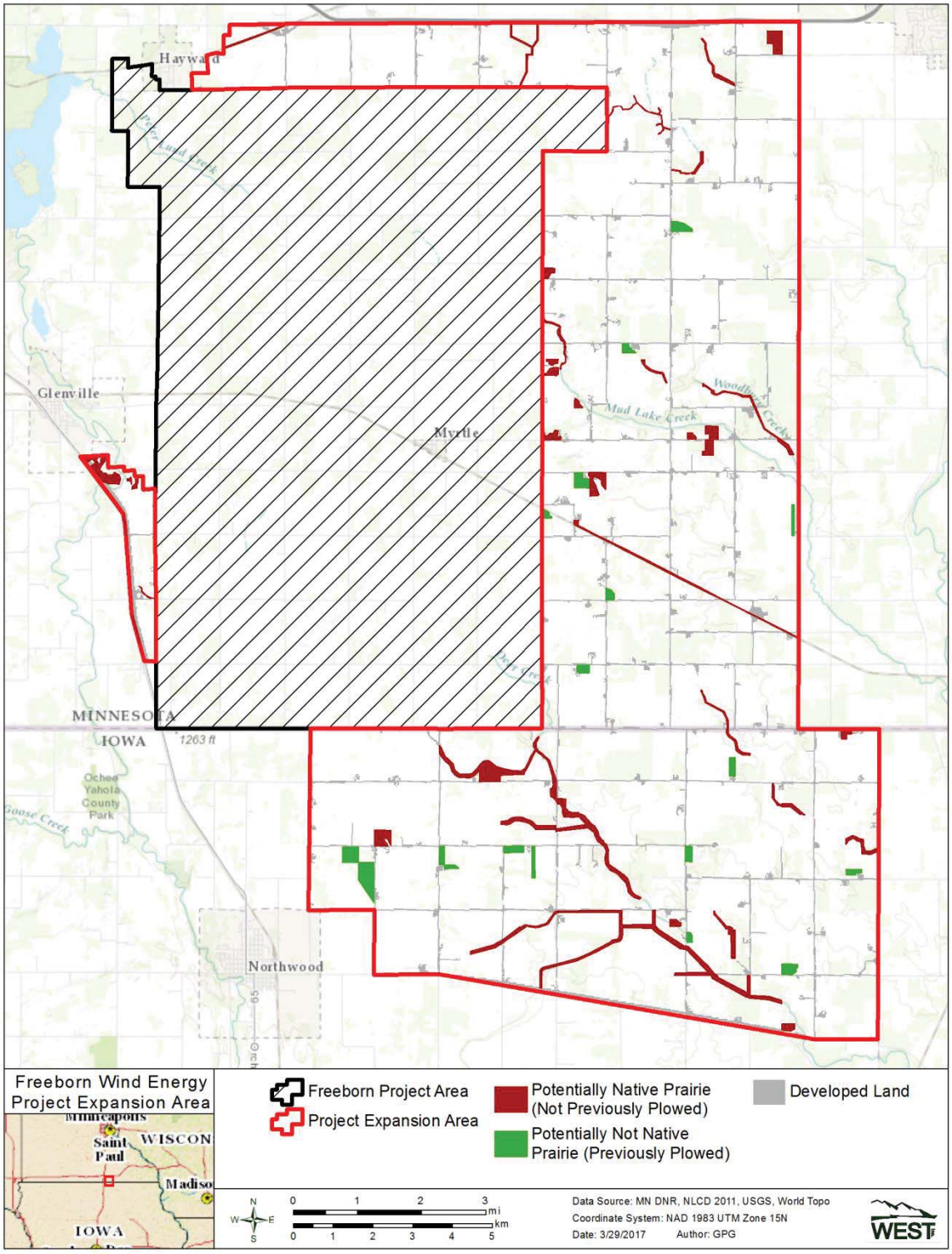

Figure 3. Desktop and field evaluations of potentially native prairie (i.e., not previously tilled or plowed) and potentially not native prairie (i.e., previously tilled or plowed) within the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota, and Worth County, Iowa.

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Appendix A. Representative Photographs

Photo 1. Cut Hayfield in the Freeborn Wind Energy Project Expansion Area, previously tilled

Photo 2. Grazed Pasture in the Freeborn Wind Energy Project Expansion Area, previously untilled

Photo 3. Grass-lined Waterway Adjacent to hay strips and agriculture field in the Freeborn Wind Energy Project Expansion Area, previously untilled

Photo 4. Ungrazed Prairie/Grassland in the Freeborn Wind Energy Project Expansion Area, previously untilled

Native Prairie Evaluation

Freeborn Wind Energy Project

Freeborn County, Minnesota

Final Report

September 2015

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1 INTRODUCTION

Freeborn Wind Energy LLC (Freeborn) is proposing the development of the Freeborn Wind Energy Project (Project) in Freeborn County, Minnesota (Figure 1). To support development of a Project layout, Freeborn requested that Western EcoSystems Technology, Inc. (WEST) conduct a preliminary desktop and field evaluation of potential native prairie habitats within the Project area. The overall purpose of this assessment was to identify grassland areas within the Project boundary and provide information on which of the grassland parcels would likely be considered native prairie by the Minnesota Department of Commerce (MNDOC) and Minnesota Department of Natural Resources (MNDNR), and therefore subject to a Native Prairie Protection Plan if any Project-related impacts are proposed within those parcels.

2 STUDY AREA

The 39,834-acre (ac; 16,120 hectares) Project is located in Freeborn County, in south-central Minnesota, approximately 6 miles (9.7 kilometers) east of the town of Albert Lea (Figure 1). The Project is located in the Eastern Iowa and Minnesota Drift Plains Level IV Ecoregion, within the Western Corn Belt Plains Level III Ecoregion (US Environmental Protection Agency [USEPA] 2013a), which covers much of Iowa and portions of southern Minnesota and eastern Nebraska.

The Western Corn Belt Plains Ecoregion is composed of glaciated till plains and undulating loess plains. Much of the region was originally dominated by tallgrass prairie, riparian forest, oak-prairie savannas, and woody and herbaceous wetlands. Today, most of the area has been cleared for farms producing corn, soybeans and livestock. Many smaller streams in this ecoregion have been tilled, ditched and tied into existing drainage systems which has caused a reduction in the amount of wetland and aquatic habitats (USEPA 2013b). Topography in the region is nearly flat to gently rolling with elevations ranging from 1,125 to 1,385-feet (343 to 422-meters).

3 METHODS

The MNDOC and the MNDNR define native prairie as grasslands that have never been tilled and contain floristic qualities representative of prairie habitat (MNDNR 2011). Therefore, planted grasslands such as Conservation Reserve Program parcels, which are typically planted in previously tilled fields, are not considered native prairie. However, agricultural grasslands such as pasture and hayfields may be considered native prairie if the land has not previously been tilled. The MNDNR's 2011 guidance therefore recommends that all grasslands, including hayfields, pastures and fallow lands be evaluated as potentially harboring native prairie (MNDNR 2011). The MNDOC requires a Native Prairie Protection Plan be developed to document avoidance measures if any potential native prairie areas are identified in the vicinity of Project impacts.

Tilling land creates a decline in soil structure (e.g., soil compaction, erosion); while non-tilled land generally contains well aggregated soils, characteristics such as crumbly soil structure capable of greater water infiltration, porous air exchange, and microbial activity, all of which enhance fast

root development (Culman et al. 2009). As such, non-tilled soils provide a more suitable environment for sensitive native grasses to establish and thrive compared to highly impacted soils, which do not create a suitable environment for most native species to grow. Therefore, though a non-tilled hayfield or pasture may not currently contain floristic qualities associated with native prairie habitats (e.g., big bluestem [*Andropogon gerardii*], Indian grass [*Sorghastrum nash*]), there is potential for native prairie species to exists within a seedbank in these areas (i.e., within the soil profile) and/or to germinate within these soils from a nearby seed source.

The following data resources were reviewed to assess the Project boundary for potential native prairie habitats as defined above: U.S. Geological Survey (USGS) LANDFIRE maps, USGS Gap Analysis maps, U.S. Department of Agriculture (USDA) crop mapping, MNDNR Minnesota County Biological Survey maps of Sites of Biodiversity Significance, and aerial photographs of the Project including current and historic imagery (1991, 2003, 2004, 2006, 2008, 2009, and 2011). Based on this review of public data, potential grasslands were identified and mapped within the Project area (e.g., pasture grasslands, hayfields, etc.) using Google Earth and Geographic Information System (GIS) mapping software.

During the September 2015 field visit to the Project area, potential native prairie features were ground-truthed and verified to the extent possible. Grasslands were assessed from public roads by driving through the Project area, and documenting the types of grassland (e.g., pasture, hayfield, etc.) and general species composition. Grassland types were verified and criteria were recorded to further assess whether the grasslands had been previously tilled (i.e., to assess whether they would potentially be considered native prairie by the MNDNR and MNDOC).

Grasslands were categorized as potential native prairie if there were no obvious characteristics of previous plowing (see criteria outlined below) and/or if vegetative species associated with native prairie habitats were observed during the field visit (e.g., sunflower [*Helianthus grosseserratus*], phlox [*Phlox* spp.], Indian grass).

Several criteria were used to determine whether grasslands had previously been tilled, including assessing land cover and soil characteristics. For the purpose of this assessment, the criteria used to identify previously tilled grasslands (either in the field or through desktop assessment) included:

- trace remnants of planted row crop (e.g., corn or soy) intermixed with grassland vegetation, which includes very weedy/nuisance vegetation (e.g., ragweed [*Ambrosia* spp.], Canada thistle [*Cirsium arvense*], waterhemp [*Amaranthus* spp.], horseweed [*Conyza canadensis*], etc.) typical of highly disturbed areas (e.g., historic plowing);
- a decline in soil structure including top soil crusting, compaction, erosion, etc., which is representative of highly impacted soils (e.g., historic plowing);
- aerial imagery reviewed on Google Earth (historic aerials from as early as 1991), which showed obvious furrows (tilled row crop) signatures; and/or
- pastures that had not had soil completely smoothed over and still had slight furrow and appeared to be left fallow.

It should be noted that grasslands that did not appear to have been previously tilled (i.e., did not meet any of the above criteria) may still have been historically tilled. For example, if tilled agricultural land had been converted to pasture 40 years ago or more, it could be difficult to determine this from visual assessment in the field or through examination of more recent aerial imagery. Therefore the methodology followed for this assessment is likely conservative and identified more parcels as potentially untilled than may be the case.

4 RESULTS

Based on WEST's review of public grassland data sets and the site visit to the Project, the Project is composed of about 879.1 ac (2.2% of the overall Project area) of grasslands (Figure 1). The majority of grasslands documented in the Project area were composed of agricultural grasslands (hayfields [377.0 ac; 42.9% of the Project's grasslands] and pastures [186.4 ac; 21.2%]) consisting of fields of hay/alfalfa; pastures composed of cool season grasses (i.e., species not typical of high quality native prairies, including species such as timothy grass [*Phleum pratense*], orchardgrass [*Dactylis glomerata*], alfalfa, and clover species [*Trifolium* spp.]); and lightly grazed pastures largely consisting of weedy/nuisance vegetation (ragweed, Canadian horseweed, etc.). The remainder of grasslands were composed of grass-lined waterways (93.9 ac [10.7%]), ungrazed prairie/grassland (77.1 ac [8.8%]), grassy buffer/filter strips (68.5 ac [7.8%]), fallow fields (i.e., previously tilled; 40.7 ac [4.6%]), and railroad verge (35.3 ac [4.0%]; Figure 1).

The grass-lined waterways and grassy buffer/filter strips are typical in agricultural lands; these areas are typically not tilled, may be mowed, and provide filtration to water resources or water conveyance in heavy rain events. Two ungrazed prairie/grasslands (one in the northwest corner [11.5 ac; 1.3%) and one in the northeast portion of the Project area [43.6 ac; 5.0%]) had floristic qualities associated with native prairie habitat (e.g., goldenrod [*Solidago* spp.], milkweed [*Asclepias* spp.], sawtooth sunflower [*Helianthus grosseserratus*], phlox [*Phlox* spp.], switchgrass [*Panicum virgatum*], and Indian grass); and, based on this review, did not appear to have been previously tilled. The desktop assessment also identified a native prairie plant community (0.2 ac) along the railroad verge in the very southwest corner of the Project, which was confirmed in the roadside field visit (Figure 1). A complete floristic inventory of the railroad verge, originally identified as a native prairie plant community by the MNDNR, was not completed during this field visit because of lack of site access.

The September 2015 site visit documented that about 95.8 ac of pasture (10.9% of the Project's grasslands) appeared to have been previously tilled based on soil characteristics, species composition, and other attributes (see those outlined in Section 3 - Methods); historic aerial review on Google Earth indicated that an additional 74.5 ac of hayfields (8.5% of the Project's grasslands) appeared to have been previously tilled. Including the fallow fields that had also been previously tilled (40.7 ac [4.6%]), there were a total of about 211.0 ac (24.0% of the Project's grasslands) that appear to have been previously tilled (i.e., would not be considered native prairie per the MNDNR's definition; Figure 2). Conversely, about 668.1 ac (76.0%) of grassland parcels appear not to have been previously tilled based on this assessment (Figure 2) and therefore would be subject to a Native Prairie Protection Plan if any Project-related impacts are proposed within them.

Table 1. Grassland types present within the Freeborn Wind Energy Project based on WEST desktop assessment and field visit on September 21, 2015.

	Project	
Grassland Type [a]	**Acres**	**Percent (%)**
Hayfield	302.5	34.4
Pasture (appears previously tilled)	95.8	10.9
Grass-lined waterway	93.9	10.7
Pasture	90.6	10.3
Ungrazed Prairie/Grassland	77.1	8.8
Hayfield (appears previously tilled)	74.5	8.5
Grassy buffer/filter strip	68.5	7.8
Fallow Field (previously tilled)	40.7	4.6
Railroad Verge	35.3	4.0
MN DNR Native Prairie Plant Community	0.2	<0.1
Total	**879.1**	**100.0**

[a] All grassland categories not followed with “appears previously tilled”, are considered potential native prairie, as defined by MNDNR and MNDOC, at this level of assessment.

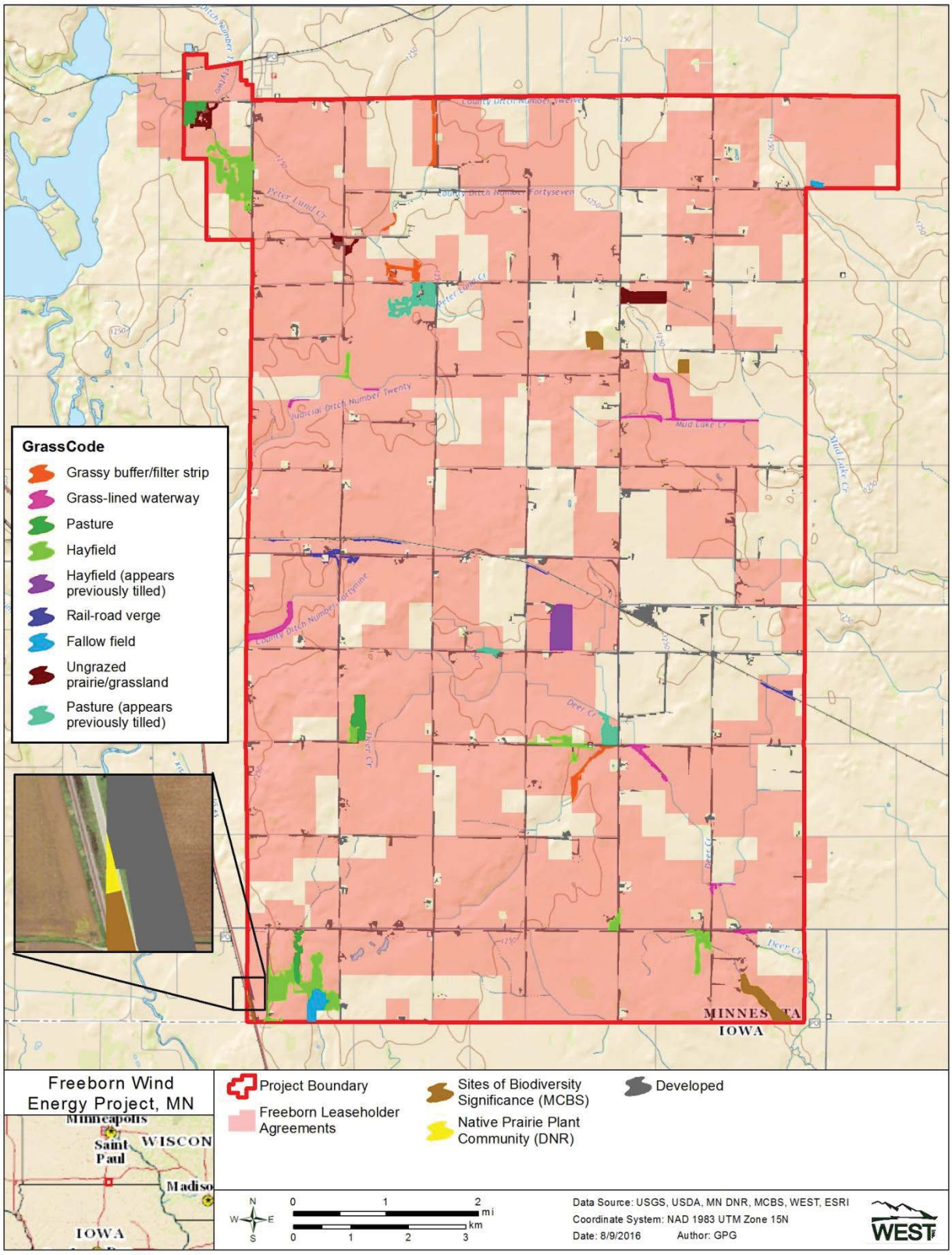

Figure 1. WEST desktop and field evaluation of grassland types within the Freeborn Wind Energy Project.

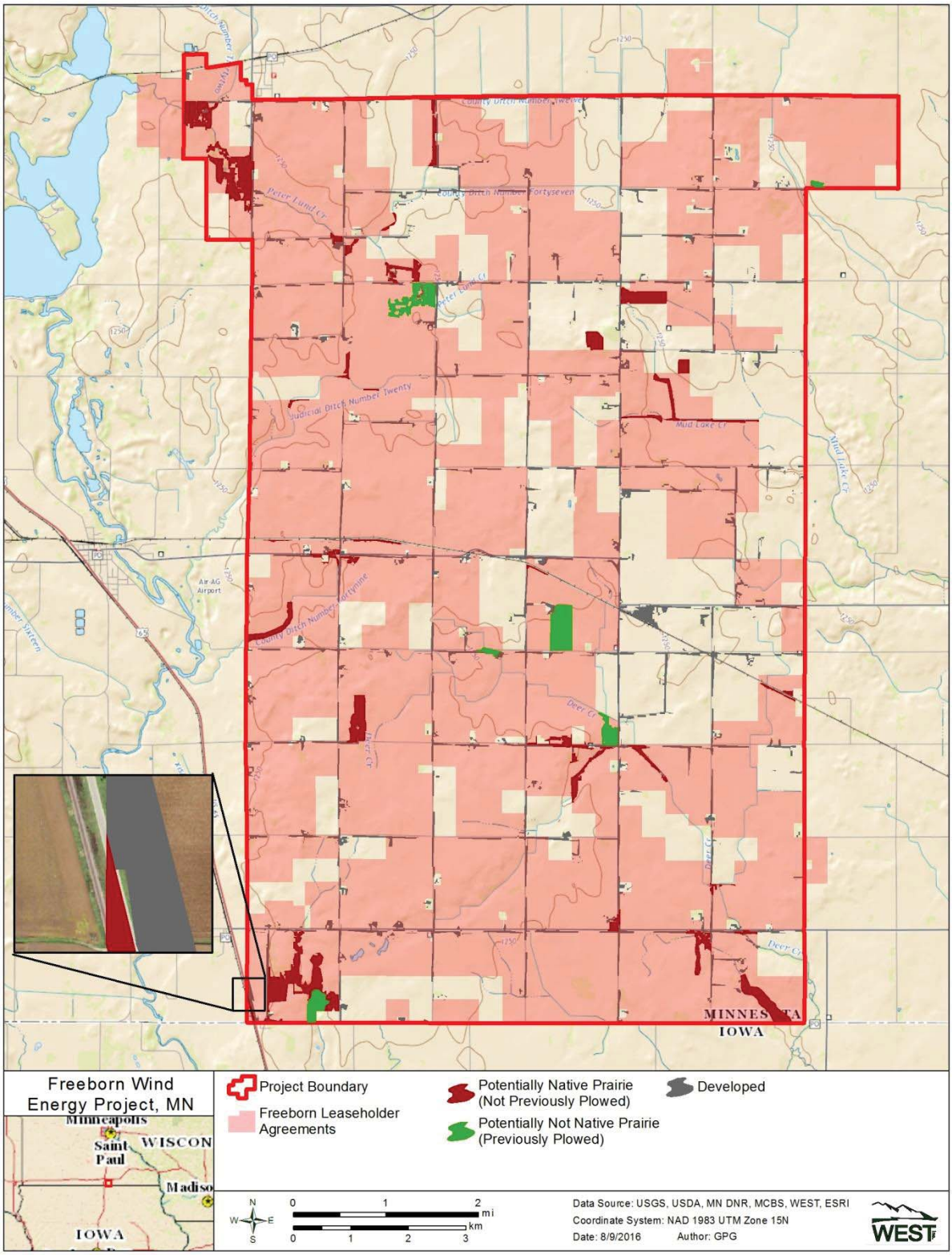

Figure 2. WEST desktop and field preliminary evaluation of potentially native prairie (i.e., not previously plowed, or tilled) and potentially not native prairie (i.e., previously tilled) within the Freeborn Wind Energy Project.

5 CONCLUSIONS

The assessment of grassland resources in the Freeborn Project area provides information on the potential for native prairies within the Project area, as defined by the MNDNR and MNDOC. Although potentially native prairie land cover (grassland that does not appear to have been previously tilled) exists in the area, it occupies a small percentage of the Project area (1.7%). The majority of grasslands, both previously tilled (211 ac) and previously untilled (668 ac), documented in the Project were agricultural grasslands (i.e., hayfields and pastures) consisting of fields of hay/alfalfa; pastures composed of cool season (i.e., non-native) grasses; and lightly grazed pastures largely consisting of weedy/nuisance vegetation.

The *Minnesota Department of Natural Resources Guidance for Commercial Wind Energy Projects* (MNDNR 2011) defines native prairie not only as grasslands that have never been tilled, but as also containing floristic qualities representative of prairie habitats. Although there is potential that some of the agricultural grasslands that were identified in the Project area have not been tilled in the past, the majority currently lack floristic qualities associated with native prairie habitat (i.e., native plant communities); and it is unlikely that these areas contain sensitive species.

The two ungrazed prairie/grasslands in the northwest corner and northeast portion of the Project had floristic qualities associated with native prairie habitat, and in preliminary review, did not appear to have been previously tilled. The MNDNR data set has also documented a small native prairie plant community, in the very southwest corner of the Project along the railroad verge directly abutting the Project boundary, which was observed during the field assessment, although a detailed species survey was not possible due to lack of access. These three locations were the only locations identified by WEST's desktop and field assessment as grasslands that appeared to be both previously untilled and potentially containing native prairie communities.

However, as described above, the MNDNR recommends that any grassland that has not been previously tilled, including hayfields, degraded pastures, and grassed waterways, be considered as potentially harboring native prairie. Therefore, all grassland areas identified as potentially not tilled (Figure 2) would likely be subject to a Native Prairie Protection Plan if they were not avoided during development of the Project layout.

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Appendix A. Photographs

Photo 1. Cut hayfield in the Freeborn Wind Energy Project.

Photo 2. Grazed pasture in the Freeborn Wind Energy Project.

Photo 3. Un-grazed grassland/prairie adjacent to grassy buffer/filter strip and agriculture field in the Freeborn Wind Energy Project.

Photo 4. Un-grazed grassland/prairie in the Freeborn Wind Energy Project.

Water Resource Evaluation
Freeborn Wind Energy Project Expansion Area
Freeborn County, Minnesota and Worth County, Iowa

Final Report

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Simon, S., and R. Duncan. 2017. Water Resource Evaluation, Freeborn Wind Energy Project Expansion Area, Freeborn County, Minnesota and Worth County, Iowa. Final Report. Prepared for Freeborn Wind Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Golden Valley, Minnesota. 7 pages.

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1 INTRODUCTION

Freeborn Wind Energy, LLC (Freeborn) is considering the development of the Freeborn Wind Energy Project (Project) and Expansion Area (Project Expansion Area) in Freeborn County, Minnesota and Worth County, Iowa (Figure 1). To support development of a Project Expansion Area layout, Freeborn requested that Western EcoSystems Technology, Inc. (WEST) conduct a preliminary desktop evaluation and field evaluation of water resources within the Project Expansion Area. This report provides a summary of the results of the water resource evaluation of the Project Expansion Area. A similar water resource evaluation was conducted for the original Project area and was described in a previous report (Simon and Mattson 2016). The primary objective of this evaluation was to identify water resources (e.g., rivers, streams, ditches, lakes, ponds, wetlands, etc.) within the Project Expansion Area.

2 STUDY AREA

The 22,482-hectare (ha; 55,553-acre [ac]) Project Expansion Area is located in Freeborn County in southcentral Minnesota, and in Worth County in northcentral Iowa (Figure 1). The Project Expansion Area in Minnesota is generally located between the cities of Albert Lea and Austin, while the Project Expansion Area in Iowa is located east of the city of Northwood (Figure 1). The original Project area is also shown on Figure 1 for reference.

The Project Expansion Area is located in the Eastern Iowa and Minnesota Drift Plains Level IV Ecoregion within the Western Corn Belt Plains Level III Ecoregion (United States Environmental Protection Agency [USEPA] 2016), which covers much of Iowa and portions of southern Minnesota and eastern Nebraska. The Western Corn Belt Plains Ecoregion is composed of glaciated till plains and undulating loess plains. Much of the region was originally dominated by tallgrass prairie, riparian forest, oak- (*Quercus* spp.) prairie savannas, and woody and herbaceous wetlands. Today, most of the area has been cleared for agricultural production, and the predominant land cover type is cultivated crops (e.g., corn [*Zea mays*], soybeans [*Glycine max*]; see Section 4.1, *Land Cover* in the *Site Characterization Study* report [Simon et al. 2017, in prep]). Many smaller streams in this ecoregion have been tilled, ditched, and tied into existing drainage systems, which has caused a reduction in the amount of wetland and aquatic habitats (USEPA 2016). Topography in the region is nearly flat to gently rolling with elevations ranging from 337 to 412 meters (m; 1,106 to 1,352 feet [ft]) above mean sea level.

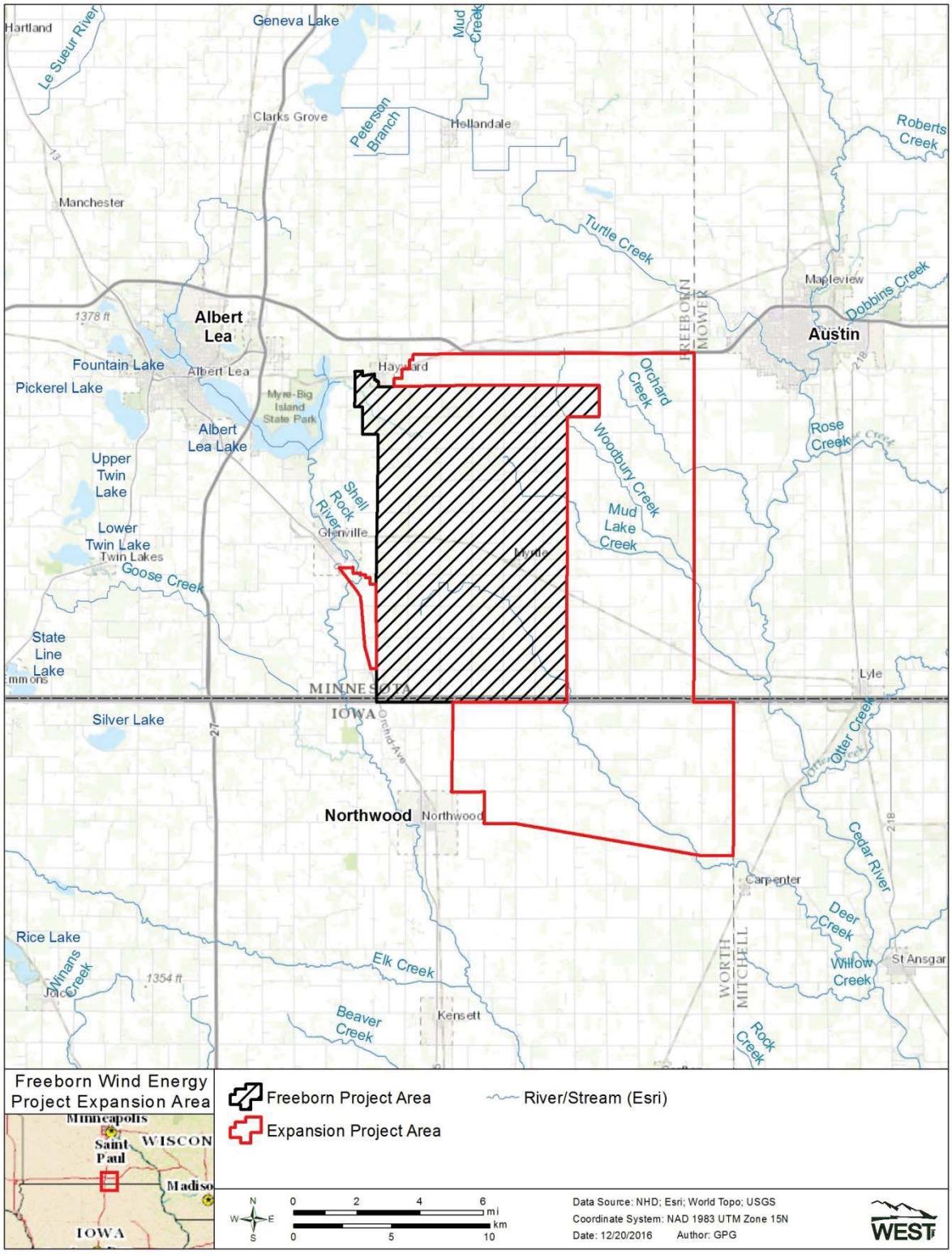

Figure 1. Location of the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota and Worth County, Iowa.

3 METHODS

3.1 Desktop Evaluation

The following databases were reviewed to assess water resources in the Project Expansion Area: U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) hydric soil mapping (USDA NRCS 2016); U. S. Geological Survey (USGS) 7.5-minute series topographic maps (USGS 2016); USGS National Hydrography Dataset (NHD), including mapped lakes, streams, rivers, and ditches (USGS NHD 2016); U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps (USFWS NWI 2016); MNDNR Public Water Inventory (PWI) maps (see Minnesota Statutes Section 103G.201 2016); and aerial photographs of the Project Expansion Area, including current and historic imagery (1991, 2003, 2004, 2006, 2008, 2009, 2011, 2012, and 2015; Google Earth 2017). Using these public data sources, the desktop evaluation identified and mapped potential water resources (i.e., wetlands and waterbodies) located within the Project Expansion Area using Google Earth and Geographic Information Systems (GIS) mapping software. Throughout this report, all wetland and waterbody types (i.e., freshwater emergent wetland, freshwater forested/shrub wetland, riverine, and freshwater pond) are based on wetland nomenclature used by the USFWS NWI (2016).

3.2 Field Evaluation

The field evaluation, conducted on November 29 and 30, 2016, confirmed the extent of water resources initially identified during the desktop evaluation. Additionally, any water resources observed in the field (i.e., wet or saturated features, hydrophytic vegetation, surface hydrology), but not recorded during the initial desktop evaluation were mapped on aerial photographs. The field evaluation was conducted from public roads within the Project Expansion Area. Where necessary, binoculars were used from the edge of public roads to confirm wetland features within the Project Expansion Area.

4 RESULTS

The field evaluation confirmed the majority of wetlands in the NWI dataset (USFWS NWI 2016), in addition to identifying several potential wetlands not included on the 2016 NWI maps for the Project Expansion Area. These combined wetlands and waterbodies totaled 302 ha (746 ac[1]; Table 1) or approximately 1% of the total Project Expansion Area (Figure 2[2]).

[1] This wetland acreage is greater than that in the Freeborn Wind Energy Project Expansion Area Site Characterization Study Report (Simon et al. in prep), given that this number reflects all wetlands evaluated at a higher level of analysis.

[2] Only desktop data were used outside the Project Expansion Area in Figure 2. The USGS NHD flowlines on Figure 2 are not to scale and have been enhanced for visual clarity on the map.

Table 1. Wetland types present within the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota and Worth County, Iowa, based on a desktop evaluation, using U.S. Fish and Wildlife Service National Wetlands Inventory (2016) data, other public wetland and soils datasets, and a subsequent field evaluation[1] conducted from November 29 – 30, 2016.

Wetland Type	Hectares	Acres	Percent Composition
Freshwater Forested/Shrub Wetland	187	461	62
Freshwater Emergent Wetland	103	254	34
Riverine	11	28	4
Freshwater Pond	1	3	<1
Total	**302**	**746**	**100**

[1] Field evaluation conducted from public roads only

Wetland and waterbody types occurring in the Project Expansion Area included freshwater forested/shrub wetland (187 ha [461 ac]), freshwater emergent wetland (103 ha [254 ac]), riverine (11 ha [28 ac]), and freshwater pond (1 ha [3 ac]; Table 1, Figure 2). The field evaluation documented additional freshwater forested/shrub wetlands not included on the original NWI maps examined during the desktop evaluation.

Wetlands were located along the riparian corridors of waterbodies within the Project Expansion Area (i.e., Shell Rock River, Mud Lake Creek, Woodbury Creek, and Orchard Creek). In particular, a large wetland complex (freshwater emergent wetland and freshwater forested/shrub wetland) occurred along Mud Lake Creek in the northern section of the Project Expansion Area (Figure 2). The portion of this wetland complex located west of 890th Avenue and north of 145th Street has been designated as a Site of Biodiversity Significance (low quality) by the MNDNR (2016).

Due to the extensive drainage systems in the Project Expansion Area, some of the NWI-identified freshwater emergent wetlands have been drained and converted to agricultural crops. There are also farmed wetlands scattered throughout the area that are appear to be put into agricultural production during dry seasons, but are likely too wet to farm during high rainfall years, based on the field observations.

A few open water areas exist within the freshwater emergent wetlands located in the western section of the Project Expansion Area. The extent of these open water areas varies seasonally, as well as with changing climatic conditions. All streams/waterways within the Project Expansion Area were confirmed during the field visit with the addition of several smaller drainage systems. The rivers and streams include Shell Rock River, Mud Lake Creek, Woodbury Creek, Orchard Creek, and Deer Creek. Segments of the streams have been ditched for agricultural purposes.

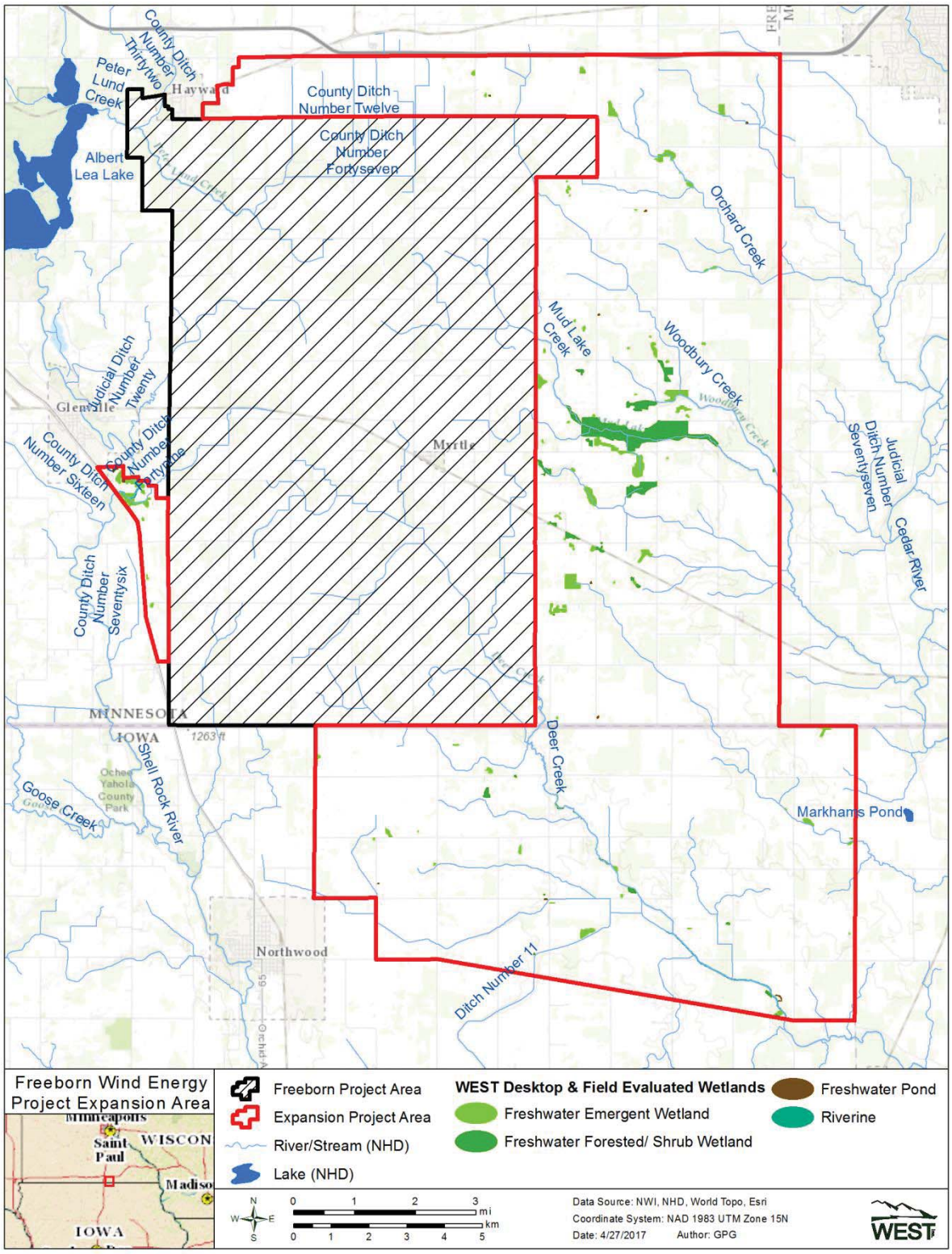

Figure 2. Desktop and field evaluations within the Freeborn Wind Energy Project Expansion Area in Freeborn County, Minnesota and Worth County, Iowa.

5 CONCLUSIONS

The desktop and field evaluations of water resources provided overall information on wetlands and waterbodies located within the Project Expansion Area. These wetlands and waterbodies are scattered throughout the area, covering approximately 1% of the total Project Expansion Area. Wetlands are located adjacent to streams and rivers, with larger wetland complexes located along Mud Lake Creek. There also is some potential for depressions within croplands to be saturated and/or to pond water when conditions are wetter.

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Preliminary Water Resource Evaluation
Freeborn Wind Energy Project
Freeborn County, Minnesota

Final Report
April 9, 2015

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Simon, S. and T. Mattson. 2016. Preliminary Water Resource Evaluation, Freeborn Wind Energy Project, Freeborn County, Minnesota. April 9, 2015. Prepared for Freeborn Wind Energy LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Golden Valley, Minnesota. August 26, 2016. 5 pages.

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1 INTRODUCTION

Freeborn Wind Energy LLC (FWE) has proposed development of the Freeborn Wind Energy Project (Project) and associated transmission line in Freeborn County, Minnesota (Figure 1). To support development of a Project layout, FWE requested that Western EcoSystems Technology, Inc. (WEST) conduct a preliminary desktop and field assessment of water resources found within the Project area. Following the desktop assessment, WEST conducted an onsite evaluation from public roads on April 9, 2015.

2 STUDY AREA

The 39,834-acre (ac; 16,120 hectares) Project is located in Freeborn County, in south-central Minnesota, approximately 6 miles (9.7 kilometers) east of the town of Albert Lea (Figure 1). The Project is located in the Eastern Iowa and Minnesota Drift Plains Level IV Ecoregion within the Western Corn Belt Plains Level III Ecoregion (U.S. Environmental Protection Agency [USEPA] 2013a), which covers much of Iowa and portions of southern Minnesota and eastern Nebraska.

The Western Corn Belt Plains Ecoregion is composed of glaciated till plains and undulating loess plains. Much of the region was originally dominated by tallgrass prairie, riparian forest, oak-prairie savannas, and woody and herbaceous wetlands. Today, most of the area has been cleared for farms producing corn, soybeans and livestock. Many smaller streams in this ecoregion have been tilled, ditched and tied into existing drainage systems which has caused a reduction in the amount of wetland and aquatic habitats (USEPA 2013b). Topography in the region is nearly flat to gently rolling with elevations ranging from 1,125 to 1,385-feet (343 to 422-meters).

3 METHODS

WEST reviewed the following databases to assess the water resources in the Project area: Natural Resource Conservation Service (NRCS) hydric soil mapping, U.S. Geological Survey (USGS) 7.5 minute series topographic maps, USGS National Hydrography Dataset (NHD) including mapped lakes, streams, rivers, and canals, U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) polygons, Minnesota Department of Natural Resources (MNDNR) Public Water Inventory (PWI) mapping, and aerial photography of the Project including current and historic imagery (1991, 2003, 2004, 2006, 2008, 2009, and 2011). Based on this desktop assessment of public data, potential water resources were identified and mapped within the Project boundary (i.e., open water/ponds, emergent wetlands, forested/shrub wetlands, and waterways) using Google Earth and Geographic Information Systems (GIS) mapping software.

During the field visit completed on April 9, 2015, WEST confirmed the presence or absence as well as the extent of wet or saturated features identified during the desktop assessment that were visible from public roads. The boundaries of wet or saturated features that were confirmed in the field evaluation were adjusted as needed to increase or decrease the boundaries identified in the desktop. Additionally, while driving throughout the Project area to confirm the desktop assessment, any additional wet or saturated features that could be observed from public roads (based on observation of hydrophytic vegetation and hydrology) were drawn on an aerial. Where necessary, binoculars were used from the edge of public roads to confirm wetland features;

however, topography, vegetation, and developed areas (i.e., homesteads) impaired the viewshed within portions of the Project area.

4 RESULTS

Based on NWI wetland resource data (USFWS 2014), about 189.3 ac (76.6 ha) (less than 0.5%) of the Project area is composed of wetlands, including the following wetland types: freshwater emergent wetland (160.3 ac [64.9 ha]), freshwater pond (15.8ac [6.4 ha]), and freshwater forested/shrub wetland (13.2 acres [5.3 ha]; Table 1; Figure 1).

Table 1. Wetland types present within the Freeborn Wind Energy Project based on U.S. Fish and Wildlife Service National Wetlands Inventory data (USFWS NWI 2014).

	Project	
Wetland Type	**Acres (ha)**	**Percent (%)**
Freshwater Emergent Wetland	160.3 (64.9)	84.7
Freshwater Pond	15.8 (6.4)	8.3
Freshwater Forested/Shrub Wetland	13.2 (5.3)	7.0
Total	**189.3 (76.6)**	**100.0**

The NWI data set identifies fewer acres of wetlands than WEST's review of public wetland and soil resource data sets and the field visit to the Project. The desktop assessment and field visit estimated that about 220.3 ac (89.2 ha; approximately 0.6%) of the Project area is composed of wetlands, including the following wetland types: freshwater emergent wetlands (150.3 ac [60.8 ha]), freshwater forested/shrub wetlands (48.7 ac [19.7 ha]), and freshwater ponds (21.3 ac [8.6 ha]; Table 2; Figure 1). The majority of features were documented as fringe wetlands found along the riparian corridors of waterbodies (i.e., Peter Lund Creek, Deer Creek, and Mud Lake Creek) within the Project (Figure 1). The majority of wetlands identified by NWI were confirmed to exist within the Project; however, during the field visit to the Project, several of the wetlands identified by NWI were not present or no longer exist. These areas appear to have been drained and have been planted in row crops. Conversely, potential wetlands were identified, based on observations of hydrophytic vegetation and hydrology, during the field visit to the Project that were not identified by NWI data. These include new wetlands and/or extensions of wetland boundaries beyond those depicted by the NWI data, particularly fringe wetlands along Peter Lund Creek (a tributary of Shell Rock River) corridor (Figure 1). A few ponds with a periphery of wetland complexes exist in the southwest and northwest corners of the Project, with the ponds in the southwest corner of the Project having substantial open water components (Figure 1). All streams/waterways within the Project were confirmed during the field visit with the addition of several smaller drainage areas. Peter Lund Creek appears to be the largest stream within the Project.

A review of PWI data showed that waters (regulated by the MNDNR) are located within the southern portion of the Project. Albert Lea Lake, located less than one mile west of the northwest corner of the Project, is the nearest PWI lake; Mud Lake Creek and Peter Lund Creek are PWI streams within the Project boundary (Figure 2). The Shell Rock River, located approximately one mile (1.6-km) west of the Project, is also a PWI river. Several of the major tributaries in the Project

are mapped on the PWI maps as dashed lines, indicating they are subject to public ditch laws and the MNDNR may not take jurisdiction over impacts to them.

Table 2. Wetland types present within the Freeborn Wind Energy Project based on WEST desktop assessment and field visit* on April 9, 2015.

	Project	
Wetland Type	**Acres (ha)**	**Percent (%)**
Freshwater Emergent Wetland	150.3 (60.8)	68.2
Freshwater Forested/Shrub Wetland	48.7 (19.7)	22.1
Freshwater Pond	21.3 (8.6)	9.7
Total	**220.3 (89.2)**	**100.0**

* The field visit was conducted from public roads only.

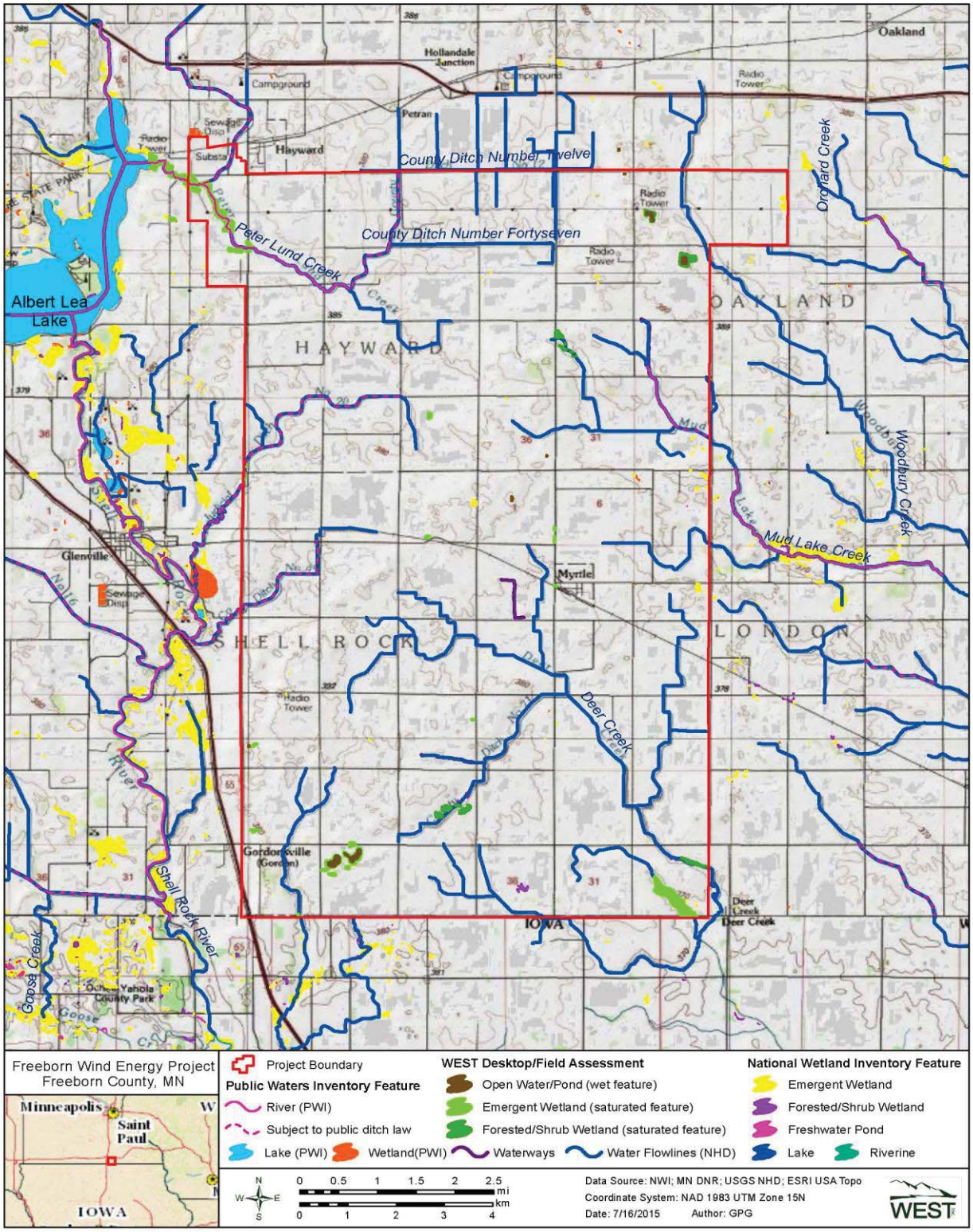

Figure 1. WEST desktop/field preliminary waters assessment, National Wetland Inventory (NWI) wetland types, and MN Public Waters Inventory (PWI) within the Freeborn Wind Energy Project.

*Note that the USGS NHD flowlines are not to scale and have been enhanced for visual clarity on the map.

5 CONCLUSIONS

This preliminary review of water resources provides information of potential wetlands and waterbodies within the Project. This information could be used to guide the preliminary layout of the Project in efforts to avoid or minimize potential impacts on water resources. Although wetlands and other waters of the U.S. (WoUS) are found in the area, they occupy a small percentage of the Project area, with the majority restricted to riparian zones. There is also potential for depressions within croplands to be saturated and/or to pond water during spring when conditions tend to be wetter. Formal wetland delineations have not yet been completed of the Project.

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Avian Use Study
for the Freeborn Wind Energy Project
Freeborn County, Minnesota

Final Report

January 2015 – March 2016

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Simon, S. and T. Mattson. 2016. Avian Studies for the Freeborn Wind Energy Project, Freeborn County, Minnesota. Final Report: January 2015 – March 2016. Prepared for Freeborn Wind Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Golden Valley, Minnesota. 44 pages + appendices.

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Freeborn Wind Energy LLC (Freeborn) is considering the development of the Freeborn Wind Energy Project (Project) in Freeborn County, Minnesota (Figure 1). To support development of the Project, Freeborn contracted Western Ecosystems Technology, Inc. (WEST) to conduct pre-construction baseline surveys to estimate temporal and spatial avian use of the Project area. The methods for this study were consistent with the U.S. Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy Guidance* (ECPG; USFWS 2013), the USFWS' *Final Land-Based Wind Energy Guidelines* (USFWS 2012), as well as the Minnesota Department of Natural Resource's (MNDNR) and the Minnesota Department of Commerce's (MNDOC) *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (MNDNR 2012).

Study objectives were to assess the following for large birds, small birds, and wetland birds: 1) species composition, relative abundance, and diversity; 2) overall use, percent of use, and frequency of occurrence; 3) flight height; 4) and spatial use. Additional objectives were to document use of the Project area by threatened, endangered, and sensitive avian species and eagles. The following report describes the results of the avian use study conducted in the Project area from January 17, 2015 – March 22, 2016.

2 STUDY AREA

The proposed Project area encompasses 16,120 hectares (39,834 acres [ac]) in Freeborn County, Minnesota (Figure 1). The Project occurs in the Western Corn Belt Plains Ecoregion (U.S. Environmental Protection Agency [USEPA] 2013), characterized by glaciated till plains and undulating loess plains. Much of the region was originally dominated by tallgrass prairie, riparian forest, oak-prairie savannas, and woody and herbaceous wetlands. Today, most of the area has been cleared for farms producing corn, soybeans, and livestock (USEPA 2013).

Many smaller streams in this ecoregion have been tilled, ditched, and tied into existing drainage systems, resulting in a reduction in wetland and aquatic habitats (USEPA 2013). A few streams are present in and adjacent to the Project area, including Woodbury Creek in the northeast, Mud Lake Creek in the east, Deer Creek and tributaries in the south, Peter Lund Creek in the northwest, and the Shell Rock River and its tributaries in the west (Figure 1).

According to the 2011 National Land Cover Database (NLCD; Homer et al. 2015), the majority (96.9%) of the Project area consists of cultivated croplands (i.e., agriculture) and developed areas (Table 1 and Figure 2). Corn (*Zea mays*) and soybean (*Glycine max*) are the most common crops. Herbaceous land cover comprises 1.0% of the Project area. Hay/pasture and deciduous forest land cover types each comprise less than 1.0% of the Project area. The remaining land cover types all comprise less than 0.1% of the Project area.

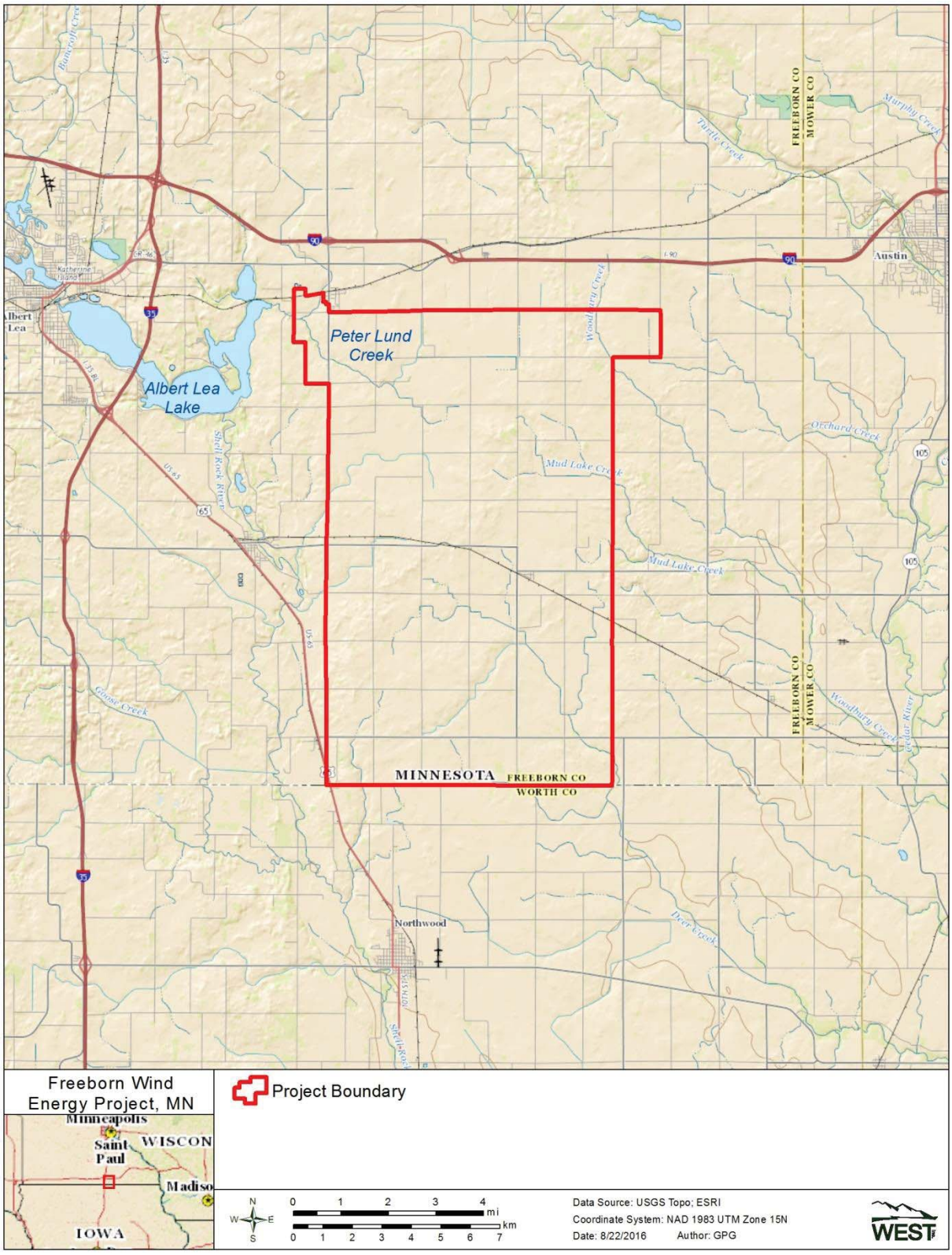

Figure 1. Location of the Freeborn Wind Energy Project in Freeborn County, Minnesota.

Table 1. 2011 National Land Cover Database land cover types within the Freeborn Wind Energy Project area.

Cover Type	Hectares	Acres	Percent (%)
Cultivated Crops	14,701.6	36,328.5	91.0
Developed, Open Space	849.8	2,100.0	5.3
Herbaceous	162.0	400.4	1.0
Hay/Pasture	133.2	329.1	0.8
Deciduous Forest	131.1	324.0	0.8
Developed, Low Intensity	56.3	139.1	0.4
Emergent Herbaceous Wetlands	40.0	98.9	0.3
Developed, Medium Intensity	21.5	53.1	0.1
Open Water	6.5	16.0	<0.1
Woody Wetlands	7.9	19.6	<0.1
Barren Land	5.3	13.1	<0.1
Evergreen Forest	2.9	7.1	<0.1
Developed, High Intensity	2.0	4.9	<0.1
Mixed Forest	0.0	0.0	0.0
Shrub/Scrub	0.0	0.0	0.0
Total	**16,120.2**	**39,833.8**	**100.0**

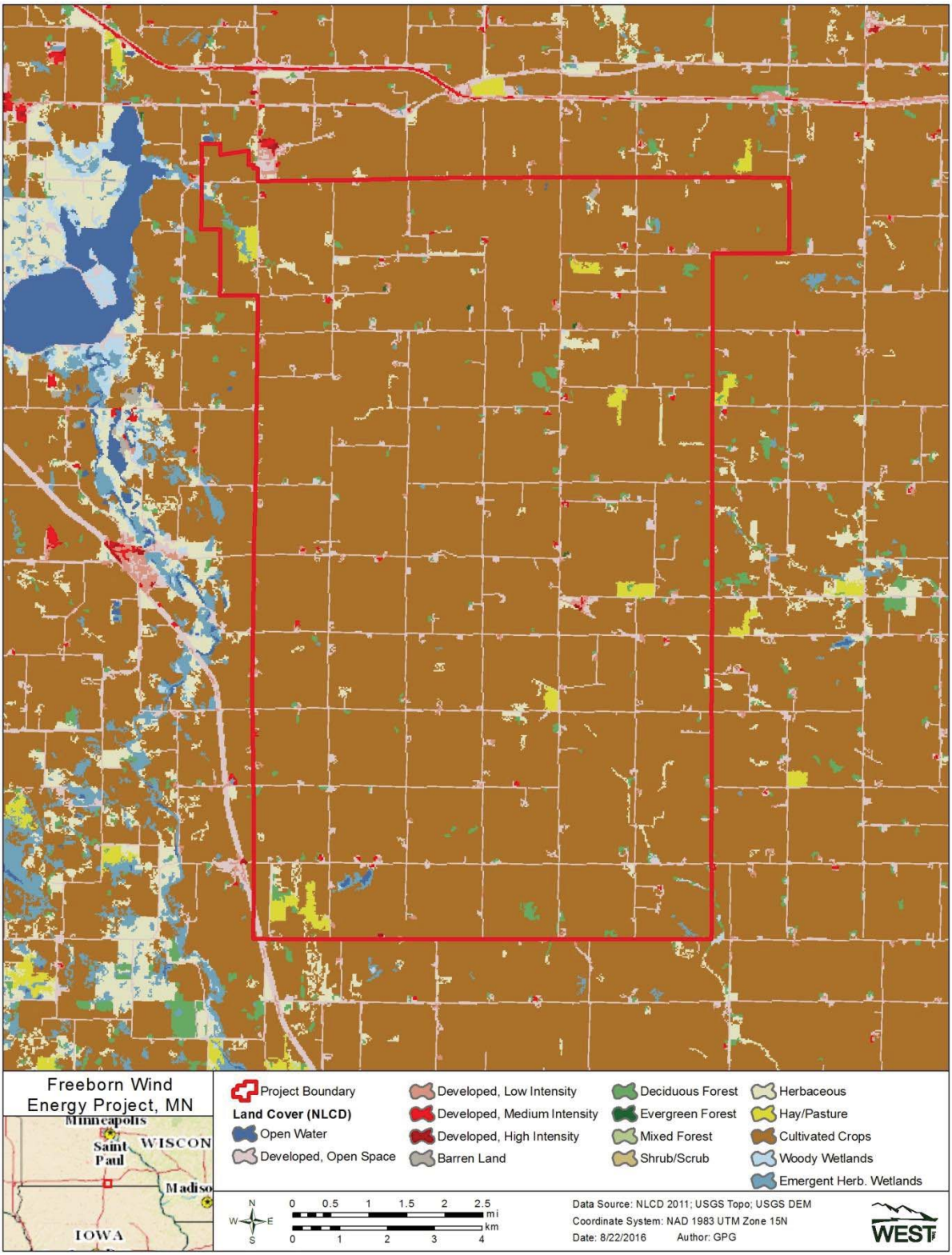

Figure 2. National Land Cover Database land cover types within and adjacent to the Freeborn Wind Energy Project area in Freeborn County, Minnesota.

3 METHODS

3.1 Large Bird Use Surveys

Large bird use surveys were conducted using methods described by Reynolds et al. (1980). Eighteen observation points consisting of 800-meter (m; 2,625-foot [ft]) radius circular plots were established within the Project area[1]. Circular plots covered approximately 31% of the Project area (Figure 3). Observation points (the center of the 800-m [2,625-ft] plot) were separated by at least 1,600 m (5,249 ft) to avoid overlap and were located along public roads using a systematic sampling scheme with a random start in ArcGIS (a Geographic Information System [GIS] software program).

Large bird use surveys were conducted once per month during the following seasons: winter 2015 (winter1; January 17 – March 31, 2015), spring (April 1 – May 19, 2015), summer (May 20 – September 2, 2015), fall (September 3 – November 9, 2015), and winter 2016 (winter2; November 10, 2015 – March 22, 2016). Surveys were conducted during daylight hours; survey periods were varied to approximately cover all daylight hours during a season. Observation points were planned to be surveyed the same number of times[2].

Point count surveys were conducted for 60 minutes. All large birds seen were recorded during each survey using a unique observation number, regardless of distance. In some cases, observations represented repeated sightings of the same individual. Observations of large birds outside the 800-m (2,625-ft) plot were recorded. These data were included in the development of species composition, relative abundance, and species diversity metrics, but were not included in analyses of avian use and flight heights. Large birds included the subtypes waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers.

[1] The majority of point 1 was originally located in the Project area in the northwest corner; however, the Project area was moved to the east in March 2015, following feedback from the MNDOC, MNDNR, and USFWS, which placed a large portion of point 1 out of the Project boundary (see Figure 3).

[2] Some surveys were missed due to poor visibility as a result of weather conditions or site access issues (e.g., muddy roads).

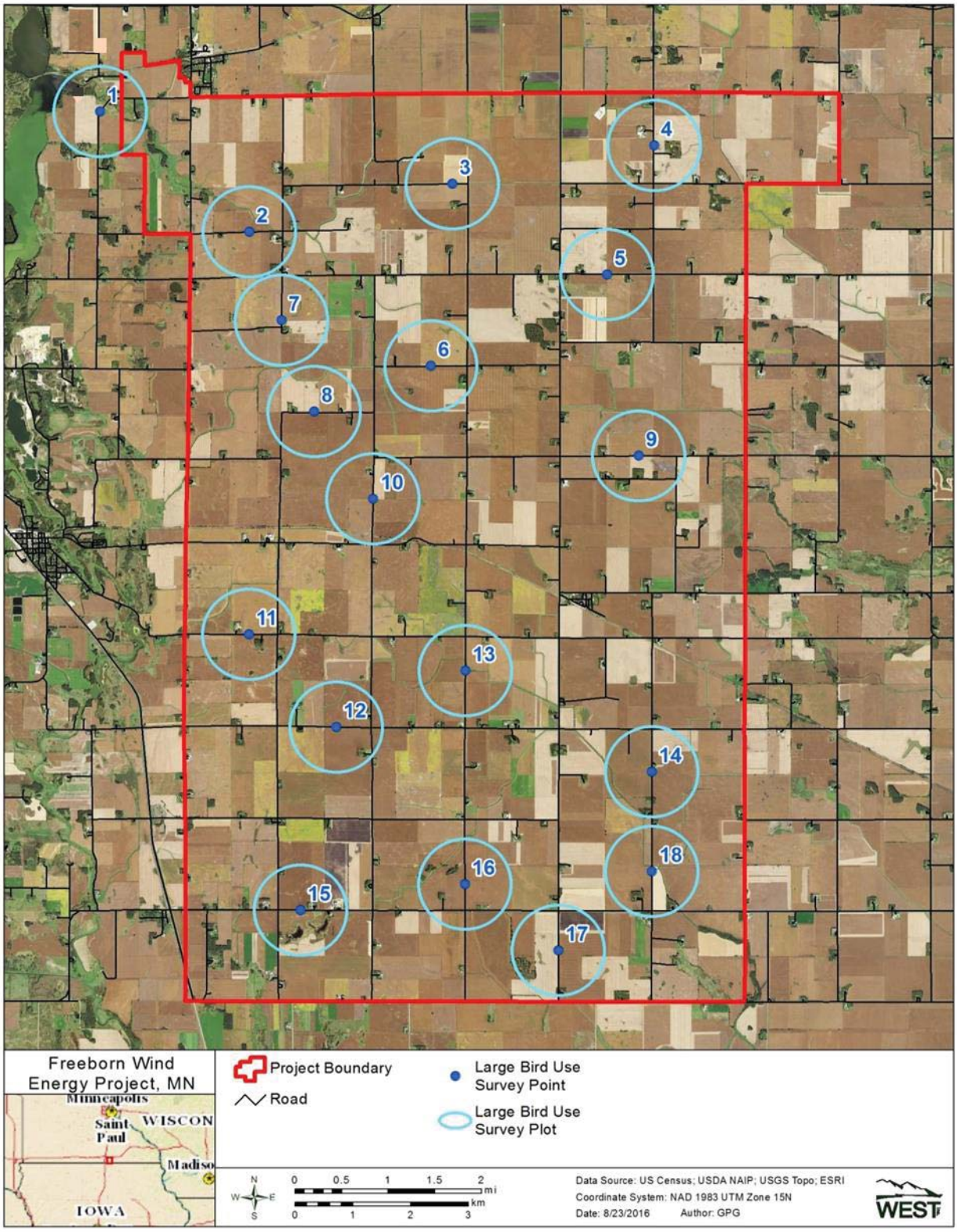

Figure 3. Location of large bird use survey plots in the Freeborn Wind Energy Project area where surveys were conducted from January 17, 2015 – March 22, 2016.

The following information was recorded during each large bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Species (or best possible identification)
- Number of individuals
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground
- Flight direction
- Activity (flying compared to perched)

Approximate flight height, flight direction, and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights were also recorded.

For bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) observations, flight height, distance, and activity (i.e., flying or perched) were recorded during each 1-minute interval the eagle was within the 800-m (2625-ft) plot and at or below 200 m (656 ft) above ground level, per the ECPG (USFWS 2013). In addition, the time eagles were observed outside of plots or flying at higher altitudes was recorded, and were treated as incidental observations but not included in statistical analyses. The perch locations and flight paths of eagles were mapped to qualitatively assess areas of eagle use within the Project.

Wildlife incidental observations were recorded to provide information on wildlife seen outside of standardized surveys. Biologists recorded all sensitive species; unusual species or behavior observations; and mammals, reptiles, and amphibians, and birds observed outside of standardized survey plots. Incidental observations were recorded in a similar fashion to standardized surveys; the observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, and flight height above ground (for bird species) were recorded. Biologists recorded the location of sensitive species by Universal Transverse Mercator (UTM) coordinates using a hand-held Global Positioning System (GPS) unit.

3.2 Small Bird Use Surveys

Small bird use surveys were conducted at nine 100-m-radius (328-ft-radius) circular plots established adjacent to forested areas (i.e., woodlots, shrubby areas, shelterbelts) along public roads within the Project area (Figure 4). Small bird use surveys were conducted five times during spring (March 21 – May 21, 2015), during daylight hours, between approximately a half hour before sunrise and four hours after sunrise. Each plot was surveyed once per visit.

The following information was recorded during each small bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Species (or best possible identification)
- Number of individuals
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground
- Flight direction
- Activity (flying compared to perched)

Small birds seen or heard during the 8-minute observation periods were recorded. Small birds observed outside the 100-m (328-ft) plots were recorded. These data were included in the development of species composition, relative abundance, and species diversity metrics, but were not include in analyses of avian use and flight heights. Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights were also recorded. Wildlife incidental observations recorded during small bird use surveys were recorded as described in Section 3.1.

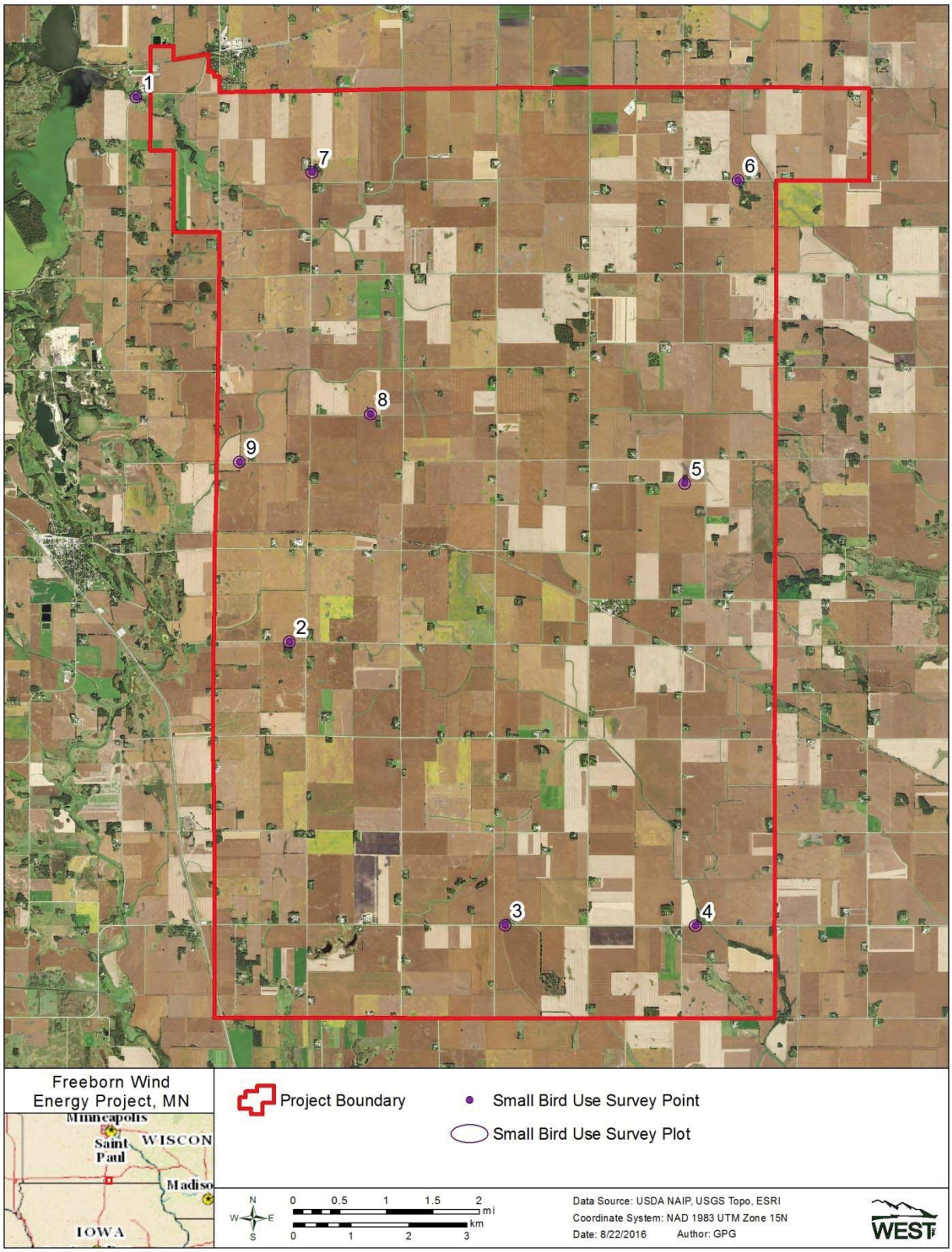

Figure 4. Location of small bird use survey plots in the Freeborn Wind Energy Project area where surveys were conducted from March 21 – May 21, 2015.

3.3 Wetland Bird Use Surveys

Three 800-m (2,625-ft) radius circular plots adjacent to or within close proximity to wetlands and/or waterbodies were established within the Project area (Figure 5). Based on available wetland/water resources in the Project area, point 1 was situated along Peter Lund Creek near the confluence of the creek and Albert Lea Lake in the northwest corner of the Project area; point 2 was situated in proximity to County Ditch Number Fortynine and just over 1 km (0.5 mi) of the Shell Rock River; and point 3 was located in the southwest corner of the Project area within close proximity to two open ponds and associated wetlands surrounding them.

The sampling protocol was designed to document bird use during spring migration and the early nesting season for wetland bird species[3], with at least one survey conducted to coincide with ice out (i.e., when the majority of waterbodies are free of ice) and peak waterfowl migration (MNDNR 2012). Wetland bird use surveys were conducted three times at intervals approximately four weeks apart during spring (March 19, April 22, and May 27, 2015). Biologists conducted wetland bird use surveys during daylight hours, between approximately dawn and 10:00 a.m. Each plot was surveyed once per visit.

Wetland birds and other large birds were recorded during wetland bird use surveys during 60-minute observation periods. Observations of wetland and large birds outside the 800-m (2,625-ft) plots were recorded. These data were included in the development of species composition, relative abundance, and species diversity metrics, but were not included in analyses of avian use and flight heights.

The following information was recorded during each wetland bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Species (or best possible identification)
- Number of individuals
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground
- Flight direction
- Activity (flying compared to perched)

[3] The wetland bird use surveys were conducted to establish avian use around lakes or wetlands with an open water component. Although these surveys were designed to emphasize use by waterfowl and shorebirds, the wetland bird use surveys are not limited to these groups of birds.

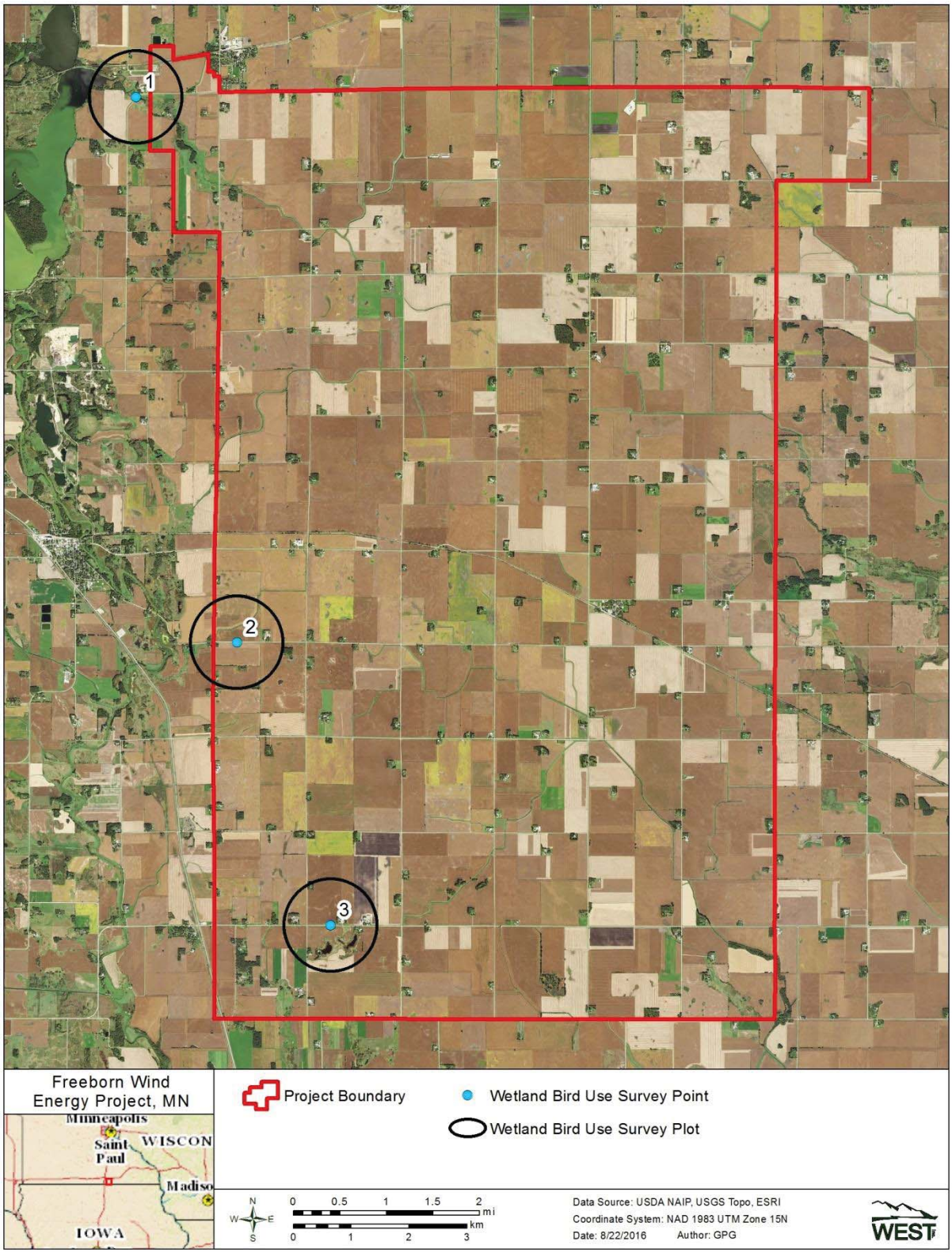

Figure 5. Location of wetland bird use survey plots in the proposed Freeborn Wind Energy Project

area where surveys were conducted from March 19 – May 27, 2015.

Approximate flight height, flight direction, and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights also were recorded.

Perches, on-water locations (i.e., birds observed swimming or floating on water), and flight paths of waterfowl, waterbirds, eagles, and other diurnal raptors were mapped to qualitatively show on maps the flight paths that were documented, flight locations within the wetland bird use plots, and flight direction (north/south, east/west). Aerial imagery was used to aid in recording locations of observations as accurately as possible. Wildlife incidental observations recorded during wetland bird use surveys were recorded as described in Section 3.1.

3.4 Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A data technician then compared a sample of records from an electronic database to the raw data forms and corrected any errors. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms and electronic data files were retained for reference. QA/QC measurements implemented for report writing included review of the final document by a technical editor, statistician, peer (research biologist), project manager, and senior manager.

4 DATA ANALYSIS

Data for each type of survey were analyzed separately (i.e., data were not combined among all studies). Data analysis for the large bird use surveys, small bird use surveys, and wetland bird use surveys were consistent among all three studies, but data for each study were presented independently based on target species groups and the viewsheds applied.

4.1 Species Composition, Relative Abundance, and Diversity

Species composition (i.e., species and bird types observed during the standardized surveys) and relative abundance (i.e., number of observations and groups of each species and bird type by season), and diversity (i.e., total number of species observed within each season) were compiled for all birds observed during point count surveys, irrespective of distance from observer (i.e., includes incidental observations). In addition, percent composition for each bird type was calculated by total percent of bird observations and total percent of bird observations

by season to assess percent composition of bird types based on all bird observations, regardless of distance from observer.

4.2 Bird Use, Percent of Use, and Frequency of Occurrence

Bird use was calculated as the number of birds per 800-m (2,625-ft) or 100-m (328-ft) plot per 60-minute or 8-minute survey for large bird/wetland bird use surveys and small bird use surveys, respectively. Bird use was calculated by season by first summing the number of birds seen within each plot during a visit, then averaging the number of birds/plot across plots within each visit, and finally by averaging the number of birds/visit across visits within the season. Overall bird use was calculated as a weighted average of seasonal values by the number of calendar days in each season (as defined by the season dates). Percent of use was calculated as the proportion of large bird/wetland bird use and small bird use that was attributable to a particular bird type or species, and frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed.

4.3 Flight Height

Flight height data were used to identify the bird species and estimated bird use within an estimated rotor swept height (RSH) ranging from 25 – 150 m (82 – 492 ft) above ground level. The group's (a single bird or a flock of 2 or more) flight height when first observed were used to calculate the percentage of the different groups flying at different height categories: below the RSH at 0-25 m (0-82 ft), RSH at 25-150 m (82-492 ft), and greater than the RSH at 150 m (492 ft).

4.4 Spatial Use

Spatial use was evaluated by comparing large bird/wetland bird and small bird use among plots. In addition, eagle, waterfowl, waterbirds, and diurnal raptor flight paths were mapped during large bird use and wetland bird use surveys to qualitatively show flight locations within the sample plots and flight direction (north/south, east/west). Aerial imagery was used to aid in recording locations of observations as accurately as possible.

4.5 Eagle Minutes

Eagle minutes were defined as the number of minutes an eagle was observed in flight[4] within 800-m (2,625-ft) radius plots and below heights of 200 m (656 ft) during 60-minute surveys. The sum of eagle minutes for each plot where eagles were documented was mapped to show eagle use minutes per plot. Eagle minutes were also calculated by total observations per month over the 15-month study to assess and compare eagle use within 800-m (2,625-ft) x 200-m (656-ft) cylinders, in accordance with the ECPG (USFWS 2013). The number of eagle minutes per minute of survey was also calculated to provide a relative measure of the level of eagle use by season.

[4] Observations of perched eagles do not apply to eagle minutes.

5 RESULTS

5.1 Large Bird Use Surveys

A total of 270 60-minute large bird use surveys were conducted in the Project area during 15 visits.

5.1.1 Large Bird Species Composition, Relative Abundance, and Diversity

A total of 7,057 large bird observations were recorded within 1,160 separate groups (Appendix A). The most commonly recorded large bird type was waterfowl, which comprised 59.7% of large bird observations during all five seasons, and 78.5% and 72.9% of observations during winter2 and winter1, respectively (Appendix A). The majority of waterfowl observations were comprised of mallard (*Anas platyrhynchos;* 2,440 observations in 67 groups), with the majority of observations recorded during winter2 (2,264 observations), accounting for 57.0% of large bird winter2 observations, irrespective of bird type (Appendix A).

Large corvids were the second most abundant bird type observed, accounting for 11.8% of large bird observations during all five seasons (Appendix A). Nine raptor species were observed during large bird use surveys, which accounted for 3.1% of large bird observations (217 observations). Bald eagles and a single golden eagle accounted for 40.6% of raptor observations (88 observations) and 1.2% of large bird observations (Appendix A). Eagles were observed more often during winter2 (39 observations; 44.3%) and winter1 (32 observations; 36.4%) surveys compared to seven observations (8.0%) in fall, six observations (6.8%) in spring, and four observations (4.5%) in summer surveys (Appendix A).

Fifty-four species were observed during large bird use surveys; species diversity was highest during winter2 and spring (32 and 29 species, respectively) seasons, compared to summer (20 species), and winter1 and fall seasons (19 species each).

5.1.2 Large Bird Seasonal Use, Percent of Use, and Frequency of Occurrence

Large bird use over the study period was 13.1 observations/800-m plot/60-minute survey and was higher during the winter2 survey (24.1 observations/800-m plot/60-minute survey; largely influenced by waterfowl observations) compared to fall (17.2), spring (10.2), winter1 (8.3), and summer surveys (4.4; Table 2; Appendix B).