Appendix C
Meridian Wind Project Field Studies Summary 2016–2018

Meridian Wind Project

Field Studies Summary 2016 – 2019

Hyde County, South Dakota

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INTRODUCTION

Meridian Wind Project, LLC (Meridian) is considering the development of the Meridian Wind Project (Project) in Hyde County, South Dakota. Meridian contracted with Western EcoSystems Technology, Inc. (WEST) to conduct baseline wildlife and habitat studies to evaluate potential impacts of wind energy facility construction and operations on wildlife.

In 2016, baseline wildlife studies were completed within a previous defined wind resources area encompassing 39,099.3 acres (ac; 15,822.9 hectares [ha]) based on a 200-megawatt (MW) project. In 2017, this wind resource area was expanded to encompass 110,142.3 ac (44,573.0 ha) based on up to three separate 250 MW phases. This expanded wind resource area was the largest of the proposed boundaries. ENGIE IR Holdings, LLC recently refined the area for the Project which is primarily located along the eastern portion of previously surveyed areas and encompasses approximately 14,606 ac (5,910.8 ha; Figure 1, Table 1).

Baseline wildlife studies at the Project were designed to address the questions posed under Tier 3 of the US Fish and Wildlife Service (USFWS) *Final Land-Based Wind Energy Guidelines* (WEG; USFWS 2012) and Stage 2 of the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013). Studies conducted at the Project from 2016 to 2019 include avian use surveys, raptor and eagle nest surveys, prairie grouse lek surveys, acoustic monitoring for bats northern long-eared bat (*Myotis septentrionalis*) summer habitat analysis, whooping crane (*Grus americana*) stop-over habitat analysis, and land cover characterization study.

The studies conducted to date also incorporate WEST's experience working in South Dakota with USFWS Ecological Services; the USFWS Region 6 Ecological Services Field Office; and South Dakota Game, Fish, and Parks (SDGFP). The following provides a summary of studies conducted, in progress, or applicable to the current Project area.

PROJECT AREA DESCRIPTION

The Project is located in Hyde County, South Dakota, approximately four miles (mi) south and southeast of Highmore, South Dakota. This area is known as the Northwestern Great Plains Level III Ecoregions (US Environmental Protection Agency 2019). The Northwestern Glaciated Plains ecoregion has significant surface irregularity and dense concentrations of wetlands. This area exhibits a topography of gentle rolling hills rather than steep hummocks, with fewer areas of high wetland density, and more stream erosion (US Environmental Protection Agency 2019). The topography of the ecoregion has level to rolling uplands and native grasslands can be found in areas of steep and rocky topography, but they have been largely converted to cultivated crops. The river breaks landform is also common near riparian areas and consists of uplands with broken terraces that descend to the Missouri River and its major tributaries. This rough and broken river break topography, with its wooded draws and uncultivated areas, provides habitat for wildlife.

The topography within the Project area consists of rolling hills, with elevations ranging from 1,860-2,149 feet (ft; 567-655 meters [m]) above mean sea level (U.S. Geological Survey [USGS] Digital Elevation Model 2017). Land ownership in the Project is primarily private with a few scattered State Resource Management Areas (USGS Protected Areas Database of the U.S. version 2 2019). South Fork Medicine Knoll Creek and Chapelle Creek are the named creeks within the Project area (USGS National Hydrography Dataset 2019). Wetlands are relatively evenly dispersed throughout the Project area with the exception of the southwest portion, where in general, there are more wetlands and wetlands are larger (National Wetlands Inventory [NWI] 2019). The majority of wetlands are freshwater emergent, followed by freshwater pond, and lakes.

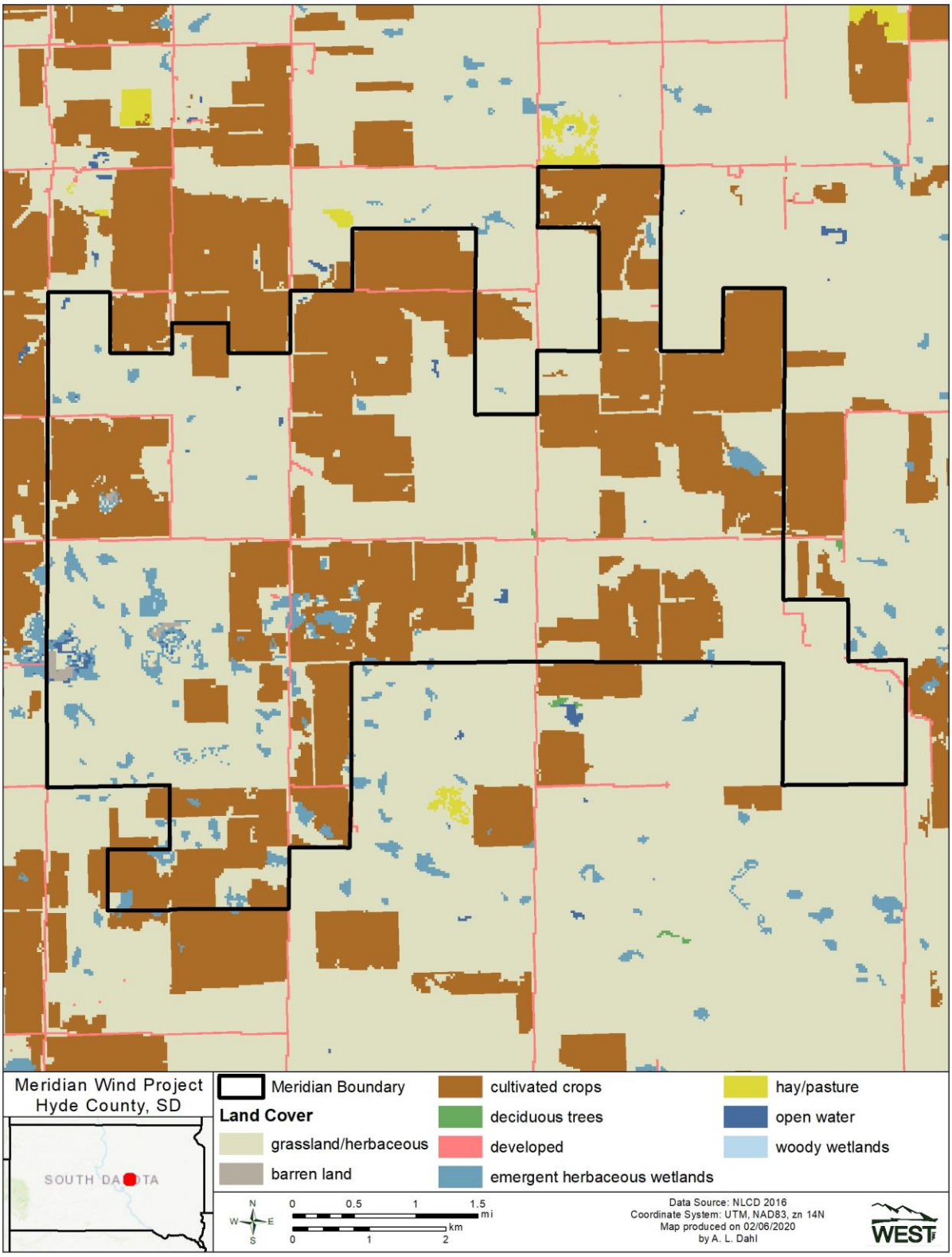

Figure 1. Land cover types within the current Meridian Wind Project boundary located in Hyde County, South Dakota.

Land Cover

Land cover types were digitized using ArcGIS (version 10.4) within the current Project area. Using USDA National Agriculture Imagery Program (NAIP [USDA 2019]) aerial imagery in combination with 2011 South Dakota Land Cover Patterns (National Land Cover Database (NLCD; Yang et al. 2018, Multi-Resolution Land Characteristics 2019), and USDA National Agricultural Statistics Service (NASS) National Cropland Layer (USDA NASS 2018) cropland classification, and field inspections, all lands within the current Project area were digitized and assigned one of nine cover types (excluding NWI wetlands; Table 1). NWI data were used to represent water for the purpose of mapping within the current Project area. Water features visible on the aerial imagery, but not located in the NWI data tables, were digitized as "open water" on the map (Figure 1).

The dominant land cover type within the current Project area is grassland/herbaceous, covering 53.6% of the land area (7,834.7 ac [3,170.6 ha]) followed by cultivated crops (5,998.3 ac [2,427.4 ha; 41.1%]; Table 1, Figure 1). Additional land cover types include emergent herbaceous wetlands (430.6 ac [174.3 ha; 2.9%]) followed by developed (276.6 ac [111.9 ha; 1.9%]). All remaining land cover types in the Project were 0.2% or less (Table 1).

Table 1. Digitized land cover within the current Meridian Wind Project, Hyde County, South Dakota.

Land Cover Type	Acres	Hectares	% of Project*
Grassland/Herbaceous	7,834.7	3,170.6	53.6
Cultivated crops	5,998.3	2,427.4	41.1
Emergent Herbaceous Wetlands	430.6	174.3	2.9
Developed	276.6	111.9	1.9
Open Water	33.8	13.7	0.2
Barren Land	29.6	12.0	0.2
Deciduous Trees	1.3	0.5	<0.1
Woody Wetlands	1.1	0.4	<0.1
Total	**14,606.0**	**5,910.8**	

* Sum may not equal zero due to rounging

Sources: Yang et al. 2018, Multi-Resolution Land Characteristics 2019

AVIAN USE SURVEYS

Avian point-count surveys are the most widely used methodology for pre-construction avian use characterization and risk analysis (e.g., USFWS Tier 3 studies [USFWS 2012]), because of their effectiveness and efficiency for characterizing the use of selected sites by a broad spectrum of diurnally active birds (Ralph et al. 1993, Strickland et al. 2011). The objective of the fixed-point avian use surveys was to estimate the seasonal and spatial use of the Project area by birds. The following provides a preliminary summary of the avian use surveys conducted or being conducted within current Project area. No analyses of these data have been completed nor has the data

been thoroughly vetted and curated. An avian use report will be drafted late May 2020 in include historical data if available.

There are twelve survey points in the current project area. Each of these points are surveyed once per month. Protocol for survey efforts remain consistent with previous years where each point is surveyed for 70 min. Only small bird observations are recorded during the first 10 min of the survey period, immediately followed by a large bird survey for the remaining 60 min as recommended by the ECPG (USFWS 2013). Survey results from 2016 and 2018 can provide general information on species composition, diversity, and use for species in the local area where the Project resides.

Year-round avian use surveys were conducted at 12 survey points. Surveys began on April 7, 2019 and were conducted once per month. This summary describes all data gathered through December 2019 but surveys will continue through March 2020. Survey plot consisted of an 800-m (2,625 ft) radius circle centered at the survey point (Figure 2). Plots were selected to survey representative habitats and topography of the 2016 Project area, while meeting ECPG spatial sampling recommendations. The ECPG recommends at least 30% survey coverage of areas within 1.0 kilometer (km; 0.62 mi) of turbine locations (USFWS 2013). Because turbine locations were unknown at the start of surveys, plots were selected such that survey viewsheds covered at least 30% of the Project area as recommended in the ECPG. Surveys covered approximately 34% of the Project area.

Points were surveyed for 60 minutes (min) each, with small bird species recorded during the first 10 min of the survey period, and then only large bird species recorded for the next 60 min. The initial 10-min surveys allowed for comparison of small use with the majority of wind projects in the region. The 60-min surveys that encompassed large birds were consistent with the ECPG and were used to obtain a stronger dataset with which to evaluate large bird use and potential risk, particularly for eagles. Large birds observed within an 800-m plot and small birds within a 100-m (328 ft) plot were used for quantitative analysis and other comparative metrics. Small birds were defined as cuckoos, hummingbirds, swifts, woodpeckers, and passerines. Large birds were defined as waterbirds, waterfowl, shorebirds, diurnal raptors (i.e., kites, accipiters, buteos, eagles, falcons, northern harrier [*Circus hudsonius*], and osprey [*Pandion haliaetus*]), vultures, upland game birds, doves and pigeons, large corvids (e.g., black-billed magpie (*Pica hudsonia*), American crow (*Corvus brachyrhynchos*), and common raven (*C. corax*), large cuckoos, and goatsuckers.

The date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Every bird group (each group may be as small as just one individual) observed during a survey was recorded and identified by a unique observation number. Information collected for each observation included: species or best possible identification, number of individuals, sex and age class (if identifiable), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s). Bird behavior and habitat type were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were

recorded to the nearest 5.0-m (16.4-ft) interval. Other information collected included whether or not the observation was auditory only, as well as the 10-min interval of the survey during which the detection first occurred. Additionally, for all eagle observations, data were collected following ECPG methodology, including minute by minute data collected throughout the duration of each eagle observation (USFWS 2013).

Locations of diurnal raptors, other large birds, and species of concern observed during surveys were recorded on field maps by unique observation numbers. Flight paths and perch locations were digitized using ArcGIS 10.4 (these data are not available at the time of this interim report).

A total of 108 fixed-point surveys were completed for each small and large bird survey representing 18 and 108 hours (hr) of survey, respectively for each size class. No bald or golden eagles (Haliaeetus leucocephalus, Aquila chrysaetos) were recorded during any fixed-point survey. For small bird surveys, 25 unique bird species were identified. The most common small bird species recorded were red-winged blackbird (*Agelaius phoeniceusI*; 278 observations, 36 groups), western meadow lark (*Sturnella neglecta*; 234, 83), and horned lark (*Eremophila alpestris*; 189, 25). For large birds the most common species recorded included sandhill crane (*Grus canadensis*; 1,343 observations, 13 groups), Franklin's gull (*Leucophaeus pipixcan*; 173, 5), and northern shoveler (*Anas clypeata*; 89, 22). The most common raptor identified within the Project area was red-tailed hawk (*Buteo jamaicensis*; 21 observations, 20 groups) followed by northern harrier (*Circus hudsonius*; 7, 7).

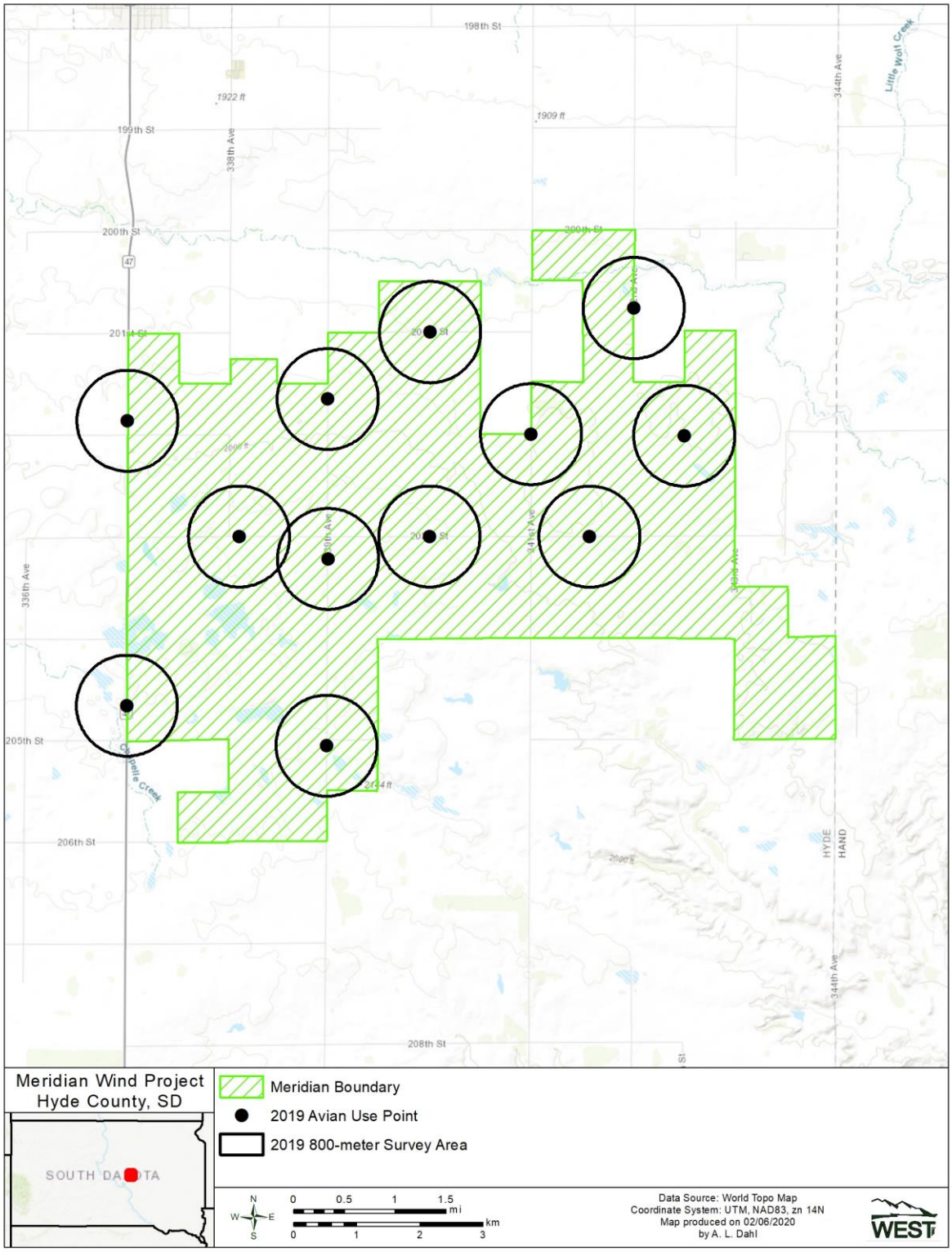

Figure 2. Location of fixed-point avian use survey stations completed in 2019 throughout the Meridian Wind Project boundary located in Hyde County, South Dakota.

RAPTOR NEST SURVEYS

Raptor nest surveys were conducted for the Project in the spring of 2016, 2018, and 2019. The objectives of the nest surveys were to gather information on eagle nest locations and other raptor species nesting in the area, which may be subject to disturbance or displacement effects from wind facility construction and operation. Surveys were conducted within the Project areas and extended to a 10.0-mi (16.1-km) buffer as pre recommendations in the ECPG (USFWS 2013). Prior to the surveys, topographic and aerial maps were evaluated to determine where raptor and eagle nesting habitat is likely to occur (e.g., riparian habitat along creeks, open lakes with large trees, etc.) so that these areas could be targeted during the aerial surveys. A biologist conducted the surveys in a helicopter operated by a pilot experienced in conducting low-altitude wildlife surveys. Surveys were generally conducted on days with good visibility and no precipitation. The locations of all raptor nests and survey paths were recorded using a hand-held onboard Global Positioning System (GPS) receiver.

For all raptor and eagle nest structures detected, the biologist recorded nest location coordinates with the GPS receiver, species present (if any), condition of the nest, presence of eggs or young (if present and visible), and the substrate of the nest (e.g., tree, power pole, rock outcrop). The status of each nest was determined as either: Occupied - an adult in incubating position, eggs, nestlings or fledglings, a newly constructed or refurbished stick nest and/or the presence of one or more adults on or immediately adjacent to the nest structure(s); or Inactive - a nest with no evidence of recent use, or attendance by adult raptors. Efforts were made to minimize disturbance to nesting raptors, livestock, or occupied dwellings to the greatest extent possible. Photographs were taken of possible eagle nests.

2016 Surveys

Aerial surveys were conducted from March 28-April 1, 2016 to search for raptor nests within 1.0 mi (1.6 km; Figure 3) and potential eagle nests within 10-mi (16.0 km) Project area.

During the 2016 aerial survey, 10 raptor nests were documented within the Project and 1.0-mi buffer (Figure 3). One nest was occupied by a red-tailed hawk, while all the remaining nests were inactive. No eagle nests were located during the survey within the Project area or 10.0-mi survey area.

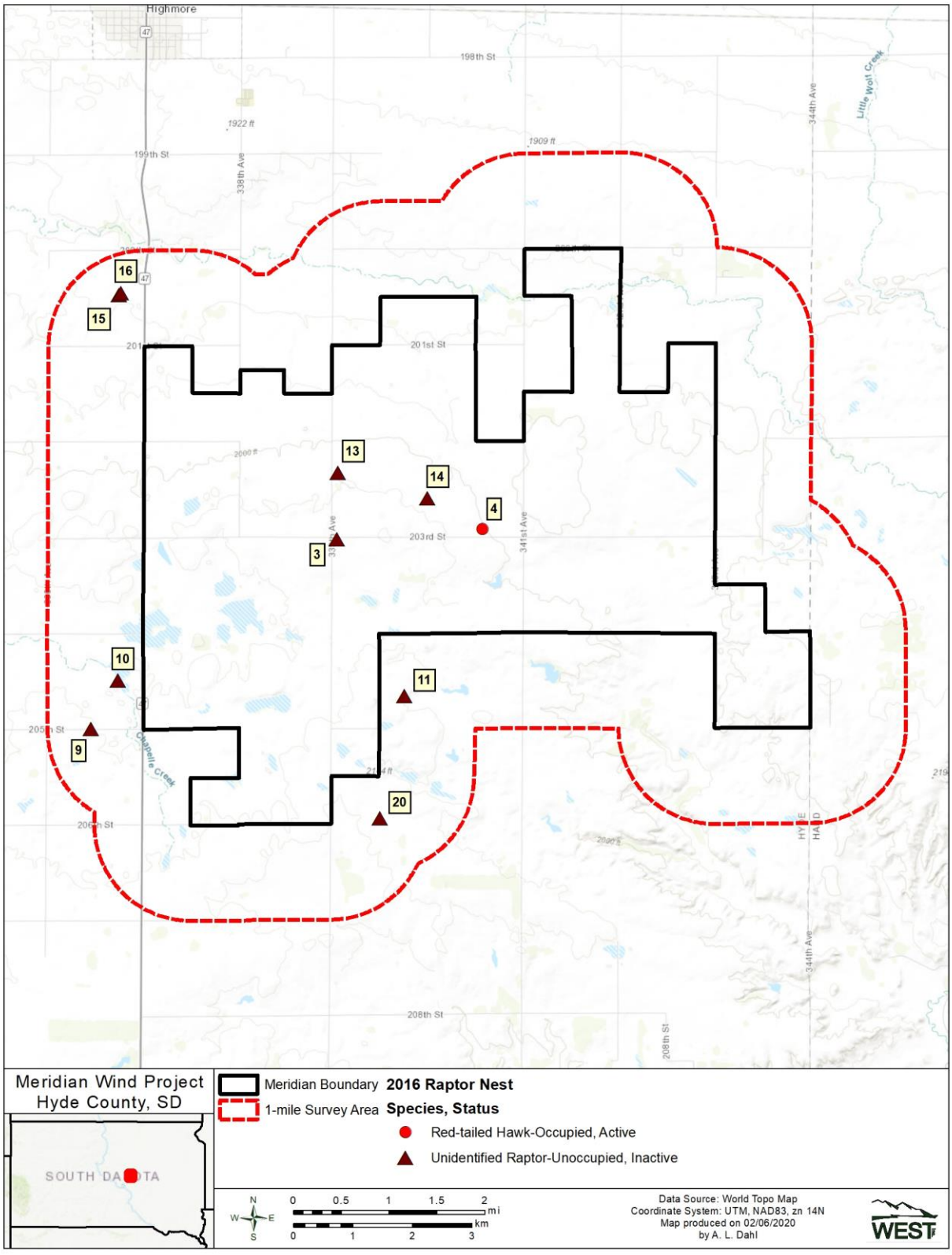

Figure 3. Location of raptor nests identified during surveys in 2016 for the Meridian Wind Project and 1.0-mile buffer in Hyde County, South Dakota. No 10-mile buffer is displayed as no potential eagle nests were identified.

2018 Surveys

Surveys for raptor nests were completed for the Project from March 9-14 with follow-up ground surveys conducted in conjunction with other work in May, 2018. During surveys in 2018, a total of 17 raptor nests were identified. Of the 10 nests previously documented in 2016 were re-visited; six were confirmed present and four could not be relocated. No potential eagle nests were identified within 10-mi of the Project area.

Of the 17 raptor nests documented, 12 were classified as unoccupied nest of unknown raptor. The five remaining occupied nests included: two great-horned owls (*Bubo virginianus*), two Swainson's hawk (*Buteo swainsoni*), and one red-tailed hawks. All nests were located within deciduous trees. Generally, great-horned owls were observed occupying nests during the aerial survey; whereas, red-tailed hawks and Swainson's hawks were observed occupying nests during May.

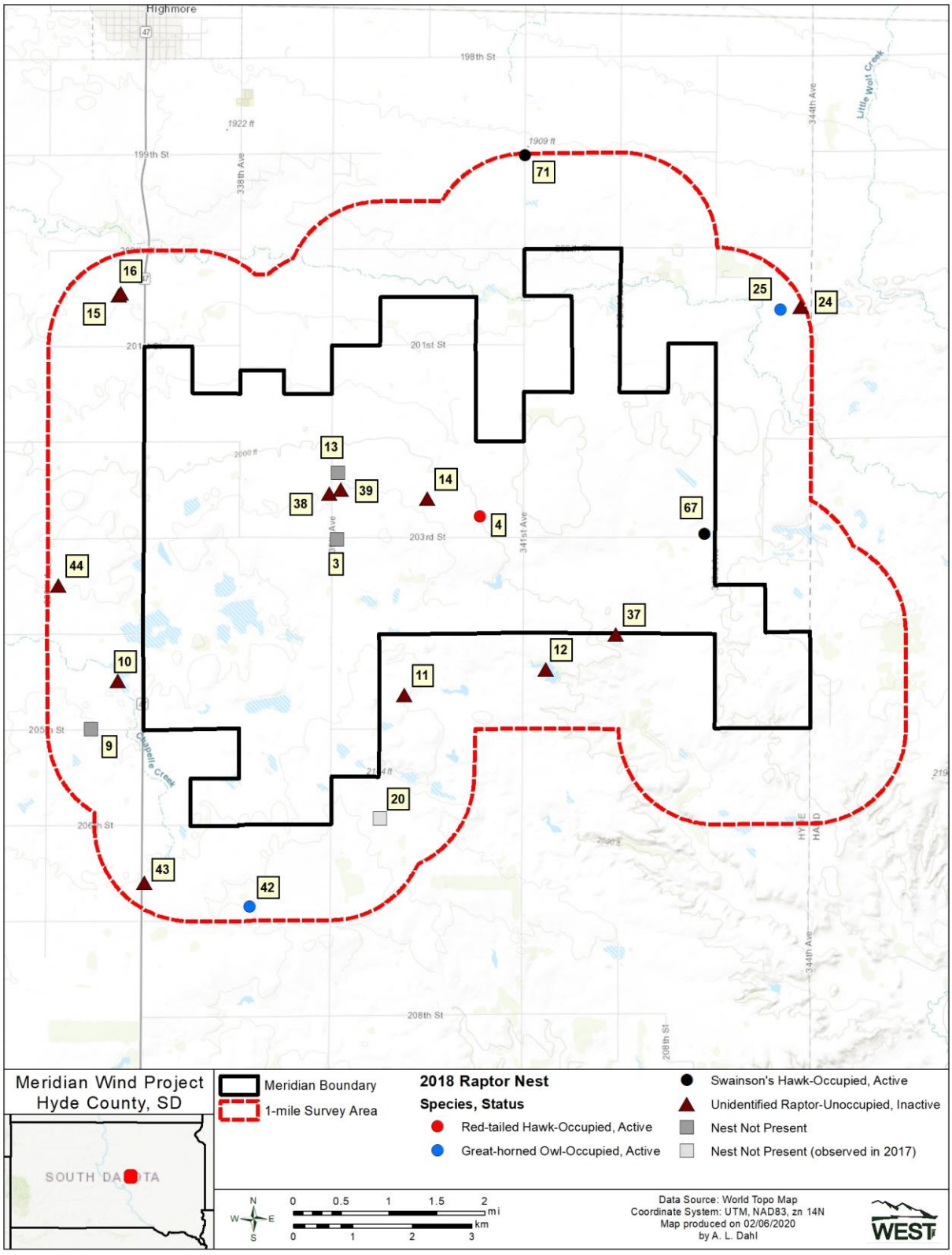

Figure 4. Location of raptor nests identified during surveys in 2018 for the Meridian Wind Project and 1.0-mile buffer in Hyde County, South Dakota. No 10-mile buffer is displayed as no potential eagle nests were identified.

2019 Surveys

In 2019, two surveys for the Project area were conducted on March 26 and April 16 – 17, 2019 and included the Project area, 1.0-mi (Figure 5), and 10.0-mi buffers. During these surveys, nests were classified as both occupied/unoccupied and active/inactive. A total 18 nests were documented during surveys and eight previously identified nests were either not present or excluded from surveys due to safety considerations. Six nests were determined to be occupied with adults in the nest, perched in the same tree, or eggs in the nest. One nest was occupied twice (Nest ID 67; Table 2) with a great horned owl during the first surveys and a ferruginous hawk during the second survey. Eleven nests were considered unoccupied as no activity was recorded during either survey in accordance with the ECPG (Figure 5). Of occupied nests three were occupied by great horned owl, two by ferruginous hawk, one by a red-tailed hawk, one by a golden eagle, and one unidentified raptor (eggs were present in the nest; Figure 5). The nest occupied by the golden eagle (Nest ID 4) was previously occupied by a red-tailed hawk in surveys conducted in 2016 (Figure 3) and 2018 (Figure 4). Table 2 presents a summary of the survey results in 2019 for occupied nests within the Project area and 1-mi buffer.

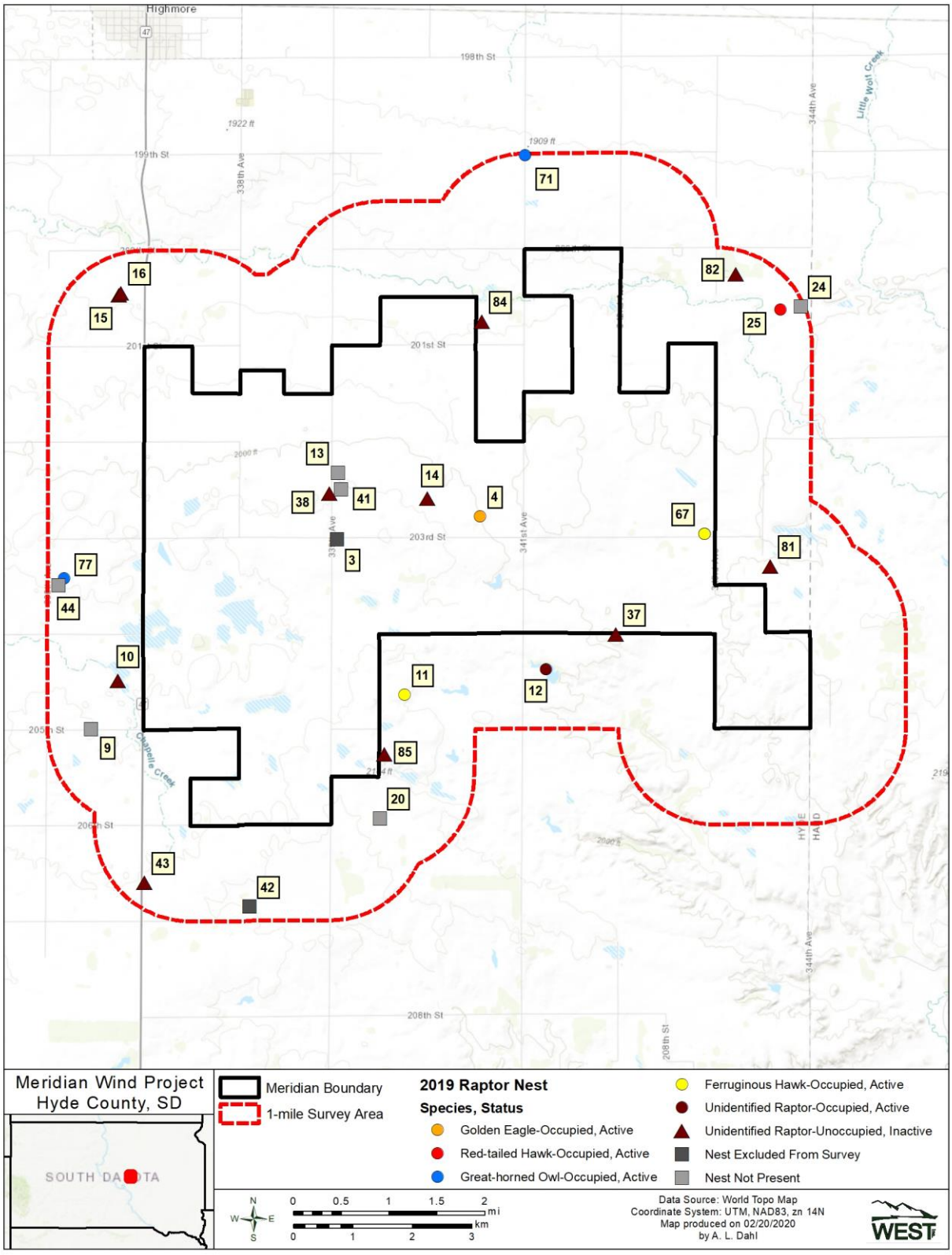

Figure 5. Location of raptor nests identified during surveys in 2019 for the Meridian Wind Project and 1.0-mile buffer in Hyde County, South Dakota. No 10-mile buffer is displayed as no potential eagle nests were identified.

Table 2. Occupied raptor nest observations during the aerial nest surveys within current Meridian Wind Project and 1.0-mile buffer, March 26 and April 16-17, 2019, Hyde County, South Dakota.

Nest ID	Northing	Easting	Date 1st Survey	Date 2nd Survey	Species	# Adults	# Eggs	# Chicks	Comments
4	470518	4921258	3/26/2019	4/17/2019	Golden Eagle	1	2		
11	469248	4918257	3/26/2019	4/16/2019	Ferruginous Hawk	1			
12	471629	4918689	3/26/2019	4/16/2019	Unidentified Raptor		1		
25	475571	4924740	3/26/2019	4/16/2019	Red-tailed Hawk	1			
67	474286	4920968	3/26/2019		Great-horned Owl	1			Same nest location, 2 different species at different times
67	474286	4920968		4/16/2019	Ferruginous Hawk	1			Same nest location, 2 different species at different times
71	471276	4927334	3/26/2019	4/16/2019	Great-horned Owl	1	2		
77	463523	4920213	3/26/2019	4/16/2019	Great-horned Owl	1			

PRAIRIE GROUSE LEK SURVEYS

The Project area occurs within the occupied range of the greater prairie-chicken (*Tympanuchus cupido*) and sharp-tailed grouse (*T. phasianellus*); "prairie grouse" is used when discussing both species together in this summary. Greater prairie-chickens are listed as a SGCN in South Dakota, but both species are considered upland game birds and are hunted in South Dakota (SDGFP 2014). WEST conducted surveys to document prairie grouse leks during the 2016, 2018, and 2019 breeding seasons within the Project area. The objective of the prairie grouse lek survey was to collect pre-construction data that can be used to help site the wind turbines to minimize impacts on prairie grouse.

2019 Surveys

In 2019, WEST conducted ground-based lek status surveys at eight previously identified (2016 and 2018) potential lek locations to document current lek usage and determine whether or not these locations meet the SDGFP criteria for a lek (i.e., active lek for at least two of the last five years). Surveys were conducted at each lek three times from April 21 to May 21, 2019. Surveys began approximately 30 minutes prior to sunrise until 1.5-2.0 hours after sunrise. To the extent possible, all surveys were conducted on relatively calm mornings (winds less than 15-20 mph) and on days with no precipitation. Surveys were conducted to verify the presence of and to document the number of male and female birds attending leks. Surveys were conducted from public roads or on lands currently under easement or to which access was otherwise obtained. Because both sharp-tailed grouse and greater prairie-chickens are found within the area, identification of species during the survey was be recorded when possible.

WEST identified a total of eight prairie grouse leks during aerial and ground lek surveys within the Project area during the 2016, 2018, and 2019 breeding season (Figure 6). Four lek locations were active in 2016, seven in 2018, and three in 2019 surveys; of these identified and potential leks, one was a sharp-tailed grouse lek and seven were greater prairie chicken leks. Only the sharp-tailed grouse lek and three greater prairie chicken leks meet the SDGFP criteria for an active prairie grouse leks and are within the Project or one mile of the Project boundary (Figure 6; Table 3).

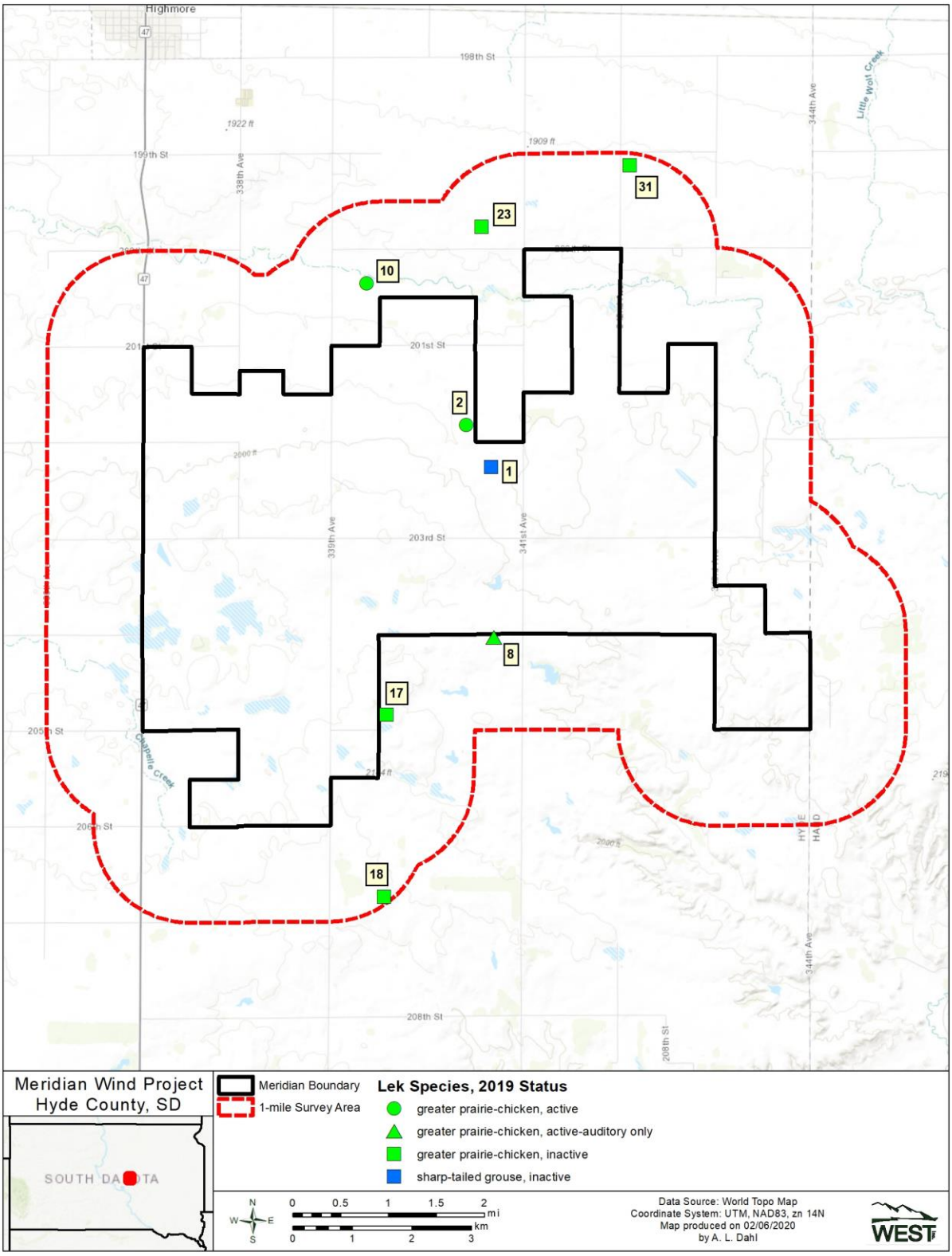

Figure 6. Location and status of potential prairie grouse leks identified during surveys within the Meridian Wind Project and 1-mile buffer during the 2019 breeding season, Hyde County, South Dakota.

Table 3. Location and maximum number of prairie grouse observed at potential leks during surveys for the current Meridian Wind Project and 1-mile buffer, Hyde County, South Dakota.

2019 ID	Northing	Easting	Species	2016 Status	2018 Status	2019 Status	SD Defined Lek	Grouse # (2019)
1	470707	4922100	STGR	Active	Active	Inactive	Yes	0
2	470285	4922806	GRPC	Active	Active	Active	Yes	4
8	470762	4919240	GRPC	Active	Inactive	Active-Auditory Only	Yes	at least 2
10	468613	4925185	GRPC	Active	Active	Active	Yes	9
17	468955	4917940	GRPC	NA	Active	Inactive	No	0
18	468913	4914881	GRPC	NA	Active	Inactive	No	0
23	470553	4926131	GRPC	NA	Active	Inactive	No	0
31	473035	4927170	GRPC	NA	Active	Inactive	No	0

BAT ACOUSTIC SURVEYS

WEST conducted acoustic monitoring surveys to estimate levels of bat activity within the Project area during summer and fall 2016 and spring, summer, and fall 2018. Studies of bat activity followed the recommendations of the USFWS WEG (USFWS 2012) and Kunz et al. (2007). Detectors were programmed to turn on approximately 30 min before sunset and turn off approximately 30 min after sunrise each night. To highlight seasonal activity patterns, the study was divided into two survey periods: summer (May 26 – August 15) and fall (August 16 – October 21). Mean bat activity was also calculated for a standardized Fall Migration Period (FMP), defined here as July 30 – October 14. The FMP was defined by WEST as a standard for comparison with activity from other wind energy facilities. During this time bats begin moving toward wintering areas, and many species of bats initiate reproductive behaviors (Cryan 2008). This period of increased landscape-scale movement and reproductive behavior is often associated with increased levels of bat fatalities at operational wind energy facilities (Arnett et al. 2008, Arnett and Baerwald 2013).

For each survey location, bat passes were sorted into two groups based on their call's minimum frequency. High-frequency (HF) bats, such as eastern red bats (*Lasiurus borealis*) and *Myotis* species have minimum frequencies greater than 30 kilohertz (kHz). Low-frequency (LF) bats, such as big brown bats (*Eptesicus fuscus*), silver-haired bats (*Lasionycteris noctivagans*), and hoary bats (*Lasiurus cinereus*), typically emit echolocation calls with minimum frequencies below 30 kHz.

To conservatively assess potential for bat fatalities, bat activity in the Project was compared to existing data at other wind energy facilities in the Midwest region. Among studies measuring both activity and fatality rates, most data were collected during the fall using AnaBat detectors placed near the ground. Therefore, to make valid comparisons to the publicly available data, the activity

rate recorded at fixed ground detectors during the FMP was used as a standard for comparison with activity data from other wind energy facilities. Given the relatively small number of publicly available studies and the significant ecological differences between geographically dispersed facilities, the risk assessment is qualitative, rather than quantitative.

2016 Surveys

WEST conducted acoustic monitoring studies to estimate levels of bat activity within the Project area from May 26 through October 21, 2016. One AnaBat™ SD2 ultrasonic bat detectors (Titley Scientific™, Columbia, Missouri) placed 1.5 m (4.9 ft) above the ground to minimize insect noise were used during the study. Acoustic surveys were conducted at one ground station located in a location anticipated to have higher than expected bat activity due to proximity with water features, trees, hedge rows, and other bat-associated habitats. This station location was selected to provide a conservative estimate of bat activity represented within the Project area (Figure 7).

Summarized results of this unit recorded approximately 58% of bat passes as HF (e.g., eastern red bats, and little brown bats [*Myotis lucifugus*]) and 42% of bat passes as LF (e.g., big brown bats, hoary bats, and silver-haired bats). Bat activity varied between seasons, with lower activity in the summer and higher activity in fall. At this station, LF and HF bat pass rates peaked during the first part September. Higher activity during the late summer and early fall may be due to the presence of migrating bats passing through the area. Activity at this site was similar to other Midwestern facilities with publically available information.

2018 Surveys

In 2018 WEST conducted acoustic surveys from April 25 – October 25, 2018 at two monitoring stations where AnaBat SD2 detectors were placed near the ground at 5.0 feet (ft; 1.5 meters [m]). One was located within croplands and one detectors was located at the same location as 2016 near habitat potentially attractive to bats (bat feature; e.g., ponds, deciduous trees, shelterbelts, etc.).

Bat activity was measured at both locations with higher activity, as expected, at the bat feature locations (Figure 7, east location). Bat activity within the cropland habitat averaged 0.27 bat passes/night while at the bat feature habitat activity averaged 0.68 bat passes/night (Table 4).

Table 4. Results of bat activity surveys conducted at stations within the Meridian Wind Project area, Hyde County, South Dakota from April 25 – October 25, 2018. Passes are separated by call frequency: high frequency (HF) and low frequency (LF).

Station	Type	# of HF Bat Passes	# of LF Bat Passes	Total Bat Passes	Detector-Nights	Bat Passes/ Night[1]
West	representative	15	33	48	179	0.27 ± 0.06
East	bat feature	38	85	123	182	0.68 ± 0.12
Total		**53**	**118**	**171**	**361**	**---**

[1]± bootstrapped standard error.

---Total not given due to differences in how stations were selected and their objectives

Bat activity in the representative habitat varied little among seasons with the lowest activity in the summer (0.10 bat passes/night) and highest activity in the fall (0.27). At these stations, activity by low-frequency (LF; e.g., big brown bats, hoary bats, and silver-haired bats) and high-frequency (HF; e.g., eastern red bats and *Myotis* species) bats peaked during the end of July and first week of August. Bat activity at bat features had similar temporal patterns with bat activity being lowest in the summer (0.25 bat passes/night) and highest in the fall (0.67). Bat feature stations had peak activity in late August and early September.

Approximately 19.3% and 49.7% of bat passes recorded at representative habitat and bat feature in the Project area were classified as LF bats. Bat activity recorded at the Project area at ground representative stations during the Fall Migration Period (0.31 bat passes per detector-night) was lower than activity at facilities in the Midwest. Use of bat activity to predict post-construction mortality, is difficult to relate and lacks any direct relationship based on other find facilities in the Midwest.

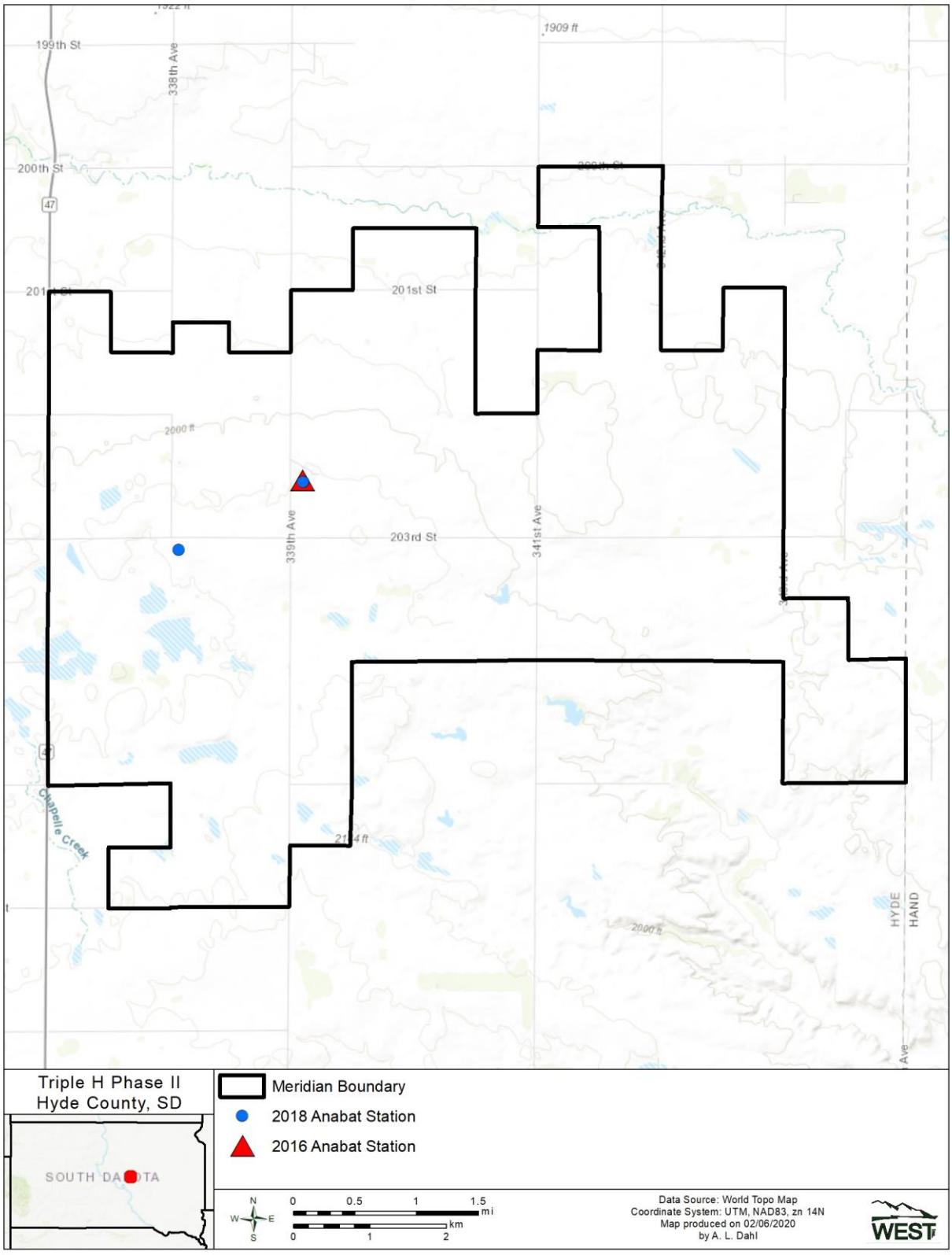

Figure 7. Location of AnaBat detectors deployed during 2016 and 2018 within the Meridian Wind Project boundary in Hyde County, South Dakota.

NORTHERN LONG-EARED BAT HABTIAT ASSESSMENT

The northern long-eared bat (NLEB) is listed as a federally threatened species. The range of the NLEB is considered to be across all of South Dakota, including Hyde County. A desktop assessment of the presence of potentially suitable habitat for the NLEB was conducted across Project area in 2017 (Figure 8). During the summer of 2018, suitable habitat for this species consists of forested areas where bats might roost, forage, and commute between roosting and foraging sites. NLEB primarily forage or travel in forest habitat and are typically constrained to forest features (Boyles et al. 2009). Therefore, habitat suitability was evaluated based primarily on the presence of forested areas that NLEB might use for roosting and foraging.

Desktop review of land cover data and aerial imagery was used to assess the presence of suitable habitat for NLEB within the Project area. WEST's definition of suitable summer habitat for the NLEB is intended to describe typical habitat used by reproductive females and juveniles during the summer. The USFWS *2017 Range-Wide Indiana Bat Summer Survey Guidelines* (USFWS 2017) was used to define suitable habitat for NLEB.

WEST conducted a desktop assessment of potential suitable NLEB habitat by reviewing the USGS NLCD within a 2.5-mi (4.0-km) buffer of the Project area, and delineating potential suitable habitat types (i.e., deciduous forest, evergreen forest, mixed forest, and woody wetlands) using GIS (version 10.4). The habitat delineations were then cross-checked and edited based on the most recent publicly available aerial imagery from the USDA NAIP for the Project area. The overall habitat layer was then edited to remove areas that had been cleared of trees and to refine habitat boundaries. Narrow commuting corridors not captured by the NLCD were also added based on the aerial imagery.

A habitat analysis was then conducted to assess connectivity of suitable foraging habitats (i.e., woodlots, forested riparian corridors, and natural vegetation communities adjacent to these habitats), roosting habitats, and commuting habitats (i.e., shelterbelts/tree-lines, wooded hedgerows) as suggested in the USFWS Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects (USFWS 2011). The guidance suggests assessing the potential presence of Indiana bats and NLEB within a Project based on availability of travel/commuting corridors within the Projects' boundary, and connectivity to foraging or roosting habitat within a 2.5-mi buffer of the Project. The minimum size for suitable foraging/roosting habitat is not well understood, but lower estimates are approximately 20 ac (8 ha; Broders et al. 2006). We used a minimum patch size of 15 ac (6 ha) to assign potential roosting habitat. Trees up to 1,000 ft (305 m) from the next nearest suitable roost tree, woodlot, or wooded fencerow were considered suitable habitat (USFWS 2011). The 1,000 ft distance is based on observations of NLEB behavior indicating that isolated trees might only be suitable as habitat when they are less than 1,000 ft from other forested/wooded habitats. These estimates are based on available telemetry data on foraging activity. Based on this informed guidance, it is reasonable to conclude that NLEB are unlikely to occur within the Project area which is located more than 1,000 ft from the nearest connected suitable habitat (USFWS 2017, USFWS 2011; Figure 10).

Forested patches were sorted by size into the following groups: less than 15 ac: small forest patches, 15-50 ac (6-20 ha): potential NLEB roost/foraging habitat, and greater than 50 ac: large potential roost/foraging habitat. All polygons representing forested habitats were buffered by 500 ft (152 m) and dissolved to group any habitat patches within 1,000 ft of each other. This buffer, representing all forested habitats within 1,000 ft of each other, was then purged of small isolated patches by selecting only those connected habitats containing forested patches at least 15 ac in size. This selection of habitat patches was then buffered by 1,000 ft to represent the potential foraging area for NLEB.

The NLEB bat habitat assessment resulted in one connected habitat patch adjacent to the Project area but within 2.5 mi of the Project area (Figure 8). No NLEB habitat was identified within the current Project area; however, further on-site evaluation may be warranted due to the some forested patches adjacent to the site being greater than 15 ac (Figure 8).

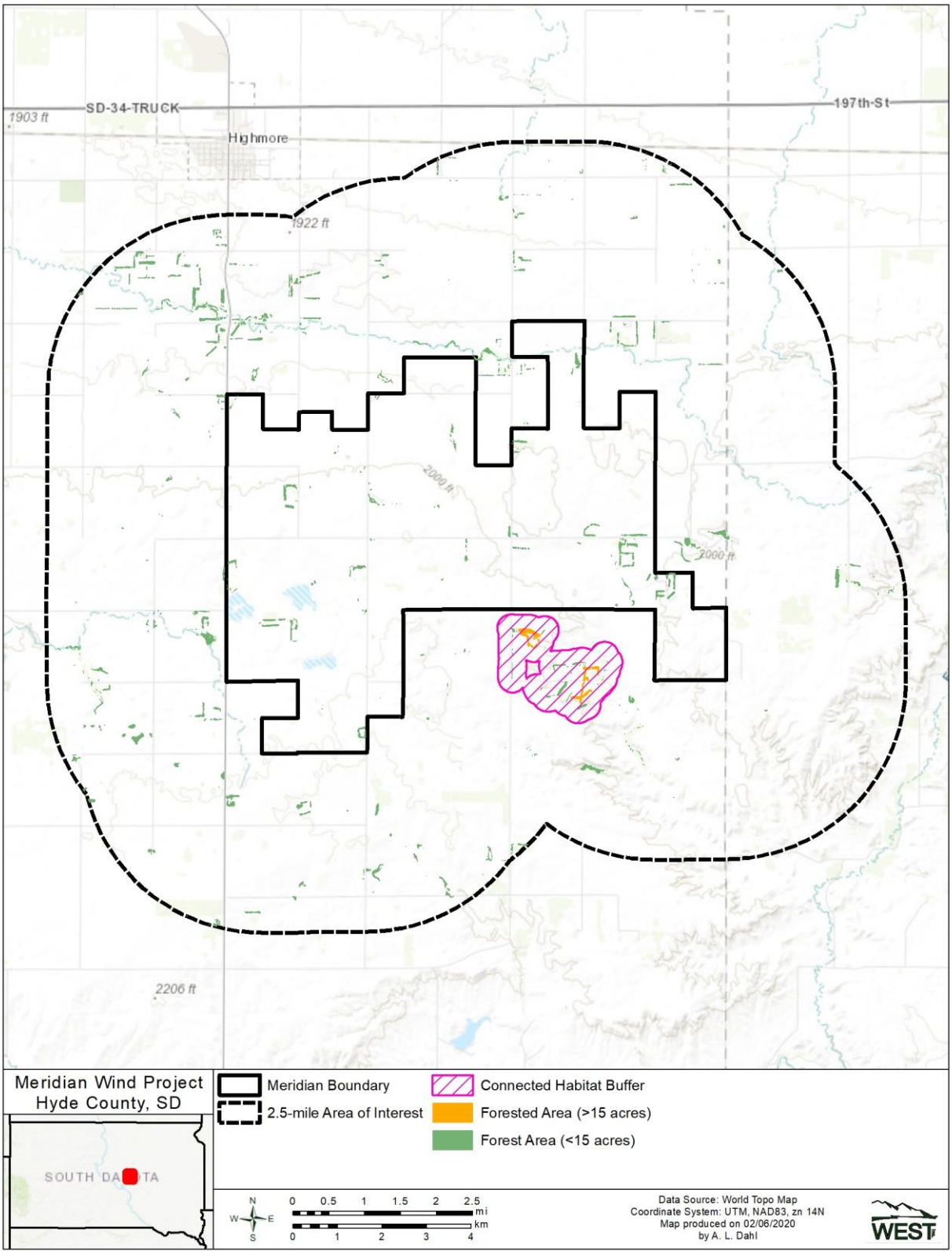

Figure 8. Northern long-eared bat habitat assessment of the Meridian Wind Project and 2.5 mile buffer, Hyde and Hand counties, South Dakota.

WHOOPING CRANE STOPOVER HABITAT

In 2016, WEST implemented a desktop review and analysis of potential whooping crane stop-over habitat within and extending out 10 miles from the Project area (Figure 9). However, this effort did not include the eastern ¼ of the 10-mi buffer as project location has changed since 2016. The habitat review and analysis evaluated whether or not the proposed Project area represents unique whooping crane stop-over habitat compared to the surrounding landscapes.

The federally listed whooping crane migrates through South Dakota enroute to breeding grounds in Canada and wintering grounds in Texas along the Gulf of Mexico (Canadian Wildlife Service and USFWS 2007). The Project area is located in the distance bands where 75-80% of observations have occurred, based on confirmed sightings (Cooperative Whooping Crane Tracking Project [CWCTP] 2016).

Potential stop-over habitat for whooping cranes was evaluated using a model developed by The Watershed Institute, Inc. (TWI; TWI 2012). The TWI habitat assessment model is a quantitative and easily replicated desktop approach to evaluating the quantity, quality, and locations of potential whooping crane stopover habitat in a given area. It is based on available data on water regime, water depth, visibility obstructions, wetland size, disturbance, and proximity to feeding areas, which are all factors that have been shown to affect how whooping cranes choose stopover habitat. The initial goal of the TWI model was to provide electric utilities with a tool for making power line-marking decisions, but the USFWS stated in a personal communication (D. Mulhern, USFWS [retired], November 19, 2012) that it should be applicable to wind power development areas for the identification of potential whooping crane stop-over habitat as well. The desktop evaluation of potential whooping crane stopover habitat using the TWI model included the Project area plus a 10-mi buffer.

Results of wetland feature scores calculated by TWI within the Project area and 10.0-mi buffer were compared to Quivira National Wildlife Refuge (Quivira), which is a traditional stop-over site for whooping cranes in Kansas. Based on the average score for Quivira wetlands, scores of 12 or higher were considered by TWI to be potentially suitable habitat.

High-scoring (12+) features were present within the Project area and 10-mi buffer area (Figure 9). When comparing the TWI model results between the Project area and the 10 mi buffer area, the areas are similar in that features scoring 12 were most common. The largest high-scoring features in terms of acreage occurred outside of the Project area. Whereas one area of densely occurring high-scoring features was present within the Project area (Figure 9). The widespread availability of suitable stopover habitat throughout the 10-mi buffer indicates that if cranes are displaced from suitable habitat by development of the Project, they are likely to find similar habitat nearby. Additional TWI model implementation within the previously unevaluated areas of the eastern portion of the 10-mi buffer can provide insights into additional features present in the adjacent landscape of the Project.

Through fall of 2016, no whooping crane observations were confirmed within the current Project and three observations were confirmed within 10.0 mi of the current Project (CWCTP 2016). These data are supported by eBird (https://ebird.org/home) as well. The CWCTP emphasizes that the whooping crane observation data are incidental sightings and not accurate documentations of absence in areas where no observations are recorded, nor are observation locations representative of all sites used by tracked cranes since only the location of the first observation is logged in the database.

The USGS evaluated spatial intensity of use by 58 whooping cranes fitted with platform transmitting terminals (Pearse et al. 2015). Stopover sites used during spring and fall migration were tracked over five years. Based on stopover site use density and duration, 20-square-kilometer grid cells were categorized as unoccupied, low use, core intensity, or extended-use core intensity. The resulting data are meant as a tool to identify areas that may be important for migrating whooping cranes. Overlaying the USGS site use intensity data with the current Project indicates that the Project is located in an area with unoccupied and lower use intensity. However, more recently Pearse et al. (2020) reported low stopover site fidelity based on 58 marked whooping cranes tracked from 2010 to 2016. The authors suggested that past use of stopover habitat was a poor indicator of future use and that use of potential stopover habitat was likely related to other factor including length of migration bout and informed landscape and habitat features.

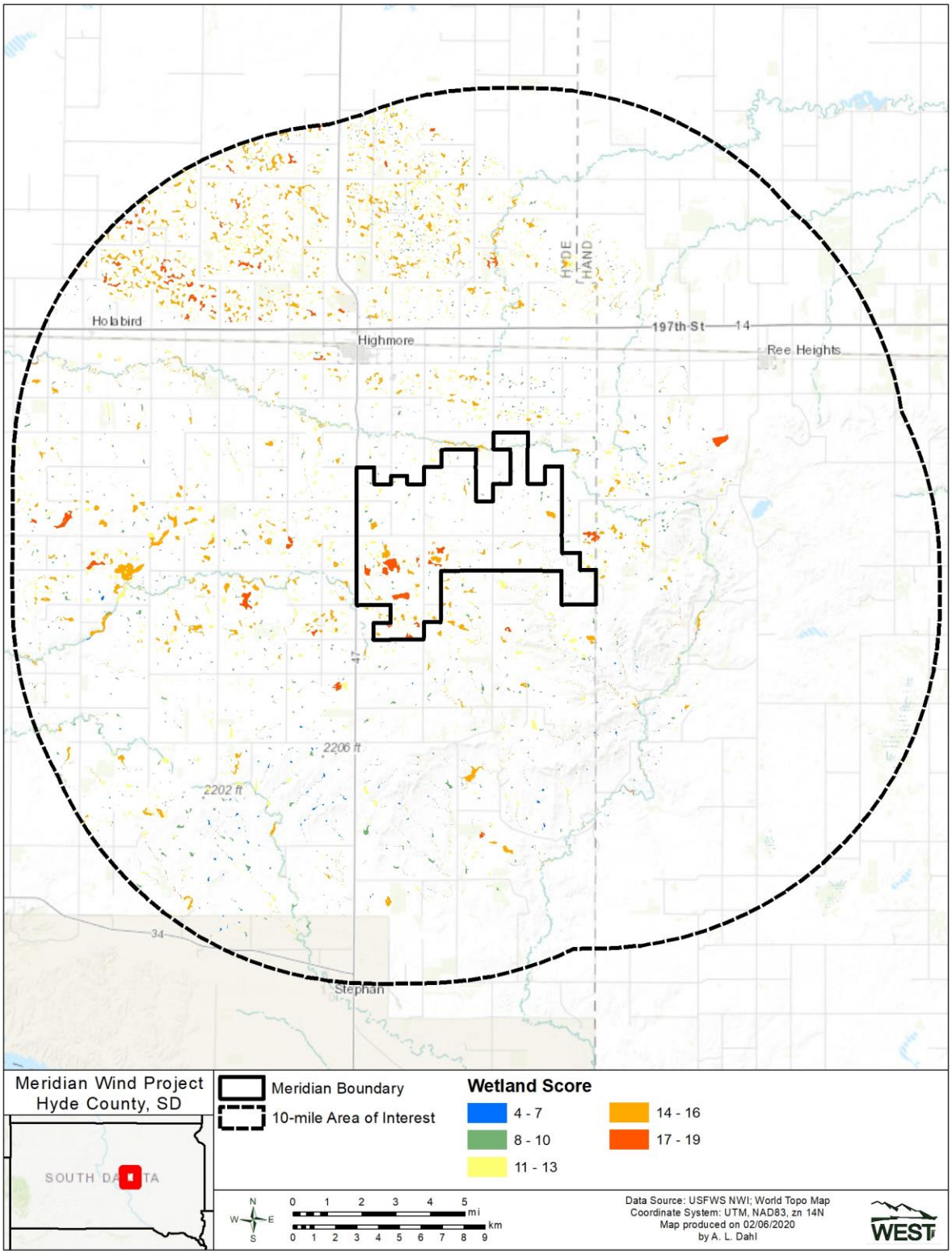

Figure 9. Map of wetlands scored using the TWI model for the current Meridian Wind Project boundary and surrounding area in Hyde and Hand counties, South Dakota.

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