Appendix M

Wildlife Survey Reports

1. Eagle and Raptor Nest Survey Reports
2. Sharp-tailed Grouse Lek Survey Reports
3. Avian Use Surveys
4. Grassland Assessment
5. Whooping Crane Desktop Assessment
6. Bat Acoustic Activity Survey
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Appendix M.5

Whooping Crane Desktop Habitat Assessment

Whooping Crane Habitat Assessment for the Proposed Homestead Wind Project Williams County, North Dakota

Final

Prepared for:

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REPORT REFERENCE

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INTRODUCTION

Homestead Wind, LLC (Homestead), is developing the proposed Homestead Wind Project (Project) located in Williams County, North Dakota (Figure 1). Western EcoSystems Technology, Inc. (WEST) completed this whooping crane (WHCR; *Grus americana*) migration habitat assessment (habitat assessment) with the objective to describe the overall suitability of habitat within and adjacent to the Project as whooping crane resting and foraging (stopover) habitat during migration.

PROJECT AREA

The Project is located within the Northwestern Glaciated Plains Level III Ecoregion (US Environmental Protection Agency [USEPA] 2012, 2013) and encompasses approximately 24,994 acres. The Northwestern Glaciated Plains ecoregion features a moderately high concentration of semi-permanent and seasonal wetlands (USEPA 2012, 2013).

Migration habitat suitability was evaluated within the Project Boundary (Project area), and within 5-kilometer (km) and 20-km buffers surrounding the Project area (5-km Analysis Area and 20-km Analysis Area respectively; Figure 2). The entirety of the Project area and 5-km Analysis Area, and the majority of the 20-km Analysis Area, are located within the portion of the migration corridor that contains 75% of the documented whooping crane sightings (Figure 2). The southwestern section of the 20-km Analysis Area includes the portion of the migration corridor that contains 95% of the whooping crane sightings, while the northeastern section includes a portion of the migration corridor that contains 50% of the whooping crane sightings (Figure 2). Approximately 20% of the 20-km Analysis Area (114,872 acres) is in Montana.

The elevation of the Project area ranges between 2,158–2,512 feet above sea level (US Geological Survey [USGS] 2025). Land within the Project area is largely privately owned but also contains North Dakota State Trust Land parcels (USGS 2024). Intermittent streams are present within the Project area, including Willow Creek and Blacktail Creek and several other unnamed streams. (USGS 2024).

Based on the USFWS National Wetlands Inventory (NWI), approximately 324 acres of wetlands are present within the Project area (USFWS NWI 2022). Most wetlands are freshwater emergent (49.6% of the wetlands within the Project area), followed by riverine (18.6%), other (16.2%), and freshwater pond (15.7%). Wetlands are relatively sparse and evenly distributed across the Project area.

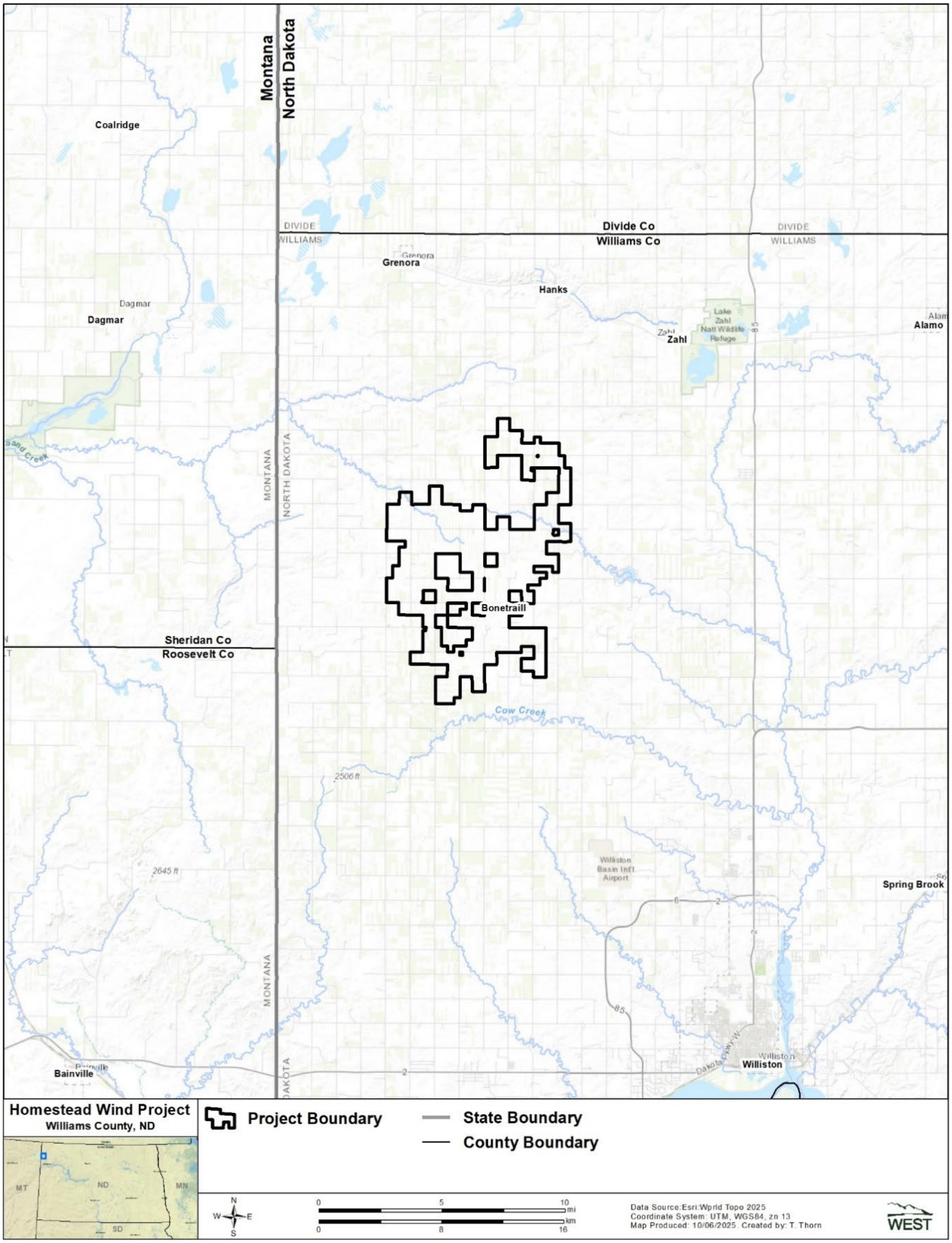

Figure 1. Location of the proposed Homestead Wind Project in Williams County, North Dakota.

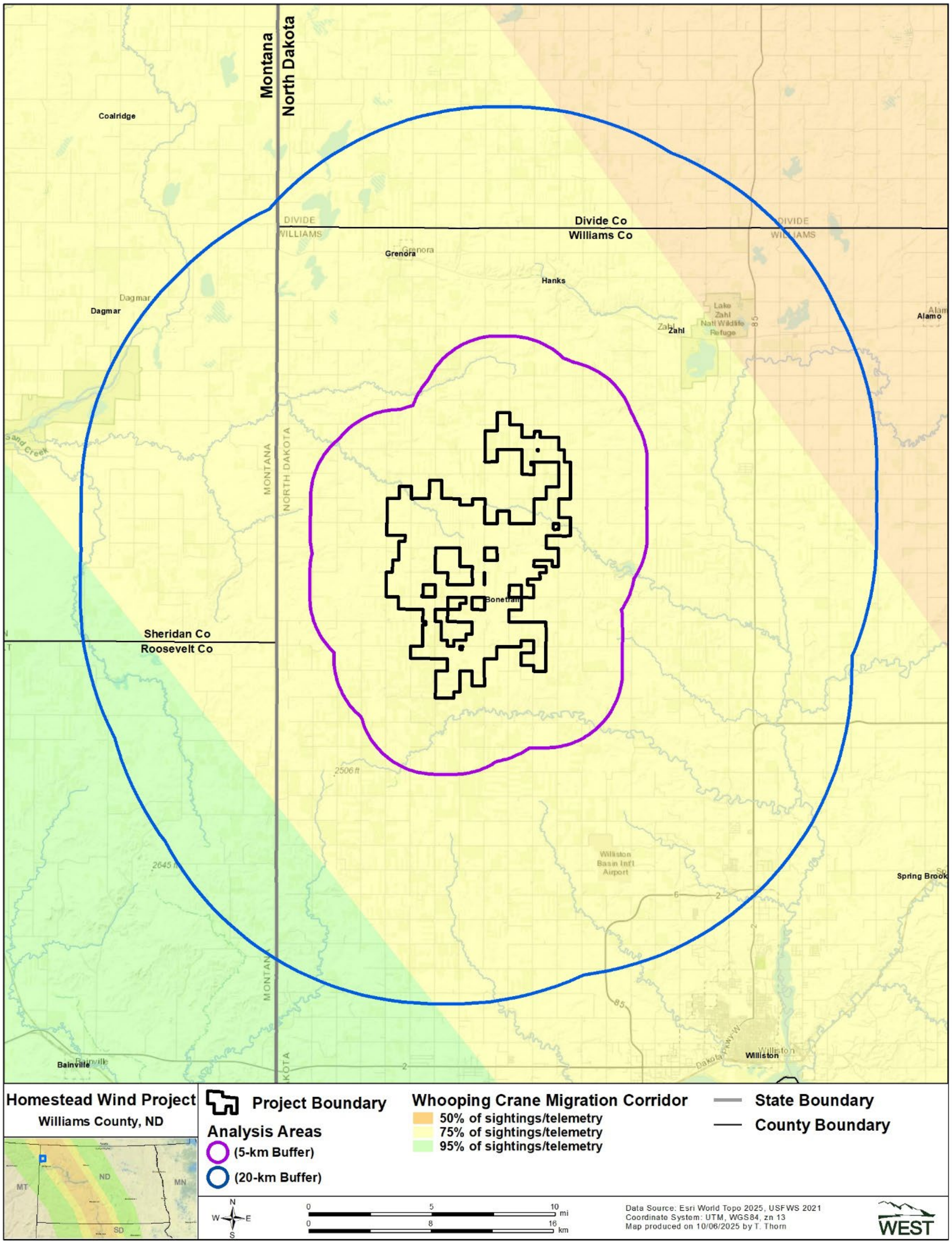

Figure 2. Location of the proposed Homestead Wind Project and Analysis Areas in relation to the Whooping Crane Migration Corridor in Williams County, North Dakota.

According to the National Land Cover Database (NLCD), the main land cover type within the Project area is cultivated crops (81.2%), followed by herbaceous (14.2%), developed (3.6%), hay/pasture (0.6%), and emergent herbaceous wetlands (0.3%; 2024; Table 1, Figure 3). The remaining land cover types account for less than 1% of the Project area (NLCD 2024; Table 1, Figure 3). The Analysis Areas have a relatively lower prevalence (percent composition) of cultivated crops and have more herbaceous cover types compared to the Project area (NLCD 2024; Table 1, Figure 3). The 20-km has a relatively higher prevalence of wetlands compared to both the Project area and 5-km Analysis Area (NLCD 2024; Table 1, Figure 3). Suitable whooping crane stopover habitat often occurs in a mixed landscape of cultivated croplands and sparsely vegetated shallow wetlands – both are (cumulatively) most abundant within the 20-km Analysis Area (337,968 acres).

Table 1. Land cover types, coverage, and percent (%) composition within the Project area and 5-kilometer (km) and 20-km Analysis Areas at proposed Homestead Wind Project in Williams County, North Dakota.

	Project Area		5-km Analysis Area		20-km Analysis Area	
Land Cover Type	**Coverage (Acre)**	**% Composition**	**Coverage (Acre)**	**% Composition**	**Coverage (Acre)**	**% Composition**
Cultivated Crops	20,302	81.2	65,599	69.0	325,848	56.7
Herbaceous	3,553	14.2	24,630	25.9	189,451	33.0
Developed[1]	888	3.6	3,645	3.8	26,181	4.6
Hay/Pasture	139	0.6	365	0.4	10,376	1.8
Emergent Herbaceous Wetlands	67	0.3	362	0.4	12,120	2.1
Shrub/Scrub	16	<0.1	107	0.1	2,714	0.5
Open Water	15	<0.1	200	0.2	6,935	1.2
Woody Wetlands	10	<0.1	46	<0.1	112	<0.1
Deciduous Forest	4	<0.1	60	<0.1	419	<0.1
Mixed Forest	–	–	<1	<0.1	14	<0.1
Barren	–	–	–	–	387	<0.1
Evergreen Forest	–	–	–	–	2	<0.1
Total	**24,994**	**100[2]**	**95,014**	**100[2]**	**574,559**	**100[2]**

1. Developed land cover types may include open space, low intensity, medium intensity, and high intensity.
2. Sums of values may not equal totals shown due to rounding.

Source: National Land Cover Database 2024.

METHODS

A desktop review of publicly available habitat data and WHCR occurrence data (NLCD 2024; Pearse et al. 2018, 2022; USFWS 2021; and Niemuth et al. 2018) were used to evaluate the likelihood of WHCR habitat use within and near the Project. Location, relative likelihood of use, and extent of suitable WHCR stopover habitat were evaluated at the three scales (Project area, 5-km Analysis Area, and 20-km Analysis Area) using the Relative Probability of Occurrence Model (hereafter, the Niemuth Model) and the Decile Model (hereafter, the Niemuth Decile Model), developed specifically for North and South Dakota (Niemuth et al. 2018). WEST additionally used a whooping crane habitat selection model developed by Pearse et al. (2021; hereafter, the Pearse Model). The Niemuth Model and Niemuth Decile Model are generally preferred by the USFWS North Dakota Ecological Service Field Office (H. Edens, USFWS, pers. comm., December 4,

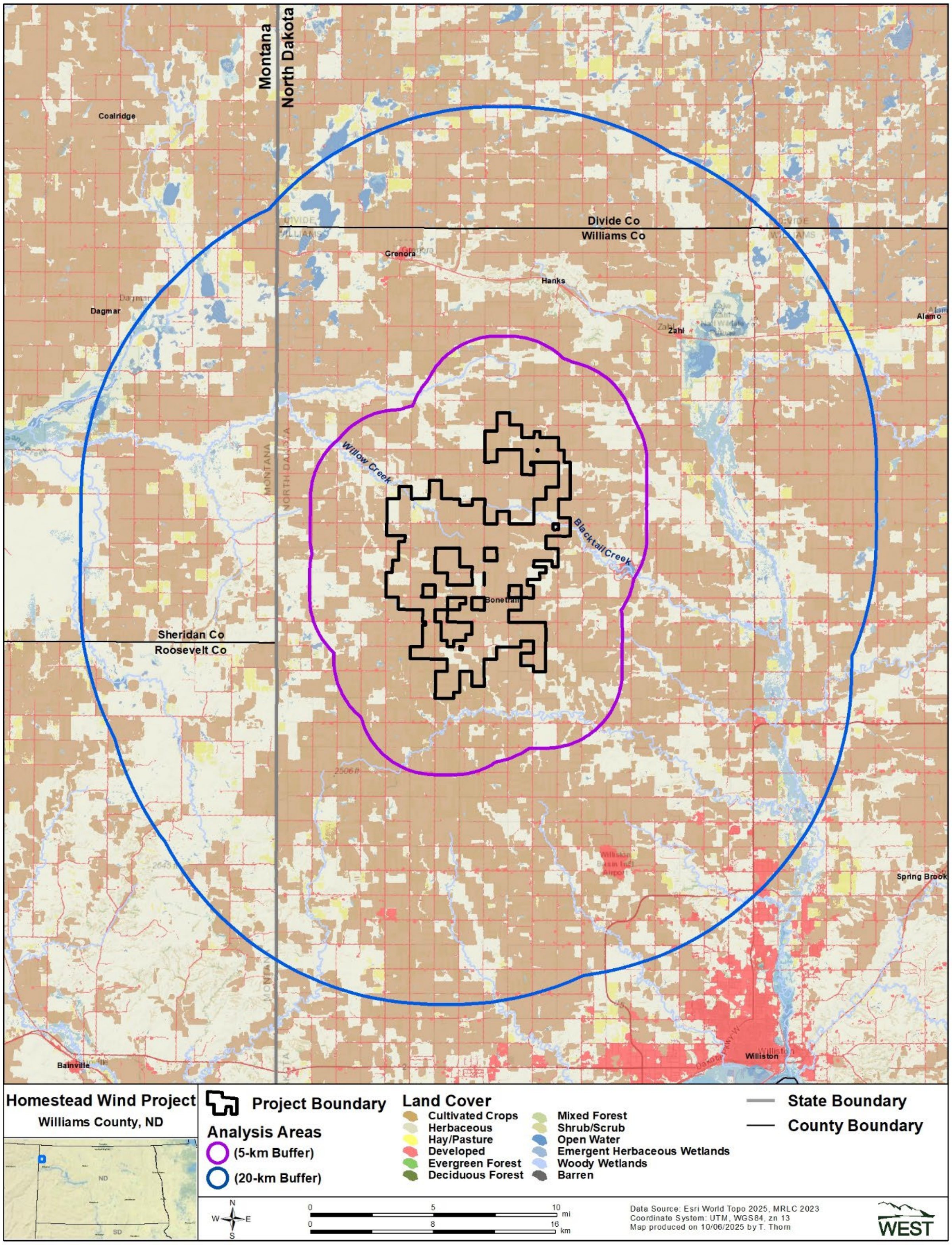

Figure 3. Land cover types and coverage within the Project area and Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

2024) to assess WHCR stopover habitat use and are consistent with the North Dakota Game and Fish Department's (NDGFD) preferred approach (NDGFD 2021).

However, neither the Niemuth Model nor Niemuth Decile Model can be used to evaluate WHCR migration habitat in Montana as the models were developed for habitat evaluations solely within the states of North and South Dakota. To evaluate migration habitat within the Montana portion of the 20-km Analysis Area was evaluated (Figures 2 and 3), WEST relied on the Pearse Model. The Pearse Model predicts the relative habitat selection probability for whooping cranes throughout the entire migration corridor. Although the Pearse Model is not designed to identify locations of suitable stopover habitat, it does provide a comprehensive comparison of the relative probability of migrating whooping cranes selecting any habitat within the analysis three scales, including habitat in Montana. The Pearse Model output also proved useful as a base layer to display historical sighting data (USFWS 2024) and telemetry locations of whooping cranes within the Project area and associated 5-km and 20-km Analysis Areas.

Relative Probability of Occurrence

Niemuth Model

The Niemuth Model was used to analyze the probability of WHCR occurrence based on habitat predictors within the Project area and associated 5-km Analysis Area and 20-km Analysis Area. The Niemuth Model provides a numerically continuous (0–1.00) prediction of the relative probability of habitat use by whooping cranes. The model considered 12 predictor variables (Appendix A) that were analyzed and validated using Global Positioning System location data from whooping cranes equipped with radio-telemetry transmitters (Niemuth et al. 2018). Raster data were reclassed into the following eight classes of relative probability of habitat use: 0–0.05; 0.05–0.10; 0.10–0.20, 0.20–0.30, 0.30–0.40, 0.40–0.50, 0.50–0.60, and 0.60–0.70. Preliminary results indicated the majority of the land within the 5- and 20-km Analysis Areas and Project area were classified below 0.10; thus, the two lowest categories (0–0.05 and 0.05–0.10) of relative probability of habitat use were split to provide a better visual representation of the variation in the probability of WHCR occurrence. The data set was then clipped to cover the 5-km Analysis Area and 20-km Analysis Area; except for the portion of the 20-km Analysis Area in Montana where no data was available.

Pearse Model

The Pearse Model was developed using WHCR habitat-use data collected from confirmed sightings of whooping cranes and whooping cranes equipped with transmitters throughout the entire US portion of the WHCR migration corridor. Raster data were reclassed into three classes (low, medium, and high) using cell values and visual breaks, working from the highest values to the lowest, due to the wide range of values associated with the modeled data values (0 to over 800,000). The data were then clipped to cover the Analysis Areas to graphically depict the relative predicted habitat selection by whooping cranes in the Analysis Areas (including lands in Montana) and Project area.

Stopover Habitat Relative Conservation Value

Niemuth Decile Model

The Niemuth Decile Model divides the Niemuth Model into 10 equal areas, referred to as deciles, to aid in conservation planning. A decile value of one indicates the highest probability of WHCR occurrence and a value of 10 indicates the lowest probability of occurrence. This value system provides succinct thresholds that allow land parcels to be identified and ranked for WHCR conservation (Niemuth et al. 2018). The Niemuth Decile Model was used to calculate and summarize acreages within each ranked decile within the separate Project area, 5-km Analysis Area and 20-km Analysis Area, except where the 20-km Analysis Area extended into Montana. The decile ranking can also be used for comparing and identifying sites for habitat conservation actions to benefit migrating whooping cranes.

RESULTS

Relative Probability of Occurrence

Niemuth Model

Over 99% of the potential stopover habitat within the Project area is represented in the lowest probability of use category (p = 0–0.05, where p = probability), suggesting a lower relative probability of WHCR occurrence compared to the 5-km Analysis Area and 20-km Analysis Area (Table 2, Figure 4). Additionally, the migration stopover habitat quality is generally low throughout Project and Analysis Areas (0–0.10), indicating the likelihood of WHCR occurrence during migration is relatively low within any of these areas compared to the larger landscape (in North Dakota) (Table 2, Figure 4).

Table 2. Niemuth Model results for whooping crane stopover habitat (acres) and relative probability of use (%) within the Project area, 5-kilometer (km), and 20-km Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

Relative Probability Range	Project Area		5-km Analysis Area		20-km Analysis Area	
	Acres	Percent	Acres	Percent	Acres	Percent
0–0.05	24,836	99.4	93,646	98.6	408,547	88.9
0.05–0.10	157	0.6	1,369	1.4	45,326	9.9
0.10–0.20	–	–	–	–	4,734	1.0
0.20–0.30	–	–	–	–	594	0.1
0.30–0.40	–	–	–	–	312	<0.1
0.40–0.50	–	–	–	–	166	<0.1
0.50–0.60	–	–	–	–	8	<0.1
Total	**24,994**	**100[1]**	**95,015[3]**	**100[1]**	**459,687[2]**	**100[1]**

1. Sums of values may not equal totals shown due to rounding and includes only the acres within North Dakota.
2. Approximately 20% of the 20-km Analysis Area (114,872 acres) in Montana is excluded.
3. Total acreage for the 5-km Analysis Area is different than total in Table 1 due to rounding of Niemuth Model acreage classifications.

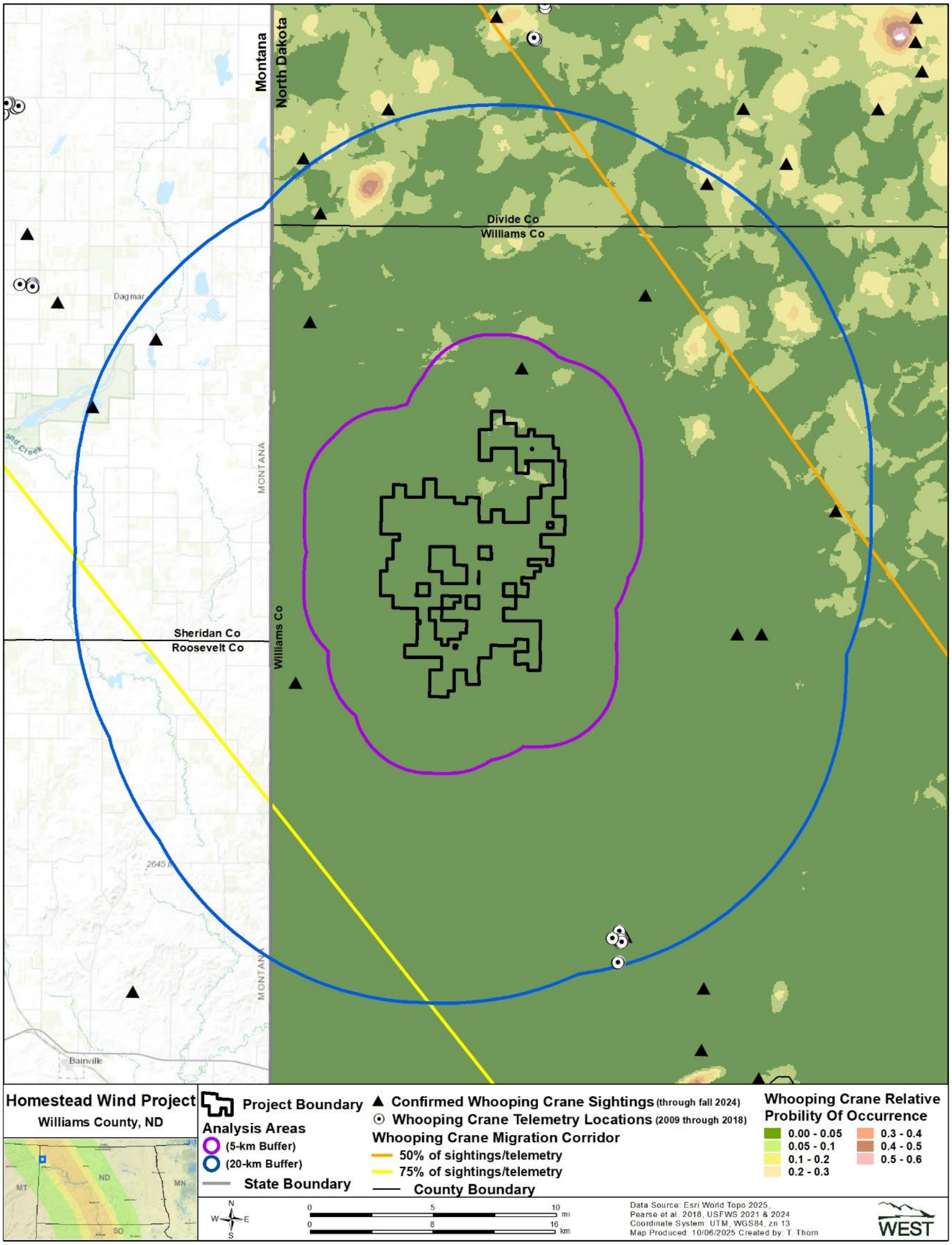

Figure 4. Niemuth Model results for whooping crane relative probability of occurrence, confirmed sightings, and telemetry locations within the Project area, 5-kilometer (km), and 20-km Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

Pearse Model

The available observational and telemetry data locations indicated no documented WHCR use within the Project area (Pearse et al. 2018, 2022; USFWS 2021, 2023; Figures 4 and 5). The nearest confirmed observation occurs approximately three km northeast of the Project area (within the 5-km Analysis Area), and there are 11 confirmed observations and five telemetry locations within the 20-km Analysis Area (Figures 4 and 5). Additional telemetry locations of whooping cranes have been recorded in nearby locations outside of the 20-km Analysis Area in Montana and North Dakota. The observational and telemetry data indicate relatively uniform habitat use by whooping cranes is throughout the 20-km Analysis Area (Figures 4 and 5).

Similar to the Niemuth Model results, the Pearse Model output (Figure 5) classified the Project area and 5-km Analysis Area landscape with the lowest relative WHCR habitat selection values, indicating WHCR use is predicted to be low. However, results from the Pearse Model indicated a slight increase in predicted WHCR use from the southern to northern extents within the 20-km Analysis Area in Montana (Figure 5).

The modeled output of predicted WHCR habitat use in North Dakota (Pearse Model) compared favorably to the probability of WHCR occurrence in North Dakota (Niemuth Model; Figure 4). This suggests that the overall modeled prediction of WHCR habitat selection was a suitable alternative to compare migration habitat suitability in Montana and throughout the extent of the Analysis Areas (Figure 5).

Stopover Habitat Relative Conservation Value

Niemuth Decile Model

The modelled output of WHCR stopover habitat within the Project area consisted of deciles 2–5, with an estimated 99% contained in deciles 2, 3, and 4 (Table 3, Figure 6). Decile 3 is the most common habitat decile category within the Project area (approximately 49%), followed by Decile 2 (approximately 29%), Decile 4 (approximately 21%), and Decile 5 (approximately 1%; Table 3, Figure 6). Increasing the size of the Analysis Area from a 5-km to 20-km area resulted in an increase in the total acreage within each decile as expected, with deciles 3 and 4 contributing the most acreage within the 5-km Analysis Area and 20-km Analysis Area within North Dakota (Table 3, Figure 6). The best stopover habitat within the Analysis areas, based on the likelihood of use, is located within the north and northeast quadrants of the 20-km Analysis Area in North Dakota (Figure 6), with a greater prevalence of higher quality habitat occurring outside the 20-km Analysis Area in Montana and North Dakota (Figures 5 and 6).

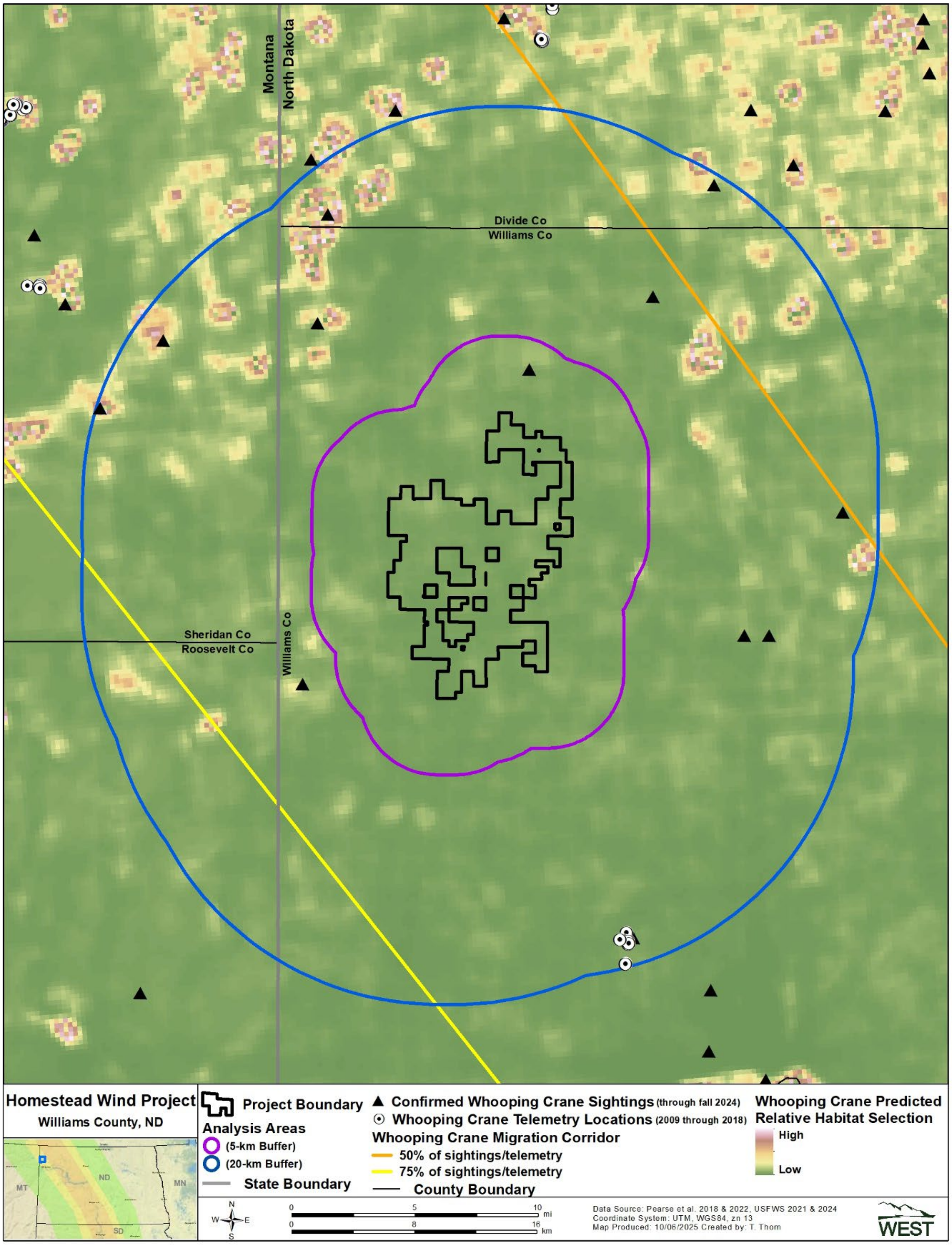

Figure 5. Pearse Model results of whooping crane predicted relative likelihood of habitat selection, confirmed sightings, and telemetry locations within the Project area, 5-kilometer (km), and 20-km Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

Table 3. Niemuth Decile Model results of whooping crane stopover habitat decile values (acres and relative abundance [%]) within the Project area, 5-kilometer (km), and 20-km Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

	Project Area		5-km Analysis Area		20-km Analysis Area	
Decile	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
1	0	0	3	<0.1	19,865	4.3
2	7,323	29.3	12,748	13.4	104,903	22.8
3	12,211	48.9	43,734	46.0	165,026	35.9
4	5,222	20.9	30,099	31.7	119,766	26.1
5	238	1.0	7,394	7.8	36,394	7.9
6	0	0	1,037	1.1	10,571	2.3
7	0	0	0	0	2,859	0.6
8	0	0	0	0	308	<0.1
Total	**24,994**	**100**[1]	**95,015**[1]	**100**[1]	**459,692**[2,3]	**100**[1]

1. Sums of values may not equal totals shown due to rounding and only includes acres within North Dakota.
2. Approximately 20% of the 20-km Analysis Area (114,872 acres) in Montana is excluded.
3. Total acreage for the 20-km Analysis Area is different than total in Table 2 due to finer resolution of Niemuth Decile Model allocations.

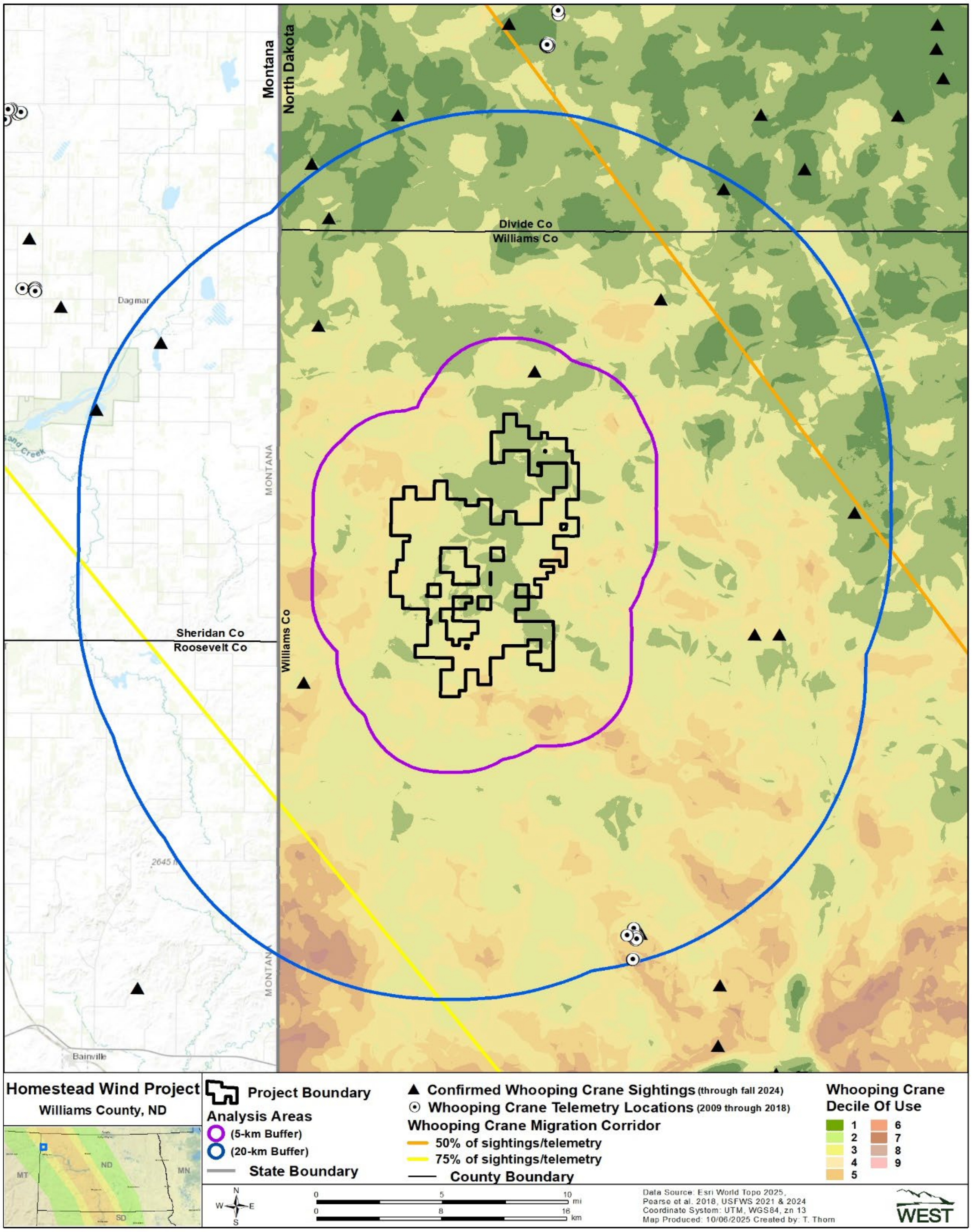

Figure 6. Niemuth Decile Model results of whooping crane relative probability of habitat use, confirmed sightings, and telemetry locations within the Project area, 5-km, and 20-km Analysis Areas at the proposed Homestead Wind Project in Williams County, North Dakota.

DISCUSSION

The Niemuth and Pearse model outputs classify the Project area and 5-km Analysis Area with the lowest relative likelihood of WHCR occurrences based on habitat selection values and likelihood of use. Despite the different analytical approaches, both models provided important insights into predicted WHCR habitat use, and the Pearse Model in particular offered helpful insights into the Montana portion of the 20-km Analysis Area where the Niemuth Model was not equipped for use. Collectively, the Pearse and Niemuth model outputs, coupled with the documented WHCR occurrences (confirmed observations and telemetry locations), suggest no historical, traditional stopover habitat areas exist within the Project area or Analysis Areas. Furthermore, the overall likelihood of species occurrence within the Project area and 5-km buffer is in the lowest ranking for habitat selection and predicted use categories during the spring and fall migration periods. Therefore, WHCR-use within 5-km of the Project area is unlikely based on landscape level comparisons of the best available data describing the existing landcover types, abundance and distribution of historical WHCR-use records, and the relatively low predicted use by whooping cranes.

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Appendix A. Predictor Variables Considered in the Development of Whooping Crane Relative Probability of Occurrence Model

Appendix A. Predictor variables considered in the development of models relating sightings and occurrences of whooping cranes in North Dakota and South Dakota to geographic location, landscape-level habitat characteristics and factors influencing detection.

Predictor Variable	Definition	Justification
Distance to Centerline	Distance (kilometers [km]) from the centerline of whooping crane (*Grus americana*) 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[1] comprised of all temporary, seasonal, semipermanent, permanent, and lacustrine wetlands as identified by the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI; 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, semi-permanent, permanent or lake, riverine) as identified by the USFWS NWI (Wilen and Bates 1995) processed to basins (Cowardin et al. 1995) within buffer[1]	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 wetland complexes might be important to whooping cranes
Wetland Number	Number of wetland basins as identified by the NWI (Wilen and Bates 1995) processed to basins (Cowardin et al. 1995) within buffer[1]	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 the 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 the 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 the 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)
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 km, derived from US 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)

Appendix A. Predictor variables considered in the development of models relating sightings and occurrences of whooping cranes in North Dakota and South Dakota to geographic location, landscape-level habitat characteristics and factors influencing detection.

Predictor Variable	Definition	Justification
Roads	Length (km) of roads (maintained gravel or better) identified by topologically integrated geographic encoding and referencing data (US Census Bureau 2011) within each buffer[1]	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 the buffer of the digital elevation model with 30-meter (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.] Characteristics within buffers were calculated using circular moving windows with radii of 800, 1,200, and 1,600 meters.

Recreated from Niemuth et al. 2018.