APPENDIX P

Whooping Crane Habitat Assessment Report

Whooping Crane Habitat Assessment

Philip Wind Project

Haakon County, South Dakota

Final Report

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1 INTRODUCTION

Philip Wind Partners, LLC (Philip Wind) is considering development of the Philip Wind Project (Project) in Haakon County, South Dakota. Philip Wind contracted Western EcoSystems Technology, Inc. (WEST) to conduct a whooping crane (*Grus americana*) habitat assessment within the August 2022 Project Area (Figure 1.1). The objective was to evaluate potentially suitable whooping crane stopover habitat within the Project Area.

Whooping cranes are endemic to North America and one of North America's largest birds, driven almost to extinction in the 1940s by hunting and habitat loss (U.S. Fish and Wildlife Service [USFWS] 2013, 2021; Urbanek and Lewis 2020). The only self-sustaining wild population of whooping cranes breeds in Wood Buffalo National Park in Canada and typically winters in the coastal marshes of Texas including in the Aransas National Wildlife Refuge (NWR, Urbanek and Lewis 2020). Surveys by the USFWS of the Aransas-Wood Buffalo (ARWB) population estimated 543 individuals during the 2021–2022 winter census (Butler et al. 2022). The ARWB population migrates between wintering and breeding habitat in the spring and fall, with 95% of whooping crane sightings occurring within a 183-mile wide corridor (Pearse et al. 2018). The Project Area is primarily located within the 95% whooping crane migration corridor (Figure 1.1).

During migration, whooping cranes stopover at resting and feeding locations, where they are typically found in shallow wetlands and marshes, edges and sandbars of shallow rivers, and agricultural fields near a water source (Baasch et al. 2019, Montana Fish, Wildlife and Parks [MFWP] 2022). During migratory stopovers, they forage in wetlands and cultivated agricultural lands on invertebrates, small vertebrates, berries, and grains (Urbanek and Lewis 2020, Caven et al. 2021). Whooping cranes typically roost in shallow-water wetlands (USFWS 2021, Urbanek and Lewis 2020, MFWP 2022, NatureServe 2021).

2 PROJECT AREA

The Project Area is located approximately 14 mi north of the city of Philip in Haakon County, South Dakota (Figure 1.1). The Project Area encompasses approximately 68,318 acres (ac) within two level IV ecoregions: the Sub-humid Pierre Shale Plains and the Rivers Breaks (U.S. Environmental Protection Agency [USEPA] 2012). These ecoregions, historically dominated by grasslands have been extensively converted for agricultural use (e.g., row crops and livestock grazing; USEPA 2012), and contain semi-permanent and seasonal wetlands, often referred to as prairie potholes. Topography within the Project Area is gently rolling to flat.

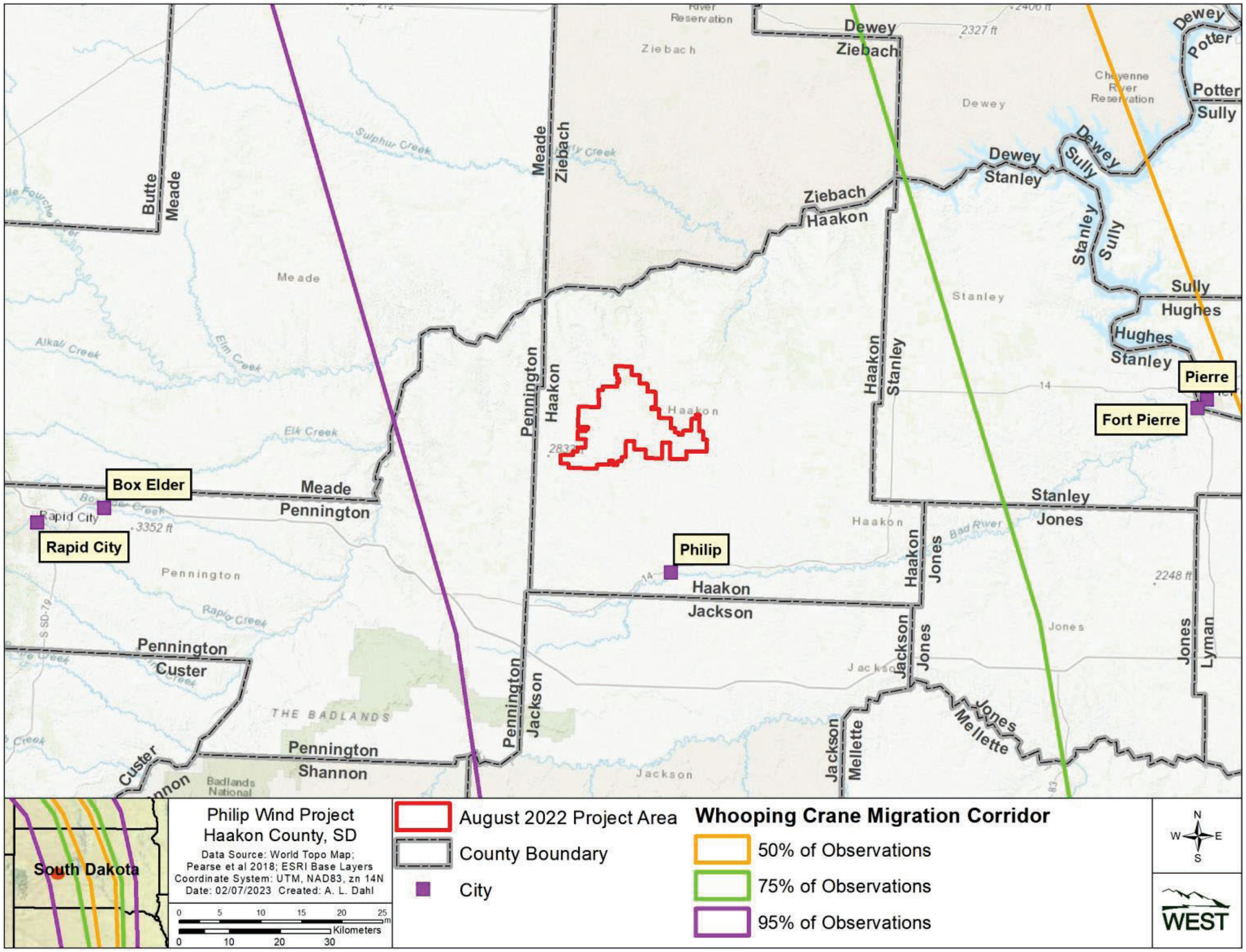

Figure 1.1 Location of the Philip Wind Project in Haakon County, South Dakota.

3 METHODS

Three methods for assessing potentially suitable whooping crane stopover habitat within the Project Area have been recommended by federal agencies including Western Area Power Administration (WAPA; B. Pauly, *pers comm.* January 13, 2023) and USFWS (N. Gates, *pers comm.* January 13, 2023) as consistent with the Upper Great Plains Programmatic Environmental Impact Statement (WAPA and USFWS 2015). These three models were used independently to analyze wetland habitat suitability:

(1) The Watershed Institute Wetland Suitability Model (TWI 2012),
(2) Predicted Habitat Use Model (Niemuth et al. 2018), and
(3) Decile Model (Niemuth et al. 2018).

3.1 The Watershed Institute Wetland Suitability Model

In 2012, The Watershed Institute (TWI) published a standardized approach to formalize and identify potentially suitable habitat for migrating whooping cranes. The TWI Model is feature specific and potentially suitable habitat was compared to habitat at Quivira National Wildlife Refuge in Kansas, which is designated Critical Habitat for the species (USFWS 1978).

This method (hereafter TWI Model) is partitioned into two steps. The first step removes National Wetland Inventory (NWI) wetlands based on proximity to anthropogenic features (buffers; Table 3.1), wetland size (≤ 0.25 ac), and visual obstructions (i.e., forests and buildings) within 328 feet of a wetland (TWI 2012). The portion of each wetland within each above classification was designated as ”unsuitable habitat” and removed from further evaluation of the wetland dataset because whooping cranes rarely use features under these conditions (Armbruster 1990 and TWI 2012) . The second step scores the remaining wetlands based on five criteria: water regime, distance to food, wetland size, wetland type, and wetland density (Table 3.2). These data are used to generate a single numeric value for each individual wetland assessed. In the TWI 2012 publication, scores of 12 or higher were considered “potentially suitable habitat” for whooping cranes. This evaluation of potentially suitable habitat was not validated with either telemetry or visual sightings in the TWI model (TWI 2012).

Table 3.1. Recommended impact distances (buffers) for anthropogenic features based on the TWI model (2012).

Anthropogenic Feature	Buffer (meters)
Urban Dwelling	800
Commercial Development	800
Paved Road	400
Railroad	400
Bridges	400
Gravel Road	200
Single Dwelling	200
Recreational Area	200
Private Road	100
Power Lines	100

Table 3.2. Wetland scoring system based on the TWI model (2012).

Wetland Characteristic	Attributes	Score Value
Water Regime[1]	Permanent (H)	5
	Intermittently Exposed (G)	4
	Semi-Permanent (F)	3
	Seasonally Flooded (C)	2
	Intermittently/Temporarily Flooded (J/A)	1
Distance to Food[2]	Within/adjacent to cropland	5
	<0.5 kilometers (km) from cropland	4
	0.51–1.00 km from cropland	3
	1.1–1.5 km from cropland	2
	>1.5 km from cropland	1
Wetland Size	>7.0 acres	5
	5.0–6.9 acres	4
	3.0–4.9 acres	3
	1.0–2.9 acres	2
	0.25 - <1.0 acre	1
Wetland Type[3]	Natural	2
	Created	0
Wetland Density[4]	Yes	3
	No	0

1. Codes in parenthesis are from the Wetlands and Deepwater Habitats Classification system (Cowardin et al. 1979) used by the U.S. Fish and Wildlife Service National Wetlands Inventory (USFWS NWI 2023) system.
2. Cropland areas are from the National Land Cover Database (2019) and include the “cultivated crops” category.
3. Based on USFWS NWI (2023) with wetland modifier “h” indicating the wetland was diked or impounded.
4. Wetland density was considered part of a mosaic if five or more wetlands were within one-quarter section (TWI 2012).

3.2 Predicted Habitat Use Model

Niemuth et al. (2018) developed a predicted habitat use model for whooping crane stopover habitat within North and South Dakota (hereafter Niemuth Model). The Niemuth Model provides a numerically continuous (0.0 – 1.0) prediction of the relative probability of habitat use by whooping cranes. The Niemuth Model was developed specifically for North and South Dakota and is a preferred model for the Ecological Service Offices for each state, respectively, (N. Gates, *pers. comm., 1/13/2023*) at the time of this habitat assessment. The model considered 12 predictor variables (Table 3.3) that were analyzed and validated using GPS location data from whooping cranes equipped with radio-telemetry transmitters (Niemuth et al. 2018).

Table[1] 3.3. Predictor variables considered in the development of models relating sightings of whooping cranes in North Dakota and South Dakota, USA, to geographic location, landscape-level habitat characteristics, and factors influencing detection (*from* Niemuth *et al.* [2018]).

Predictor Variable	Definition	Justification
Distance to centerline	Distance (km) from centerline of Whooping Crane migration corridor calculated from data	Whooping Cranes generally follow a narrow migration corridor (Howe 1989, Tacha et al. 2010)
Wetland area	Proportion of area within the buffer comprised of all temporary, seasonal, semipermanent, permanent, and lacustrine wetlands as identified by the National Wetlands Inventory (Wilen and Bates 1995)	Whooping Cranes use wetlands for roosting and foraging (Howe 1989, Johns et al. 1997, Austin and Richert 2005)
Wetland variety	Number of different wetland water regimes (temporary, seasonal, semipermanent, permanent or lake, riverine) as identified by the National Wetlands Inventory (Wilen and Bates 1995) processed to basins (Cowardin et al. 1995) within buffer	Seasonal shifts in wetland use and presence of multiple wetlands in the vicinity of Whooping Crane stopover sites (Howe 1989, Johns et al. 1997, Austin and Richert 2005) suggest that wetland complexes might be important to Whooping Cranes
Wetland number	Number of wetland basins as identified by the National Wetlands Inventory (Wilen and Bates 1995) processed to basins (Cowardin et al. 1995) within buffer	Wetlands used for roosting are generally large (Johns et al. 1997), but most prairie potholes and stock ponds are small (Kantrud et al. 1989); this variable evaluated whether multiple small wetlands of a given area were as attractive to Whooping Cranes as fewer large wetlands of the same area
Perennial cover	Proportion of buffer comprised of grassland, hay fields, and shrubs as identified by the 2001 National Land Cover Database (NLCD; Homer et al. 2007) cover classes 71, 81, and 52	Perennial cover is common at or adjacent to roosting and feeding sites (Howe 1989, Johns et al. 1997, Austin and Richert 2005)
Cropland	Proportion of buffer comprised of cultivated crops as identified by the 2001 NLCD (Homer et al. 2007) cover class 82	Whooping Cranes use agricultural fields for foraging (Howe 1989, Johns et al. 1997, Austin and Richert 2005)
Forest	Proportion of buffer comprised of forest cover as identified by the 2001 NLCD (Homer et al. 2007) cover classes 41, 42, and 43	Whooping Cranes use sites with few trees (Johns et al 1997, Austin and Richert 2005)

Table[1] 3.3. Predictor variables considered in the development of models relating sightings of whooping cranes in North Dakota and South Dakota, USA, to geographic location, landscape-level habitat characteristics, and factors influencing detection (*from* Niemuth *et al.* [2018]).

Predictor Variable	Definition	Justification
Distance to increased survey effort	Distance (km) from 24 areas of known intensive Whooping Crane observation effort, including district offices of wildlife management agencies and wildlife refuges and fish hatcheries with permanent staff	Disproportionate numbers of Whooping Crane sightings are in proximity to refuges or other sites with knowledgeable observers (Howe 1989, Tacha et al. 2010)
Human population density	Number of people per 2.6 km2, derived from U.S. Census Bureau data (Seirup and Yetman 2006)	Human observers are necessary to detect and report Whooping Cranes; sightings are biased toward urban centers (Howe 1989)
Roads	Length (km) of roads (maintained gravel or better) identified by topologically integrated geographic encoding and referencing (TIGER) data (U.S. Census Bureau 2011) within each buffer	Whooping Cranes avoid roads (Johns et al. 1997, Belaire et al. 2014), but roads may enable increased detection of Whooping Cranes
Terrain roughness	Standard deviation of cells within buffer of digital elevation model with 30-m spatial resolution	Whooping Cranes use wetlands with shallow shoreline slopes (Johns et al. 1997, Austin and Richert 2005); detection of Whooping Cranes may be influenced by topographic variation
Whooping Crane population size	Number of birds estimated to be in the Aransas–Wood Buffalo flock each year	Number of Whooping Cranes detected annually increased as population size increased during the analysis period

[1] Recreated from Niemuth et al. (2018).

3.3 Decile Model

Niemuth et al. (2018) also generated a Decile Model that divided the Niemuth Model into 10 equal areas referred as deciles, to aid in conservation planning. For this analysis, suitable wetland stopover habitat is defined as any NWI wetland within the five highest use deciles (deciles 1–5; B. Pauly, WAPA, pers. comm., 12/19/2022). The Decile Model was developed specifically for North and South Dakota and is a preferred model for the Ecological Service Offices for each state, respectively, (N. Gates, USFWS, pers. comm., 1/13/2023) at the time of this habitat assessment.

4 RESULTS

The most recently available data (USFWS 2023; Pearse et al. 2020), indicate no observations or telemetry locations of whooping cranes have been documented within the Project Area. Two observations of whooping cranes have been observed 5.5 mi west and 8.8 mi east of the Project

Area (USFWS 2023) along with two individuals < 0.5 mi south and 5.5 mi southeast of the Project Area confirmed by telemetry locations (Pearse et al. 2020).

4.1 The Watershed Institute Wetland Suitability Model

The Project Area contains 1,799 ac of NWI wetlands and of these, 872 ac of wetlands were evaluated using the TWI Model (Table 4.1). Of the scored acres of wetlands, 415 ac were considered potentially suitable habitat (scores of 12 or more; Table 4.1, Figure 4.1).

Table 4.1. The Watershed Institute (TWI 2012) scored wetlands within the Philip Wind Project Area, Haakon County, South Dakota.

TWI Score[1]	Acres of Scored Wetland	% of Total Scored Wetlands[2]
1	0	0.0
2	0	0.0
3	0	0.0
4	2.5	0.3
5	4.0	0.5
6	18.1	2.1
7	29.6	3.4
8	53.3	6.1
9	78.5	9.0
10	120.1	13.8
11	150.9	17.3
12	226.3	26.0
13	165.8	19.0
14	22.8	2.6
Total	**871.7**	**100.0**

[1] Scores 12 and greater are considered “potentially suitable habitat” based on TWI criteria (TWI 2012).

[2] Sums may not add to 100% due to rounding

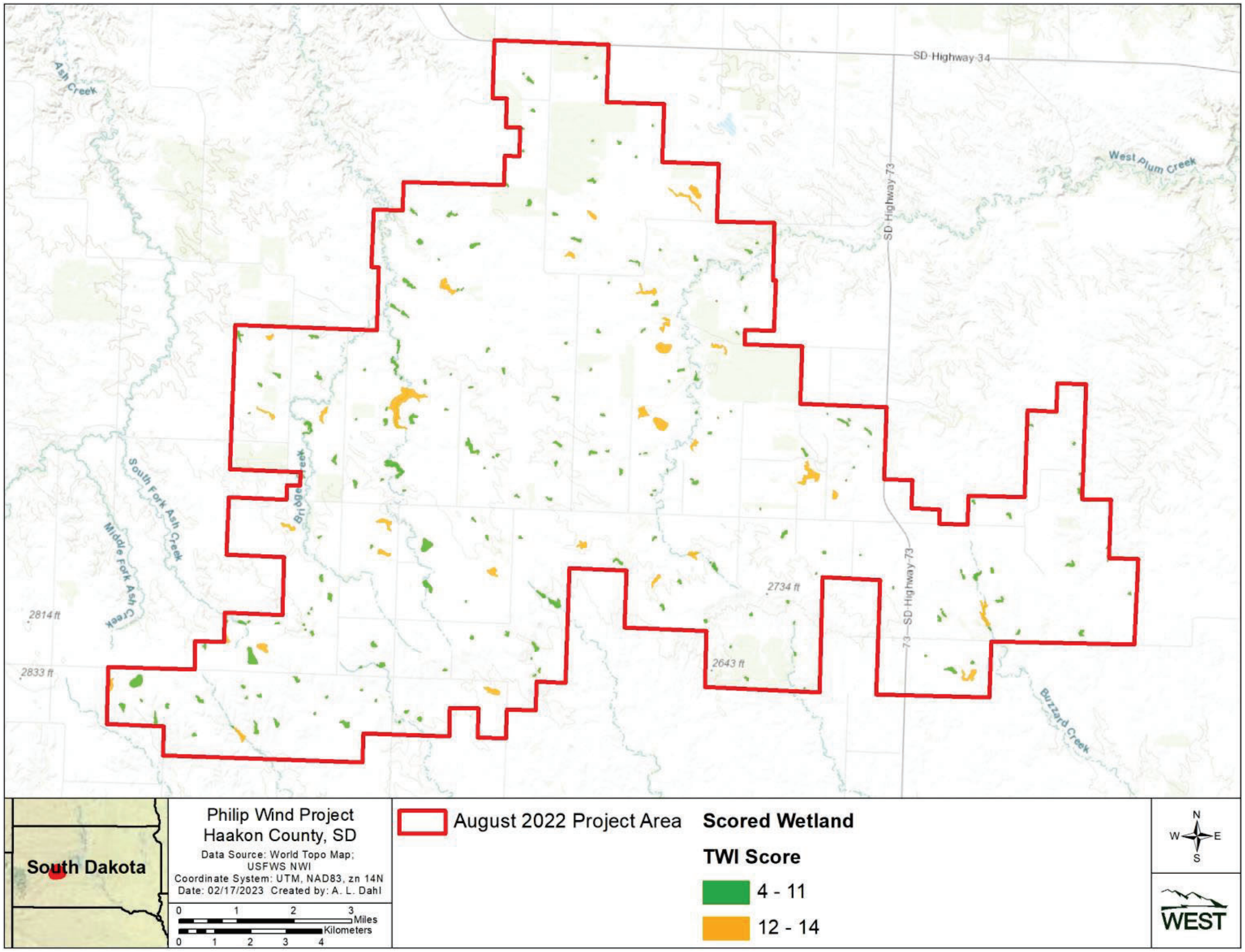

Figure 4.1. **The Watershed Institute (TWI) scored wetlands classified as non-suitable habitat (scores 4-11) and potential suitable habitat (scores 12-14) within the Philip Wind Project Area, Haakon County, South Dakota.**

4.2 Predicted Habitat Use Model

Predicted whooping crane habitat use within the Project Area ranged from < 0.0001 to approximately 0.0038 on a scale of 0 to 1.0 (Figure 4.2). Therefore, it is expected that habitat within the Project Area would have a maximum of a 0.38% chance of use by whooping cranes during migration.

4.3 Decile Model

Five deciles (5-9) are represented within the Project Area (Table 4.2) of which only one (Decile 5), representing 348 ac, is considered a whooping crane high use decile (Table 4.2). Five acres of NWI wetlands occur within Decile 5 (Figure 4.3).

Table 4.2. Number of acres within the Philip Wind Project for each decile (Niemuth et al. 2018), Haakon County, South Dakota.

Decile[1]	Acres
1	0
2	0
3	0
4	0
5	348.2
6	9,110.0
7	28,385.1
8	27,224.1
9	3,250.8
10	0
Total	**68,318.2**

[1] Deciles 1-5 are considered whooping crane high use deciles (B. Pauly, WAPA, pers. comm., 12/19/2022)

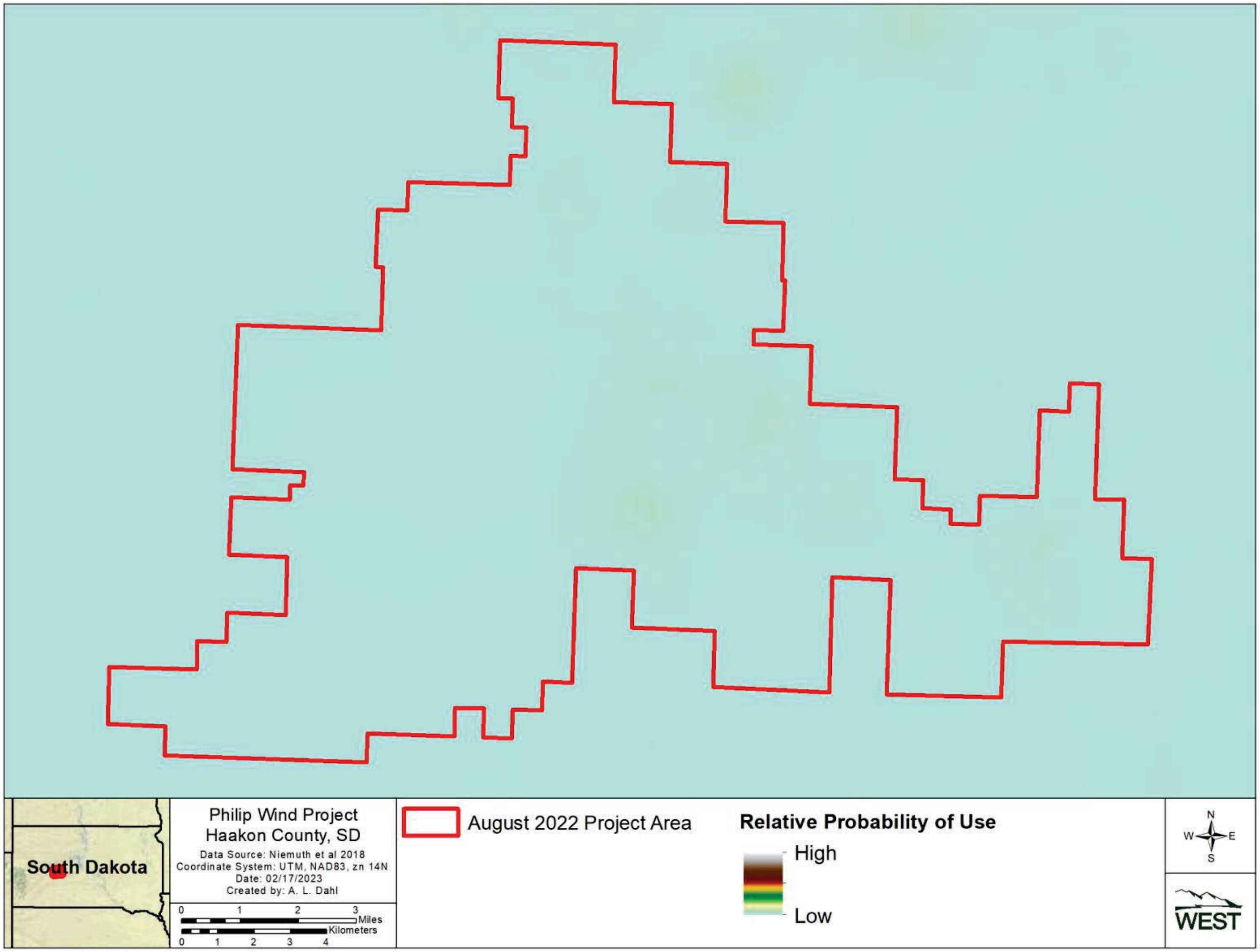

Figure 4.2. **Predicted whooping crane habitat use model (Niemuth Model) output for the Philip Wind Project, Haakon County, South Dakota.**

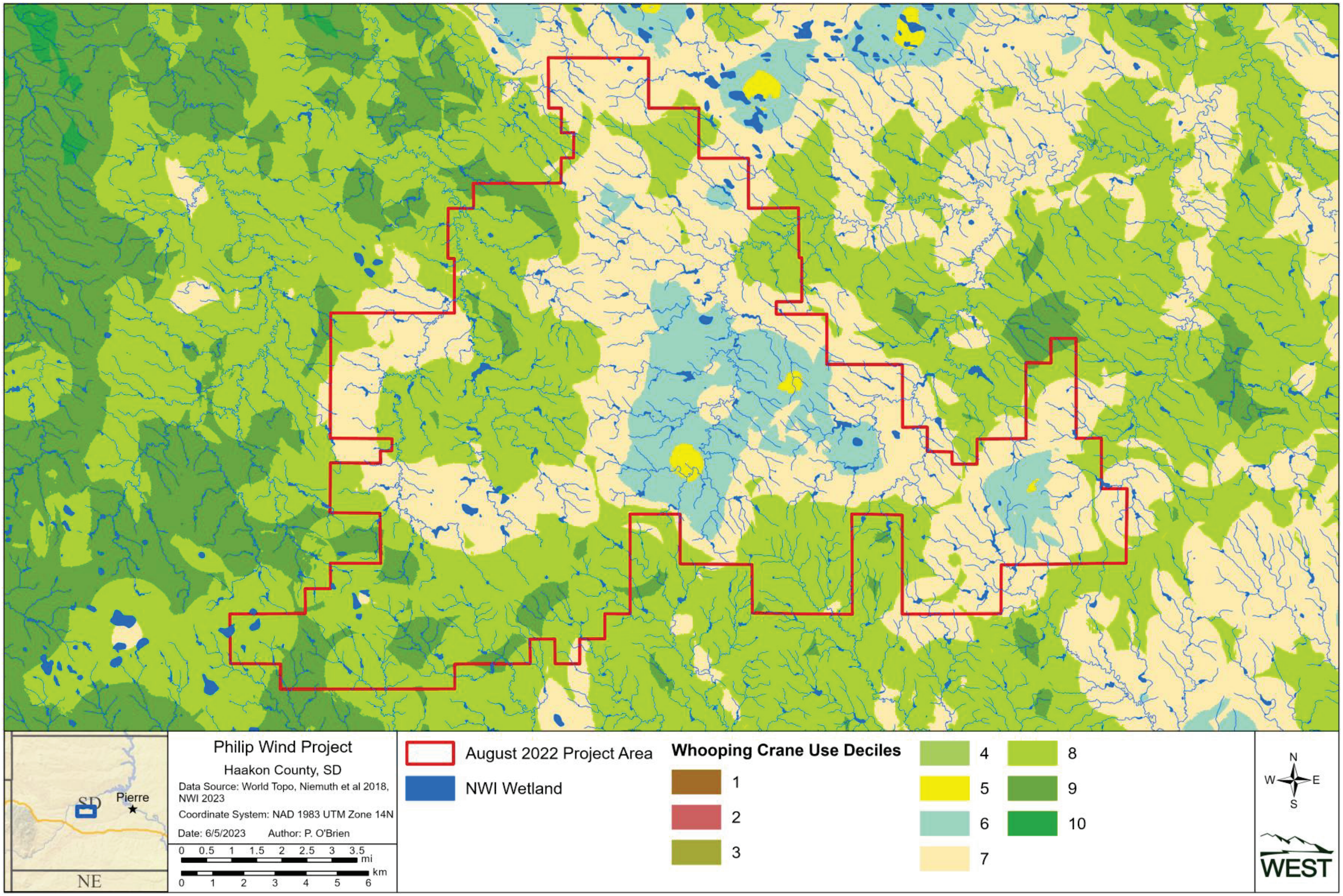

Figure 4.3. NWI wetlands and Neimuth Model whooping crane use deciles (Neimuth et al. 2018) at the Philip Wind Project Area in Haakon County, South Dakota.

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