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**Stage 1 Initial Site Assessment of Eagle Use/Risk
Glacier Ridge Wind Energy Project
Barnes County, North Dakota**

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August 12, 2016

INTRODUCTION

Glacier Ridge Wind Farm, LLC is considering the development of a proposed wind energy facility in Barnes County, North Dakota (Figure 1), known as the Glacier Ridge Wind Farm (Project). The Project developer has asked Western Ecosystems Technology, Inc. (WEST) to develop an initial site assessment for eagles, which determines the relative importance of the Project area (defined as the Project boundary as currently defined by Glacier Ridge Wind Farm, LLC and portrayed in figures below) to resident breeding and non-breeding eagles and migrant and wintering eagles. This initial site assessment is intended to meet the requirements of a Stage 1 Initial Site Assessment as described in the US Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-Based Wind Energy, Version 2* (ECPG; USFWS 2013).

The principal objective of this Stage 1 Initial Site Assessment for the Project is to assess whether the Project is within areas known or likely to be used by eagles, and if so, to determine the expected extent and type of eagle use of the site.

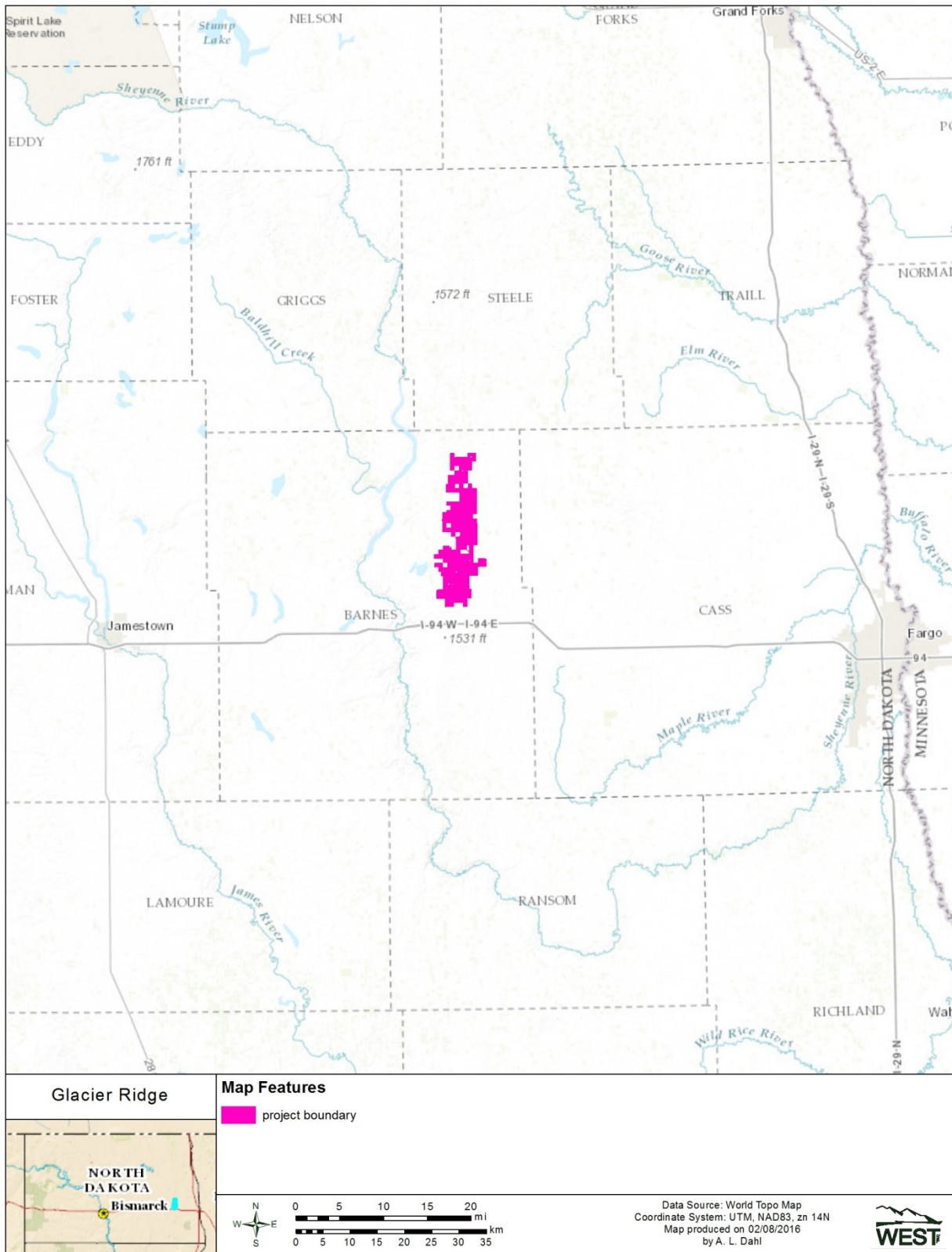


Figure 1. Location of the Glacier Ridge Wind Farm in Barnes County, North Dakota.

Study Area

The Project area encompasses approximately 34,000 acres in Barnes County, North Dakota (Figure 1). The Project falls within the Northern Glaciated Plains Level III Ecoregion, which stretches from eastern North and South Dakota into north-central North Dakota and the Drift Plains Level IV Ecoregion (USEPA 2013). Much of the Northern Glaciated Plains region was originally characterized by fescue grasslands, tall and short-grass prairie, trembling aspen, oak groves, mixed tall shrubs, and seasonal wetlands but is now primarily farmland (Griffith 2010). The Northern Glaciated Plains region is a very productive agricultural area with a variety of crops including spring wheat, flax, rye, barley, oats, corn, soybeans, and sunflowers (Griffith 2010). The majority of the land cover within the Project is cultivated crops, herbaceous emergent wetlands, developed open space (lawn grasses), hay/pasture and herbaceous grassland (US Geological Service [USGS] National Land Cover Data [NLCD] 2011).

The topography of the Project area is primarily flat (Figure 2) with the elevation ranging from approximately 387 – 466 meters (m; 1,270 – 1,529 feet [ft]; Figure 3). Though most of the Project area is composed of cultivated cropland, there is some grassland (6%), wetlands (5%), deciduous forest (<1%), evergreen forest (<1%) and mixed forest (<1%). Open water and woody wetland habitat is present within the Project area as well. There are no named lakes within the Project area (Figure 4) with several larger lakes outside of the Project area.

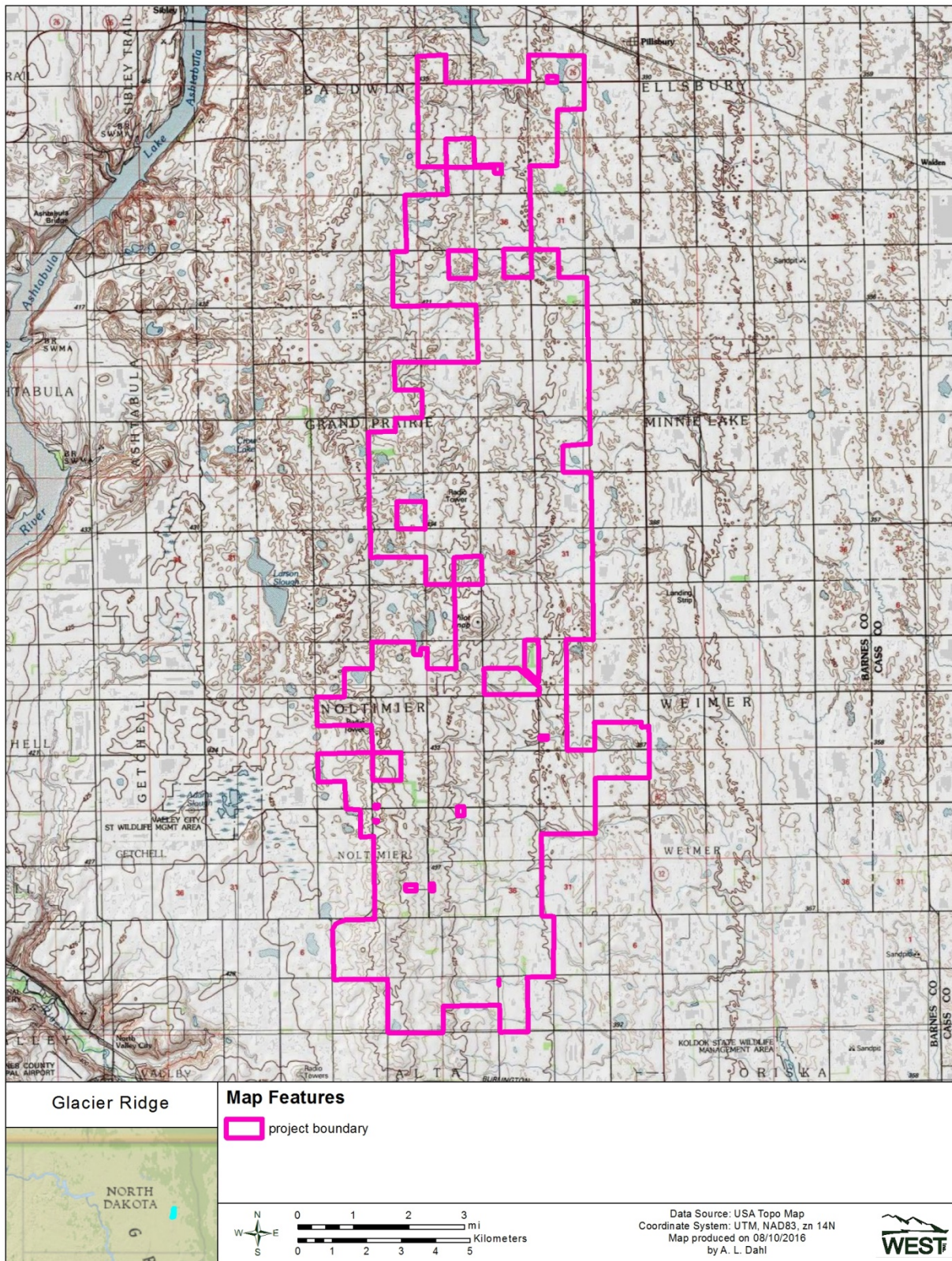


Figure 2. Topographic image of the Glacier Ridge Wind Farm.

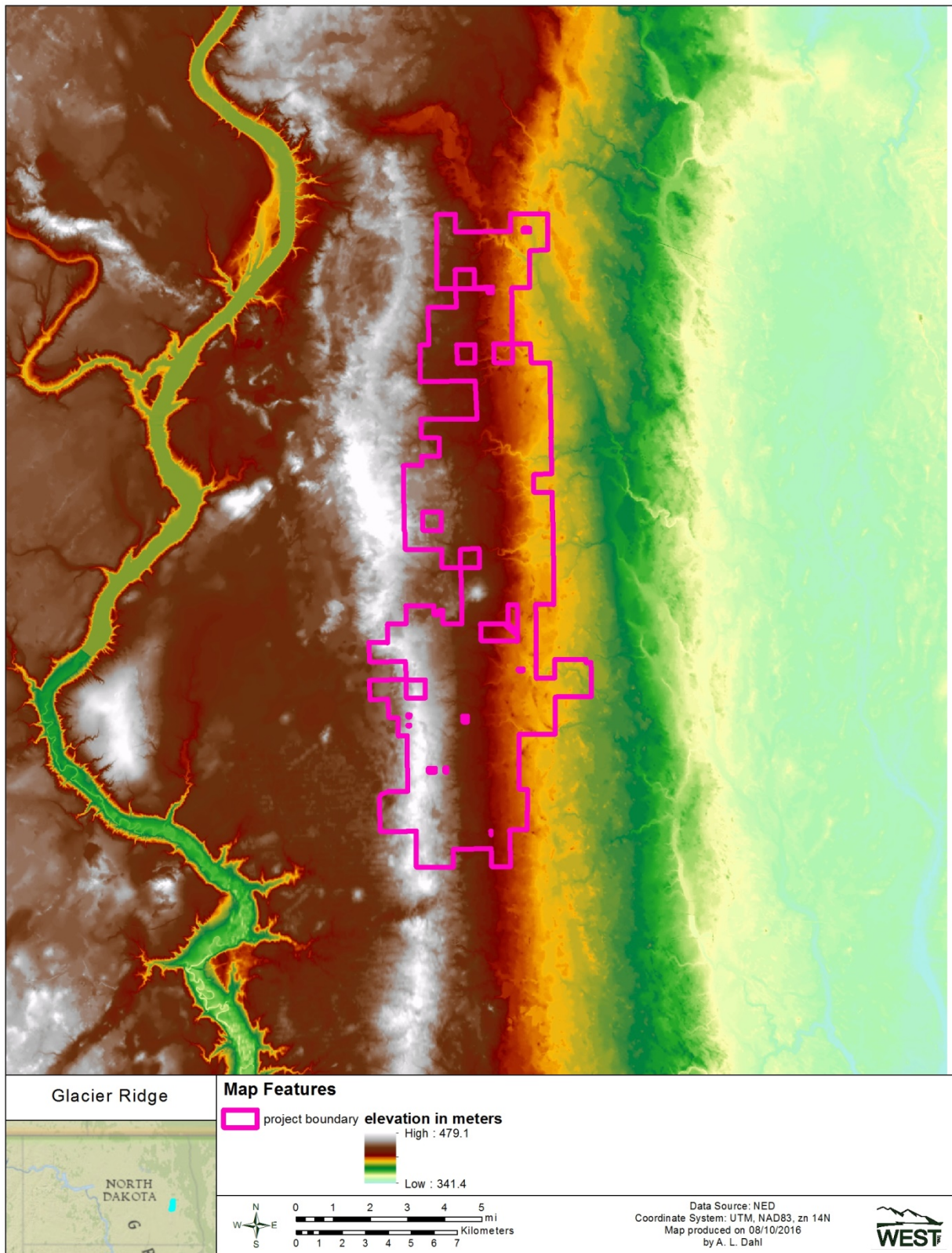


Figure 3. Elevation at the Glacier Ridge Wind Farm.

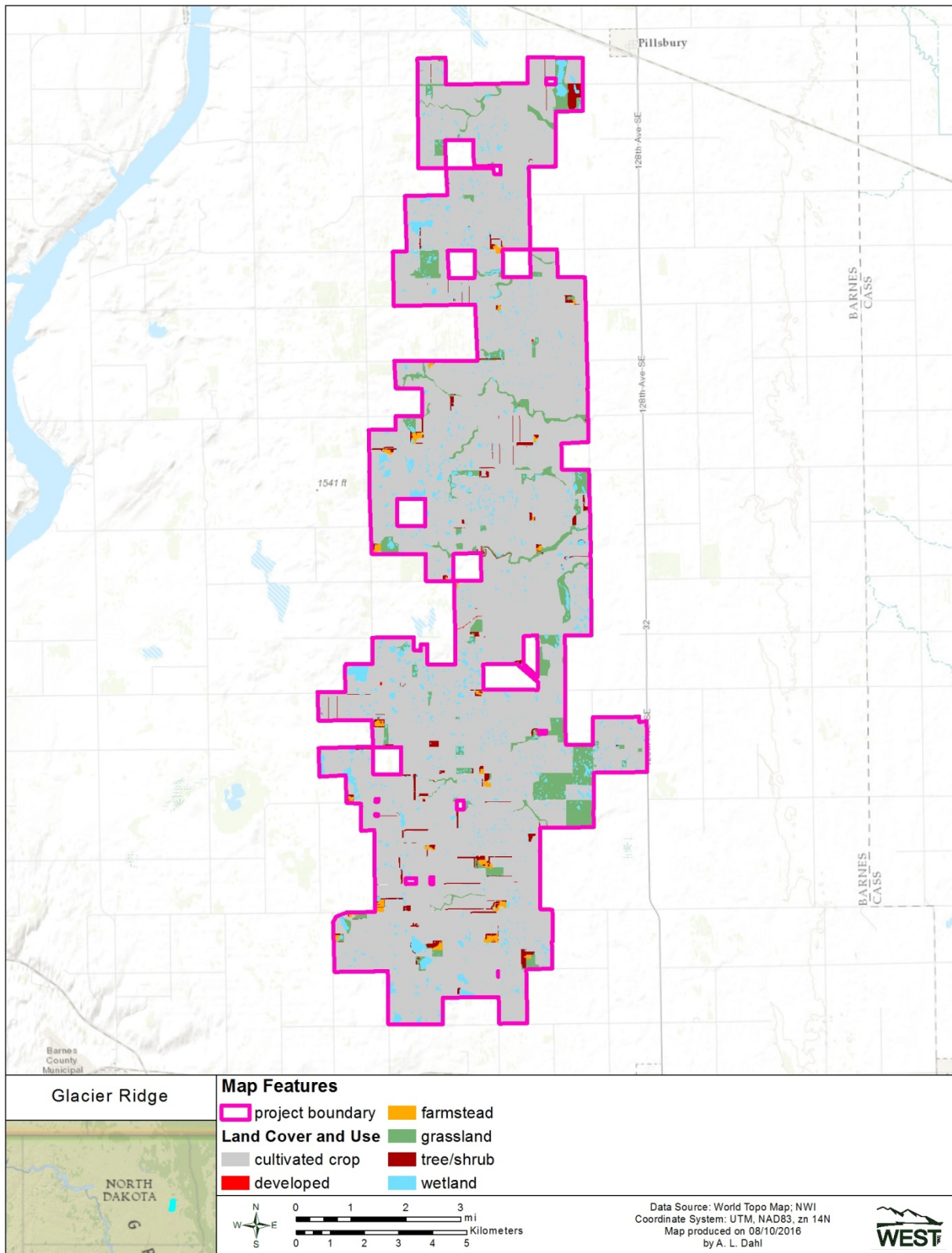


Figure 4. Land cover in the Glacier Ridge Wind Farm (USFWS NWI 2014, Derby 2016).

METHODS

This Stage 1 Initial Site Assessment describes existing information from publicly available literature, databases and other sources to evaluate the appropriateness of the Project area for development as it relates to potential risk to eagles. Several sources of available data were used to identify biological resources within the Project area. These sources included publicly available reports, publications, geographic information system (GIS) maps, agency reports, species experts, and online databases. Per the ECPG (USFWS 2013), areas of focus for this Stage 1 Initial Site Assessment include:

- recent or historical nesting and seasonal occurrence data for eagles at the prospective area;
- migration or other regular movement by eagles through the area or surrounding landscape;
- seasonal concentration areas, such as a communal roost site in a mature riparian woodland, or waterfowl concentration serving as a major forage base; and
- physical features of the landscape, especially topography that may attract or concentrate eagles.

PROJECT SITE CHARACTERISTICS

Land Use/Land Cover

Approximately 87% of the Project area land use/cover is cultivated crop; dominant minor land use/cover categories include grassland (~6%); wetland comprising approximately (~5%); tree and shrub (mixed forest) (~2%) and farmstead (~0.7%) (Table 1, Figure 4; USFWS NWI 2014, Derby 2016).

Table 1. Land use/cover types present within the Rolette Wind Power Project (WEST).

Land Use/Cover	Percent Composition
Cultivated Crop	87.07
Grassland	5.95
Wetland	4.66
Tree/Shrub	1.63
Farmstead	0.67
Developed	0.03
Total	100

Wetlands

Based on National Wetland Inventory (NWI) polygon data (USFWS NWI 2014), there are approximately 1,591 acres (643.7 hectares [ha]) of wetlands, found in the Project (Table 2, Figure 5). Freshwater emergent wetlands account for 1,476 acres; followed by freshwater pond

(52 acres); lake (36 acres); and freshwater forested/shrub wetland (27 acres). There are no named streams within the Project.

Table 2. National Wetland Inventory polygon types present within the Rolette Wind Power Project (USFWS NWI 2014).

Wetland Type	Project Acres	Percent Composition
Freshwater Emergent Wetland	1476.2	92.80
Freshwater Pond	52.3	3.28
Lake	35.7	2.24
Freshwater Forested/Shrub Wetland	26.5	1.67
Total	1590.7	100

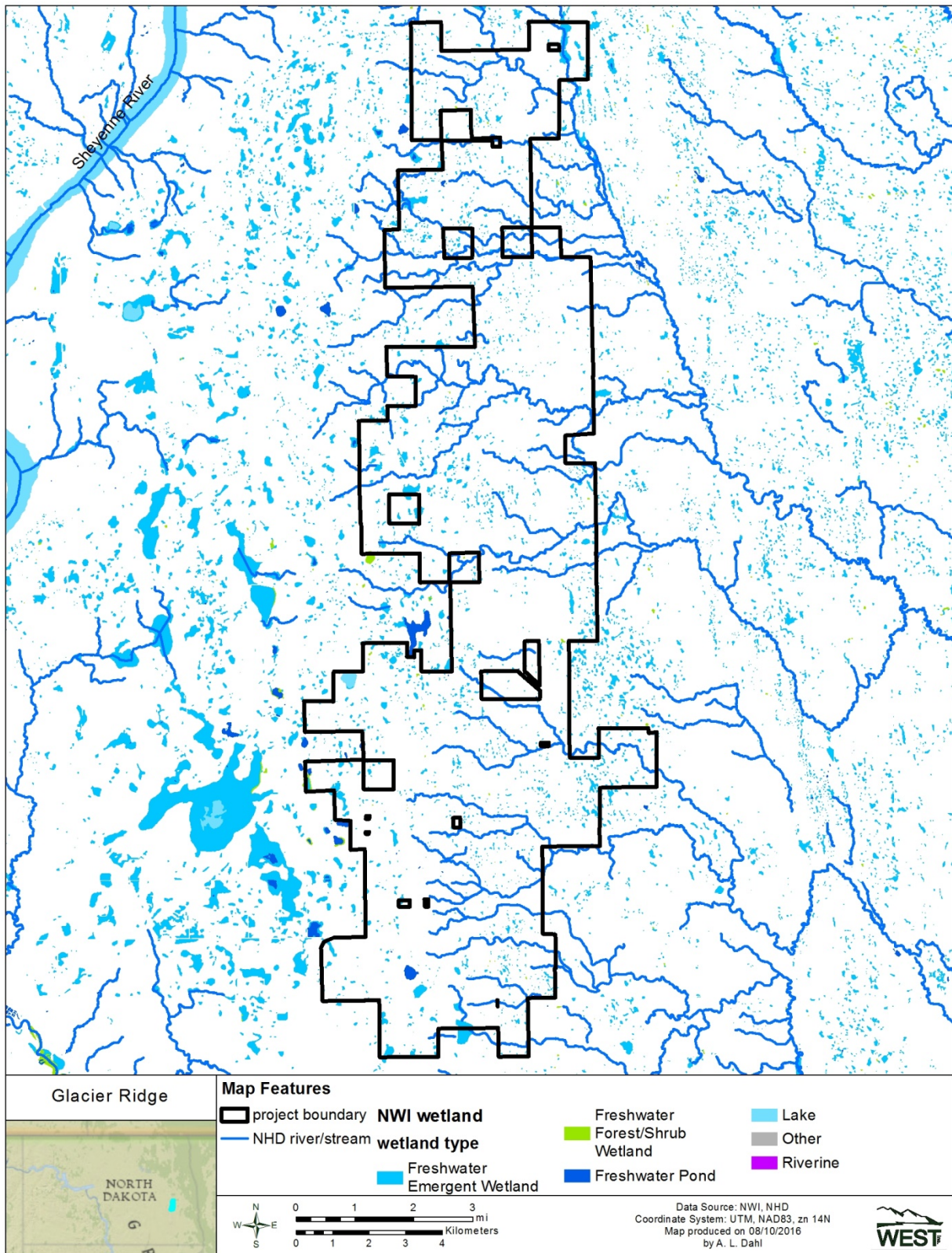


Figure 5. Wetlands and streams in the Glacier Ridge Wind Energy Project (USFWS NWI 2014, USGS NHD 2015a).

Protected Areas

A review of the Protected Areas Database (PAD-US) from the USGS notes that there are no Waterfowl Production Areas (WPAs) or Wildlife Management Areas (WMAs) within the Project area (USGS 2012b). However, there are 42 Federal, Barnes County, and other county wildlife areas within 10 miles of the Project area. There are three state Wildlife Management Areas (WMA's) within 10 miles (16 km) of the Project area. These WMAs are managed by the North Dakota Game and Fish Department (NDGF) and are located approximately 6 miles west of the Project area. All wildlife protected areas within 10 miles of the Project area have a total area of approximately 16,330 acres (6,609 ha). Protected areas within 10 miles of the Project area are largely composed of herbaceous grassland, emergent herbaceous wetlands, open water, and hay/pasture that may provide suitable foraging opportunities for eagles.

Important Bird Areas

The National Audubon Society (Audubon) has identified Important Bird Areas (IBAs) that provide essential habitat for one or more bird species (Audubon 2014). There are no IBAs within the Project area. The closest registered IBA to the Project area is Fort Ransom State Park; a state recognized IBA located approximately 26 miles south of the Project area in northwestern Ransom County. This IBA contains woodland, wetland, and open water habitat along the Sheyenne River that is used by a variety of bird species. The next closest IBA, the Edward M. Brigham III Alkali Lake Sanctuary (Sanctuary) IBA, is located approximately 30 miles west of the Project area. This IBA encompasses 2,300 acres in Stutsman County and is considered one of North Dakota's more unique and significant wetland areas containing a variety of habitats including mixed grass prairie, wetlands, wet meadows and Alkali Lake. These habitats are important for migratory birds, waterbirds, shorebirds, and many other avian species.

EAGLE OCCURRENCE IN THE PROJECT AREA

Golden Eagle

Golden eagles (*Aquila chrysaetos*) are typically considered more susceptible to wind turbine collision than bald eagles (*Haliaeetus leucocephalus*), as evidenced by higher mortality rates throughout their range (Allison 2012). Eastern North Dakota is outside of the breeding range of the golden eagle. There are no records of golden eagle observations within the Project area, but there are several golden eagle observations recorded along the Sheyenne River approximately 5-miles from the Project area (eBird 2015e; Figure 6). The North Dakota Game and Fish Department (NDGFD) classify golden eagle as "uncommon" throughout North Dakota (NDGFD 2012), although this species has been reported more frequently in the western half of the state (Figure 6).

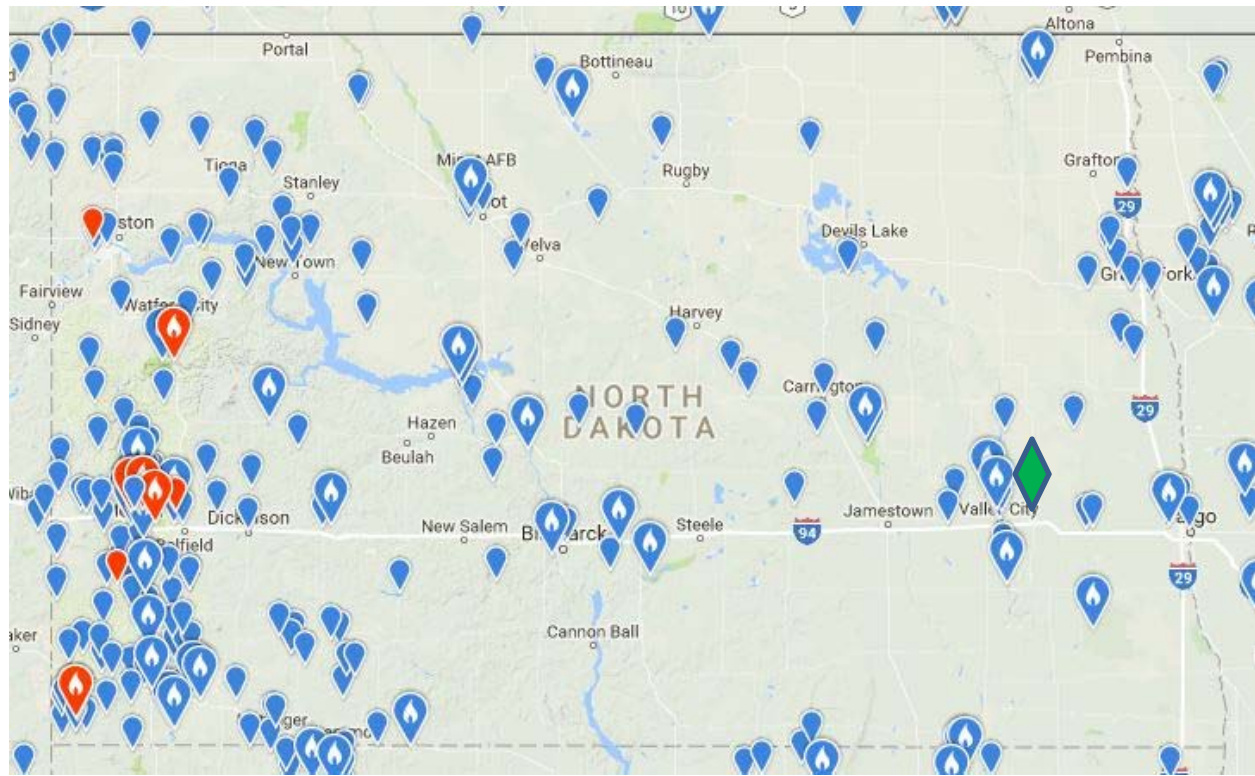


Figure 6. eBird data map of golden eagle occurrences observed during all seasons in North Dakota (ebird 2016e). The green diamond indicates the approximate location of the Glacier Ridge Wind Farm. Blue markers indicate all golden eagle observations from 1900-2016, red markers indicate observations less than 30 days old (data from August 10, 2016). Each blue marker can represent one golden eagle observation or multiple golden eagle observations in the same location.

Bald Eagle

In North Dakota, bald eagles historically nested along the Missouri River, Red River, and in the Devils Lake area (Johnson 2010). Bald eagles prefer nesting, roosting, and foraging in areas with mature trees near permanent water bodies in undisturbed areas with abundant prey resources such as fish and waterfowl (Swenson et al. 1986, Mojica et al. 2008). Though North Dakota has experienced a large increase in the number of nesting bald eagles over the past four decades, challenges and threats to bald eagles remain. Threats to bald eagles include loss or alteration of nesting and roosting habitat, exposure to poisons and environmental contaminants (e.g., lead, pesticides, pollution), electrocution and collision with power lines, and collision with wind turbines (Kochert and Steenhof 2002). Potential impacts to bald eagles from wind energy development and operations include collision with wind turbines and associated transmission lines, as well as disturbance of nests, roosting sites, and foraging areas.

A review of all years of bald eagle year-round data in the eBird database for a 4-county region (Barnes County and the surrounding North Dakota counties [Cass, Griggs and Steele Counties]) indicates a very strong seasonal trend, with eagle occurrence peaking in March with some additional peaks in observations occurring in August and December and less frequently

throughout the year (Figures 7). Bald eagle observations within Barnes County peak in December with a few additional increases in observations occurring between January-April and again in May and July (Figure 8). The bald eagle observations from this region are primarily concentrated along the Sheyenne River and Hobart Lake National Wildlife Refuge, approximately 5-mile and 9-mile west of the Project area, respectively. Bald eagle sightings are dispersed throughout the landscape in lower densities in this region of North Dakota, typically where suitable habitat exists (Figure 9). It should be noted that eBird data is a citizen-science database and is comprised of reported observations collected without a systematic sampling structure. These data should be interpreted with caution as observation locations are often skewed toward birding hotspots and accessible areas. However, these data are useful for the investigation of broad spatial and temporal trends.

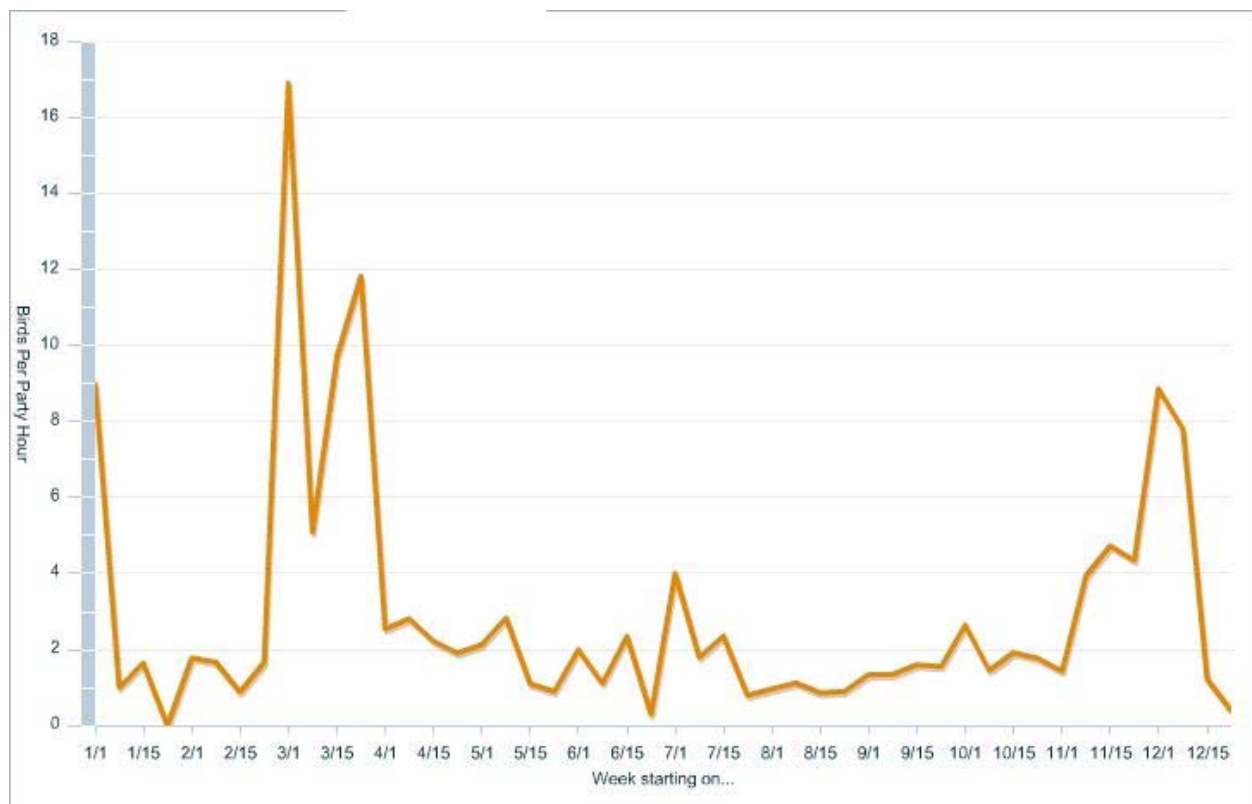


Figure 7. eBird data showing bald eagles per hour within the 4-county region in North Dakota, including Barnes County, in which the Glacier Ridge Wind Farm is located (eBird 2016b). Birds per hour is the average number of bald eagles seen per hour spent birding within a specified date range and region. Dates range from January 1, 1900, to August 10, 2016.

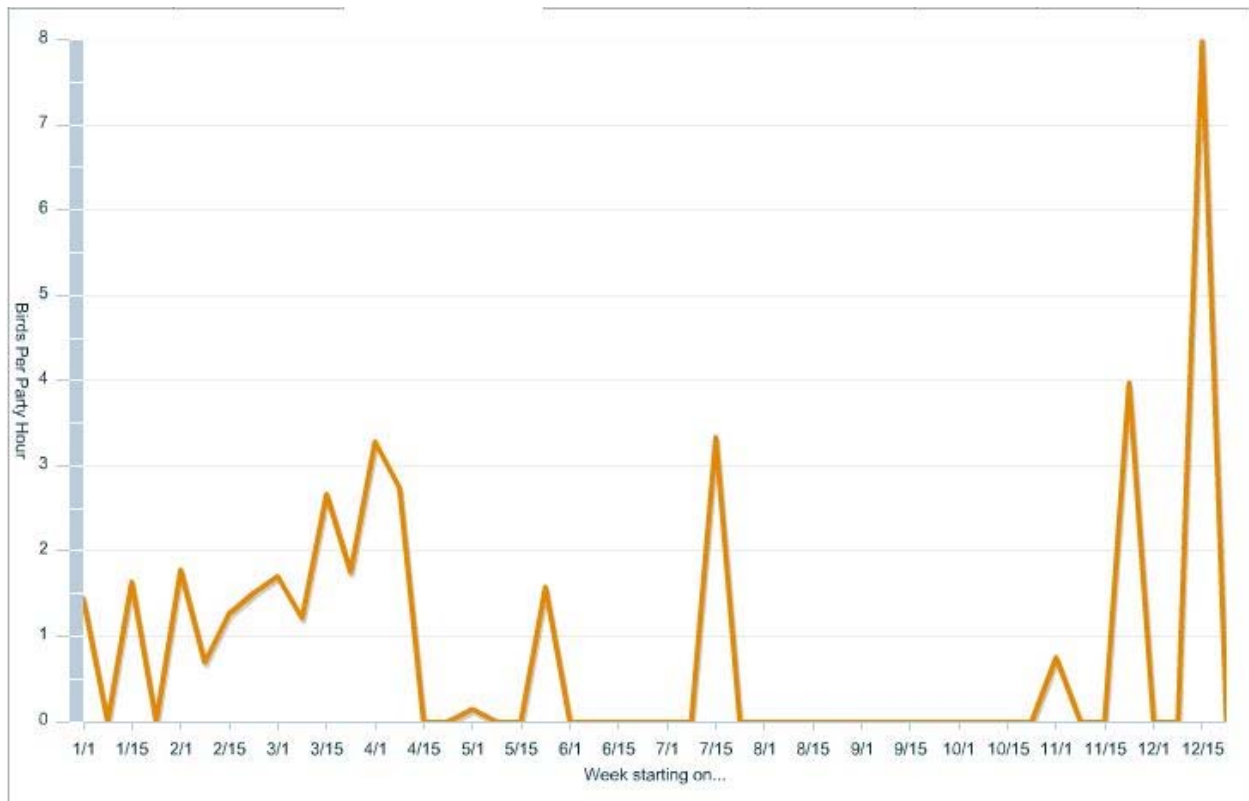


Figure 8. eBird data showing bald eagles per hour in Barnes County, North Dakota (eBird 2016d). Birds per hour is the average number of bald eagles seen per hour spent birding within a specified date range and region. Dates range from January 1, 1900, to August 10, 2016.

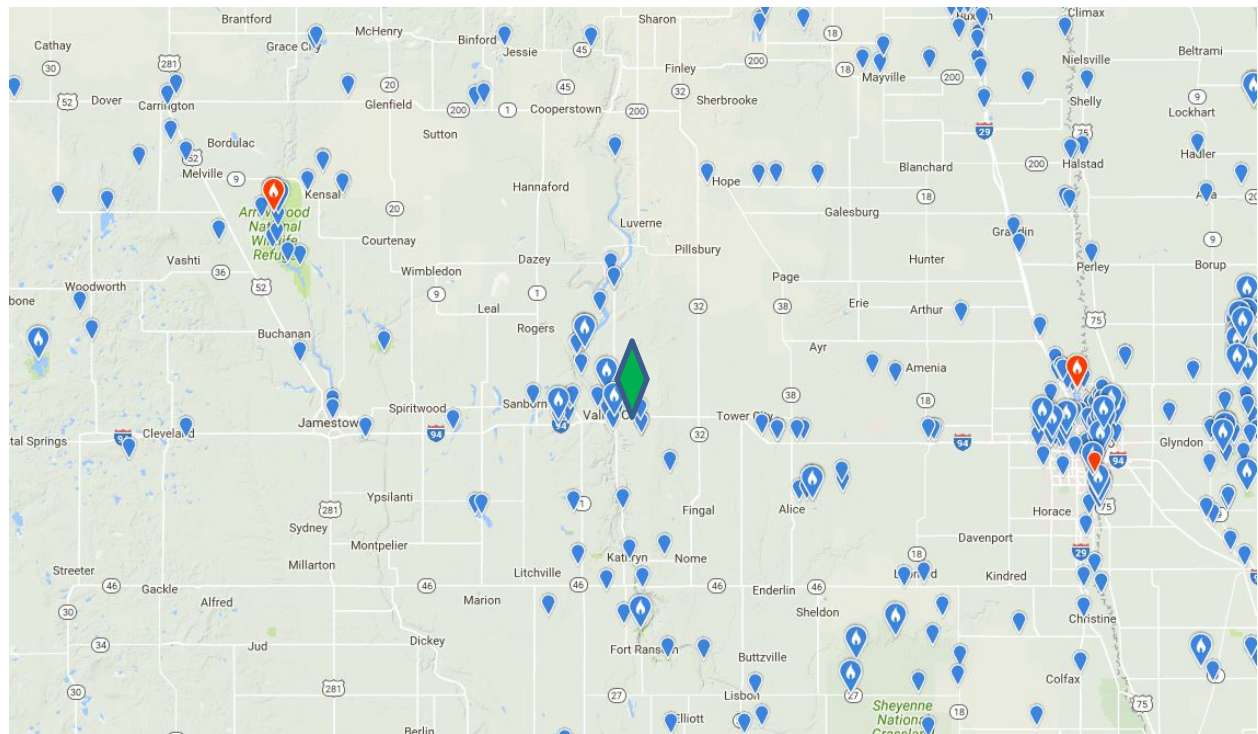


Figure 9. eBird data map of bald eagle observations within the region in which the Glacier Ridge Wind Farm is located (eBird 2016a). Observation data are from all months and all years. The green diamond indicates the approximate location of the Glacier Ridge Wind Farm. Blue markers indicate all year round observations from 1900-2016 that are more than 30 days old. Red markers indicate data from the last 30 days (data from August 10, 2016). Each blue marker can represent one bald eagle observation or multiple bald eagle observations in the same location.

Resident Breeding and Non-Breeding Eagles

In the 1800s, bald eagles were common breeders along North Dakota's major rivers and lakes, such as the Missouri River, Red River and Devils Lake (Johnson 2010). A significant decline in their numbers caused by environmental contaminants and loss of habitat led to the enactment of the Bald and Golden Eagle Protection Act in 1940; however, in 1978, the bald eagle was listed as an endangered species (Johnson 2010). Nationwide conservation efforts led to the recovery of bald eagles, and the bald eagle was removed from the federal list of endangered and threatened wildlife and plants in 2007 (USFWS 2007b, Johnson 2010).

In 2009, the NDGFD reported 66 pairs of bald eagles nesting in 29 counties in the state (Johnson 2010). Johnson (2010) reported two occupied bald eagle nest in northeastern and west central Griggs County, approximately 25 miles from the Project area, respectively (Figure 10). Nesting bald eagle numbers are increasing, as the NDGFD estimated 140 active bald eagle nests in North Dakota in 2015 (Kessler 2015). An increase in migrating bald eagles has also been observed throughout the state as bald eagles migrate through grassland areas in the fall and spring (Kessler 2015). The NDGFD reports that there are two historic bald eagle nests located in 2013 and 2014 located within a 10-mile buffer of the Project area; these nests were recorded as occupied during spring 2015 aerial surveys conducted by WEST (NDGFD, April 2016, Figure 11).

The closest USGS Breeding Bird Survey (BBS) route to the Project area is the Cooperstown route, which covers southeastern Griggs County, running east from the city of Cooperstown to the Sheyenne River, turning south and ending at the northern portion of Lake Ashtabula. (<http://www.pwrc.usgs.gov/BBS/PublicDataInterface/>). The next closest route is the Wimbledon Route, which extends from northeast Stutsman County running SW to the Jamestown Reservoir. This route passes near the Audubon Sanctuary IBA. Routes are typically 24.5 miles (39.4 km) long and consist of 50 3-minute counts along the length of the route (USGS 2001b). Information gathered from the survey provides information about what species may occur in the Project area either transiently or during the breeding season.

Between 1969 and 2015, a total of 80 species were observed along the Cooperstown BBS route, including five raptor species: red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), ferruginous hawk (*Buteo regalis*) and Swainson's hawk (*Buteo swainsoni*); two owl species: great-horned owl (*Bubo virginianus*) and short-eared owl (*Asio flammeus*). No bald eagles have been observed along the Cooperstown or Wimbledon BBS routes during these years (Wimbledon route has been surveyed from 1981-present).

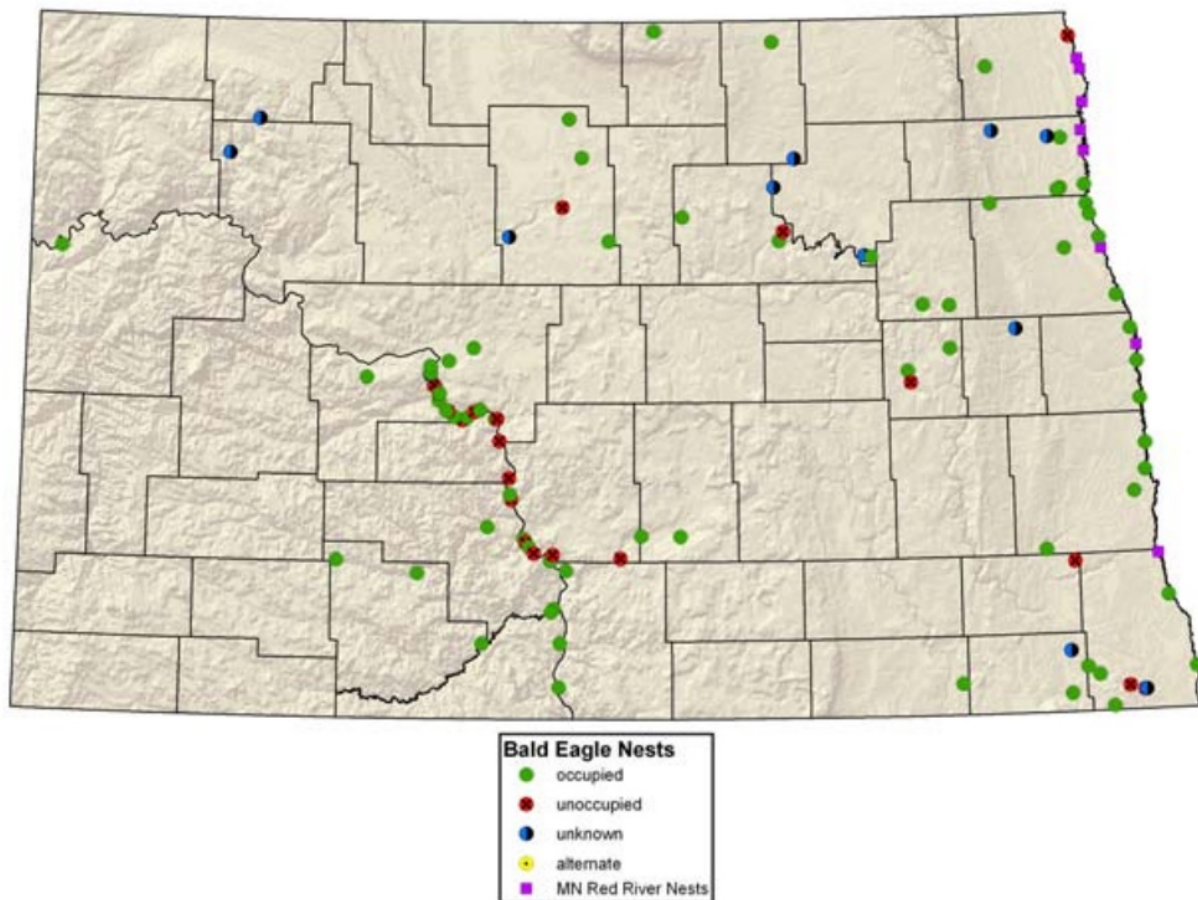


Figure 10. Spatial distribution of bald eagle nests in 2009 (Johnson 2010).

During the breeding season, bald eagles typically breed in forested areas adjacent to large bodies of water, nesting in large mature deciduous or coniferous trees in forest tracts that have relatively open canopies or foliage-height diversity that allow for access to nest trees (Buehler 2000, Anthony and Isaacs 1989, Wood et al. 1989). The distance to water varies depending on the population, and occasionally, distance to water appears to be less important than the presence of quality foraging areas (defined by diversity, abundance, and availability of prey [MacDonald and Austin-Smith 1989]), and absence of human disturbance (McGarigal et al. 1991). Trees that bald eagles use for perching are variable and include both coniferous and deciduous species, if available (Buehler 2000). Perch trees encompass a wider range of tree species and sizes than nest or roost-trees (Stalmaster 1987).

The Project area land use is primarily cultivated crops and grassland, with limited mixed forest. These land cover types are not likely to provide abundant forage and habitat for eagles. However, there is some open water and large wetland complexes within the Project area which provides some suitable foraging habitat for bald eagles. If bald eagles are found within the site,

they will likely be near these lakes; however, none within the Project area are known to contain fish, a potential forage base for bald eagles.

Raptor and eagle nest surveys have been completed three times for the Project. In spring 2010, a ground based survey was conducted within the Project area and 1-mile buffer around the Project area. In spring 2012 a ground based survey was conducted within the Project area and a 10-mile buffer. The larger buffer was surveyed to follow the direction from the 2012 Eagle Conservation Plan Guidance. Low numbers of raptor nests and no eagle nests were found during these surveys. In spring 2016 a helicopter based survey was conducted within the Project and 1-mile buffer, and a 10-mile buffer. Again, there were low numbers of raptor nests observed but four new bald eagle nests were located (including two historic bald eagle nests), one within the 1-mile buffer, two within the 10-mile buffer, and two just outside of the 10-mile buffer. After the April 2016 agency meeting, a request of known eagle nests and other information was made to the NDGFD. No other bald eagle nests were identified from the data requests beyond those located in the 2016 survey. Reports on all three years of survey have been submitted to the North Dakota Public Service Commission.

The potential exists that these nesting eagles could pass through the Project area from time to time or forage within the Project area. The habitat within the Project area includes some open water/ wetland complexes (less than 5% of the Project area) that could provide habitat for eagles with more open water areas outside of the Project area. However, there is no reason to believe that the Project area habitat is more attractive to eagles than habitat outside of the Project area (e.g., more attractive habitat is likely found along the Sheyenne River and Lake Ashtabula to the west). Bald eagle home range size varies based upon location, time of year, breeding status, and food availability (Griffen and Baskett 1985; Buehler 2000) and may vary considerably even within the same region. Bald eagles also defend territories, often using the same territory each year (USFWS 2009). Bald eagle nest territory size and shape can vary widely based on food supply, habitat, nest density, and human disturbance. However, as noted in the ECPG, a majority of eagle territorial and foraging behavior is typically observed within 0.3 to 2 miles of nests (Buehler 2000, Hodges and Robards 1982, Gerrard et al. 1992). Thus, while the majority of eagle activity will likely take place within 0.3 to 2 miles of the two known bald eagle nests, it is possible that the eagles could use the Project area to some level.

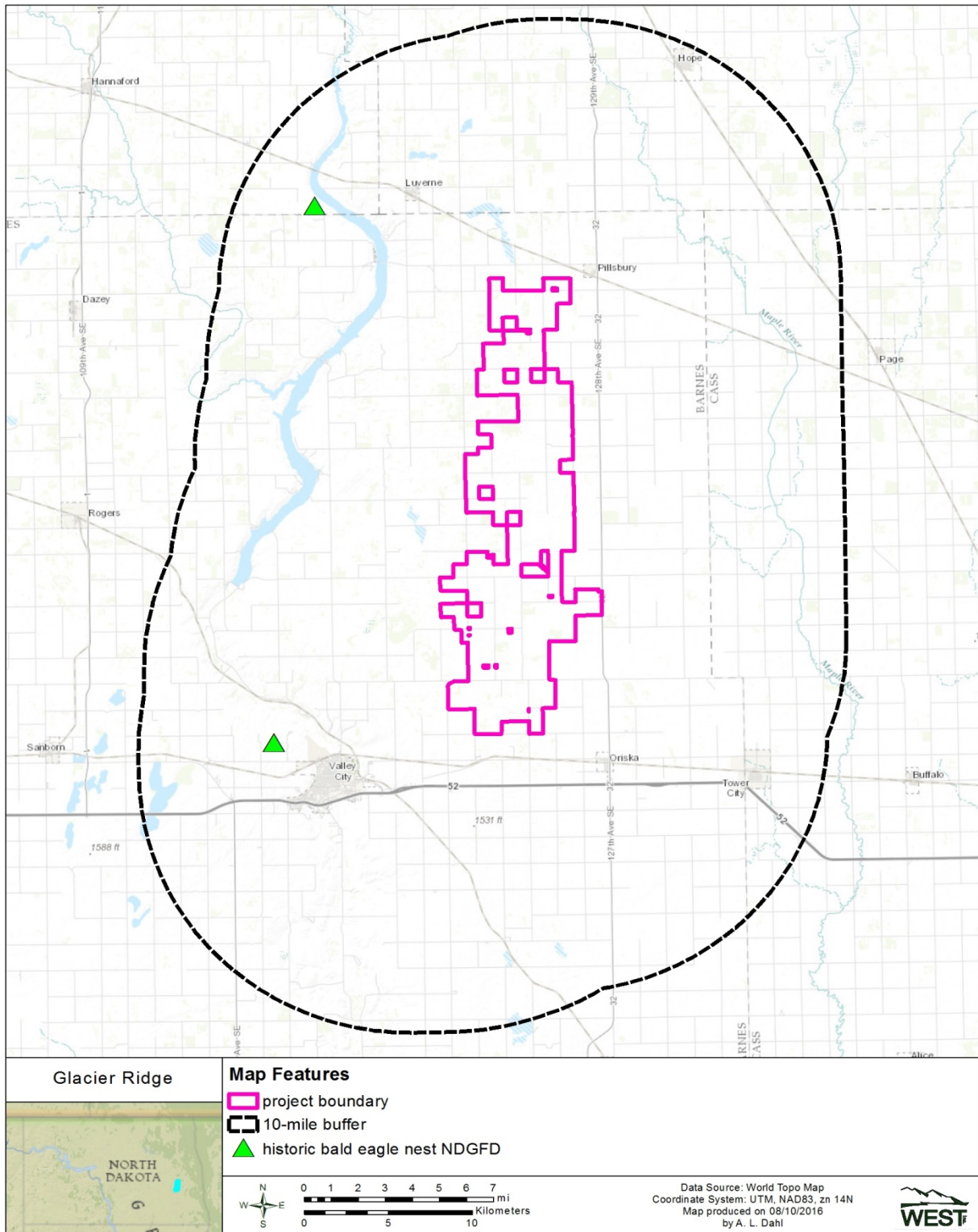


Figure 11. Location of historic bald eagle nests within 10 miles of the Project (NDGFD 2016).

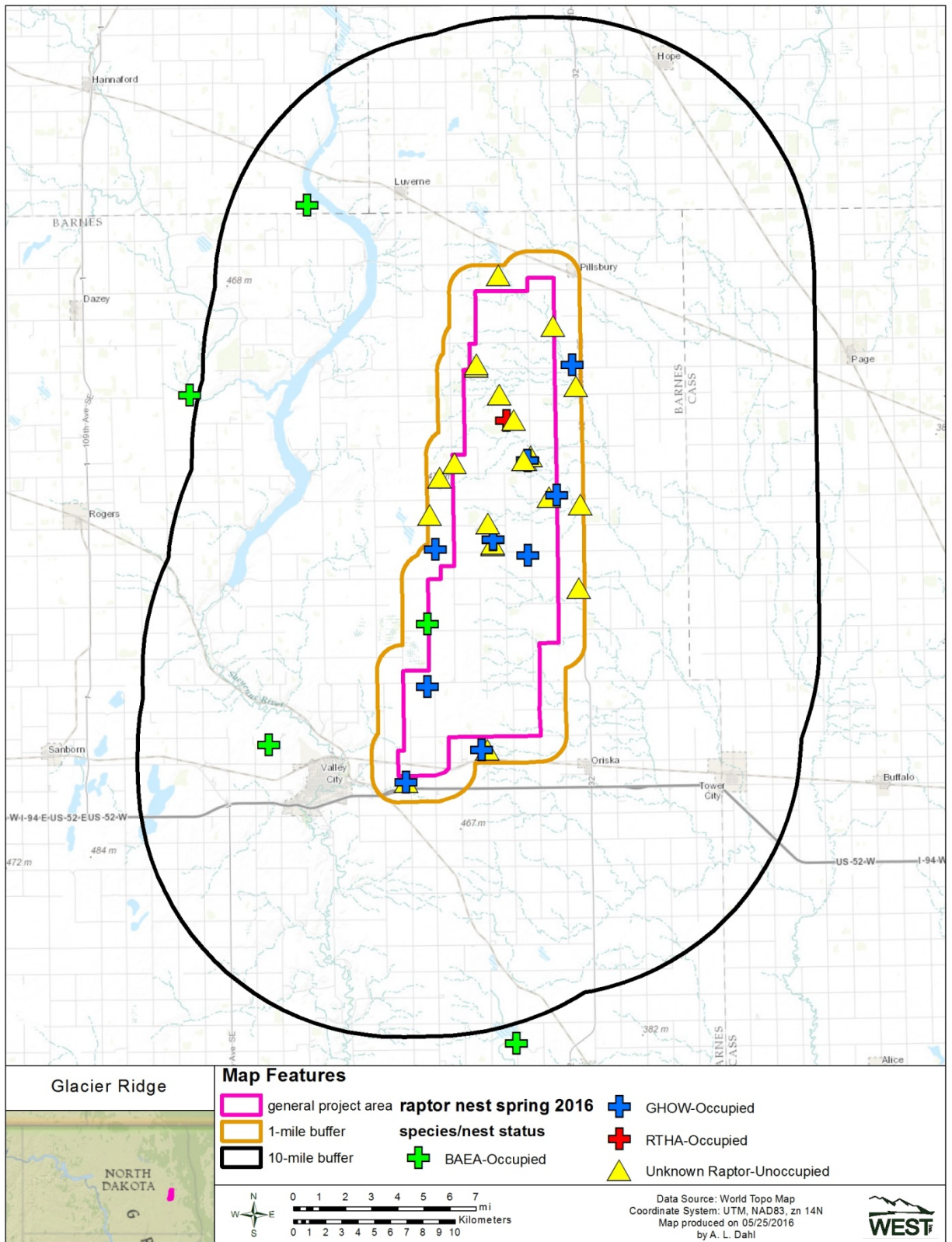


Figure 12. Location of bald eagle nests within 10 miles of the Glacier Ridge Wind Farm, as identified by the WEST, April 2015.

Wintering Eagles

Bald eagles may congregate in communal roosts in winter to conserve energy, exploit protective microclimates, and reduce foraging costs (USFWS 2010). Roost sites are typically in mature trees where eagles are sheltered from the wind and inclement weather (USFWS 2007a). Buehler et al. (1991) found that winter communal roosts are more often located close to water sources and away from human development than at random sites. Bald eagles are considered opportunistic foragers and food habits vary and depend on prey species available (Mersmann 1989). Bald eagles are often attracted to aquatic habitats and prefer foraging on fish (DeLong 1990). During the winter months, bald eagles may rely heavily on carrion (fish, birds, and mammals) as a primary food source, and may be found feeding on carrion in dry, open uplands during the winter (Buehler 2000). Bald eagles also forage at waterfowl concentration areas during the winter where mortality due to hunting provides a reliable supply of waterfowl carcasses for scavenging (Griffin et al. 1982). Perching habitat during the winter is similar to other times of the year and is characterized by tall trees located adjacent to foraging areas (Buehler et al. 1992, Chandler et al. 1995).

Bald eagles are present during the winter in North Dakota, especially near rivers and reservoirs (Kessler 2015). The annual Arrowwood National Wildlife Refuge Christmas Bird Count reported four bald eagles in December 2015; and has reported an average of 3.2 eagles annually over the last five years (Kessler 2015). In 2014, bald eagles were reported during 13 of the 20 Christmas Bird Counts that take place throughout the state of North Dakota, with a total of 113 bald eagles observed statewide (National Audubon Society, 2015).

The Project area does not contain significant habitat features that would be attractive to wintering eagles. However, the open water/wetland complexes within the Project area and the Waterfowl Production Areas or Wildlife Management Areas adjacent to the Project area could attract eagles if waterfowl are present during open water periods in late fall and early spring. Bald eagles may occur within the Project area during the winter; however, larger bodies of water that are free of ice longer, such as Lake Ashtabula to the west and Hobart Lake to the southwest of the Project area, are expected to provide better winter habitat. The Project area does contain areas where carrion (e.g., deer carcasses, road kill) or small game may be present and could be an attractant for bald eagles. However, the Project area has similar to lower potential to have bald eagle use compared to surrounding areas because the biological resources eagles often rely on are more abundant outside of the Project area, such as large waterbodies with forest cover.

Bald Eagle Migration or Other Regular Movement

Bald eagle migration patterns depend primarily on the age of the bird (immature or adult), location of the breeding site, breeding site climate, and food availability (Buehler 2000). Bald eagle migration is not as regular as with other migratory birds, as movements are often opportunistic, somewhat unpredictable and widely dispersed in time (Buehler 2000). Bald eagles typically do not migrate in kettles or flocks but concentrations of migrants may occur at communal feeding and roost sites during migration (Buehler 2000). Fall migration occurs during August through January. Bald eagles often migrate along major river systems in search of food

(Buehler et al. 1991). In the spring, bald eagles may return to their breeding grounds as soon as the weather improves and food is available, again often using major river valleys as migration corridors. The spring migratory period is generally considered to occur from January to March. Migration occurs during the day, when thermals provide opportunities to soar with limited energetic expense.

Eagles may pass through the Project area in a broad-front fashion during migration, especially if there are food sources such as carrion available. Little information is available regarding the characteristics of stopover habitat used during migration. It is likely that the suitability of stopover habitat is most related to food availability rather than vegetative composition or structural characteristics. Stopover sites are usually areas with consistent fish-kills, concentrations of fish and waterfowl, or the presence of large mammals as carrion (McClelland et al. 1996). Roosts that most commonly see repeated use as stopover sites consist of clumps of mature deciduous trees in riparian areas protected from human disturbance and proximate to foraging opportunities. Locations within the Project area that may serve as stopover sites for eagles are limited to small wooded patches and around lakes with opportunities for foraging. Grasslands and other areas within the Project area may attract bald eagles if carrion or small game is present. Bald eagles are more likely to occur in areas with more water and trees (e.g., Shyenne River corridor) during the migratory period, but use within the Project is possible.

Eagle Seasonal Concentration Areas

The Project area does not contain habitat or landscape features that would appear to lead to significant seasonal concentrations of bald or golden eagles. Most of the Project area consists of cultivated cropland with little grassland and forest or wetland habitat. There are a few wetland complexes within the Project area that eagles could use during winter, migration, or during the breeding season. Ephemeral foraging opportunities in the form of carrion and road kill may temporarily attract eagles, especially during the winter.

Eagle Physical Landscape Features

Physical features of the landscape that may attract or concentrate eagles are limited within the Project. The general topography across the Project area is flat to rolling. It is likely that bald or golden eagles will migrate through the Project area in a broad-front fashion. The Project area is lacking prominent north/south ridges or valleys that would funnel migrants through the Project area (Liguori 2005; Figures 2 and 3). The available tree, shrub, and open water/wetland complexes may provide some stopover habitat for migrating eagles, but concentrated use is not expected within the Project area since these features are very limited with the Project area.

CONCLUSIONS

The ECPG (USFWS 2013) suggests specific questions that should be considered to help place a prospective project site into an appropriate risk category. These questions are answered below based on the information compiled during the Stage 1 Initial Site Assessment.

1. *Does existing or historical information indicate that eagles or eagle habitat may be present within the geographic region under development consideration?*

Eagles have been observed within the geographic region under development consideration. While there are no known bald or golden eagle nests within the Project, there is one active bald eagle nest within one mile and two active bald eagle nests within 10 miles of the Project. Bald eagle habitat is limited within the Project area as there are few trees (<2% cover) and open water/wetland complexes (<5% cover). The Project area has similar to lower potential to have bald eagle use compared to surrounding areas because the biological resources eagles often rely on are more abundant outside of the project area, such as large waterbodies with forest cover.

2. *Within a prospective project site, are there areas of habitat known to be or potentially valuable to eagles that would be destroyed or degraded due to the project?*

There is some potentially valuable habitat in the form of wetland complexes for eagles within the Project area. Land use is predominantly cultivated crops with some (<5%) wetlands. Impact to larger wetlands will be avoided by project development.

3. *Are there important eagle use areas or migration concentration sites documented or thought to occur in the project area?*

To date, no important eagle use areas and migration concentration sites have been documented or are thought to occur within the Project area. The important bald eagle use areas and migration concentration sites are located approximately 47 miles to the east along the Red River of the North and approximately 50 miles to the northwest at Devil's Lake. No bald or golden eagle nests are known within the Project area; however, three active bald eagle nests were found within 10 miles of the Project area.

4. *Does existing or historical information indicate that habitat supporting abundant prey for eagles may be present within the geographic region under development consideration?*

Abundant prey for eagles is not expected to be present within the Project area, but may be found in the larger geographic region. Some foraging opportunities may be present in the form of waterfowl, small game, and road killed deer and other carrion within the Project area. However, better foraging opportunities and more abundant concentrations of suitable prey are likely to be outside the Project area.

5. *For a given prospective site, is there potential for significant adverse impacts to eagles based on answers to above questions and considering the design of the proposed project?*

Bald and golden eagles have the potential to occur in the Project area during all seasons, but will likely occur in low numbers. Given golden eagles are uncommon in this area, the potential for the Project to result in significant adverse impacts to this species is particularly low. There are three bald eagle nests within 10 miles of the Project area and this species has been observed in the general area more commonly than golden eagles. Generally, bald eagles do not move broadly across the landscape during the nesting season. As such, the potential risk of

bald eagles interacting with wind turbines at this site could be greater during the migratory season; however, no migration concentration sites have been documented or are thought to occur within the Project area. Based on available information, it is not likely that eagle populations will be significantly adversely impacted by development of the proposed Project.

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